정책연구 99-37

다자간 전략기술 수출통제체제의 최근 강화추세와 우리의 대응전략

(바세나르체제 참여전략 및 성과의 극대화 방안을 중심으로)

Ways and Means for an active participation in The Wassennaar Arrangement

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다자간 전략기술 수출통제체제의 최근 강화추세와 우리의 대응전략

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본 보고서를 “다자간 전략기술 수출통제체제의 최근 강화추세와 우리의 대응전략(바세나르체제 참여전략 및 성과의 극대화 방안을 중심으로)”의 최종보고서로 제출합니다.

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목 차

표 목 차

그 림 목 차

요 약 문

Ⅰ. 제 목

다자간 전략기술 수출통제 체제의 최근 강화추세와 우리의 대응전략
(바세나르체제 참여 전략 및 성과의 극대화 방안을 중심으로)

Ⅱ. 연구 목적

다자간 전략기술 수출통제체제 활동에의 능동적인 대응을 위해 국내 전문가협의회의 구성을 통해 주요 회의의제에 대한 사전검토 및 분석은 물론 회의결과의 효과적 확산을 위한 전략적 방안을 제시한다.

주요 회의에의 참여성과를 극대화하기 위해 과학기술부가 주도하는 관련부처간 정책조정체제의 구성을 통해 회의의제에 대한 최종 입장의 정립과 대응책을 체계적으로 수립하여 다자간 회의에서 이를 효과적으로 관철시킨다. 이를 위해 주요 회의결과를 정책기초자료로 체계적으로 분석・정리하고 이를 바탕으로 구체적인 전략적 방안을 제시한다.

Ⅲ. 연구 내용

○ 바세나르체제 및 운영의 현황
- 바세나르체제의 특성
- 바세나르체제 운영의 특성

○ 바세나르체제의 최근 동향 및 주요 정책 이슈
- 바세나르체제의 최근 변화 추세
- 바세나르체제의 주요 정책 현안

○ 바세나르체제 참여성과의 극대화를 위한 기반구축
- 국내 정책 협조 체제 구축
- 바세나르체제 전문가협의회 구성
- 바세나르체제 전문가협의회 운영

○ 바세나르 주요 회의에의 효과적 참여전략 수립
- 주요 회의 의제별 분석
- 회의 참여자료 준비 · 작성
- 우리의 입장정립 및 대응책 수립

○ 바세나르 주요 회의에의 참여 결과
- 주요 회의 배경
- 주요 토의 쟁점 및 결과
- 종합적 관찰

○ 주요 정책적 시사점 및 대응 방안
- 정책적 시사점
- 적극적 대응 전략
- 구체적 추진 방안

Ⅳ. 연구결과

○ 본 연구의 목적은 다자간 전략기술 수출통제체제에의 참여성과를 극대화하기 위한 전략적 방안을 제시하는데 있다. 이러한 목적을 달성하기 위한 본 연구의 주요 내용은 바세나르체제의 최근 동향 및 주요 정책 이슈의 파악, 참여의 질을 향상시키기 위한 국내 정책 협조체제의 구축, 주요 회의결과를 국내 정책에 즉시 반영하기 위한 추진 전략을 제시하는 것으로 구성되었다.

○ 바세나르체제의 최근 동향

1. 바세나르체제의 최근 변화 추세는 첫째, 탈냉전 이후 민군겸용기술에 대한

통제 완화에 따른 위험요소를 조기에 제거하기 위한 차원에서 전략기술이전에 대한 통제가 강화되고 있다.

2. 둘째, 신흥공급국들의 자체개발능력이 날로 향상됨에 따라 민군겸용기술에 대한 통제의 수위가 수출 및 이전 단계에서 연구개발(R&D) 및 생산단계로 강화되고 있다.

○ 바세나르회의 참여성과의 극대화를 위한 기반 구축

1. 바세나르체제 전문가협의회 구성
2. 바세나르체제 전문가협의회 운영

○ 바세나르 주요 정책 이슈

1. 통제 지침의 제도적 보완・강화

1) "Global View" Framework Document 및 Technology Assessment를 통한 수출・이전에 대한 통제 강화

- 현재까지 위험 지역에 대한 평가를 회원국의 임의적인 정보에 의존해오던 비효율적인 방법에서 벗어나 범세계적 차원(극동 지역을 포함한 16개 지역)에서 체계적인 평가를 통해 총회에서 Technology Assessment를 포함한 "Global View" framework document를 최종 검토·승인함으로써 통제 제도를 한층 강화한다.

2. 연구개발(R&D) 단계에서의 통제 강화

1) 소프트웨어 및 기술의 무형 이전에 대한 통제

- 무형이전 수단(서류, 전화, e-mail, Internet, 기술 data 및 지원 목적의 과학기술인력 교류 등)에 대한 통제를 강화한다.

2) 공공영역(public domain)의 암호화 소프트웨어에 대한 통제

- 미국은 암호화기술의 군사전용을 방지키 위해 현재의 바세나르 규정을 개정하여 공공영역에서의 암호화 소프트웨어를 통제한다.

3. 자체기술개발 목적의 전략기술에 대한 통제 강화

1) 신기술(emerging technologies)에 대한 통제

- 영국을 중심으로 자체개발능력의 향상을 목적으로 수출·이전되는 신기술(Stealth기술, UAVs, 생명공학의 지식 및 생산능력 등)에 대한 통제를 강화하기 위해 새로운 범위를 설정하려 한다.

2) Clustering technology 컴퓨터 통제

- 고성능컴퓨터(HPC)를 대치할 수 있는 Clustering technology에 대한 통제를 강화하려 한다.

3) 항법장치를 위한 accelerometers에 대한 통제 강화

- 항법장치를 위해 고안된 군사 활용이 가능한 angular 또는 rotational accelerometers에 대한 수출통제를 강화하려 한다.

○ 바세나르 회의 참여성과 및 결과

- 우리나라는 종전의 한두 항목에 대한 입장 표명의 소극적인 자세에서 벗어나 준비된 검토의견과 전문 대표단의 전문성을 십분 활용하여 2000년 제1차 전문가그룹 정기회의에서 총 65개의 정식 프로포즐 중 16개의 제안에 대해 공식 입장을 표명함으로써 국익의 보호는 물론 통제리스트 개정과정에 실질적인 기여를 하였다.

○ 정책적 시사점 및 대응 방안

1. 정책적 시사점

1) 바세나르체제는 전략기술에 대한 수출·이전을 범세계적 차원에서 체계적으로 통제하는 제도('global view')를 도입하고 나아가 연구개발(R&D)활동으로 통제 범위를 확대하는 새로운 정책들을 마련했다.
2) 이러한 새로운 통제규범의 태동은 국제 과학기술교류·이전을 통해 국내 연구개발자원의 한계를 극복하려는 우리 정부의 과학기술 국제협력정책전반에 대한 새로운 변혁을 강력히 시사하고 있다.

3) 이러한 통제 강화 추세와 우리나라의 기술적 위상 변화는 우리나라의 WA 참여정책에 대한 근본적인 변화(단순 참여형태에서 적극적 참여형태로)를 강력하게 요구하고 있다.

2. 대응 전략

1) 능동적인 참여를 위해 우선 이미 구성된 "WA체제 전문가협의회"를 활성화하여 주요 회의결과 및 정책현안에 대한 종합적인 분석을 통한 정책자문체계를 확립한다.
2) 국내 종합조정을 통해 최종 입장을 수립하고 이를 통제리스트 검토과정에 효과적으로 반영시키는 전략을 지속적으로 추진할 수 있는 정책 프로그램의 도입을 통한 제도적인 지원 및 기반의 구축이 바람직할 것이다.

3. 추진 방안

1) 우선 파악된 주요 정책 이슈에 대한 우선 순위의 설정을 통해 과기부의 공식 입장을 정립하고 나아가 "WA체제 전문가협의회"를 활용하여 다양한 이슈를 개발한다.

- 단순 대응 과제: 특정 제안에 대한 지지, 반대 및 보류에 대한 기본 논리 개발·제시하여 우리의 입장 표명한다.

- 적극적 대응 과제:
  · 특정 제안에 대한 지지의 경우, 공동 발제자로서 참여하기 위한 추가 제안서를 작성한다.
  · 특정 제안에 대한 반대 또는 보류의 경우, 우리의 입장을 적극적으로 관철하기 위한 Counter Proposal을 작성한다.
  · 새로운 이슈를 주도적으로 창출할 경우, 기존 통제항목 개정의 필요성에 대한 공감대를 형성하기 위한 비공식 Working Paper를 작성·제출한다.
  · 제시된 Working Paper에 대한 진행결과를 바탕으로 공식 제안서를 작성·제출하고 이를 성공적으로 관철시키는 전략을 수립한다.

Summary

Ⅰ. Title

Ways and Means for an active participation in Wassennaar Arrangement

Ⅱ. Purposes

The main purpose of this study is to investigate and analyze major changes in the Wassenaar Arrangement and to draw a balanced prescription for the promoting of an active participation policy.

Ⅲ. Contents

○ Profiles of the Wassenaar Arrangement
- Major characteristics of its structures
- Major characteristics of its functions

○ Analyses of recent policy developments of WA
- Major policy changes
- Major policy issues

○ Policy-support mechanisms for active participation in WA
- Set-up of "WA Experts Forum"
- Operation of "WA Experts Forum"

○ Major results of participation in WA meetings
- Major backgrounds

- Major policy issues and results
- Major observations and policy recommendations

○ Major policy implications and policy responses

- Major policy implications
- Major policy responses

Ⅳ. Results

○ Chief among the major changes in WA are as follows: First, WA's recent export control policy on the transfer of sensitive dual-use technologies has increasingly been tightened in order to avoid possible circumvention resulting from massive liberalization of export control items in the wake of post-Cold War.

Second, as the indigenous technology capabilities of the non-industrialized advanced countries has dramatically increased in recent years, the scope of export control has begun expanded even to the R&D level.

○ To promote an active participation "WA Experts Forum" was set up in November 1999 under the auspices of The Ministry of Science and Technology. On the basis of its recommendations the final positions on the agenda of WA meetings were well established and articulated in the meetings in a meaningful way. After reviewing the results of WA meetings by the "WA Experts Forum, they were at once reflected in the domestic WA policy-making process.

With the well-balanced positions papers prepared in advance, Korean government made substantial contributions to the reviewing process of WA export control items. To take the year of 2000 for example, sixteen official positions on 65 national proposals for the WA Control

Lists were expressed and well received during the first Expert Group(EG) meeting in last April.

○ Chief among major policy issues are as follows:

- Strengthening information exchange process by introducing a new "Global View" Framework document(Technology Assessment);
- Tightening control on intangible transfer of technology and software;
- Tightening export control on emerging technologies.

○ Policy implications and responses

- Policy implications of WA's recent export control-tightening trends for a major policy shift in Korea's international S&T cooperation policy

- Policy measures of promoting a more active participation
  · Revitalization of "WA Experts Forum" for policy advices
  · Set-up of inter-departmental WA policy coordination mechanism
  · Development of concrete national proposals for revising WA policy guidelines and control lists

제 1 장 서 론

제 1 절 연구의 필요성

○ 국제정세의 변화, 신기술의 출현, 새로운 경제・무역활동이 급속히 확산됨에 따라 전략적 기술수출 통제체제가 강화되고 있다. 특히, 바세나르협정(WA)체제(조직 및 기능)의 전반적인 재정립을 통해 다자간 전략품목 및 기술・수출 통제를 강화하려는 추세가 두드러지게 나타나고 있다.

○ 특히 '99 바세나르 평가회의에서는 WA활동의 투명성 및 책임성을 강화하기 위해 정보교환에 관한 새로운 지침을 마련 중에 있다. 특히, 민군겸용기술에 대한 통제를 강화하기 위해 출연기술에 관한 정보교환을 독립의제화하는 새로운 기본틀(agenda framework)이 제시되어 심층논의가 진행중이다.

○ 최근 선진 열강 특히 미국, 영국, 일본 등은 다자간 전략기술 수출통제체제를 통해 출연기술에 대한 수출통제를 강화하기 위한 구체적인 지침서를 작성 중에 있다.

○ 이러한 강화 추세에 능동적으로 대응하기 위해서는 주무부서인 과학기술부가 수동적인 단순참여에서 벗어나 다자간 전략기술 수출통제체제의 새로운 정책지침 설정과정에 적극 참여하여 우리나라의 입장을 적극 반영함으로써 우리나라의 기술수출정책을 보호해야 할 필요성이 증대되고 있다.

제 2 절 연구의 목표

○ 다자간 전략기술 수출통제체제 활동에의 능동적인 대응을 위한 국내 전문가협의회의 구성을 통해 주요회의 의제에 대한 사전검토, 분석 및 회의결과의 효과적 확산을 위한 전략방안을 제시한다.

○ 주요 회의참여의 성과를 극대화하기 위해 과학기술부가 주도하는 관련부처간

정책조정체제의 구성을 통해 우리나라의 입장정립과 대응책수립 및 회의결과의 체계적인 정책반영을 촉진하는 전략방안을 제시한다.

제 3 절 추진전략 및 방법

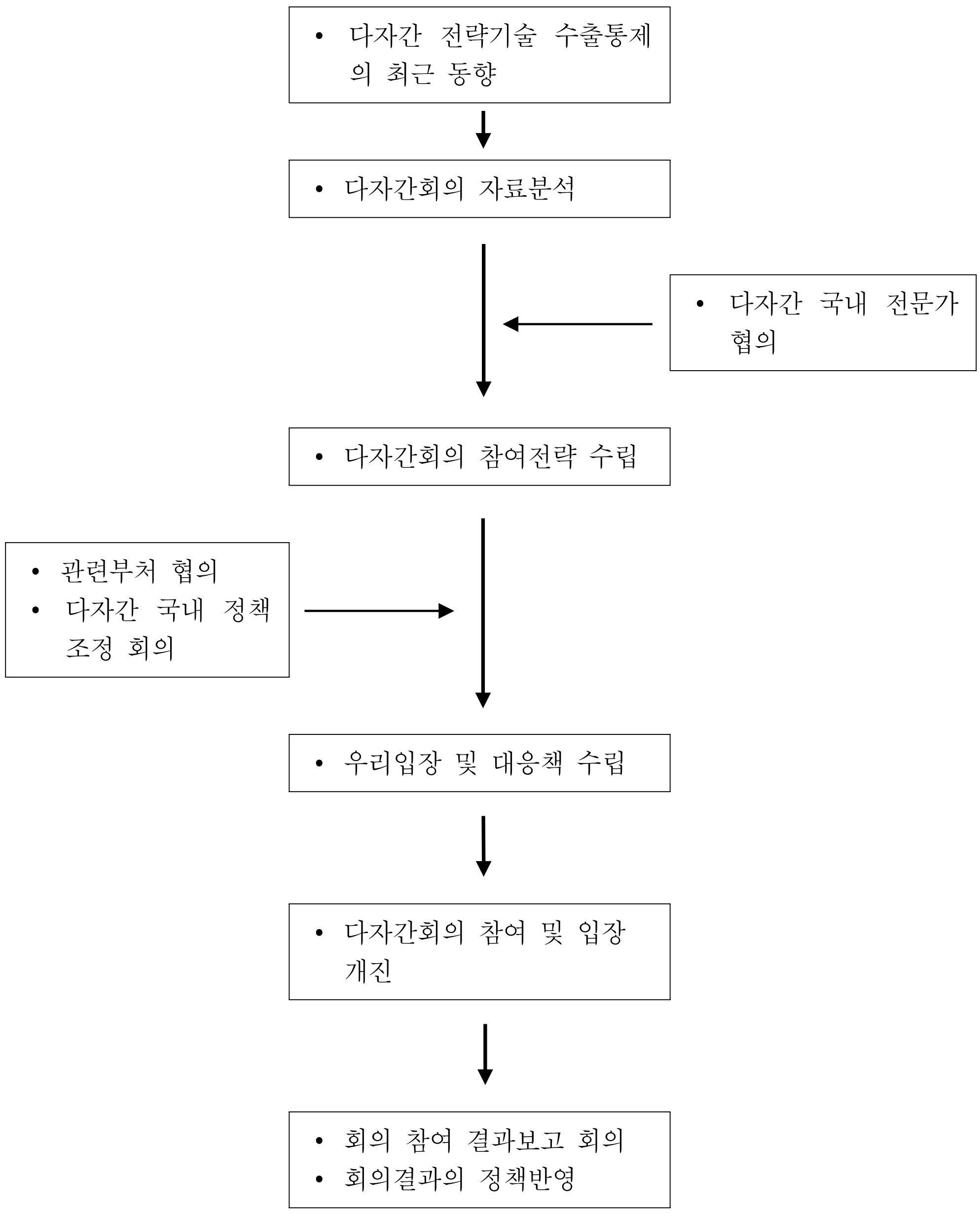
○ 정부가 중심이 되고 관련 연구소 및 학계전문가가 참여하는 소규모의 가칭 "국내 전문가협의회"의 구성을 통해 차기회의 의제를 검토, 조사, 분석하여 구체적인 참여계획을 수립한다.

○ 과기부가 주도하는 관계부처간의 국내 정책조정회의를 개최하여 최종적인 우리나라 입장 및 대응책을 수립한다.

○ 주무부처의 정책관련 실무자와 함께 주요 회의에의 적극적 참여를 통해 정책결정 과정에서 우리 입장을 적극 반영한다.

○ WA 회의결과의 체계적 정책반영을 위한 전문가 및 실무자회의를 개최한다.

<그림 1> 추진 체계


• 다자간 전략기술 수출통제의 최근 동향
• 다자간회의 자료분석
• 다자간 국내 전문가 협의
• 다자간회의 참여전략 수립
• 관련부처 협의
• 다자간 국내 정책 조정 회의
• 우리입장 및 대응책 수립
• 다자간회의 참여 및 입장 개진
• 회의 참여 결과보고 회의
• 회의결과의 정책반영

제 2 장 바세나르체제 및 운영 현황

제 1 절 바세나르협정의 성격

○ 재래무기, 민군겸용품목 및 기술 수출통제에 관한 바세나르협정 (Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies)체제는 기존의 대량살상무기 비확산 체제를 회원국들이 보강하여 지역 및 세계안전에 기여를 위한 공동 목표 하에 자발적으로 참여하는 비공식 협의체이다.

제 2 절 회원국 현황

○ 총 33 개국 (1999년 현재: 아르헨티나, 호주, 오스트리아, 벨기에, 불가리아, 캐나다, 체크, 덴마크, 핀란드, 불란서, 독일, 그리스, 헝가리, 아일랜드, 이태리, 일본, 한국, 룩셈부르크, 화란, 뉴질랜드, 노르웨이, 폴란드, 포르투갈, 루마니아, 러시아, 슬로바키아, 스페인, 스웨덴, 스위스, 터키, 우크라이나, 영국, 미국).

○ 17개 구COCOM 회원국, 6개 협력국, 러시아 및 동구권 국가들.

○ 우리나라는 1996년 4월 가입하여 창립 회원국이 되었다.

제 3 절 설립 경위

○ 94. 3월 신체제 설립을 목표로 COCOM이 발전적으로 해체. 구 COCOM회원국 및 협력국(총 23개국)이 참여하는 고위급회의 및 3개 실무회의 (통제절차 및 기준, 통제목록, 행정)를 구성, 설립 준비 진행

○ 95. 9월 고위급 회의시 러시아, 헝가리, 폴란드, 체코, 슬로바키아 등 5개국 추가 참여

○ 96. 4. 2～3 신체제 발족을 위한 제 1차 총회 개최

- 기본 설립 문서 (Initial Elements)채택에 실패함으로써 가동 시기, 사무국 설치 등에 관한 합의에 실패
- 한국, 아르헨티나, 루마니아 창설회원국 자격으로 가입(31개국)

○ 96. 7. 10～12 제 2차 총회 속개회의 개최

- 기본 설립 문서, 사무국 설치, 가동시기 등에 합의함으로써 신체제가 공식출범
- 우크라이나, 불가리아 신규회원국 가입 (33개국)

○ 96. 11. 1 Wassenaar Arrangement가 가동되기 시작함으로써 정보교환 시작

제 4 절 설립 배경 및 목적

I. 설립 배경

○ 탈냉전 이후 전개되는 경제의 세계화 과정에 수반되는 생산과정의 분권화 양상에 따라 심화되는 대량살상무기(WMD) 확산에 대한 통제가 필요하게 되었다.

○ 군사기술과 민수기술간의 구분이 모호해지는 첨단기술의 개발과정이 확산됨에 따라 과학기술 보호 및 상업적 이익 추구의 차원에서 민군겸용기술에 대한 다자간 통제의 필요성이 대두되었다.

II. 설립 목적

○ 전력물자 및 기술 수출통제를 통한 국제평화 증진

- 재래무기 및 민군겸용품목 및 기술이전의 투명성 및 책임성 강화
- 군사력 증강 목적의 이전을 억제하기 위한 회원국간의 협력 강화
- 분쟁지역에의 무기 및 기술이전 통제를 통한 비확산 강화
- 회원국의 국내 입법 추진을 통한 협정 이행의 촉진

○ 미국 제안으로 북한, 이란, 이라크, 리비아를 “문제국가(rogue states)”로 지정 전략물자 수출통제를 강화키로 합의하였다.

제 5 절 기구 운영방식 및 구성

I. 운영 방식

○ 소규모의 사무국을 두고 최소한 연 1회 개최되는 총회(Plenary), 일반실무그룹회의(GWG), 전문가그룹회의(EG)를 중심으로 운영

○ WA체제 및 운영에 대한 전반적인 평가회의를 매 3년마다 정기적으로 개최

II. 구성

○ 총회 (Plenary)

- 의장: Amb. Alojz Nemethy(Slovakia Republic)
- 기능: 의사 결정
  - ·GWG 및 EG에 mandate 부여
  - ·GWG 및 EG 논의결과 채택 및 결정
  - ·WA의 기본방향 설정
  - · 예산 및 행정사항 결정
- 회의: 연 1회

○ 일반실무그룹회의 (General working Group)

- 의장: Mr. George Papadopoulos (Greece)
- 기능:
  - · 일반 및 특수 정보 교환을 통해 민군겸용품목, 기술 및 재래식무기 투명성 제고 방안 마련
  - · 예산 및 행정사항 논의
- 회의: 연 2회

○ 전문가그룹회의 (Expert Group)

- 의장: Mr. Roger Cucchietti (France)
- 기능:
  · 통제품목리스트 개정 검토
  · 수출통제 범위 및 방식 검토
- 회의: 년 2회

III. 의사결정방식

○ 합의제 방식

IV. 사무국

○ 사무국장: Mr. Luigi Lauriola (Italy)

○ 회원국의 합의에 따라 소규모의 사무국 운영

제 6 절 수출·통제 내용 및 방식(별첨 1 참조)

○ 전략물자·기술에 대한 수출·이전 통제

- 비회원국에 대한 재래식 무기 및 민군겸용물자·기술의 수출·이전을 통제
- 회원국들 각자가 독자적으로 수출·이전에 대한 통제를 수행(회원국에게 재량권 부여)
- 정치적 합의의 결과로 인해 기본적으로 체제운영이 회원국들의 자발적 이행에 의존(강제력의 부재에 따른 구속력 미흡)

<표 1> 바세나르체제와 COCOM의 비교

	바세나르체제	COCOM
설립 목적	재래무기 및 전략물자・기술 수출통제를 통한 확산방지	구공산권으로의 전략물자의 유출방지(동서의 상대적 기술격차 유지)
회 원 국	33국(러시아, 구동구권 포함)	17국(일본 및 서방 선진국)
규제 범위	세계 전지역(국제안보변화에 신축적 대응 확보의 차원)	구공산권 국가(우회수출 가능 지역)
심사 방법	규제대상품목의 사양심사(최종수요자, 최종용도 심사)	규제대상품목의 사양(스펙) 심사
수출 허가	참가국이 재량에 따라 결정	원칙적인 만장일치제
규제 방법	사전협의・통보 폐지, 회원국간 Veto권 폐지	사전협의 통보의무, 회원국간 Veto권 행사

○ 수출・이전에 대한 정보교환(통제기능 약화의 보완 조치 = 주요 통제 수단: 표 2 참조)

- 전략물자・기술(BL, SL, VSL) 수출・이전에 대한 허가 및 거부사항을 모든 회원국에게 연 2회 그리고 undercutting에 대해서는 30-60일 내에 의무적으로 통보(표 3 참조)

- 재래식 무기에 대한 수출 실적을 모든 회원국에게 연 2회 자발적으로 통보

○ 전략 및 방산물자・기술 통제 리스트의 검토 및 통제방식 개선

- 매년 방산 및 전략물자・기술에 대한 수출・이전의 통제범위를 검토

- 전략 및 방산물자・기술 수출・이전에 대한 새로운 방식의 채택

제 3 장 바세나르체제의 최근 동향 및 주요 정책 이슈

제 1 절 WA의 최근 정책 변화

○ 탈냉전 이후 경제안보의 중요성이 신국제질서 확립의 주요 변수로 부각되는 가운데 전략품목·기술의 수출·이전통제 완화(특히, 전자 및 통신분야)에 대한 요구가 거세짐에 따라 주요 회원국들은 바세나르체제의 통제리스트 검토과정을 주도함으로써 자국의 이익을 극대화하려는 추세가 확산되고 있다.

○ 한편 바세나르에서는 이러한 수출·이전통제의 완화에 따른 위험요소를 조기에 제거하기 위해 수출·이전실적에 대한 정보교환의 기본틀(agenda framework)을 새로이 구축 중에 있음(부록 1 참조). 이러한 기본틀 작정과정에서 '출현기술'에 관한 이슈를 독립 의제화 함으로써 전략기술이전의 전반에 대한 통제를 강화하려는 움직임이 나타나고 있다.

○ 재래무기 및 첨단기술의 신흥공급국들의 자체 생산능력이 증대됨에 따라 무기 및 기술에 대한 수출, 이전, 생산 및 배치 단계의 통제에서 연구개발(R&D) 단계의 통제로 전환되는 추세이다.

제 2 절 주요 정책 현안

I. Global View Framework 및 Technology Assessment

○ 제안 배경

- 1999년 총회에서 GWG는 수출통제실적에 대한 정보교환의 활성화를 통해 바세나르체제의 통제기능을 강화하기 위한 일환으로 Global View Framework 구축에 대한 mandate를 부여받음

○ 주요 내용

- 프랑스는 민군겸용기술이전을 통한 자체기술개발능력의 제고를 방지하기 위해 Global View Framework 구축과정에 regional 및 global 차원의 Technology Assessment를 포함할 것을 정식으로 제안

- 프랑스는 지난 5월 GWG회의에서 기본입장을 재확인하고 차기회의에서 Technology Assessment 원칙에 대한 합의를 유도하고 이를 바탕으로 구체적인 통제 범위 및 수단에 대한 최종 합의를 도출한다는 계획을 제시함

- 이러한 프랑스의 발제에 대해 주요국들(특히, 미국, 영국, 독일 등)은 적극적인 협조의 입장을 표명함

II. 신기술(emerging technologies)에 대한 통제

○ 제안 요지

- 군사 전용이 가능한 신기술 통제에 대한 공통 인식의 도모 및 방안 모색

○ 주요 내용

- 영국: 확산가능국의 자체개발능력을 제고시킬 수 있는 신기술에 대한 통제 범위 설정

  · Stealth 기능의 Organic matrix composites

  · 복합적인 모델링과 분석이 가능한 소프트웨어 패키지 기술

- 프랑스, 독일, 미국 등: 무인 비행체(UAVs)에 대한 통제

- 캐나다: 생명공학의 지식 및 생산능력에 대한 통제

III. 소프트웨어 및 기술의 무형 이전에 대한 통제

○ 제안 요지

- 바세나르 통제리스트의 모든 소프트웨어 및 기술의 무형 이전수단에 대한 통제

○ 주요 내용

- 무형이전수단(서류, 전화, e-mail, Internet, 과학기술인력 교류 등)에 대한 회원국의 국내 통제정책 조사분석
- 여타 통제체제(NSG, AG, MTCR)와의 공조
- 통제 시행(enforcement) 방안 도출
- 법적, 정치적 및 기술적 문제점에 대한 합의점 도출

IV. 공공영역(public domain)의 암호화 소프트웨어에 대한 통제

○ 제안 요지

- 공공영역(public domain)에서의 비제한적인 암호화 소프트웨어에 대한 통제

○ 주요 내용

- 미국은 암호화기술의 군사전용을 방지키 위해 현재의 바세나르 규정을 변경하여 공공영역에서의 암호화 소프트웨어를 통제하고자 함
- 이를 위해 미국은 공공영역의 암호화 소프트웨어를 현재의 GTN part 2에서 삭제하고 Cryptography Note로 통제할 것을 제안함

V. Clustering technology 컴퓨터 통제

○ 제안 요지

- 고성능컴퓨터(HPC)를 대치할 수 있는 Clustering technology컴퓨터에 대한 통제

○ 주요 내용

- 각 회원국의 clustering technology에 대한 통제 정책 및 입장의 규명
- Clustering technology 통제를 위한 추가 parameter에 대한필요성 및 방법 논의

VI. 항법장치를 위한 accelerometers에 대한 통제 강화

- 제안 요지
  - · 항법장치(inertial navigation 및 guidance system)를 위해 고안된 angular 또는 rotational accelerometers에 대한 수출통제 강화
- 주요 내용
  - · linear accelerometers는 통제되고 있으나 군사목적의 angular 또는 rotational accelerometers는 통제되고 있지 않음
  - · 우주항공 및 군사전용을 위한 MEMS 기술 개발에 관계된 기업들 중의 하나로 Samsung Electro Mechanics Co. 가 거명됨.

VII. 무인 비행체(UAVs)에 대한 통제 강화

- 제안 요지
  - · 20Kg 이상 및 특수부품을 사용하는 무인 비행체(UAVs)에 대한 수출 통제 강화
- 주요 내용
  - · UAVs 통제에 대한 심층적 검토의 필요성이 제기됨에 따라 TWG개최에 대한 의제 논의
  - · 독일은 대우가 한국정부의 ARCH(Agricultural Remote Control Helicopter) 프로그램의 일환으로 러시아의 KAMOV ka-37을 바탕으로 자체 개발중인 UAV를 통제해야한다는 입장

제 4 장 바세나르 참여성과의 극대화를 위한 기반 구축

제 1 절 국내 정책 협조 체제 구축

I. 국내 정책협조 체제 구축의 목적

○ 회의결과를 국내 전략기술 수출통제정책에 적극 반영

○ 관련전문가 활용의 체계화를 통한 차기회의 참여준비의 내실화

II. 추진 방안

○ 과기부 기술협력총괄과가 국내 정책협조 체제의 구축을 위한 실무반을 구성・운영하고 STEPI가 지원

○ 과기부 관련실무자가 중심이 되고 각계 전문가들이 참여하는 "국내 WA 전문가협의회"의 구성・운영

III. 주요 추진 사항

1. 주요 회의결과의 심층적 분석

○ 국내 전문가협의회 구성 및 개최

○ 관련전문가로부터 핵심 이슈에 관한 기술적 자문

○ 회원국 동향 및 전문가의 기술적 분석자료의 취합

2. 차기 회의에 대한 대응전략 및 입장 수립

○ 차기 회의 의제분석 및 협의자료 작성

○ 관련부처 협의를 통한 대응전략 및 입장 수립

○ 차기 회의 관련자료 작성 및 최종 참가준비 점검

IV. 추진 일정

○ 1999년 10월 28일: 주요 이슈에 대한 심층적 분석을 위한 관련전문가 선정 및 전문가회의 개최에 관한 협의

○ 1999년 11월 3일: 주요 이슈에 대한 효율적 분석방법의 도출을 위한 전문가회의 개최

○ 1999년 11월 15일: 전문가 분석결과 보고 및 종합 검토를 위한 전문가회의 개최

○ 1999년 11월 20일: 차기회의 의제 분석 및 회원국 동향을 파악하여 관련부처와의 협의자료 작성

○ 1999년 11월 21일: 관련부처 협의를 통한 대응전략 및 최종 입장 수립

○ 1999년 11월 24일: 회의참가 관련자료 작성 및 참가 준비 최종 점검

제 2 절 바세나르체제 전문가협의회 구성

○ 구 성(별첨 2 참조)

- 총괄조정위원회 및 9개 캐티고리 전담반으로 구성

1) 신소재 캐티고리 전담반
2) 소재가공 캐티고리 전담반
3) 전자 캐티고리 전담반
4) 컴퓨터 캐티고리 전담반
5) 통신장비 캐티고리 전담반
6) 센서 및 레이저 캐티고리 전담반
7) 항법장치 캐티고리 전담반

8) 해양기술 캐티고리 전담반

9) 추진장치 캐티고리 전담반

- 40대 전후의 경험이 출중한 2-3명의 각 분야별 전문가를 중심으로 구성(14명)
- 협의회 위원장: 과기부 기술협력총괄과 과장
- 협의회 간사: 과학기술정책연구원(STEPI) 바세나르체제 정책전문가

○ 주요 기능:

- 바세나르체제 회의 의제에 대한 사전 검토 및 우리의 입장의 수립
- 바세나르체제 통제 리스트 개정에 대한 공식 프로포즐 준비를 위한 분과별 협의 및 분석연구 수행
- 국내 "전략기술수출공고"의 연례 개정에 대한 정책자문
- 기타 바세나르체제 정책 전반에 관한 사항에 자문

제 3 절 제1차 바세나르체제 전문가협의회 개최

○ 제1차 "바세나르체제 전문가 협의회"를 아래와 같이 개최함

- 일시: '99. 11. 19 (금) 11: 00 - 13: 00
- 장소: 과기부 대회의실 (정부과청청사2동 626호실)
- 회의내용:
  - · 협의회 운영에 관한 사항 (과기부 관계자)
  - · 바세나르체제 최근 동향 및 개요설명 (최영식)
  - · EG 임시회의 주요 안건에 대한 기술적 검토 및 대응전략 등

제 5 장 주요 WA회의 참여 현황 및 결과

제 1 절 1999년 제1차 전문가그룹(EG) 정기회의(별첨 3 참조)

○ 회의 장소: 바세나르협정체제(WA) 사무국 (Vienna)

○ 회의 기간: 1999년 4월 19 ~ 28일

I. 배경 및 목적

○ 재래무기, 민군겸용품목 및 기술 수출통제리스트 및 개정 프로포즐에 대한 검토 및 논의

○ 1998년 12월 총회(Plenary)에서 전문가그룹이 부여받은 mandate에 대한 토의

- Cat. 3, 4 and 5 Part-1의 전략적 연계성(Strategic relevance)에 대한 검토
- Cat. 3과 5 Part-1의 일관성 제고를 위한 ITU 할당 대역 해제사항에 대해 검토

II. 주요 내용 및 결과

○ 수출통제리스트 개정 프로포즐에 대한 종합 심의

- Cat. 1~9(Cat. 7 제외) 리스트 개정 프로포즐에 대한 토의가 활발히 진행됐으나 대부분이 추가 연구를 위해 보류됨
- 주요 프로포즐 토의 및 결과

· Cat. 3 (Electronics): 네덜란드의 마이크로프로세서 (3.A.1.a.3) 규정변경 제안서

요 지: 현행 260MTOPS 성능기준을 2,000MTOPS로 상향조정

결 과: 추가 study를 위해 보류(미국, 일본, 독일, 영국, 러시아 등)

· Cat. 4 (Computers): 네덜란드의 디지털컴퓨터(4.A.3.b) 규정변경 제안

요　지: 현행 Computer 통제기준(CTP)을 2,000MTOPS에서 10,000으로 상향조정

각국 입장:

US: fav. Res on 4,000 MTOPS

UK: full Res on 10,000 MTOPS

DE: No position

JP: 4,000 MTOPS

결　과: 추가 study를 위해 보류

○ Cat. 3, 4 & 5 Part-1에 관한 연구

- 일본의 microprocessor 및 컴퓨터에 관한 연구결과

• 이미 전세계에 걸친 확산의 결과로 2,000 MTOPS의 microprocessor에 대한 통제가 불가능한 상황

• microprocessor의 발전 추세로 볼 때 1999-2000년에는 컴퓨터의 성능이 4,000 MTOPS를 능가할 것으로 추정

* • U.S 입장: 2nd-hand 품목까지 통제해야 한다는 입장. 미국은 licensing 제도를 통해 통제가 가능하다고 주장함.

• EU입장: 통제 불가론

• 결　과: 9월로 예정된 회의에서 논의 속계

- 프랑스의 고성능 컴퓨터에 대한 연구결과

• Clustering technology를 통해 10,000 MTOPS 이상의 고성능 컴퓨터 개발이 가능함

• 따라서 CTP 수준의 조정을 통한 통제 방식보다는 “latency time”의한 통제방식을 추가적으로 도입해야 함.

• 결　과: 9월 회의에서 추가 논의

III. 종합 관찰 및 건의 사항

1. 종합적 관찰

○ 군사 통제품목 및 기술리스트의 해제 추세에 따라 본격적으로 통제리스트에 대한 개정 검토과정에 적극 참여하여 국익(특히, 북한으로의 핵심기술 유입 방지 및 우리나라 기술수출에 대한 악영향의 최소화 등)을 보호해야 하는 중요성이 증대되는 시점

○ 군사안보 측면을 강조하여 통제를 강화하려는 미국의 입장과 자국의 경제적 이익을 보호하기 위해 통제완화를 주장하는 일본 및 EU 입장간의 첨예한 대립으로 인해 바세나르 협정체제는 다소 어려운 국면에 처해 있는 상황

○ 따라서 각각의 프로포즐에 대해 대부분의 대표단은 총역량 (충분한 사전 연구 등)을 동원하여 격렬한 토론을 벌이는 자세 및 분위기

○ 새로운 이슈가 돌출했을 경우, 주요회원국 대표단은 통신수단을 활용하여 국내 전문가팀과 신속히 협의하여 다음 심의과정에서 자국의 입장을 적시 적소에 대변하는 국내외 협조체제를 구성・운영

○ 주요 회원국들은 관계부처의 서로 다른 입장을 주무부처가 통합조정하여 일관된 입장을 효과적으로 표명하는 추진체제를 운영

○ 미국, 일본과 같은 대국을 제외한 중소회원국들은 우선 순위가 높은 분야에 대한 통제리스트에 한정하여 토론을 집중함.

2. 정책적 건의사항

1) 단순 참여 방안

○ 국내에 WA추진체제가 구성되지 않은 현재의 상태에서는 당분간 지금과 같은 단순 참여형태를 통해 본 회의에 대한 참여경험의 축적 및 회의결과물에 대한 수집분석능력을 강화하여 국내 WA추진체제의 수립에 필요한 정책적 수요를 파악하는 데 주력함.

○ WA운영의 특수성(미국의 전횡적인 행위)을 감안해 볼 때, 기술적 이슈에

한정하는 전문가회의(EG) 보다는 WA정책 차원의 정보교환 및 '99년 WA 평가회의(전반적인 조직 및 기능의 검토) 준비를 위해 개최되는 GWG회의에의 지속적인 참여가 기여의 폭을 기대할 수 있을 것임.

2) 적극적 참여 방안

○ WA 회의결과를 신속하게 정부정책에 반영하기 위해서는 WA 활동방향을 지속적으로 follow-up하고, 회의결과 및 주요 관련정보를 수집·분석할 수 있는 종합적이고 체계적인 추진체제를 수립해야 함. 이를 위해서는

○ 첫째, 정부가 주체가 되고 출연연구소 및 기업전문가가 참여하는 국내 전문가 지원체제(가칭 "WA 전문가 협의회")의 구성을 통해 국익보호 차원에서의 우선 순위가 높은 통제품목 및 기술분야를 선별하는 작업에 착수해야 함.

○ 둘째, 이러한 기초작업을 통해 주무부처는 관련부처와 협의하여 WA 정책 조정팀을 구성・운영해야 함.

○ 셋째, WA는 비확산체제와는 달리 최첨단 수출품목 및 기술에 대한 통제여부를 결정하는 심의기구임에 따라, 최신 정보와 동향을 수집하여 정부정책에 반영할 수 있는 다자간 체제임. 따라서 국내전문가가 지속적으로 참여하여 일관성 있게 follow-up 할 수 있는 지원책의 수립이 뒤따라야 할 것임.

제 2 절 1999년 제1차 실무그룹(GWG) 정기회의 및 제2차 평가회의

○ 회의 장소: 바세나르 협정(WA) Vienna 사무국

○ 회의 기간: 1999년 5월 25 - 28일

Ⅰ. 회의 배경 및 목적

○ 재래무기, 민군겸용품목·기술 수출통제에 관한 일반 및 특수 정보 교환 및 논의를 위한 1999년도 제1차 정기 General Working Group 회의

○ 본 회의와 병행하여 1998년 12월 총회(Plenary)에서 합의된 WA 기능에 대

한 제2차 평가회의

○ 제1차 평가회의는 이미 1999년 2월 15일에 WA 평가에 관한 기본틀 및 의제설정에 대해 회원국의 의견수렴을 위해 개최됨

Ⅱ. 회의 주요 내용 및 결과

1. GWG 회의 (25 - 26일)

1) 일반 정보교환의 개선을 위한 새로운 지침 채택

○ 캐나다가 일반 정보교환의 활성화를 위해 제안한 제안서["Proposals for Strengthening the Function of the General Information Exchange:" WA-GWG(98-5) CA2 Rev.]가 향후 정보교환의 새로운 지침서로 채택됨

- 본 지침서에는 보다 심도 있는 논의를 통해 정보교환의 실질적 효과(practical effects) 진작을 위해 관련실무·전문가 (policy makers, licensing officers, law enforcement officers, and intelligence and defense officers)의 균형 있는 참여를 장려하는 새로운 기본 원칙이 포함됨
- 또한, 새롭게 제시된 정보교환 의제의 기본틀(agenda structure)에서 기술에 관한 이슈를 독립 의제화하고 나아가 주제별로 세분화함. [WA PLM (98) CHAIR 38 Rev. 및 WA GWG (98-5) CA 2 Rev. 참조)

2) 일반 정보 교환

① 정보 및 기밀 교환

○ 지역 안보

- 아프리카(특히, ECOWAS) 지역의 안보 상황에 관한 정보교환
  - 영국, 미국, 독일 등의 입장: 동 지역의 불안정한 안보의 원인이 불법적인 무기 유입(러시아를 간접적으로 겨냥) 이라는 주장
  - 프랑스, 러시아 등의 입장: 동 지역의 불안정한 안보의 원인 무기축적

보다는 정치적인 갈등에서 찾아야 한다는 주장. 그러나 러시아는 전향적 방향으로 노력하겠다는 입장을 표명

- 일본 등의 입장: 지난 총회에서 합의된 "동 지역으로의 무기수출에 대한 회원국들의 '최대한 자제'(maximum restraint)"를 재천명함
- 의장: 동 지역으로의 무기수출에 대한 '최대한 자제'에 대한 합의를 도출함

○ 재래무기 및 민군겸용 기술프로그램 동향

- 동남아 지역의 회원국 안보를 위협하는 무기 축적 조짐
  - 영국, 호주[WA GWG(99)GB2, AU1]: 특히, 차세대 공ㆍ해상 무기의 유입 추세에 대한 우려 표명
  - 프랑스: 'reverse engineering'기술 축적에 대한 우려 표명
  - 미국: 중국이 동 지역의 최대 무기수출국임을 강조
  - 일본: No comment!
  - 의장: 동 지역 안보를 위협할 정도의 무기축적 상황은 아님. 그러나 지속적인 감시(vigilance)가 요구됨

  * 한국 대표단: 동 지역의 안보문제가 처음 GWG회의 의제로 다루어지게 된 사태의 심각성에 주목. 그러나 역내 안보협의체제(ARF)를 감안할 때, 타 지역에서의 무기축적에 따른 지역 안보이슈와는 구별되어야 한다는 입장. 차기 회의에 동 이슈에 관한 한국의 기여 의사를 표명

○ 재래무기 및 민군겸용 기술획득 네트워크 및 최종 사용자

- 화란: 불법 무기·기술이전 및 최종 사용자(end-users) 허가증 위조사례에 관한 정보교환 과정에서 화란은 한국기업의 불법 무기거래 활동에 대해 보고함

  * 한국 대표단: 화란의 보고에 대한 보다 자세한 정보를 요청. 아울러 동 사건에 관한 조치가 필요할 경우 양자간 외교채널을 통해 해결할 의사를 표명

○ 주요 기술관련 이슈 (Technology Issues)

- 민군겸용기술

- 영국은 차기 GWG회의에서 출현기술 (emerging technologies)에 관한 통제 범위 설정에 대한 논의를 제안함.[WA GWG(98-5) GB 5]
- 제안 기술 목록:
  — Signal Processing - software and new hardware
  — Communications - compression techniques / high bandwidths
  — Materials - new composites - organic and ceramic compounds "Civil" and military applications
  — New variants of propellants
  — High energy chemicals
  — Micro electronics - hybrids and other new microchips
  — Micro-Electro-Mechanical Systems
  — Fabricating systems - laser modeling production
  — Non-lethal weapons (distinguishing between those with temporary and permanent effects)
  — Laser blinding weapons
  — New underwater breathing equipment
  — New structures and new materials for nuclear devices

- 출현 기술(emerging technologies)

- 기술 드라이버(technology drivers)의 항시적 변환에 따라 최근에는 민간기업에 의해 개발된 새로운 출현기술이 군사기술 spin-off의 원천이 됨. 나아가 이러한 민간 출현기술의 군사기술개발에의 응용기회에 대한 평가가 이루어지기 전에 곧 바로 public domain에 흘러드는 상황임
- 영국은 이러한 출현기술(특히, Organic Matrix Composites, complex modelling and analytical software packages covering computational Fluid Dynamics and Structural Analysis)의 효과적 통제를 위한 동 기술에 대한 새로운 인식, 통일된 접근방법 및 지속적 감시의 필요성을 강조
- 영국은 급격히 변화하는 신기술의 효과적 대처방안의 일환으로 "quick response 통제" 개념에 관해 논의할 것을 구체적으로 제안함

- 무기 제조 및 기술 개발 추세
  - 미국은 중국, 수단 등의 자체 기술개발 능력 향상에 관한 정보교환에 많은 관심을 표명하고 회원국들의 협조를 요청함

② 주요 이슈에 관한 정보교환

○ 다음 여섯 이슈(ECOWAS 잠정협정, 소형무기, MANPADS, Quick response mechanism, 최종 사용자 중심의 통제, 잉여 군사장비의 처리)에 관한 정보교환 및 논의가 이루어짐

- 이 중에 ECOWAS 소형무기금지 잠정협정과 잉여 군사장비 처리이슈에 관해서는 합의가 도출됨

- 또한, 소형무기와 출현기술의 통제에 관한 "quick response mechanism" 방안은 중요한 논의 대상으로 부각됨

- 특히, 독일은 군사 목적에 활용될 수 있는 새로운 민간기술을 효과적으로 통제하기 위해서는 기존의 군사기술을 통제하던 "기술 파라미터(technology parameter) 조정" 방법에서 벗어나 "최종 사용자 중심의 통제(end-use oriented controls)" 방안을 도입해야한다고 주장함

3) 특수 정보 교환

○ 특수 정보 교환과정에서는 첫째, 재래무기 및 민군겸용 기술이전 통보의 현황 둘째, 기술이전에 관한 거부통보 셋째, 재래무기거래에 관한 자발적 통보에 대한 정보 교환이 있었음

○ 그러나 민군겸용 기술이전 통보 및 특단의 감시(extreme vigilance), 재래무기 투명성 제고에 관한 논의는 특수 정보교환 기능에 대한 평가회의에서 다루기로 합의함.

4) 민군겸용품목 및 기술이전에 관한 거부통보

○ 민군겸용기술(cryptography) 거부통보 이슈 [WA EG(99) CHAIR 7]에 대한 논의
- 프랑스, 캐나다 등: 1998년 12월을 기준으로 동 item의 통제수위가 SL

에서 BL로 변경된 이상 개별거부통보(individual denial notification)의 의무가 없다는 입장

- 미국 등: 3년의 validity기간이 있으므로 통보해야한다는 입장
- 독일: 동 item을 “decontrol”로 오해한 상태에서 “더 이상의 거론이 불필요하다”는 독일 대표단의 주장으로 인해 본 이슈에 대한 논의가 혼돈 속에 마감됨

5) 재래 무기거래에 관한 자발적 통보

○ [WA GWG(98-5) SEC 10 Rev.4와 5]의 비교에서 볼 수 있듯이 많은 회원국들은 자발적 통보에 대한 추가적으로 입장을 표명함

6) 신규 가입 및 홍보 활동

○ 영국: 무기 및 기술이전 중개국가들의 국내 수출통제제도에 관한 검토과정에서 중국의 WA 가입에 대한 지원 요청을 접수함

○ 러시아: COMECON 회원국, 이란, 중국 등에게 WA활동에 관한 홍보활동에 대한 정보 교환

○ 의장: WA체제에 관해 타 국제기구 및 비회원국 등에 보다 적극적인 홍보활동을 요청

2. 평가 회의 (27 - 28일)

1) 일반 검토 및 평가

○ 미국, 독일, 이태리, 영국 등: WA의 근본 목적을 달성하기 위해서는 WA 기능을 재검토(restructuring) 차원에서 평가해야 한다는 입장

○ 러시아, 프랑스 등: WA 기능에 대한 평가가 이 시점에 필요하다면, 수정보완(fine-tuning) 차원의 평가에 그쳐야 한다는 입장

○ 일본, 뉴질랜드 등: WA 평가의 필요성 여부보다는 어떻게 평가를 해야 할 것인가에 대한 논의에 초점을 맞추어야 한다는 입장

* 한국 대표단: WA 평가의 필요성여부에 관한 비건설적인 논의보다는 평가방법에 관해 이미 제시된 여러 제안에 관한 논의가 바람직하다는 입장을 표명

○ 네델란드는 정보교환의 최대 결함이 민군겸용 기술이전에 관한 거부통보 의무와 재래무기거래에 관한 자발적 통보방식간의 불균형(imbalance)에 있음을 지적함

○ 미국은 WA체제의 새로운 도전을 테러리즘으로 규정하고 이에 관한 대응을 WA체제의 새로운 과제로 다루어야 한다는 입장

○ 일본은 이러한 주장에 대해 WA기능의 범위를 확대하기보다는 Initial Elements테두리 내에서 테러리즘에 대한 통제방안을 모색하자고 제안함

2) 지침, 절차 및 집행에 관한 검토

① 정보 교환

○ 스위스가 제시한 제안서[WA GWG(99)CH1]를 중심으로 정보교환의 범위, 시의성, 내용, 효율성에 관해 논의함. 특히, 스위스는 1998년부터 자발적 통보가 다소 증가하고 있으나 무기거래에 대한 투명성을 보다 근본적으로 제고해야한다는 입장을 강력하게 표명함

- 호주는 민간기술이 군사기술의 개발을 주도하는 기술 드라이브 변환시기에 무기거래에 대한 투명성을 제고하기 위해서는 정보교환의 활성화가 우선되어야한다는 입장을 표명

- 영국, 프랑스 등은 정보교환을 개선하기 위해서 거부통보 의무와 자발적 통보방식간의 불균형을 해소해야한다고 주장함

- 또한 스위스, 독일 등은 무기이전에 대한 투명성 제고를 위해서 '최종 사용자 중심의 통제(end-users oriented controls)'를 제안함

- 이러한 제안에 대해 캐나다, 러시아 등은 상업비밀의 보호 차원에서 신중을 기해야 한다는 이유로 보류입장을 표명

* 한국 대표단: 스위스의 무기거래 투명성 제고에 대한 제안에 동의하면서

현재 무기거래 통보 범위(7개 카테고리)를 확대해야한다는 적극적 입장을 표명

○ 영국의 제안서[WA GWG(99)GB3]를 중심으로 무기이전 투명성 제고를 위한 정보교환의 개선에 관해 논의함

- 대부분의 주요 회원국들은 영국의 기여에 대한 감사의 표시와 동시에 적극적인 지지의 입장을 표명함.

- 특히, 프랑스는 무기이전 통보에 대한 종전의 소극적 입장에서 후퇴하여, 일본과 한국의 입장과 같이, 무기이전 통보범위의 확대에 관해 탄력적인 입장을 표명함

- 그러나 소형 무기의 최대 생산수출국인 러시아는 소형 무기를 무기통제 대상에 포함하는 것은 WA 정보교환의 범위를 벗어난다는 이유를 들어 거부의사를 분명히 함

- 이러한 입장에 대해 영국은 무기통제 투명성의 획기적인 제고를 위해서는 WA가 처음 결성되는 과정에 경험했던 '정치적 대타협'의 재차 필요성에 대한 개연성을 언급함

* 한국 대표단: 프랑스의 무기이전 투명성 제고에 관한 탄력적 입장을 환영함 과 동시에 동남아시아 지역의 무기축적 프로그램에 관한 보다 자세한 정보를 요청함

② 민군겸용기술 및 무기수출에 관한 통제

○ 일본의 제안서[WA GWG(99) JP2]를 중심으로 민군겸용기술 및 무기수출 통제의 근본 목적에 관한 성취도에 대해 논의함

- 일본은 민군겸용기술 및 무기수출통제의 목적을 근본적으로 재검토하기보다는 수정·보완하는 방안에 대한 입장을 표명함

- 대부분의 주요 회원국들도 일본 제안서에 적극적인 지지를 표명함.

Ⅲ. 종합 관찰 및 건의 사항

1. 종합적 관찰

1) GWG 회의

○ 금번 GWG회의에서 투명성 및 회원국의 책임감 진작 기능의 하나인 정보교환을 촉진하기 위한 새로운 지침(guidelines)이 채택됨. 따라서 국내 수출통제에 관한 회원국간의 협력강화에 대한 논의가 향후 GWG회의의 초점이 될 것으로 예상됨

○ 또한, 본 지침서는 보다 심층적 논의를 통해 정보교환 기능의 실용적 효과(practical effects)를 증대하기 위해 회원국의 균형 있는 참여를 장려하는 기본원칙을 제시함.

○ 특히, 주요 회원국들(영국, 프랑스, 독일 등)의 출현기술에 관한 실질적인 정보교환 및 심도 있는 논의의 필요성에 대한 요청을 적극 반영하여 기술에 관한 이슈를 독립 의제화함.

○ 영국은 새로운 민군겸용 출현기술 (emerging technologies)에 관한 효과적 통제를 위한 통일된 접근방법 모색의 일환으로 차기 GWG회의에서 12개의 민군겸용 출현기술에 관한 통제 범위설정 및 방법에 대한 논의를 제안함.

○ 한편, GWG회의 의제로는 처음으로 동남아 지역의 무기 축적 사태가 채택되어 회원국간의 많은 정보가 교환됨. 아시아 지역을 일본이외에 유일하게 대표하는 우리나라의 역할과 기여가 그 어느 때보다도 요구됨

○ 끝으로, 관련 다자간 체제 및 비회원국에게 WA에 관한 주요 회원국들의 활발한 홍보활동이 보고됨. 이러한 홍보활동은 우리나라의 다자간 지역협력체제(APEC, ARF 등)정책 및 남북한 과학기술협력정책에 대해 시사하는 바가 큼.

2) WA 평가 회의

○ 평가의 필요성과 범위에 관한 주요 세력들간의 상반된 입장(특히, 코소

보의 정치적 문제에 따른 러시아의 소극적 자세) 및 충분한 논의에 대한 시간의 부족 등으로 인해 합의가 도출되지 못한 상태에서 주요 평가이슈에 대한 논의가 차기회의로 미루어짐

○ 거부통보 의무와 자발적 통보간의 불균형 해소에 관한 많은 회원국들의 적극적인 입장표명 및 프랑스의 탄력적 입장 변화 등은 WA 평가에 대한 전망을 한층 밝게하는 중요한 발전적 변화로 평가됨

2. 정책적 건의사항

○ GWG회의에서 정보교환의 활성화를 위한 새로운 guidelines의 채택, 평가회의에서 가장 민감한 이슈인 무기이전 투명성 제고에 관한 논의의 진전, 불가리아의 ECOWAS에 대한 무기수출 중단 입장 표명, 특히 코소보 문제의 종결 이후 러시아의 기대되는 입장변화 등을 감안해 볼 때 WA 주요 기능이 강화될 전망임.

○ 이러한 환경 변화에 능동적으로 대응하기 위해서는 타 회원국들의 제안서에 대한 단순한 논평 차원에서 벗어나 WA 평가에 관한 합의를 유도할 수 있는 종합적 제안서를 작성·제시하는 수준의 적극적 참여전략을 확립해야 할 것임

○ 국내 수출통제에 관한 회원국간의 협력강화에 대한 효율적 대응을 위해 국내 수출통제 관련 주무부처와 관련부처의 담당자 및 전문가를 포함하는 Task Force의 구성이 필요함

○ 우리나라의 WA 참여활동경험 및 WA 체제에 관한 홍보활동(outreach activities)을 다자간 지역협력체제(APEC, ARF 등) 및 남북한협력정책에 반영하는 전략이 필요함. 특히, 남북한 과학기술협력의제로의 활용가능성에 대해 분석해 볼 필요가 있음

○ 특히, 기술관련 이슈를 독립 의제로 채택한 새로운 지침을 민군겸용기술에 관한 국내 다자간 기술수출통제정책에 적극 반영함으로써 보다 능동적인 참여방안을 강구해야 함

○ 구체적으로 영국이 차기 GWG회의에서 12개의 민군겸용 출현기술(emerging technologies)에 관한 통제 범위설정 및 방법에 관해 논의하자는 제안에 대한 우리나라의 입장을 정립하기 위한 Task Force의 구성이 필요함

제 3 절 1999년 제2차 전문가그룹(EG) 정기회의

I. 전문가그룹(EG) 정기회의 의제 검토 의견

1. 디지털 컴퓨터 - 네덜란드 프로포즐

○ 요 지

▪ 현재 2,000 MTOPS 이상의 개인용 PC 통용 중. 따라서 실질적 수출통제에 대한 효과를 기대하기 어려운 상황임

▪ 컴퓨터 통제기준을 2,000 MTOPS에서 10,000 MTOPS로 상향조정을 제안

○ 1차 회의 결과

▪ US, UK 등: 유보

▪ 일본: 4,000 MTOPS 제안

▪ 프랑스: “latency time″ parameter라는 새로운 통제기준을 제안

○ 검토 의견

▪ 향후 1년 사이에 우리나라의 기술수출에 부정적 영향이 예상되는바 적당한 CTP level(지난 EG회의에서 일본과 미국이 절충선으로 제시한 4,000 MTOPS)에서 조속히 개정안이 합의 도출되는 방향으로 유도하는 입장이 바람직할 것임

2. 마이크로프로세서 - 네덜란드 프로포즐

○ 요지

▪ 현행 260 MTOPS 성능기준을 2,000 MTOPS 수준으로 상향조정

○ 1차 회의결과

- 일본: 현재 시판중인 2,000 MTOPS 제품에 대한 controllability 문제제기
- US: 군사적 활용 가능성의 경우 수출허가발급의 통제를 통한 규제
- 프랑스: CTP 통제기준은 특정기업에 의한 세계시장의 독식 우려됨. 따라서 “latency time”과 같은 다른 통제기준이 바람직함

○ 검토 의견

- 상기 디지털컴퓨터 프로포즐에 대한 입장을 참조

3. 민간주파수대역에 대한 조정(ITU allocated bands) - 미국 프로포즐

○ 요지

- 미국은 할당 주파수대역을 수입국에서 민간용으로 사용될 경우만 비통제대상으로 보자는 개편을 제안

○ 1차 회의 결과

- 네덜란드: 동의
- 프랑스: study reserve
- 러시아: 유보

○ 검토의견

- 회원국간의 토의과정을 좀 더 지켜 본 후에 매 수출건마다 주파수 통제기준에 변화를 초래하지 않는 제안을 지지하는 입장이 바람직함

4. 화란의 디지털컴퓨터 제안에 대한 프랑스 contribution paper

○ 요지

- CTP 상향조정 기준 외에 “latency time″ 통제기준의 추가를 제안

○ 회의 결과

- 지난 7월 파리에서 열린 특별전문가회의에서 대부분의 회원국들은 올해에 처리되기에는 어렵다는 부정적 반응을 나타냄

○ 검토 의견

- 새로운 성격의 제안이므로 충분한 연구가 필요함. 따라서 회의 진행을 관망한 후 다음 회기에 상정할 것을 제안함이 바람직할 것임

II. 전문가그룹(EG) 정기회의 결과

○ 회의 장소: WA 사무국 (Vienna)

○ 회의 기간: 1999년 9월 20 ~ 30일

1) 배경 및 목적

○ 지난 4월 제 2차 회의에 이은 재래무기, 민군겸용품목 및 기술수출통제 리스트 및 개정프로포즐에 대한 최종 검토

○ 작년 12월 총회(Plenary)로부터 전문가그룹이 부여받은 mandate (Cat. 3, 4 and 5 Part-1 Study 및 ITU 할당 대역 해제사항 검토) 에 대한 최종 논의

2) 주요 내용 및 결과

□ 소프트웨어 및 기술의 무형이전에 대한 통제강화를 위한 프로포즐

○ 제안 요지

- 바세나르 통제리스트에 현재 수록되어 있는 모든 software와 기술을 이전유형과 상관없이 통제

○ 주요 논의사항

- 무형수단 (Internet, fax, oral 등)을 통해 이전되는 기술 및 소프트웨어에 대한 통제문제
- "Public domain"에서의 encryption 통제 강화문제
- Mass market items에 대한 수출통제의 비효율성문제

○ 토의 결과

- 차기 긴급회의에서 최종 검토

□ 마이크로 프로세스의 CTP level 상향 조정

○ 주요 논의 사항

- 영국 제안: 현재의 260 MTOPS를 유지
- 미국 제안: 530 MTOPS로 상향 조정
- 의장 타협안: 530 MTOPS with 2,000 MTOPS(automatic increase by mid-2000)로 조건부 상향 조정
- 영국 대안: 530 MTOPS with decontrol Note X로 조건부 상향 조정
- 일본 제안: 2,000 MTOPS로 상향 조정; 화란이 철회한 제안을 인수하여 재 상정함
- 미국 대안: 2,000 MTOPS with SOU로 조건부 상향 조정

○ 토의 결과

- 차기 긴급회의에서 최종 검토

□ Digital computer의 CTP level 상향 조정

○ 주요 논의 사항

- 일본 제안: 현재 2,000 MTOPS에서 4,000 MTOPS로 상향 조정
- 미국 제안: 6,500 MTOPS with SOU로 조건부 상향 조정
- 의장 타협안: 6,500 MTOPS without SOU로 상향 조정
- 영국 제안: 4,000 MTOPS or containing equipment controlled by 4.A.3.c to 4.A.3.e로 조건부 상향 조정

○ 토의 결과

- 차기 긴급회의에서 최종 검토

□ Cat. 3, 4, 5 and Part-1에 대한 전략적 연계성 연구

○ 주요 논의 사항

- Clustering technology의 발달에 의한 고성능 컴퓨터(HPC)의 수출통제에 대한 circumvention 문제
- 마이크로프로세스 및 컴퓨터에 관한 수출통제 parameter로서 현재 통용되고 있는 CTP level 이외에 프랑스가 추가적 통제 parameter로서 제안한 "latency time"에 대한 타당성 문제

○ 토의 결과

- 내년 초에 고위급 기술실무회의 개최에 합의

□ 미국의 암호화(Encryption) 품목 및 기술에 관한 새로운 수출허가 정책

○ 정책 요지

- 미국은 오는 12월 15일부터 encryption 품목 및 기술에 대한 수출허가를 면제할 예정

○ 주요 논의 사항

- 미국의 기업을 유리하게 하는 일방적 수출허가 조치에 의해 야기되는 level-playing field 원칙에 대한 위배성 문제
- Encryption 품목 및 기술과 같은 mass market items에 대한 수출통제의 비현실성 문제
- 러시아의 프로포즐 (Cat. 5 Sub-items A and D에 수록된 모든 품목 및 기술을 WA 통제리스트에서 완전 삭제)

○ 토의 결과

- 11월말에 본 안건을 다루기 위한 긴급회의 개최에 합의

III. 종합관찰 및 건의 사항

○ 지난 7월 미국은 HPC에 대한 수출통제 수준을 상향조정 발표함. 주목해야 할 변화는 우리나라와 같이 Tier 2 단계에 속해 있던 네 나라들(Czech Republic, Hungary, Poland, Brazil)이 Tier 1 단계로 새로이 분류됨. 이러한 미국의 조치는 그 동안 이 나라들의 비확산체제에 대한 기여에 따라 신장된 국제 신인도를 반영한 결과로 평가됨. 결과적으로 이러한 상향 조정은 이들 국가에 대한 여타 선진국들의 수출통제수준의 완화로 확산될 전망임.

- 우리나라가 이러한 국제적 신임을 확보하기 위해서는 다자간 수출통제규제에 대한 최신 정보를 신속히 수집·분석하여 국내 수출통제정책에 반영해야 할 것임. 즉, 변경된 국제 규정을 국내관계법에 과감하게 수용하고 수출입통제를 보다 철저히 집행하기 위해서는 범부처적인 차원에서 국내 수출통제시스템에 대한 전반적인 검토가 시급히 이루어져야 할 것임.

- 또한, 국내 수출통제에 관한 회원국간의 협력강화 추세에 대한 효율적 대응을 위해서는 국내 수출통제 관련부처들의 실무자 및 전문가를 포함하는 Task Force(정책조정위원회)를 구성하여 정책 우선 순위의 설정 및 우선 분야를 선정해야 할 것임

○ 본 회의의 최대 이슈 중의 하나는 무형 수단(intangible means)을 통해 이전되는 software와 기술에 대한 통제 여부에 모아졌음. 즉, 현재의 WA 통제리스트에 수록되어 있는 software와 기술을 이전유형과 상관없이 통제해야 한다는 주장이 제기됨.

- 지난 7월 파리에서 개최되었던 WA 비공식회의에 밝힌 화란의 입장에 의하면 이전의 유형에 따른 기술통제에 대한 논의는 WA 설립이래 전례가 없는 것임. 그러나 미국은 이러한 주장에 대해 현재 WA 통제리스트에서 제외된 public domain에서의 software와 기술도 통제해야 한다는 강력한 입장으로 응수함으로써 통제에 대한 수준이 한층 강화되어 가는 추세가 입증됨.

- 이러한 새로운 차원의 전략기술 수출통제에 대한 강화 추세와 이밖에 집중 논의되었던 주요 이슈 및 통제리스트 검토에 대한 분석을 통한 정부의 구체적 대응전략의 개발 및 종합적 입장을 정립하기 위해 실무자가 중심이

되고 관계 전문가가 참여하는 소규모 협의회가 구성·운영되는 것이 바람직 할 것임

제 4 절 1999년 전문가그룹(EG) 임시 회의

I. 전문가그룹(EG) 임시회의 의제 검토 의견

1. 마이크로프로세서

○ 요지

- 현행 260 MTOPS에 대한 상향 조정

○ 2차 회의결과

- 의장 타협안: 530 MTOPS with 2,000 MTOPS(automatic increase by mid-2000)
- 영국 제안: 현재 260 MTOPS 유지
- 미국 제안: 530 MTOPS 상향 조정
- 영국 제안: 530 MTOPS with decontrol Note X
- 일본 제안: 2,000 MTOPS 상향 조정
- 미국 제안: 2,000 MTOPS with SOU로 조건부 상향 조정
- 우리나라 입장 표명:
  [CHAIR: 530 MTOPS with 2,000 MTOPS (automatic increase by mid-2000] 지지

○ 검토 의견

- 마이크로프로세서의 기술적인 발전추세를 감안할 때 향후 1년 사이에 우리나라의 기술 이전 및 수출에 부정적 영향이 예상됨.
- 또한, 지난 7월에 발표된 미국수출통제규정에 대한 개정안에 의하면 미

국은 CTP level을 1차로 1,200 MTOPS에서 1,900 MTOPS로 상향조정한 후 조만간 재차 상향조정할 예정임

- 이러한 국내외 상황을 고려해 볼 때 토의과정에서 새로운 제안이 제시되지 않는 한 현재의 우리나라 입장 [의장 타협안: 530 MTOPS with 2,000 MTOPS (automatic increase by mid-2000) 지지]를 견지함이 바람직

2. 디지털 컴퓨터

○ 요 지

- 현재의 컴퓨터 통제기준(2,000 MTOPS)에 대한 상향조정

○ 2차 회의 결과

- 의장 타협안: 6,500 MTOPS without SOU 상향 조정
- 일본 제안: 현재 2,000 MTOPS에서 4,000 MTOPS 상향 조정
- 미국 제안: 6,500 MTOPS with SOU 상향 조정
- 영국 제안: 4,000 MTOPS or containing equipment controlled by 4.A.3.c to 4.A.3.e 상향 조정
- 우리나라 입장 표명:
  [미국 제안(6,500 MTOPS with SOU)]에 대해 favorable study reserve 입장 표명

○ 검토 의견

- 기술적인 발전추세를 감안할 때 산업적 측면에서는 CTP level의 상향조정을 지지하는 것이 바람직함. 그러나 군사안보 측면에서 SOU에 대한 보다 심층적 연구가 필요함으로 현재의 입장 (favorable study reserve)을 견지함이 바람직

3. 소프트웨어 및 기술의 무형이전에 대한 통제강화를 위한 SOU

○ 요지

- 바세나르 통제리스트의 모든 software와 기술 및 무형이전에 대한 통제

○ 2차 회의결과

- 의장 타협안: 현재 이러한 통제규정이 부재한 회원국들의 입장을 반영하는 절충안
- 독일 제안: 바세나르 통제리스트에 현재 수록되어 있는 모든 software와 기술을 이전유형과 상관없이 통제

○ 검토 의견

- Internet, fax 등을 통해 이전되는 기술 및 소프트웨어에 대한 통제문제는 현실적으로 매우 어려운 문제일 뿐만 아니라 국익에 미치는 영향 또한 막대할 것으로 전망됨. 따라서 국내 통제규정에 대한 심층적인 연구를 바탕으로 구체적인 대응전략의 수립을 위해 의장안에 대한 study reserve 입장을 표명함이 바람직.

4. 미국의 암호화 품목 및 기술에 관한 새로운 수출정책

○ 요지

- 미국은 오는 12월 15일부터 encryption 품목 및 기술에 대한 수출허가를 면제할 예정

○ 2차 회의결과

- 러시아가 Cat. 5 Sub-items A and D에 수록된 모든 품목 및 기술을 WA 통제리스트에서 완전 삭제할 것을 제안

○ 검토 의견

- 미국의 technical review에 대한 추가적 설명 및 변화된 입장 등에 대한 회원국간의 토의과정을 지켜 본 후에 다소 파격적인 러시아의 제안에 대해 신축적으로 대응함이 바람직함

II. 전문가그룹(EG) 임시회의 결과

○ 회의 장소: 바세나르 협정(WA) 사무국 (Vienna)

○ 회의 기간: 1999년 11월 26~29일

1. 회의 배경 및 목적

○ 미국의 encryption 품목 및 기술에 관한 일방적인 수출허가면제정책에 대해 러시아가 제출한 프로포즐에 대한 긴급 논의

○ 지난 9월 제2차 EG회의에서 미합의된 주요 통제리스트 안건에 대한 최종 토의
- 마이크로프로세스 및 digital computer CTP level의 상향 조정
- Intangible Transfer of Software 및 Technology에 대한 수출통제강화 안건

2. 주요 토의 내용 및 결과

○ 新 U. S. Encryption Policy에 대한 러시아의 프로포즐

- 제안 요지
  · Cat. 5 Sub-items A and D에 수록된 모든 encryption 품목 및 기술을 통제리스트에서 완전 삭제

- 토의 결과
  · 러시아 프로포즐에 대한 보류

  * 우리나라 입장 표명:
  러시아를 제외한 모든 회원국과 함께 보류 입장을 표명함

○ 러시아 프로포즐에 대한 일본의 counter proposal

- 제안 요지
  · Cryptographic 품목 및 기술에 대한 통제수준을 56 bits 64 bits key length로 상향조정하기 위한 일환으로 Cat. 5-Part2 Cryptography Note의 d 항목 삭제

- 토의 결과

· 대부분의 회원국들의 study reserve 표명

· 2000년 4월 EG회의에서 다시 토의키로 합의

○ Intangible Transfer of Software 및 Technology에 대한 수출통제강화 안건

- 제안요지

· 모든 software와 기술의 무형(intangible) 이전에 대한 통제

- 주요 토의 사항

① 독일안

· 찬성: 미국, 프랑스, 일본을 비롯한 주요 17회원국

· 보류: 한국, 벨지움 및 화란 3개국

② 의장안

· 찬성: 한국, 영국, 러시아, 화란을 비롯한 15개국

· 보류: 미국 및 독일

- 토의 결과

· 독일 proposal 및 EG의장 타협안 모두 합의 실패

· 2000년 EG회의에서 재 토의

○ 마이크로프로세스 및 컴퓨터 향후 통제 강화에 관한 의장안

- 제안요지

· 마이크로프로세스 및 컴퓨터에 관한 현재의 통제 방법 및 기준에 대한 강화의 모색

- 주요 토의 사항

· 마이크로프로세스 및 컴퓨터의 군사전용 방지를 강화하는 대안 마련의 필요성

· 마이크로프로세스 및 컴퓨터의 발전 속도에 걸맞게 통제기준을 현실적으로 상향조정하기 위한 정기적인 검토장치의 개발에 대한 필요성
· 마이크로프로세스 및 컴퓨터에 관한 통제강화 수단(catch all: supplemental end-use oriented control) 채택의 건의
· Clustering technology를 통한 컴퓨터의 고성능화에 대한 통제 이슈에 관한 2000년 논의

- 토의 결과
  · 1)과 2)를 총회에 제출할 EG의장의 observation statement로 채택
  · 3)과 4)는 총회에 보고할 EG의장의 보고서에 포함키로 합의

○ 마이크로프로세스 CTP level 상향 조정

- 제안 요지
  · CTP level 상향 조정
- 주요 토의 사항
  · 미국 입장: SOU를 철회하고 급격한 기술발전의 현실을 반영한 3,500 MTOPS로 상향조정하는 타협안 제시
  · 영국 입장: 3,500 MTOPS로 상향조정할 경우 발생하는 군사전용의 위험성을 줄이기 위한 decontrol Note X의 첨부 주장
- 토의 결과
  · 의장이 제안한 observation statement[특히, 1)]가 채택됨에 따라 영국이 보류 입장을 철회함으로써 미국이 제안한 3,500 MTOPS로 합의됨

○ 컴퓨터 CTP level 상향 조정

- 제안 요지
  · CTP level 상향 조정
- 주요 토의 사항
  · 미국 입장: SOU를 철회하고 6,500 MTOPS로 상향조정하는 타협안 제시
  · 영국 입장: 6,500 MTOPS로 상향조정할 경우 발생하는 군사전용의 위험성을 줄이기 위한 decontrol Note X의 첨부 주장

- 토의 결과
  · 의장이 제안한 observation statement[특히, 1)]가 채택됨에 따라 영국이 보류 입장을 철회함으로써 미국이 제안한 6,500 MTOPS로 합의됨

III. 종합적 관찰 및 건의 사항

○ 1999년도 WA활동의 가장 두드러진 특징은 민군겸용기술 수출통제에 관한 중요성의 부각과 보다 효율적 전략기술 수출통제시스템 구축에 대한 공감대의 형성임. 따라서 2000년부터 전략기술 통제리스트에 대한 검토과정의 체계화 작업이 특히, 미국의 주도로 본격화될 것으로 전망됨

○ 이러한 수출통제리스트 검토에 관한 개정작업에 적극 참여하여 우리나라의 국익을 효율적으로 대변하기 위해서는 전략기술관련 주무부처인 과학기술부가 최근 구성한 '바세나르체제 전문가협의회'에 관한 전략적 활용계획을 마련해야 할 것임.

○ 우선적으로 전문가협의회를 통해 1999년 WA활동결과(부록 2 참조) 및 2000년 WA Workplan에 대해 면밀히 분석하고 이를 바탕으로 2000년 對바세나르활동에 대한 종합적 계획 및 구체적인 전략을 수립해야 할 것임.

제 5 절 2000년 전문가그룹(EG) 특별 회의

I. 전문가그룹(EG) 특별회의 의제 검토 의견

1. Clustering technology 현황 검토 및 컴퓨터 통제수준 조정

○ 참조 사항:
- WA-EG(99) FR 4
- WA-EG(99) CHAIR TWG 9
- Cat. A. 3. c. 및 Cat. A. 3. g

○ 회의 배경

- 1999년 9월 제2차 전문가그룹회의에서 clustering technology의 발달로 발생할 수 있는 고성능컴퓨터(HPC) 수출통제에 대한 circumvention 문제 논의

- Clustering technology에 대한 심층검토를 위해 high-level 전문가 회의를 2000년 초에 개최하기로 합의하고 TWG 회의를 통해 본 회의에 부여할 mandate를 확정

○ 검토 사항

- Clustering technology 검토 [WA-EG(99) CHAIR TWG 9]
  · Computer Nodes
  · Cluster Interconnect Interfaces
  · Interconnection devices(e.g. switches)
  · Message Passing Library
  · Operating Systems
  · Application Software

- 컴퓨터 통제수준에 대한 토의

  · Cat. A. 3. c:
  "Electronic assemblies" specially designed or modified for enhancing performance by aggregation of "computing elements" ("CEs)" so that the "CTP" of the aggregation exceeds the limit in 4.A.3b.;

  · Cat. A. 3. g:
  Equipment specially designed to provide external interconnection of "digital computers" or associated equipment which allows communications at data rates exceeding 80 Mbyte/s.

○ 검토 의견

- 본 특별회의가 준비되는 과정에 지난 2월 1일 미국은 Tier III 해당국가들에 대한 고성능컴퓨터 수출통제 CTP수준을 현재의 6,500 MTOPS에서 12,500 MTOPS로 상향조정한다는 새로운 수출통제규정을 발표함.

- 이러한 새로운 상황을 감안할 때 특별회의의 전개 방향에 커다란 차질이 빚어질 것으로 예상됨. 아마도 주요 회원국들은 특정사안에 대한 합의 도출보다는 본 주제에 대한 문제제기 차원에서 다양한 질의와 토의에 집중하게 될 전망임.

- 따라서 우리나라는 이러한 토의과정에서 표출되는 주요 회원국들의 입장 및 관심사를 면밀히 분석하여 새롭게 전개되는 기술수출통제에 대한 정책 방향 및 구체적 이슈 파악에 주력하는 방향으로 우리의 입장을 개진함이 바람직함.

II. 전문가그룹(EG) 특별회의 결과

○ 회의 장소 : 바세나르 협정(WA) 사무국 (Vienna)
○ 회의 기간 : 2000년 2월 15 ~ 17일

1. 회의 배경 및 목적

○ 1998년 12월 총회(Plenary)에서 전문가그룹은 Cat. 3, 4, and 5 Part-1 Study에 대한 mandate를 부여받음.

○ 1999년 4월 제1차 EG 정기 회의에서 프랑스는 본 주제에 대한 연구결과에서 clustering technology의 급진전에 따른 고성능컴퓨터(HPC) 수출통제에 현재 적용되는 CTP parameter의 한계점을 지적하고 추가적인 통제수단으로서 latency time을 도입해야 한다고 제안함.

○ 1999년 9월 EG 제2차 정기회의에서 프랑스가 제출한 정식 프로포즐에 대해 일차적 검토가 이루어짐. 토의 결과 clustering technology에 대한 보다 심도 있는 검토를 위해 high-level 전문가 회의를 2000년 초에 개최하

기로 합의하고, TWG 회의를 열어 본 회의에 관한 의제[WA EG(99) TWG 9]를 발굴・제시함.

2. 주요 토의 사항 및 토의 결과

○ 회의 의제범위 조정 및 정식 프로포즐의 제출 절차에 관한 문제

- 의제 채택 과정에서 회원국들은 화란이 제안한 Cat. 3, 4, and 5 Part-1 Study[WA EG(00) NL 1] 및 [WA EG(00) NL 2]에 대해 보다 심층적인 검토를 진행하고, clustering technology에 대해서는 구체적인 합의도출 보다는 일차적인 탐색(exploration) 수준에서 회의를 추진키로 합의.

- 본 회의결과를 바탕으로 제출될 clustering technology에 대한 정식 프로포즐의 마감시한을 4월 EG 정기회의 전날까지 연장하는 예외적 절차(WA 규정상 원칙적으로 정식 프로포즐은 정기회의 6주전까지 제출되어야 함)를 적용키로 합의.

○ Cat. 3, 4 and 5 Part-1의 strategic relevance에 관한 심층 연구
- 토의 요지
- 컴퓨터의 군사전용 가능성에 대한 명확한 규명
- 토의 결과
- CTP(MTOPS)를 기준으로 컴퓨터의 군사전용 가능 분야가 처음으로 파악・제시된 matrix 작성 [WA EG(00) CHAIR 3 version: 3.0]
- Matrix의 구체화를 위한 향후 검토 합의

○ Clustering technology 통제의 필요성 여부에 대한 논의

- 토의 요지
- Clustering Technology(CT) 통제의 필요성 여부에 대한 판단을 돕기 위한 CT 특성의 규명 방법

- 토의 결과

- TWG 구성을 통해 유형별 분류(LAN, SAN, Proprietary Optimized 등) 및 기능 적 특성을 규명하여 clustering technology에 대한 종합적

개념도를 처음으로 작성[WA EG(00) TWG 1 version: 2.0]

- 본 개념도의 구체화를 통해 clustering technology 통제의 필요성 여부에 대한 명확한 가치판단을 내리기 위해 향후 검토하기로 합의

○ 현재의 컴퓨터 통제조항의 clustering technology 통제 포함 여부에 대한 논의

- 토의 요지

- Clustering technology의 통제 여부를 판단하기 위해 현재의 컴퓨터 통제조항 (Cat.4.A.3.c. 및 Cat.4.A.3.g)에 대한 회원국의 입장 표명

- 토의 결과

- 앞에서 언급한 바와 같이 clustering technology에 대한 특성만이 파악된 상황에서 대부분의 회원국들이 본 주제에 대한 입장을 유보하는 신중한 자세를 취함에 따라 토의가 제대로 진행되지 못함.

- 주요 회원국들도 명확한 입장 표명(프랑스만 예외)보다는 여타 회원국들의 동향을 주시하며 준비한 working paper를 통해 간접적으로 그들의 의견을 조심스럽게 개진하는 상태임:

  · 미국, 일본 등 의견 : Clustering technology가 이미 Cat.4.A.3.c. 및 Cat.4.A.3.g.에 의해 통제되고 있으나[WA EG(00) US 3] 표현상의 보완이 필요함[WA EG(00) JP 1].

  · 프랑스 입장 : Clustering technology가 Cat.4.A.3.c 및 Cat.4.A.3.g에 의해 통과되고 있지 않음[WA EG(00) FR 1]. 왜냐하면 현재의 CTP 통제수단은 단일 기업이 생산한 cluster에 대한 통제에는 효과가 있으나, 서로 다른 기업들이 생산한 cluster 기기 (compute nodes, interconnect devices, software 등)를 활용하는 clustering technology 통제에는 한계가 있다는 입장.

- 본 주제에 대한 향후 검토 합의

※ 우리나라 입장 표명:

○ Clustering technology에 대한 보다 심층적인 자체 연구가 필요하다는 판단 하에 정부 대표단은 본 조제에 대한 입장을 보유함.

○ CTP 통제수단에 대한 대안 탐색

- Clustering technology에 대한 새로운 통제 수단을 모색하는 주제가 예정되어 있었으나, 앞에서 이미 언급한 바와 같이 clustering technology 통제 여부에 대한 토의가 원만히 진행되지 못함에 따라 (미국 등이 working paper를 제출하였음에도 불구하고) 본 주제에 대한 토의 자체가 무산됨.

III. 종합적 관찰 및 전망

○ 본 특별회의는 의제채택 과정에서 합의한 대로 Cat. 3, 4 and 5 Part-1 Study에 대한 보다 심층적 검토와 clustering technology에 대한 적절한 탐색이 이루어졌음. 따라서 4월 정기 회의에서는 본 회의결과를 바탕으로 제출될 프로포즐과 수출통제 리스트 전반에 대한 일반 검토가 병행될 것으로 예상됨.

○ 본 특별회의가 갖는 의미는 다음 세 가지로 요약될 수 있음. 첫째, 본 회의결과에서 WA 체제가 컴퓨터와 같은 품목통제 중심에서 clustering technology와 같은 민군겸용기술에 대한 통제 중심의 전환을 통해 우리나라와 같은 신흥공업국들의 고성능컴퓨터에 대한 자체개발능력의 확보를 원천 봉쇄하려는 정치적 의도를 엿볼 수 있음.

○ 둘째, 이러한 정치적 배경 하에서 본 회의의 기술적 성과를 살펴보면,

- 우선 컴퓨터의 군산전용 가능 분야[WA EG(00) CHAIR 3 version: 3.0]가 구체적으로 파악됨으로써 대북한 안보정책 (예 : 5만 MTOPS 정도의 고성능 컴퓨터로 가능한 nuclear simulation 등등), 국내 수출통제정책, 나아가 컴퓨터분야에 대한 외국투자 유인에 적용되는 구체적인 통제기준의 설정에 관한 정책 지침이 마련되는 기반이 확보 됨.

- 또한, clustering technology에 대한 종합 개념도[WA EG(00) TWG 1 version: 2.0]의 작성은 우리에게 고성능컴퓨터 및 clustering technology에 관한 종합적 시각을 제시함으로서 본 분야에 대한 보다 체계적인 기술개발계획을 수립할 수 있는 전기가 마련됨.

○ 세 번째 의미는 미국의 주도적인 회의 참여 행태와는 대조적으로 본 회의 내내 의도적인 관망자세를 견지한 데에서 찾을 수 있음. 주요 배경으로 우선 프랑스 주도의 clustering technology 이슈가 미국이 주도하는 신수출통제정책 (6개월 단위로 CTP수준을 상향조정하는 메커니즘의 구축)과 정면 배치되는 문제(“latency time” 통제수단이 정보통신기술발전에 미치는 영향 등등)를 바세나르체제 차원에서 해결하려는 노력의 일환으로 볼 수 있음.

또한 국가안보 측면을 내세우는 국방부 입장에 맞서 CTP 통제방식을 선호하는 기업을 대표하는 상무부 입장을 국내 대통령 선거를 감안하여 전폭 반영해야 하는 국내 정치적 상황 등을 짐작할 수 있음.

○ 이러한 정황을 감안할 때 4월 정기 회의에서는 고성능컴퓨터 통제방식 및 clustering technology에 대한 면밀한 검토가 종합적 측면을 고려하는 신중한 분위기에서 진행될 것으로 예상됨.

IV. 건의 사항

○ 우선 우리 정부는 본 회의 결과를 중장기적, 단기적, 정치 외교적, 기술수출통제 측면에서 종합 분석하여 정부 정책에 신속 반영함이 바람직함.

○ 둘째, 차기 회의에 대비한 핵심 추진과제를 발굴하고 이에 대한 체계적인 연구분석을 수행함.

○ 셋째, 본 연구결과를 기초로 관련부처의 종합 조정을 통해 차기 회의에 대한 구체적인 대응전략을 마련하고, 핵심 의제에 대한 정부의 최종 입장을 수립하는 참가준비체제를 구축해야 할 것임.

제 6 절 2000년 제1차 전문가그룹(EG) 정기회의

I. 전문가그룹(EG) 정기회의 의제 검토 의견

1. 현재의 CTP 상향조정 방식에 대한 대안 모색

○ 참조사항

- WA-EG(99) US 50(6개월 단위의 CTP 상향조정 메커니즘 구축)
- WA-PLM(99) CHAIR 1 (현재의 CTP 통제수단에 대한 대안 검토를 위한 mandate)
- WA-EG(00) US 1 〔CTP 상향조정 발표(6,500 MTOPS -> 125,000 MTOPS)〕
- WA-EG(00) US 4 (현재의 CTP 통제수당에 대한 대안 예시)
- 지난 3월 10일 미상무부는 1999년 11월 EG특별회의에서 고성능 컴퓨터(HPC) 통제수단을 2,000 MTOPS에서 6,500 MTOPS로 상향조정하기로 합의한 규정을 공식 집행 할 것을 공고함

○ 검토 사항

- CTP 통제수중의 상향조정을 현재의 1년 단위에서 6개월 단위로 단축하자는 제안

◦ 찬성파 :

- 마이크로프로세서 및 컴퓨터의 급격한 발전에 따른 CTP 통제수준에 대한 탄력적 조정 방식의 도입 필요

◦ 반대파 :

- 6개월마다 CTP 통제수중을 상향조정할 경우 실제로 집행 할 때 행정상의 어려움을 야기할 우려가 있음
- 따라서 현재의 1년 단위를 유지하되 상향 폭을 현실에 맞게 넓히자는 주장

• 미국이 자국기업에게 유리하도록 time gap를 최대한 벌려 놓으려는 의도라는 주장

○ 검토 의견

- 과학기술의 급격한 발전으로 인해 1년 이내에 현행 통제기준을 초과하는 새로운 마이크로프로세스 및 컴퓨터가 출현하는 것은 기정사실임. 그러나 국가안보 및 국내 집행체제 및 여건 등을 충분히 고려해야 하는 복합적인 주제임.

- 따라서 우선 회의 진행과정에서 표명되는 주요 회원국들의 입장을 충분히 검토한 후, 국내 관계 실무자 및 전문가들에 의한 보다 면밀한 분석을 위해 일단 'study reserve' 입장을 표명함이 바람직 할 것임

2. 초민감(VSL) 통제품목 및 민군겸용기술에 대한 선정 기준의 설정

○ 참조 사항

- WA-PLM(99) CHAIR 1 (초민감 통제리스트 작성 기준에 대한 mandate를 EG에게 부여함)
- WA-EG(00) JP 7 〔민감 및 초민감 컴퓨터의 CTP 통제수준의 사항조정 제안(6,500 MTOPS -> 민감 : 20,000 MTOPS ; 초민감 : 33,000 MTOPS)〕

○ 검토 사항

- 초민감 통제리스트에 포함할 수출 및 이전 품목 및 기술에 대한 선정 기준의 개발

○ 검토 의견

- 본 의제는 지금까지 General Working Group(GWG)에서 주로 논의되어 왔던 사항인 관계로 현재 충분한 검토를 위한 자료가 준비되지 않은 상태임.

- 그러나 본 의제가 바세나르체제의 향후 강화추세를 가늠할 수 있는 핵심주제 중의 하나가 될 것임(앞으로 선정기준이 설정될 경우 현재 회원국의 자체판단에 일임하는 수출허가 정차가 앞으로는 지난 COCOM체제

때와 같이 회원국들이 바세나르체제로부터 모든 SL 및 VSL에 대해 사전에 수출허가를 받아야 하는 불리한 상황으로 전개될 것임)

- 따라서 회의 진행을 충분히 관망한 후 본 주제에 대한 신중하고 종합적인 자체 검토를 위해 일단 'study reserve'입장을 표명함이 바람직할 것으로 생각됨

3. ITU 할당 주파수 대역의 조정 문제

○ 참조 사항

- WA-EG(99) US 1(ITU할당의 민간 주파수 대역에서 작동하는 장비는 제외)
- Cat. 3.A.1.b.1, Cat.3.A.1.b.2, Cat.3.A.1.b.8, Cat.5.E.1.c.4.b
- WA-EG(00) US 24
- WA-EG(00(US 25

○ 검토 사항

- ITU할당 주파수 대역과 상이한 민간주파수 대역과의 조정문제
- 현행 규정하에서 ITU할당 주파수 대역은 모두 민간용으로 취급하고 있으나 실제로는 군사용으로 사용이 가능함
- 따라서 미국은 현행 규정을 수입국에서 민간용으로 사용할 경우에만 통제대상으로 제외하도록 개정할 것을 제안함

○ 검토의견

- 본 의제는 1999년에 이미 많이 논의되었으나 회원국의 이해상충으로 인해 부분적인 합의에 머물고 있는 상태임. 따라서 본 회의과정에서 표출되는 핵심 이슈와 회원국의 입장을 면밀히 검토한 후에 우리의 입장 정립이 바람직함.

4. 공공영역(public domain)에서의 암호화(encryption) 소프트웨어에 대한 통제

○ 미국의 제안서 : WA-EG(00) US 16

- 제안 요지
  · 암호화(encryption) 소프트웨어(Cat.5.A.2)를 General Software Note

의 part 2에서 삭제하고 대신에 공공영역에서의 암호화 소프트웨어를 Cryptography Note로 일반(mass market) 암호화 소프트웨어 및 하드웨어와 유사한 방법으로 통제하자는 제안

- 검토 의견

· 본 의제 역시 1999년에 이미 많이 논의되었으나 회원국의 이해상충으로 인해 합의 도출에 실패함. 그럼에도 불구하고 미국이 재 상정함에 따라 본 의제에 대한 격렬한 토론이 예상됨.

· 우리나라는 앞으로 정보기술이전 통제강화의 핵심이슈로 대두될 본 사안에 대한 심층적 연구·분석이 필요함으로 토의과정에서 핵심쟁점을 정확히 파악하고 주요국의 입장을 검토한 후에 일단 'study reserve'입장을 표명함이 바람직할 것임.

II. 전문가그룹(EG) 정기회의 결과

○ 회의 장소: 바세나르체제(WA) 사무국 (Vienna)

○ 회의 기간: 2000년 4월 5 - 14일

1. 회의 개관

○ 표제회의에서는 4월 5 - 14일간 민군겸용품목·기술(Cat. 1 - 9) 및 방산품목 리스트에 대한 개정안 그리고 초민감(VSL)품목·기술의 선정기준을 검토함. 이와 병행하여 1998년 12월 총회가 mandate를 부여한 Cat. 3, 4, 5 Part-1의 전략적 연계성(strategic relevance)에 대한 Study 및 ITU 할당대역 해제사항도 아울러 검토함

○ 검토된 65개의 정식 제안 중 7개 제안에 대해 합의가 도출되고, 미국 등이 제안한 5개 제안서는 철회되었으며, 나머지 53개 제안에 대해서는 추가적인 검토를 위해 보류됨

2. 주요 회의 내용 및 결과

□ 민군겸용품목·기술 통제 리스트에 대한 주요 개정안 검토

1) Category 3 (전자)

○ Microwave 또는 Millimetre Wave 부품 통제기준 완화
(미국 제안: US24)

- 제안 요지
  · 31 GHz 주파수 이하의 Microwave 또는 Millimetre Wave 부품 관련에 대한 규제 해제

- 토의 내용
  · 프랑스: 51 GHz로 상향조정을 제안
  · 일 본: 31 GHz를 통제수치로 정한 근거제시 요구

- 토의 결과
  · 지지: 호주, 캐나다, 스위스, 스페인, 영국, 이태리, 일본, 우크라이나
  · Study Reserve: 독일, 네덜란드, 포르트갈, 러시아

※ 우리나라 입장: 지지 표명

○ CVD 반도체 가공장치 통제 기준의 완화
(일본 제안: JP5 및 미국 제안: US32)

- 제안 요지
  · CVD (Chemical Vaper Deposition) 반도체 가공장치 통제기준의 상향조정

- 토의 내용
  · 일본: 0.18㎛ 이내 불순물 입자의 플라즈마 장치 및 0.13㎛ 이내 입자의 laser 빔 장치로 상향조정
  · 미국: 0.5㎛ 이내 불순물 입자의 플라즈마 장치 및 0.35㎛ 이내 입자의 laser 빔 장치로 상향조정

- 토의 결과

· JP5 ┌지지: 벨기에, 스위스, 체코, 독일, 프랑스, 이태리, 폴란드, 루마
│니아, 러시아, 슬로바키아, 우크라이나
└Study Reserve: 영국, 네델란드, 미국

· US32 ┌지지: 無
└Study Reserve: 일본, 네델란드

2) Category 4 (컴퓨터)

○ 디지털 컴퓨터의 Processor Module(CPU)에 대한 통제
(영국 제안: GB2 및 미국 제안: US12)

- 제안 요지

· Processor Module의 통제리스트에 포함 여부

- 토의 내용

· 영국: Processor Module을 Cat. 3과 4 통제항목에 포함

· 미국: 컴퓨터가 아닌 4-way Mother Board를 4.A.3.c. 통제항목에서 제외

- 토의 결과

· Processor Modules 자체는 컴퓨터가 아니기 때문에 Cat.4 보다는 Cat.3에 포함하는 것으로 결론

· US12 ┌지지: 無
└Study Reserve: 일본, 영국

○ CTP 수준의 통제기준을 민감, 초민감 품목에 추가(일본 제안: JP7)

- 제안 요지

· 4-way 컴퓨터가 대량생산됨에 따라 4.A.3.b.에서의 현재 6,500 MTOPS 통제기준을 민감품목(SL)에서는 10,000 MTOPS로, 초민감품목(VSL)에서는 33,000 MTOPS로 각각 상향조정

- 회의 결과

· CTP 레블 조정에 대한 검토를 포함한 Cat. 3, 4, 5 Study가 현재 진

행 중이므로 일본이 제안한 수치를 최소한(minimum)의 통제기준으로 잠정합의

○ 컴퓨터 그래픽 가속기의 3-D 벡터 처리율 통제완화
(미국 제안: US13 및 일본 제안: JP6 및 영국 제안: GB3)

- 제안 요지: 그래픽 가속기의 3-D 벡터 처리율의 상향조절 또는 통제항목 삭제
  · 미국 제안: 현재 3,000,000에서 200,000,000으로 상향조정
  · 일본 제안: 현재 3,000,000에서 20,000,000으로 상향조정
  · 영국 제안: 통제 해제

- 토의 결과
  · 영국 제안 ┌지지: 벨기에, 체코, 핀란드, 프랑스, 그리스, 아일랜드
  │ 이태리, 일본, 네덜란드, 노르웨이, 폴란드,
  │ 포르트갈, 루마니아, 러시아, 스웨덴
  └보류: 캐나다, 독일, 미국
  · 미국 제안 ┌지지: 그리스, 일본, 우크라이나
  └보류: 캐나다, 독일, 영구, 포르트갈
  · 일본은 자국의 제안을 유지한 상태에서 영국과 미국 제안 모두를 지지함

※ 우리나라 입장: 미국 제안에 지지 표명

★ 이밖에 주요 제안 중에 Cat. 3, 4, 5 Study가 현재 진행중인 관계로 충분히 토의되지 못한 상태에서 9월 회의로 이월된 제안은 다음과 같음:

- 디지털 컴퓨터의 외부압력속도 통제조항 삭제(미국 제안: US14)
  · 초기의 통제조항 삭제의 입장을 변경하여 data rates의 통제 레블을 80 Mbytes에서 1,000 Mbytes로 상향조정하자는 수정안을 제출한 상태
- 클러스터링 컴퓨터에 관련된 Category 4에 대한 전반적 검토 (프랑스 제안: FR2)
- CTP 레블을 75,000 MTOPS로 상향조정(네덜란드 Working Paper: NL5)

3) Category 5 part 1 (통신)

○ 통신 소프트웨어의 Source Code를 해독하는 소프트웨어 통제 해제 (미국 제안: US15)

- 제안 요지

  · 통제된 통신소프트웨어의 Source Code에 대한 해독능력을 제공하는 소프트웨어가 존재하지 않으므로 본 사항을 해제

- 토의 결과

  · 지지: 호주, 벨기에, 체코, 독일, 핀란드, 그리스, 헝거리, 아일랜드, 이태리, 일본, 네덜란드, 노르웨이, 폴란드, 포르트갈, 루마니 아, 스웨덴, 우크라이나

  · Study Reserve: 프랑스, 영국

※ 우리나라 입장: 지지 표명

4) Category 5 Part 2 (정보안보)

○ 공공영역(public domain)의 암호화 소프트웨어에 대한 통제 해제 (미국 제안: US16)

- 제안 요지

  · 공공영역(public domain)에서의 비제한 암호화 소프트웨어에 대한 통제

- 토의 내용

  · 미국 등은 공공영역에서의 암호화(Encryption) 기술 및 소프트웨어가 군사적 목적으로 전용·확산될 것을 우려함

  · 통제 강화를 통해 미국이 암호화 소프트웨어 및 기술의 세계시장을 독점할 것이라는 우려

- 토의 결과

  · 전면보류(Full Reserve): 벨기에, 캐나다, 스위스, 독일, 스페인, 아

· Study Reserve: 덴마크, 핀란드, 프랑스, 영국, 노르웨이

· 지지: 無

※ 우리나라 입장: Study Reserve 표명

○ 정보암호화(symmetric algorithm)의 허가 범위 key length에 대한 통제 완화 (벨기에 제안: BE1 및 일본 제안: JP10)

- 제안 요지

  · 정보암호화에서 symmetric algorithm의 허가 범위 key length를 상향조정

- 토의 내용

  · 벨기에 제안: 현재 56 bit에서 128 bit로 상향조정

  · 일 본 제안: 현재 56 bit에서 168 bit로 상향조정

- 토의 결과

  · 벨기에 제안 ┌지지: 스위스, 스페인, 핀란드, 아일랜드, 일본
  └Study Reserve: 호주, 독일, 프랑스, 미국, 한국

  · 일 본 제안 ┌지지: 無
  └Study Reserve: 호주, 독일, 프랑스, 미국

5) Category 7 (항법장치)

○ 항법장치를 위한 accelerometers에 대한 수출통제 강화 (노르웨이 및 미국 제안 US18)

- 제안 요지

  · 항법장치(inertial navigation 및 guidance system)를 위해 고안된 angular 또는 rotational accelerometers에 대한 수출통제 강화

- 토의 내용

  · 일본, 불란서, 영국 등은 Cat.7.A.2에서 현재 통제되고 있을 지적

  · 미국은 linear accelerometers는 통제되고 있으나 군사목적의 angular 또는 rotational accelerometers는 통제되고 있지 않다고 주장

- 토의 결과
  · 지지: 호주, 벨기에, 캐나다, 스위스, 영국, 이태리
  · Study Reserve: 독일, 불란서, 일본, 네덜란드

※ 우리나라 입장: 우주항공 및 군사전용을 위한 MEMS 기술 개발에 관계된 기업들 중의 하나로 Samsung Electro Mechanics Co. 가 거명됨에 따라 본 주제에 대한 국내 검토를 위해 일단 Study Reserve 입장을 표명함

6) Category 9 (추진 장치)

○ 20Kg 이상의 무인 비행체(UAVs)에 대한 통제 강화
(독일 제안: DE9)

- 제안 요지
  · 20Kg 이상 및 특수부품을 사용하는 무인 비행체(UAVs)에 대한 수출통제 강화

- 토의 내용
  · UAVs 통제에 대한 심층적 검토의 필요성이 제기됨에 따라 TWG를 개최함
  · 또한 본 주제에 대해 MTCR에서 현재 논의중인 회의 결과를 반영할 필요성 제기
  · EG의장은 독일대표단에게 이러한 사항을 감안하여 9월까지 수정안 제출을 제안

- 토의 결과
  · 독일이 수정안을 다시 제출하게 된 관계로 모든 회원국이 보류한 상태임

※ 독일이 추가로 제시한 자료(DE.06.04.00)에는 대우가 한국정부의 ARCH (Agricultural Remote Control Helicopter) 프로그램을 위해 개발 중인 UAV의 원형 (러시아의 KAMOV ka-37)이 포함되어 있는바, 본 의제에 대한 국내 검토가 요구됨

7) Cat. 3, 4, 5 part 1의 Strategic Relevance에 대한 Study

○ Cat. 3, 4, 5 part 1 Study에 대한 지속 여부

- 토의 내용
  · 미국, 일본, 영국 등: 정규 List Review 방식이 충분하므로 별도의 Cat. 3, 4, 5 Study가 더 이상 필요하지 않음을 주장
  · 프랑스, 네덜란드 등: CTP 상향조정, 통제 parameter 대안, latency time 등의 주요 이슈를 보다 현실적으로 검토하기 위해 Cat. 3, 4, 5 Study를 완료해야 한다고 주장

- 토의 결과
  · 오는 9월 제 2차 정기회의에서 Cat. 3, 4, 5 Study를 완료하기로 합의함
  · 이를 위해 각 회원국은 Cat. 3, 4, 5 Study에 대한 공식 입장을 9월 회의 개최 2개월 전(7월 18일)까지 제출할 것을 통보함

□ 방산 품목(Munitions)의 주요 제안 검토

1) Munitions List(ML) 4

○ 휴대용 금속 탐지기에 대한 통제 해제
(호주 제안: AU1 및 영국 제안: GB7)

- 제안 요지
  · 휴대용 금속 또는 지뢰 감지기에 대한 수출통제 해제 Note 삽입

- 토의 내용
  · 네덜란드, 독일, 노르웨이 등은 현재의 통제 항목(ML4.b.)에 휴대용 금속・지뢰 감지기에 대한 통제사항이 없음을 지적
  · 호주 및 영국 수출허가 담당자(licence officer)의 보다 쉬운 이해를 돕기 위한 취지라는 주장을 위해 필요함을 역설

- 토의 결과

  · 호주 제안 ┌지지: 독일, 미국, 노르웨이
  　　　　　　└보류: 스페인, 일본, 네덜란드, 러시아

· 영국 제안 ┌지지: 독일
└보류: 러시아

※ 우리나라 입장: 호주 제안에 대한 지지 표명

※ 초기 입장 변경 회원국: 독일, 우크라이나는 보류에서 찬성으로 입장 변경함

2) 방산 품목 용어에 대한 定議

○ 군사특수목적의 디자인(Specially-designed for Military Use)에 대한 定議 (영국 제안: GB8)

- 제안 요지

· 군사적 목적을 위한 특수 디자인에 대한 定議

- 토의 내용

· 군사특수목적의 디자인에 대한 정의를 통해 수출통제 강화

· 군사특수목적의 디자인에 대한 MTCR의 정의를 참고하여 guideline 으로만 활용을 제한하자는 대다수 의견

□ 초민감(VSL) 품목·기술에 대한 선정 기준의 설정
(EG의장 제안: CHAIR 7)

- 제안 요지

· WA 설립 초기부터 현재까지 미뤄져 온 VSL 품목·기술 선정기준에 대한 검토

- 토의 내용

· Annex 1의 선정기준에다 보다 강화된 “the most” 첨단 재래무기의 자체개발 및 생산에 ”essential” (품목·기술)의 새로운 선정기준을 추가

· 러시아는 (이러한 확산이 바세나르체제의 목적을) “very”(중대하게 위협하는)의 첨가를 제안

- 토의 결과

· 지지: 호주, 스위스, 체코, 독일, 프랑스, 영국, 그리스, 아일랜드, 일본, 네덜란드, 노르웨이, 폴란드, 루마니아, 스웨덴

· Study Reserve: 캐나다, 미국

III. 종합적 관찰

○ 정식 프로포즐(총 65개) 및 주요 이슈에 대한 1차 검토가 마무리됨에 따라 금년도 통제 리스트 개정에 대한 향후 검토방향 및 우선 검토 대상이 파악됨.

○ 우리나라는 금번 회의에서 준비된 검토의견과 관련 전문가들의 참석을 십분 활용하여 16개의 제안에 대해 우리나라의 입장을 표명함으로써 통제 리스트 개정과정에 실질적인 기여를 함.

○ 1999년 총회에서 準민감품목·기술에 대한 통제를 가능한 한 완화하자는 합의에도 불구하고 금번 회의에서 통제 강화를 목적으로 제안한 주요 프로포즐[Samsung Electro Mechanics Co.가 개발중인 항법장치를 위한 accelerometers와 대우가 개발 중인 무인 비행체(UAVs) 기술이전]에 대한 검토 과정에서 우리나라와 같은 신흥공업국들의 자체기술개발을 연구개발(R&D) 차원에서 억제하려는 의도를 재확인 함.

○ 이러한 통제 강화 추세와 미국의 예기치 못한 접근[자국이 제안한 Category 3(전자)의 차세대 반도체 제조기술(CVD) 프로포즐에 대해 미국 대표단은 본 회의 진행과정에서 우리 대표단과 사전 협의할 것을 요청해 옴]은 우리나라의 보다 적극적인 바세나르체제 활동에 대한 구체적인 시사점을 발견할 수 있는 계기로 평가됨.

V. 건의 사항

○ 금번회의에서 우리의 입장을 표명한 항목(16개)에 대한 보다 심층적인 분석을 통해 우리의 최종입장을 수립하고 이를 차기 통제 리스트 개정과정에 적극 반영하기 위해서는 실무자가 중심이 되고 관계 전문가가 참여하는 국내 협조체제가 구축되어야 할 것임.

○ 특히 9월 회의 첫 번째 의제로 설정된 Cat. 3, 4, 5 Study에 대한 우리나라 입장을 수립하여 오는 7월 18일까지 제출하기 위해서는 관련 실무자와 전문가를 중심으로 “Task Force”를 구성하여 이러한 후속작업을 추진해야 할 것임.

○ 아울러 이러한 준비과정에 우리나라가 미국 및 일본과 어깨를 나란히 하는 반도체 제조기술 분야에 관한 심도 있는 정책자문의 확보를 위해 관련 전문가를 선정하여 적극 참여케 함이 바람직 할 것임.

제 6 장 정책적 시사점 및 대응 방안

제 1 절 정책적 시사점

- 다자간(바세나르)체제는 지식 창출을 위해 경쟁하는 새로운 국제환경 속에서 국가산업경쟁력의 핵심인 전략기술에 대한 수출·이전을 범세계적 차원에서 체계적으로 통제하는 제도(‘global view’)를 도입하고 나아가 연구개발(R&D) 활동으로 통제 범위를 확대하는 새로운 정책틀(부록 1 참조)을 마련하였다.
- 이러한 새로운 통제규범의 태동은 국제 과학기술교류·이전을 통해 국내 연구개발자원의 한계를 극복하려는 우리 정부의 과학기술 국제협력정책전반에 대한 새로운 변혁을 강력히 시사하고 있다.
- 이러한 통제 강화 추세와 차세대 반도체 제조기술(CVD) 프로포즐에 대해 우리 대표단과의 사전 협의를 위한 미국의 예기치 못한 접근 등에서 노정된 일련의 정책환경의 가시적 변화는 우리나라의 WA 참여정책에 대한 근본적인 변화(단순 참여형태에서 적극적 참여형태로)를 강력하게 요구하고 있다.
- 따라서 바세나르체제의 최근 통제정책의 변화를 국내 정책에 신속히 반영하고 나아가 WA체제의 의사결정과정에의 적극적인 참여를 통해 향후 정책의 변화를 주도하기 위해서는 아래와 같은 대응전략 및 추진방안의 마련이 필요하다.

제 2 절 대응 전략

- 능동적인 참여를 위해 우선 지난해 11월에 과학기술정책의 주무부처인 과기부에 의해 구성된 “WA체제 전문가협의회”를 활성화하여 주요 회의결과 및 정책현안에 대한 종합적인 분석을 통한 정책자문체계를 확립해야 할 것이다.
- 국내 종합조정을 통해 최종 입장을 수립하고 이를 통제리스트 검토과정에 효과적으로 반영시키는 전략을 지속적으로 추진할 수 있는 정책 프로그램의 도

입을 통한 제도적인 지원 및 기반의 구축이 바람직하다.

제 3 절 추진 방안

- 우선 파악된 주요 정책 이슈에 대한 우선 순위의 설정을 통해 과기부의 공식 입장을 정립하고 나아가 중장기적인 이슈를 개발하기 위해 “WA체제 전문가 협의회”를 활용한 체계적인 연구분석의 수행을 통해 아래와 같이 추진 과제와 방안을 도출해야 할 것이다.
  - 단순 대응 과제: 특정 제안에 대한 지지, 반대 및 보류에 대한 기본 논리 개발·제시하여 우리의 입장 표명
  - 적극적 대응 과제:
    - · 특정 제안에 대한 지지의 경우, 공동 발제자로서 참여하기 위한 추가 제안서의 작성
    - · 특정 제안에 대한 반대 또는 보류의 경우, 우리의 입장을 적극적으로 관철하기 위한 Counter Proposal을 작성
    - · 새로운 이슈를 주도적으로 창출할 경우, 기존 통제항목 개정의 필요성에 대한 공감대를 형성하기 위한 비공식 Working Paper를 작성·제출
    - · 제시된 Working Paper에 대한 진행결과를 바탕으로 공식 제안서를 작성·제출하고 이를 성공적으로 관철시키는 전략을 수립
- 예를 들면, 중장기적으로는 추진 기반을 확립하기 위한 WA 정책프로그램의 개발과 단기적으로는 프랑스 주도의 전략기술의 수출·이전에 대한 통제 강화를 위한 “Technology Assessment 제안”, “Cat. 3, 4, 5 + part 1에 대한 공통 통제 방안 Study” 그리고 기타 주요 이슈에 대한 공식 및 최종 입장을 수립하고 이를 효과적으로 관철하기 위한 전략을 도출하기 위한 정책연구를 수행할 필요성이 제기된다.

<별 첨 1> 전략물자·기술에 대한 수출·이전 통제

1. 수출통제 대상 종류

○ 재래무기 통제

○ 민군겸용기술 통제

2. 통제대상 품목 리스트

○ 민군겸용품목 리스트의 종류

- 기본 품목·기술 리스트 [Basic List(BL)]
- 민감품목·기술 리스트 [Sensitive List(SL)]
- 초민감품목·기술 리스트 [Very Sensitive List(VSL)]

○ 민군겸용 일반리스트(BL) 통제대상 분야 (category)

1) 신소재
2) 소재가공
3) 전자
4) 컴퓨터
5) 통신장비
6) 센서 및 "레이저"
7) 항법장치
8) 해양기술
9) 추진장치

3. 수출 및 이전통제실적에 관한 정보교환

○ 전략 품목 및 기술이전에 대한 통보 의무

- 비회원국과의 이전·거래시 우선적으로 통보
  - · 통보 항목: 획득활동, 수출통제정책, 의혹 개발사업
- 민군겸용 BL에 대한 모든 비회원국 거부실적 통보
- SL 및 VSL에 대한 사안별 통보
- 통제에 대한 손상(undercutting: 최근 3년 내의 거부품목에 대한 이전)의 경우는 30-60일 이내에 모든 회원국에게 통보

○ 정보교환 시기

- 민군겸용품목

  · 1월~6월 실적: 해당 연도 9월 30일까지 마감

  · 7월~12월 실적: 익년도 3월 31일까지 마감

- 재래식 무기

  · 1월~6월 실적: 해당 연도 9월 30일까지 제출을 원칙. 늦어도 10월 31일까지 제출 가능

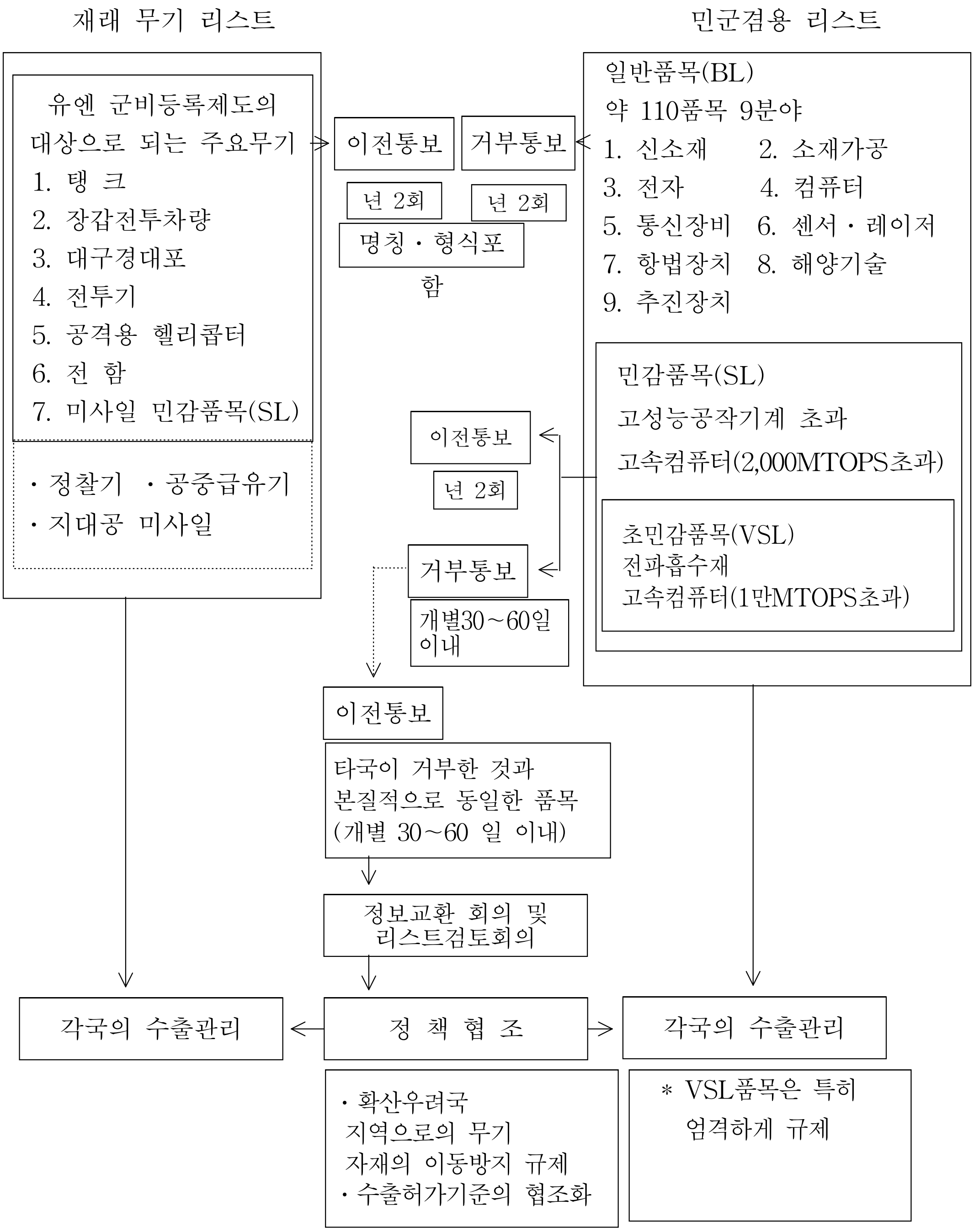
  · 7월~12월 실적: 익년도 3월 31일까지 제출을 원칙. 늦어도 4월 31일까지 제출 가능

4. 전략 및 방산물자·기술 통제 리스트의 검토

○ 매년 방산 및 전략물자·기술에 대한 수출·이전의 통제범위를 검토

○ 개정된 새로운 통제 리스트는 총회에서 승인된 직후 발효됨

<표 2> 바세나르협정 체제의 개요



<표 3> 민감 및 초민감품목 내역

카테고리별	민 감 품 목 (SL)	초 민 감 품 목 (VSL)
1. 신 소 재	- 세라믹 복합재료 - 섬유, 섬유를 사용한 성형품	- 섬유를 사용한 성형품
2. 소재가공	- 수치제어 공작기계 - 치차제어용 공작기계	
3. 전 자	- 원자주파수 표준기 - 반도체 제조장치	- 전파흡수제, 도전성고분자 - 핵열원물질
4. 컴 퓨 터	- 전자계산기	- 전자계산기
5. 통신장비	- 전송통신장비 - 통신관련 설계・제조・측정・시험・수리용 장치 - 암호장치 - 정보전달 신호누수 방지장치 - 다단계 비밀보호 기능을 가진 장치 - 도청탐지 기능을 가진 통신케이블 시스템 - 암호장치 등의 설계・제조・측정・시험・수리용 장치	- 1,000채널을 초과하는 초디지털 전송통신장비
6. 센서・레이저	- 음파이용 수중탐지장치 - 광검출기 - 카메라 - 광학부품 - 광학기계 제어장치 - 자력계, 자력광배계 - 레이더	- 수중탐지장치 - 우주용 광검출기 - 레이더
7. 항법장치		
8. 해양기술	- 잠수정・수상선 - 선박의 부분품・부속품 - 수중로봇 - 동력장치	- 잠수정(단독 항행이 가능한) - 선박용 방음장치
9. 추진장치	- 추진장치 관련 시험・측정・검사・제조장치	

<별 첨 2> 바세나르체제 전문가협의회 위원위촉

구 분	바세나르체제 통제기술분야	기 관 명	성 명	소속부서(직위)
위원장	-	과학기술부	구본제	과학기술협력국 기술협력총괄과장 (부이사관)
위원	제1장 신소재	전자부품연구원	박종천	통신부품연구센터 (센터장/수서연구원)
		한국화학연구소	유성은	화학물질연구부 (책임연구원)
		한국전기연구소	이희웅	신소재응용연구그룹 (그룹장/책임연구원)
	제2장 소재가공	한국기계연구원	이용태	재료공정연구부 (책임연구원)
		한국표준과학연구원	조양구	물질량표준부 (부장/책임연구원)
	제3장 전자	한국전기연구소	임근희	전기물리연구그룹 (그룹장/책임연구원)
		전자부품연구원	이철동	시스템IC연구센터 (센터장/수석연구원)
	제4장 컴퓨터	한국전기연구소	허영	영상응용연구그룹 (그룹장/책임연구원)
	제5장 전기통신 및 정보보안	한국전기연구소	허영	영상응용연구그룹 (그룹장/책임연구원)
	제6장 센서 및 레이저	한국과학기술연구원	서상희	정보재료·소자연구센터장 (책임연구원)
	제7장 항법 및 항공전자공학	한국항공우주연구소	이수용	우주기반기술연구부 (그룹장/책임연구원)
	제8장 해양기술	한국해양연구소 (선박해양공학분소)	이진태	해양개발시스템연구센터장 (책임연구원)
	제9장 추진장치	한국항공우주연구소	조광래	우주기반기술연구부 (그룹장/책임연구원)
	산업계 기술계발	한국산업기술진흥협회	허현회	기술정책팀 (팀장/부장)

<별 첨 3> 1999년 전략물자·기술 수출통제리스트에 관한 제1차 검토 결과

I. Category 1: 신소재

1. 독일 프로포즐(DE 4)

○ 제안 요지

- Monomer를 IUPAC (국제 순수・응용화학연합: International Unit of Pure and Applied Chemistry)에서 사용되는 국제적 표준용어인 “Group as a Constitutional Unit"으로 대체

○ 토의 결과

- 상기 독일안 수용 합의

2. 영국 프로포즐(GB 5)

○ 제안 요지

- 1.c.2.a.2와 1.c.2.b는 상호 참조토록 하여 혼선을 야기하므로 조정 필요

○ 주요 논의사항

- Technical Working Group(이하 TWG)를 구성하여 통제대상을 변경시키지 않고 logical한 문안 작성
- TWG가 작성한 문안에 대해 일본은 study reserve 표명

3. 독일 프로포즐(DE 5)

○ 제안 요지

- zirconium과 hafnium간의 관계를 명백히 규정할 필요

○ 주요 논의사항

- zirconium allory를 포함하고 있는 hafnium의 핵응용 가능조건(%)을 논의하기 위해 TWG 구성

- TWG가 제시한 문안에 대해 일본, 프랑스, 네덜란드, 미국 등 study reserve 표명

4. 독일 프로포즐(DE 2)

○ 제안 요지

- Nitroguanidine은 의약품, air bag 등에도 사용되고 있으므로 Munition List 8.a.4에서 Dual List로 이전

○ 토의 결과

- 프랑스 study reserve 표명

5. 영국 프로포즐(GB 6)

○ 제안 요지

- 해당 규제 물질이 nuclear heat resourceaks 위해 사용되는 것은 아님을 명시할 필요(의미있는 내용 변경을 의도하고 있지 않음을 부언 설명)

○ 토의 결과

- 프랑스 study reserve 표명

Ⅱ. Category 2: 소재 가공

1. 영국 프로포즐(GB 7 및 GB 24)

○ 제안 요지

- 규제대상 마모방지 베어링 조건을 구체적으로 규정하는 Technical Note(TN) 명시 제안

○ 주요 논의사항

- 영국, 일본, 독일, 러시아는 ABEC 7/9가 ABEC 7과 같은 내구성을 보유한다는 입장
- 미국은 ABEC 7/9가 ABEC 9와 마찬가지로 잠수함, 미사일 제조 등에 활용 가능하다면서 기능에 따른 기준 설정 필요성 제기

2. 미국 프로포즐(US 17)

○ 제안 요지

- Diamond-Like Carbon(DLC) Coating 통제대상 범위 변경

○ 주요 논의사항

- 일본, 러시아 등은 DLC Coating에 관한 국제기준이 현재 정립되어 있지 않다면서 특히 70%를 기준으로 삼은 이유를 납득하지 못한다는 이의 제기
- 미국은 보통 상용의 경우에는 70% 이하의 경우인 바, 6월말까지 measurement 기준 관련 문건을 제출하겠다고 밝힘.

Ⅲ. Category 3 : 전자

1. 영국 프로포즐(GB 20)

○ 제안 요지

- computers module에 관한 규제범위를 규정함에 있어 개념이 모호한 “integrated circuit”을 사용하기보다는 “substrate”의 개념을 보완하여 사용하는 것이 바람직

○ 주요 논의사항

- 영국안이 혼란을 야기할 수 있다면서 미국, 네덜란드, 일본 등이 reserve 의사 표명

2. 영국 프로포즐(GB 25)

○ 제안 요지

- 대량 생산되고 있는 특정 조건하의 microprocessor는 통제 불가능함을 제기

○ 주요 논의사항

- 미국은 대량생산이 된다고 하여 첨단기술이 아닌 것으로 간주할 수 없으며, 대량생산 물품의 군사적인 전용도 통제 불가능하다고 보지 않는다는 입장 표명

3. 마이크로프로세스 CTP 수준 상향조정

i) 독일프로포즐(DE 6)

○ 제안 요지

- microprocessor(MD) 규제범위와 관련한 CTP (composite theoretical performance)기준에 대한 타협안 제시

ii) 네덜란드 프로포즐(NL 2)

○ 제안 요지

- 이미 2,000MTOPS 이상의 물품이 광범위하게 판매되고 있으며, 금년 말 시판예정인 펜티엄 III 감안시 2,000MTOPS이하의 컴퓨터는 규제 대상에서 해제 당연

○ 주요 논의사항

- 일본은 이미 수백만 명이 2,000MTOPS 이상의 제품을 사용하고 있는 현실을 감안할 때 동 제품의 controllability가 의문시된다고 발언
- 미국은 시판되고 있어서 통제될 수 없다는 것은 저급 MP의 군사적 활용 가능성을 이해 못하는 소치이며, 법규를 어길 시 처벌한다는 방침을 명확하게 하고 수출허가 발급을 엄격히 해야 한다고 강조
- 프랑스는 microprocessor의 성능을 CTP로 평가하는 것은 어느 한 기업의 세계시작 독식을 초래할 수 있다며 “latency time” 등 다른 기준을 검토할 필요성이 있다고 강조
- 네덜란드와 미국간 극명간 의견대립 후 양안에 대해 각각 다수의 reserve가 표명됨.

4. 미국 프로포즐(US 5)

○ 제안 요지

- ultra low power 마이크로 프로세서는 해저 지뢰기폭장치 등에 응용될 수 있으므로 민간 장비라도 규제 필요

○ 주요 논의사항

- 일본, 러시아 등이 군사적 전용 위험보다 민간부문 활용여지가 더 크다며 reserve 표명

- 네덜란드, 노르웨이 등은 ultra low power 마이크로 프로세서에 대한 구체적 정보 요청(reserve 표명)

5. 스페인(ES 1) 및 미국(US 22) 프로포즐

○ 제안 요지

- Analogue-to digital 및 Digital-to-analogue converter를 통제하는데 있어 통제기준을 명확히 할 필요

○ 주요 논의사항

- 스페인 제안과 미국안을 종합하기 위해 TWG 구성, 종합안을 제시
- TWG안에 대해 중국과 일본이 study reserve 표명

6. 미국 프로포즐(US 8)

○ 제안 요지

- field programmable gate arrays를 logic device로 용어를 대체하여 명확하게 표현하는 것이 필요 (규제대상 범위를 변경할 의도가 없음을 표명)

○ 주요 논의사항

- 영국, 일본, 독일은 미국안 지지(3.A.1.a.7항내 b와 c는 이론상 다르나 실제상 차이가 없음을 인정)
- 네덜란드, 노르웨이 등은 통제 대상범위가 확대될 가능성이 있다며 study reserve 표명

7. 영국 프로포즐(GB 18)

○ 제안 요지

- ITU에 의해 배정된 주파수대 중 31GHz 이하는 민간 사용해도 무방(테스트용 microwave 제품에도 같은 기준을 채택할 필요)

○ 주요 논의사항

- 미국, 일본, 프랑스, 영국 등 다수국 study reserve 표명
- 네덜란드는 기준을 51GHz으로 상향 제시하는 경우 지지 표명

8. 미국 프로포즐(US 11)

○ 제안 요지

- 3.A.1.b.1.C항 및 1, 2는 상호 중복되며 특히 1에 해당하는 물품이 없으므로 삭제 타당

○ 주요 논의사항

- 프랑스만 study reserve 표명

- 동 사안 논의시 미국은 필요시 dual-use list와 munition lists cross reference 필요 주장, 일본, 영국, 네덜란드는 redundant한 cross reference는 필요 없다는 입장 표명

9. 미국 프로포즐(US 12)

○ 제안 요지

- 3.A.1.d 항하 1,2,3은 상호 중복되며, 특히 1은 민간 사용물품이 아니므로 삭제 제안

○ 주요 논의사항

- 영국은 3.A.1.d 항내 1, 2 중 어느 쪽을 삭제해야 하느냐에 대한 추가적인 정보 요청(study reserve)

- 그 외 회원국 지지 표명

10. 미국 프로포즐(US 6)

○ 제안 요지

- 규제기준을 과정(process)에 두기보다는 기능(function)에 따라 바꾸는 것이 합리적(일관성을 주기 위함이며 규제확대(roll-back) 의도는 없음을 강조

○ 주요 논의사항

- 일본, 영국 등은 미국이 제시한 기준이 명확하지 않고 오히려 혼란만을 초래한다고 지적

- 러시아, 프랑스 등은 추가적인 검토 필요(study reserve) 의견 표명

11. 미국 프로포즐(US 7)

○ 제안 요지

- US6과 마찬가지고 기능에 따른 규제 및 통제품목 설정 필요

○ 주요 논의사항

- 일본, 네덜란드, 영국 등 이견 표명으로 차기 회의에서 추가 논의키로 함.

12. 독일 프로포즐(DE 7) 및 미국 프로포즐(US 9)

○ 제안 요지

- 초기 상용제품 하자 검사에 쓰이는 testing integrated circuits 규제 기준과 관련하여 독일은 333MHz, 미국은 220MHz을 제시

○ 주요 논의사항

- 미국은 실용상의 이유로 현재 규제 수준을 완화할 필요가 있으나 현 microprocessor 규제 수준에 맞추어 220Mhz 기준을 제안한다고 설명

- 독일은 미국 제안과 차이가 크지 않음을 설명

- TWG가 구성되어 240/250Mhz 제시

- 각 안에 대해 각각 reserve가 표명되어 미합의

Ⅳ. Category 4: 컴퓨터

1. 영국 프로포즐(GB 3)

○ 제안 요지

- Computer와 Cryptographic 장비 등 개별 기능장비는 다른 종류의 물품이므로 개별 기능장비는 Cat.5 part 2로 이전 필요

○ 주요 논의사항

- 미국 등이 현재 안이 명확하며, Cat. 4는 기본적으로 CTP value 등 컴퓨터의 핵심 사항을 주로 다루게 되어 있으나 컴퓨터와 밀접히 관련된 기재도 포함되어 다루는 관례를 존중하는 것이 바람직하다고 대응

2. 네덜란드 프로포즐(NL 1)

○ 제안 요지

- 내년부터 시판될 펜티엄III가 10,000이상의 MTOPS 기능을 수행하므로 현행 2,000MTOPS는 너무 제한적

★ 영국안(GB 2)

○ 제안 요지

- CTP 기준을 4,000MTOPS로 상향조정하는 대신 commodity digital computers는 기존 기준을 적용

○ 주요 논의사항

- 러시아, 스위스 등 다수국들이 통제수준 상향조정 필요성에 공감, 일본은 개인용 컴퓨터가 4,000MTOPS 기능을 수행하므로 commodity digital computers를 포함하여 기준을 4,000MTOPS로 설정하는 타협안 제시

- 미국은 자국내 어려움에도 불구하고 현행 기준에 따라 수출을 규제하고 있다고 대응

* 프랑스는 CTP로 컴퓨터 수준을 정하면 한 회사가 독점하는 결과가 유발되며 MTOPS가 낮아도 고성능 컴퓨터로 개량이 가능하다며 "latency time"등을 기준으로 설정할 것을 제의

Ⅴ. Category 5 part I: 통신장비

1. 일본 프로포즐(JP 1)

○ 제안 요지

- frequency agility가 frequency hopping 개념을 포함하고 있지 않으므로, 현 문안 개정 필요성 대두, 또 Frequency hopping 개념을 추가하여 명시할 필요성

○ 주요 논의사항

- 본문 개정과 관련해서는 합의 도출
- Frequency hopping 개념에 대해서는 “by a random or pseudo-random sequence” 문안을 포함시키자는 스페인 추가 제안에 대해 찬성이 대부분이었으나, 미국, 네덜란드, 독일, 벨기에 등은 study reserve 표명

2. 독일 프로포즐(DE 8)

○ 제안 요지

- 규제 대상 Technology중 digital cellular radio system technology 삭제 바람직(동 제품의 경우 digital과 non-digital간 실질적 차이가 없음을 설명)

○ 주요 논의사항

- 미국은 TDMA 등과 관련하여 동 문안 삭제가 어렵다고 대응하고, 필요시 상기 문안 중 system을 equipment로 대체할 경우 지지용의 표명

3. 영국 프로포즐(GB 18)

○ 제안 요지

- 상업용 민간 cellular radio communication system용 기재의 규제 해제를 note로 명시할 필요 및 radio equipment에 대한 규제 단순화 필요

○ 주요 논의사항

- note 문안 삽입에 대해서는 commercial 용어를 삭제하자는 의견을 영국이 수용함으로써 합의 도출
- radio equipment 규제 단순화에 대해서는 현재 5.D.1.d.4항에 놓인 note는 규제대상이 없으므로(empty box) 삭제하자는 의견이 다수였으나, 미국은 31GHz 이상 주파수 기재는 전략적 필요가 있다고 하여 삭제 논의에 제동

Ⅵ. Category 5. part II: 정보 보안

1. 미국 프로포즐(US 18)

○ 제안 요지

- 구독료를 지불하고 방송을 통해 정보를 얻는 상품이 등장함에 따라 동 정보의 탈취 방지를 위한 암호화 기술이 규제 해제 요망

○ 주요 논의사항

- 네덜란드, 러시아, 핀랜드 등은 미국측의 의도에 관한 추가적인 정보 요청
  - 미국은 전파를 통해 손목시계 등에 주식, 날짜 정보를 제공하는 상품을 상정하고 있다고 답변
- 노르웨이, 독일 등은 5.A.2.a.2 Note b에 규정하여야 할 대상이라고 언급
  - 미국은 copyright 보호를 위한 것이므로 Note cgkd하에 규제하는 것이 적절하다고 설명
- 미국을 제외하고 모든 회원국이 미국측에 추가적인 정보를 요청하고 study reserve 표명

2. 영국 프로포즐(GB 4)

○ 제안 요지

- 원 제조자만이 추가할 수 있는 암호화 부품 이용가능 장치를 내장한 제품의 규제 해제

○ 주요 논의사항

- 다수국들이 영국측의 의도에 대한 해명 요청
- 일부 국가는 암호화 기재 중 해제되는 품목을 나열하는 방식이 적절치 않음을 제기
- Executive Manager 등은 통제대상 물품을 장치할 수 있는 기재 허용 여부는 향후 복잡한 논란을 일으킬 수 있음을 지적하고 신중한 접근 요청(판도라의 상자라고 언급)
- 거의 모든 회원국들이 study reserve 표명

3. 오스트리아 프로포즐(AU 1)

○ 제안 요지

- 현재 5.D.2항 software 제품은 hardware등 tangible component와 연계되지 않는 부품임을 명백히 할 필요

○ 주요 논의사항

- 회원국들은 모든 software는 hardware 등 tangible component와 연계되어야 함을 지적하고 또 현재 삽입 제안 위치에 대해서도 이견 표명

4. 영국 프로포즐(GB 27)

○ 제안 요지

- Software 정의와 관련 개정안 제출

○ 주요 논의사항

- 일본, 네덜란드, 프랑스 등 study reserve 표명

5. 미국 프로포즐(US 19, 20 및 27, Public Domain 규정 관련) 논의여부

○ 미국(캐나다)

- 미국 제안은 작년에 회원국간에 논의키로 한 바 있으므로 비록 제출시한을 못지켰음에도 불구하고 금번 회의에서 논의 희망

- 캐나다는 총회에서 recognize한 사항이므로 비록 6주전까지 제출하는 시한에 이틀 늦게 제출하였음에도 불구하고 금번 전문가 회의에서 다루는 것이 적절하다는 의견 제시

○ 그 외 거의 모든 회원국

- 현재 미국안은 결정을 내릴 수 있는 non-paper 지위 상태이므로 금번 회의시 논의 불가

○ 의 장

- extra-ordinary circumstance로 규정할 것인지가 문제인 바, 금번에는 제안설명만 한 후, 내년 재차 제안서 제출 및 논의 필요

Ⅶ. Category 6: 센서 및 레이저

1. 영국 프로포즐(GB 16)

○ 제안 요지

- 1000m이하 Acoustic 장비는 석유탐사에는 유용하나 군사적 활용도는 없으므로 규제 해제 요망

○ 논의결과: 합의

2. 미국 프로포즐(US 3)

○ 제안 요지

- 35m 수심을 기준으로 수중음향탐지기의 민간 및 군사사용이 구별될 수 있다고 설명하고 현재 규제가 되지 않는 35m 이상 수심용 towed acoustic hydrogen arrays 등 기재 규제 필요

○ 주요 논의사항

- 일본, 러시아, 네덜란드 등은 study reserve 표명

- 프랑스, 영국 등은 통제영역을 일부 확대시킴에도 불구하고 통제 필요성이 납득된다면서 지지 표명

3. 영국 프로포즐(GB 22) 및 미국 프로포즐(US 25)

○ 제안 요지

- 수출허가 공무원 편의상 관련 비규제 물품을 개별적으로 명시할 필요

○ 주요 논의사항

- 일본은 미국안이 더 정확하나 Multi-element와 관련하여 modification 요망
- 상기 일본 제안에 네덜란드 등이 지지하는 등 다양한 의견이 제시되어 추후 더 논의키로 함.

4. 영국 프로포즐(GB 8)

○ 제안 요지

- Camera 규제에 허점이 있음을 지적하고 기능에 따라 Electronic module 등 규제 필요

○ 주요 논의사항

- 일본은 module을 규제하기보다는 module이 내장된 카메라를 규제할 것을 제안
- 독일은 영국안이 별도 heading을 설정하여야 함을 지적

5. 미국 프로포즐(US 4)

○ 제안 요지

- military 감시에 주로 Tm이고 허블 망원경 등 일부 첨단 민간용 기재에는 제한적으로 사용되는 Aspheric optical elements 규제 필요

○ 주요 논의사항

- 일본과 독일은 동 물품이 프리즘에도 사용됨을 지지
- 그 외 대다수 국가 study reserve 표명

Ⅷ. Category 8: 해양기술

1. 영국 프로포즐(GB 9)

○ 제안요지

- non-magnetic이 아닌 잠수장비는 스포츠용품이므로 규제 품목에서 제외

○ 주요 논의사항

- 일본은 note 보다는 본문(8.A.2.9)에서 다루는 것이 바람직하다고 의견을 개진하고 관련 ML도 개정을 검토해야 한다고 설명
- 미국은 테러를 방지하기 위해 동 물품을 계속 규제해야 한다는 입장
- 독일은 non-magnetic 용품이 아닌 것이 모두 스포츠 용품인지 조사가 필요하다고 언급

Ⅸ. Category 9: 추진장치

1. 독일 프로포즐(DE 9)

○ 제안 요지

- 민간용 aero gas turbine engine을 규제대상에서 제외하고 대신 군용으로 전용된 물품을 규제함을 포함

○ 주요 논의사항

- 미국은 현행 문안이 민간용 aero gas turbine도 규제코자 하는 취지임을 강조

- 러시아는 자국이 군사용 비행기 부품을 민간용 비행기용으로 수출하고 있다면서, 비회원국들이 이미 15~20년전 gas turbine을 개발한 상태임을 지적

- 독일은 헬기 엔진과의 관련성을 검토한 후 추가적인 논의 희망

2. 프랑스 프로포즐(FR 2)

○ 제안 요지

- 현재 우주선 platform이나 platform sub-system이 규제되고 있지 않은 상황이나 새로운 기술이 개발되고 있어 이를 명확히 규정하는 등 규제보완 필요

○ 주요 논의사항

- 독일은 platform이 satellite의 중요 구성부분으로 본다고 수정안(DE 10) 제출
- 영국은 독일안이 규제대상을 확대시킬 가능성이 있다며 유보 표명

3. 미국 프로포즐(US 13)

○ 제안 요지

- 9.B.1항 a,c,d에서 규제하고 있는 물품은 현재 민간용으로 광범위하게 사용되고 있으므로 규제 의미가 없음.

○ 주요 논의사항

- 영국은 9.B.1.aso 일부 물품은 핵 제조와의 관계 있는 sensitive한 물품이라며 해제 타당성에 대한 의문 제기
  - 미국은 이에 대해 동 물품이 9.E항에서 규제되고 있다고 설명
- 다수국이 a항을 제외하고 c항 및 d항을 삭제할 것을 지지하는 가운데 프랑스는 추후 검토 의향

4. 미국 프로포즐(US 14 전반부)

○ 제안 요지

- 9.E.3.a.2.3항에서 규제하는 품목을 확대할 것을 프로포즐

○ 주요 논의사항

- 일본, 러시아, 네덜란드 등이 미국의 의도가 불명확하다고 이의 제기

5. 미국 프로포즐(US 14 후반부)

○ 제안 요지

- 9.E.3.a.11 삭제 제안

○ 주요 논의사항

- 네덜란드 등이 현 문안이 불명확하다고 지적하고 미국안 지지
- 캐나다만 study reserve 표명

6. 미국 프로포즐(US 15)

○ 제안 요지

- 9.E.3.a.11내 규제 물품이 이미 상용화되어 더 이상 규제는 의미가 없음.

○ 주요 논의사항

- 영국은 현재 규제되고 있는 물품이 해제될 경우 여타 규제 대상에도 영향을 미치게 될 것임을 제기
- 여타 회원국들은 지지 표명

7. 미국 프로포즐(US 16)

○ 제안 요지

- 9.E.3.d 항내 Technology 규정이 너무 광범위하여 통제 범위를 축소시킬 필요

○ 주요 논의사항

- 일본 등은 tilt rator 또는 tile wing 비행기가 헬기보다 더 민감한 분야임을 지적하고 통제 해제에 이의 제기

Ⅹ. 재래무기 리스트

1. 영국 제한(GB 14)

○ 제안 요지

- 민간용 cartridge를 ML에서 해제시키는 것이 타당

○ 주요 논의사항

- 회원국들은 규제 필요성 제기, 영국안 지지, cartridge 기준 문제점 제기, 문안 위치 등 다양한 의견 개진
- 의장은 영국이 cartridge에 대한 추가적인 정보 제공 요청

2. 영국 프로포즐(GB 13)

○ 제안 요지

- 현 문안(military pyrotechnics)은 military pyrotechnic devices를 의미하는 것으로 이해

○ 토의결과: 합의

3. 영국 프로포즐(GB 10)

○ 제안 요지

- tear gas에 대한 회원국간 일치된 자세가 필요하며 tear gas에 사용되는 화학물질을 열거할 필요

○ 주요 논의사항

- 미국과 독일은 규제물품을 나열하는 경우 exhaustive list처럼 이해될 가능성 우려
- 일본은 영국이 제시한 Oleoresin of Capsicum 물질이 여성용 호르몬 관련 의약품 제조에 사용된다며 규제에 이의 제기

4. 독일 프로포즐(DE 1)

○ 제안 요지

- ML.7.e 및 f는 규제대상 물질에 있어 ML.7.a부터 c까지의 규제와 밀접히 관련되나, ML.7.b 및 c와 관련된다는 문안이 누락된 것으로 이해

○ 주요 논의사항

- 네덜란드, 일본, 영국 등이 para-military용 물품이 규제대상에 포함될 우려 제기

5. 독일 프로포즐(DE 3)

○ 제안 요지

- 규제되고 있는 물품이 하나가 아님을 명확히 하기 위해 문안 조정 필요

○ 토의결과: 합의

6. 영국 프로포즐(GB 12)

○ 제안 요지

- 현 문안은 명확하지 않아 Helmet에 부착하는 야간 관측 안경 및 무전기 등이 군사용인데도 불구하고 규제대상에서 누락될 가능성 제기

○ 주요 논의사항

- 노르웨이 등이 군사용 accessories를 의미하는 것이라고 지적하자, 영국측은 accessories와는 다른 차원의 물품이라고 답변
- 이에 독일이 accessories도 별도로 명시·규제해야 한다고 제의
- 벨기에, 네덜란드는 구체 물품을 나열하자는 의견 개진

7. 영국 프로포즐(GB 11)

○ 제안 요지

- 군사용 교량도 규제에 포함 필요

○ 주요 논의사항

- 독일 등이 교량용으로 용도 변경한 component도 규제하는데 대해 이의 제기

- 영국은 독일 의견을 수용한 개정안을 제출하여 합의 도출

8. 영국 프로포즐(non-paper)

○ 제안 요지

- NGO들이 인도적 차원에서 지뢰를 제거하는데 도움을 줄 수 있도록 휴대용 금속탐지기 수출을 허용하자는 취지

○ 주요 논의사항

- 당초 제출 시한을 지키지 못했음에도 불구하고 금번 회의에서 논의키로 하였으나, 러시아가 제출시한을 엄격히 준수해야 한다고 강변하여 실제 논의 무산
- 영국은 논란을 피하고자 한다며 추후 정식 제안할 예정임을 표명

XI. 민감 리스트

1. 영국 프로포즐(GB 19)

○ 주요 논의사항

- 미국이 자국 생산자에 미칠 부담을 감안시 영국안을 수용할 수 없다면서 현 문안 유지가 바람직하다고 입장을 밝혀 추가적으로 논의하지 않음.

XII. 용어 정의

1. 영국 프로포즐(GB 21)

○ 제안 요지

- "Modified", "Designed", "Specially Designed" 등 개념 정립

○ 주요 논의사항

- 미국과 일본은 새로운 guideline 설정 작업이므로 신중을 기해야 한다는 의견 개진
- 네덜란드는 동 문구 해석은 회원국 재량에 일임하는 것이 바람직하다는 입장 표명
- 각국의 다양한 의견 제시 Legal Officers' Meeting 등을 거친 후 추후 논의키로 함

2. 사무처 프로포즐(SEC 23)

○ 제안 요지

- 현 문안 중 Notes, Technical Notes 및 Nota Bene이 혼용되고 있어 혼란을 초래하는 바, Note는 통제지위에 영향을 미치는 문구, Technical

Note는 기술적인 참고사항 NB는 관련 이슈나 문항을 표시하는데 사용함으로써 구별 필요

○ 주요 논의사항

- Case by Case로 논의하여 상당부분 변경에 대해 합의 도출

<부 록 1> 1999 ASSESSMENT OF THE FUNCTION OF THE WASSENAAR ARRANGEMENT PLENARY CONCLUSIONS

GENERAL

1. Participating states agreed that Wassenaar Arrangement objectives remain valid as laid down in the Initial Elements.
2. Participating states agreed that, in line with these goals, the WA should also continue to contribute to preventing circumvention of export controls, inter alia, by terrorist or organised criminal groups that seek to acquire armaments and dual-use items.
3. Recalling the Elements for Objective Analysis and advice concerning Potentially Destabilising accumulations of Conventional Weapons adopted by the WA in 1998 (Annex B to WA-PLM (98) CHAIR 37), Participating states confirmed the importance of all these elements.
4. Participating states, while deciding not to revise the WA Initial elements at this point (i.e., articles I. To IX. And appendices 1 and 4), reaffirmed again the evolutionary nature of the WA, noting the provisions in the IE for review of particular issues outside an overall assessment. With regard to the Information exchange, it was also generally recognized that there was room for improvement in the WAs operation and scope.

INFORMATION EXCHANGE

5. Participating states recognised the need to improve the efficiency of the WA information exchange. In this regard, they agreed that the Plenary should review and endorse annually a Global View framework document which would include the regions on which Participating states agreed that information can most usefully be exchanged in furtherance of the Purposes of the WA Initial elements, in order to focus and record assessments within the General Working Group.
6. Following Plenary agreement, with the General Working group chairman as facilitator, individual Participating States or groups of Participating States will agree to work on the compilation of Regional Views. These will take into account arms and dual-use items, and will be based on reliable general information, the Elements for Objective Analysis and Advice Concerning Potentially destabilising accumulations of Conventional Weapons, and specific information on transfer and denials. Regional Views will be circulated to the general working group with a view to discussion and possible agreement on an overall assessment. These

Regional views will contribute to an annual updating of the Global View as well as highlight possible transfer concerns.

7. The global view/regional assessment process should not limit the agenda or the free flow of information to the General Information Exchange (GIE) as envisaged in the Initial elements. The secretariat will compile and collate information supplied by Participating states. In particular, the secretariat will be tasked to compile specific information on transfers and denials by regions of destination rather than country of origin as well as by categories of items and, where appropriate, to append this to the relevant Regional view. This data may be updated electronically upon establishment of the automation system. Regional views and the Global view will include all views submitted by individual participating states, whether or not an agreement is achieved. Such assessment may be used by Participating States for reference in the process of national decision-taking on transfers.

General Information Exchange

8. where the risks are judged greatest, e.g., in areas of tension or conflict, Participating states agreed to:
   a) make use of the criteria for assessing destabilising accumulations, adopted in 1998, in discussion and analysis;
   b) use the Global View to help identify problems before they turn into crises;
   c) exchange information on the military capability, and dual-use goods and technologies needed to improve that capability, in the regions and states referred to in IE I.3;
   d) consider, as appropriate, relevant information on transfers of uncontrolled items;
   e) study further the possibility of including a technology assessment as part of the Global View.
9. Participating states agreed that more information should be exchanged on weapons acquisitions by non-state actors in non-Wassenaar arrangement countries.
10. Participating states agreed that a separate GIE agenda item should be established (by the GWG) for the exchange of information on indigenous conventional arms production capacity.
11. As regards information important to licensing and enforcement officers, Participating states will:
   a) continue on a voluntary basis to exchange information regarding the areas outlined in Appendix I of the IE and as envisaged in the 1997 Plenary Chairmans statement on Voluntary Information Exchange (Annex 3 to WA-PLM (12-97) CHAIR 14);

b) also on a voluntary basis, continue to share information on, inter alia, networks, agents, unreliable brokers and end-users if there is an apparent risk of their involvement in the acquisition of conventional weapons capabilities by terrorists or criminals.

12. Participating States will foster substantive input to the GIE from licensing and enforcement officers, and appropriate linkages and information flow between the GWG (including LEOM) and the EG.

13. It was reiterated that paper should be submitted in advance of WA sessions in good time for the efficient conduct of the GIE.

Specific Information Exchange

14. It was generally agreed that the Specific Information exchange (SIE) discussions and analysis of submitted data needed to be enhanced.

15. Submitted transfer and denial data will in future be compiled by the WA secretariat to assist Participating states to determine where destabilising accumulations have occurred, are occurring, or are likely to occur.

16. Participating states, having analysed the agreed criteria for assessing destabilising accumulations of weapons and proposals to improve arms transparency, agreed to elaborate reporting requirements for the exchange of information on arms deliveries and, accordingly, amend Appendix 3 of the IE as set forth in Attachment 1.

17. Whilst acknowledging the current practice of voluntary reporting on arms transfer denials on an individual basis and undercuts of such denials and of transfers and denials of items on the Correspondence List, Participating States agreed to study the value of reporting such transfers and denials.

18. Recognising that the level of transparency in the dual-use pillar is already advanced, Participating states decided to study the possible inclusion of end-user data in basic List denial notifications and of reporting all transfers of SL and VSL dual-use items. A study could also be undertaken on conducting prior consultations before undercut decisions on SL or VSL denials.

19. Participating States acknowledged the recent trend toward, and agreed to take account of the contribution of increased voluntary reporting, with the understanding that this should not be a substitute for mandatory reporting.

20. The Plenary mandates the GWG to study further, as a matter of urgency:

a) the desirability and feasibility of including small arms and light weapons in the specific information exchange of the arms pillar;

b) the possible scope of any new reporting requirement, including definitions and thresholds for small arms and light weapons. Such review shall include, in addition to other weapons, MANPADS and man- and crew-portable anti-tank weapons.

The GWG is to report the results of the study of a) and b) to the 2000 Plenary.

The Plenary also mandates the GWG to study the possibility of increasing transparency in the following categories:

a) amphibious and deep-water fording vehicles, armoured vehicle-launched bridges, and armoured recovery vehicles;
b) gun carriers and tractors specially designed for towing the large calibre artillery systems covered in Category III of Appendix 3 to the Initial elements;
c) the range of missiles and torpedoes and the tonnage of warships; and
d) missiles and missile launchers.

21. Participating states reaffirmed their wish to establish a simple, secure and cost effective electronic communication system to complement diplomatic channels, which would be a key step in developing the SIE.

<u>CONTROLS</u>

22. Participating States agreed that the process of reviewing control list by the Expert Group worked well and was valuable.
23. They agreed that the list should be updated in due time to keep them relevant with security, technological and commercial developments in accordance with WA purposes and procedures.
24. It was agreed in principle that, in considering the timely control of rapidly emerging critical technologies, the use of 2 to 3-year validity notes, or other alternatives, was worth examining in the EG in the coming year. They also agreed that, whenever appropriate, they should work to liberalise controls for less sensitive items, in the interests of efficiency and credibility, while taking into account security concerns.
25. Participating States will also in the coming year develop criteria in the EG for selection of items for the VSL, after agreeing on the nature of the criteria.

26. It was also agreed to expedite and conclude, in the course of the next year, the study on the definition and interpretation of specially designed for military use and work out practical implementation of issues arising from the study, i.e., to ensure that all items on the control lists meet the agreed definition and interpretation. .
27. Participation States will also consider in the next year, having examined relevant national practices and legislation, whether to adopt WA-wide end-use oriented controls, including supplementary controls on currently uncontrolled goods (catch-all or catch-more mechanisms) destined for where the risks are judged greatest.
28. Participating States will also, in the next year, examine the question of whether there should be, in future, contacts with relevant non-proliferation regimes, first at the political/institutional level, then at a technical level, with the intention of proposing closer alignment of the parameters, wording and formats of their control lists with that of the WA lists.
29. Participating States recognised it is important to have comprehensive controls of listed items, including control on intangible transfers. Participating States also recognised that it is important to continue deepening WA understanding of how and how much to control those transfers. In this context, the possibility of taking national measures should be considered.
30. Building on their commitment in the IE to assess the scope for co-ordination national control policies, participating States agreed in principle that they will seek to align more closely such licensing procedures and practices, as well as enforcement measures, as each may deem beneficial at the national level.
31. Participating States will exchange information on national practices regarding controls on arms brokerage.
32. Participating States confirmed that they share the concerns regarding the threat to civil aviation, peace-keeping, crisis management and anti-terrorist operations posed by the illicit possession of MANPADS and recognised the need for appropriate measures to prevent such possession. In this connection, the Plenary mandated the GWG to continue discussion of this issue, in particular, to compare the national practices of Participating States on this matter and possibly develop guidelines, and to report the results of this work to the next Plenary.

PARTICIPATION AND OUTREACH

33. Participating states reaffirmed their commitment in the IE that the WA will be open, on a global and non-discriminatory basis, to prospective adherents that comply with the agreed criteria in Appendix 4 of the IE, and that admission of new participants will be based on consensus.
34. It was acknowledges, however, that outreach should not be at the expense of enhancing cooperation among current WA Participating states.
35. They agreed to work actively with non-Participating states in accordance with the approved General Guidelines on Outreach activities (annex O to WA-PLM (98) CHAIR 37) with a view to contributing to the ability of non-participants to implement national policies that meet WA purposes, to establish and enforce effective national export control systems, and to provide support, as appropriate, I meeting criteria for membership by non-Participating states.
36. Taking into account the experience of other multilateral export control bodies, Participating States decided to consider, for example, holding seminars for non-participants (whether on behalf of the WA, or on behalf of individual participants at their own expense) to:
   a) facilitate achievement of the goals in paragraphs 1.1-1.3 of the General guidelines for Outreach activities (i.e., inform of WA objectives, encourage adoption of national policies consistent with WA objectives, encourage establishment of fully effective export controls);
   b) gain a better understanding of non-Participating states approaches to the WA, their export control systems and non-proliferation policies.

37. As regards outreach to other for a relevant to the WA, Participating states agreed that detailed exchanges of information, or other interactions by WA bodies with those for a, would be subject to prior approval by the Plenary. It was agreed that contacts with appropriate regional organisations offered the most promising opportunities.
38. It was also agreed to consider the experience of other multilateral export control bodies with respect to outreach.
39. There was agreement on the use of the criteria for assessing destabilising accumulations as an analytical tool and frame of reference in appropriate bilateral and multilateral contexts.
40. It was also agreed that an information exchange at the political/institutional level

with other international for a dealing with similar issues as the WAs, may be developed not only concerning the areas and nature of each others activities to avoid duplication of work, or to facilitate complementarity, but also concerning parallel or even joint actions, after comprehensive coordination and preparation, including in the area of confidentiality.

41. In particular, in order to facilitate such contacts with other multilateral export control bodies, the issue of compatibility of their automated information exchange systems should be considered.

PROCEDURES AND ADMINISTRATION

42. Participating states agreed that intersessional communication means may be used to exchange information, including via the automated system, in order, inter alia, to address exceptional developments that should not be postponed until the next regularly scheduled meeting.
43. In order to help prepare WA meetings, and to facilitate timely submission of papers and elicit initial reactions, other modes of intersessional communication may continue to be employed, as agreed and appropriate, including open-ended meetings, circular letters and sessions with points of contact in Vienna.
44. With regard to the flexibility rules for Chairmanships, Participating states reaffirmed their commitment in the IE that Plenary meeting should be chaired by a Participating state on the basis of annual rotation, and agreed that the Chairmanships of the GWG and the EG would be by annual rotation also. They agreed that the term in office of an EG Chairman could be extended by consensus for one year.
45. On budgetary matters, Participating states recognised that the establishment of an automated, secure information system will have resource implications which should be met, as far as possible, from within existing resources and contributions.
46. It was also recognised that requests to the Secretariat to undertake increased responsibilities may have resource implications which should be met, as far as possible, from within existing resources and contributions.
47. It was further recognised that budgetary matters should be as transparent as possible.
48. On confidentiality, Participating states agreed that a policy for downgrading WA classified documents should be explored.
49. Whenever possible, and in accordance with national requirements participating states will downgrade the classification of information they exchange.

50. Participating states noted that the Head of the secretariat will develop staff and financial rules, based on the already adopted staff and Financial regulations, for subsequent Plenary approval.

NEXT ASSESSMENT

51. Participating States decided to conduct the next assessment of the overall functioning of the WA in the year 2003.

주　　의

1. 본 보고서는 과학기술부에서 시행한 정책연구사업의 연구보고서입니다.

2. 본 보고서는 국익에 관련되는 내용이 포함되어 있으므로 대외 보안에 유의 바랍니다.

<부 록 1> 1999 ASSESSMENT OF THE FUNCTION OF THE WASSENAAR ARRANGEMENT

PLENARY CONCLUSIONS

GENERAL

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2. Participating states agreed that, in line with these goals, the WA should also continue to contribute to preventing circumvention of export controls, inter alia, by terrorist or organised criminal groups that seek to acquire armaments and dual-use items.
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   b) use the Global View to help identify problems before they turn into crises;
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    a) the desirability and feasibility of including small arms and light weapons in the specific information exchange of the arms pillar;
    b) the possible scope of any new reporting requirement, including definitions and thresholds for small arms and light weapons. Such review shall include, in addition to other weapons, MANPADS and man- and crew-portable anti-tank weapons.

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c) the range of missiles and torpedoes and the tonnage of warships; and
d) missiles and missile launchers.

21. Participating states reaffirmed their wish to establish a simple, secure and cost effective electronic communication system to complement diplomatic channels, which would be a key step in developing the SIE.

CONTROLS

22. Participating States agreed that the process of reviewing control list by the Expert Group worked well and was valuable.

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24. It was agreed in principle that, in considering the timely control of rapidly emerging critical technologies, the use of 2 to 3-year validity notes, or other alternatives, was worth examining in the EG in the coming year. They also agreed that, whenever appropriate, they should work to liberalise controls for less sensitive items, in the interests of efficiency and credibility, while taking into account security concerns.
25. Participating States will also in the coming year develop criteria in the EG for selection of items for the VSL, after agreeing on the nature of the criteria.
26. It was also agreed to expedite and conclude, in the course of the next year, the study on the definition and interpretation of specially designed for military use and work out practical implementation of issues arising from the study, i.e., to ensure that all items on the control lists meet the agreed definition and interpretation. .
27. Participation States will also consider in the next year, having examined relevant national practices and legislation, whether to adopt WA-wide end-use oriented controls, including supplementary controls on currently uncontrolled goods (catch-all or catch-more mechanisms) destined for where the risks are judged greatest.
28. Participating States will also, in the next year, examine the question of whether there should be, in future, contacts with relevant non-proliferation regimes, first at the political/institutional level, then at a technical level, with the intention of proposing closer alignment of the parameters, wording and formats of their control lists with that of the WA lists.
29. Participating States recognised it is important to have comprehensive controls of listed items, including control on intangible transfers. Participating States also recognised that it is important to continue deepening WA understanding of how and how much to control those transfers. In this context, the possibility of taking national measures should be considered.
30. Building on their commitment in the IE to assess the scope for co-ordination national control policies, participating States agreed in principle that they will seek to align more closely such licensing procedures and practices, as well as enforcement measures, as each may deem beneficial at the national level.

31. Participating States will exchange information on national practices regarding controls on arms brokerage.

32. Participating States confirmed that they share the concerns regarding the threat to civil aviation, peace-keeping, crisis management and anti-terrorist operations posed by the illicit possession of MANPADS and recognised the need for appropriate measures to prevent such possession. In this connection, the Plenary mandated the GWG to continue discussion of this issue, in particular, to compare the national practices of Participating States on this matter and possibly develop guidelines, and to report the results of this work to the next Plenary.

PARTICIPATION AND OUTREACH

33. Participating states reaffirmed their commitment in the IE that the WA will be open, on a global and non-discriminatory basis, to prospective adherents that comply with the agreed criteria in Appendix 4 of the IE, and that admission of new participants will be based on consensus.

34. It was acknowledges, however, that outreach should not be at the expense of enhancing cooperation among current WA Participating states.

35. They agreed to work actively with non-Participating states in accordance with the approved General Guidelines on Outreach activities (annex O to WA-PLM (98) CHAIR 37) with a view to contributing to the ability of non-participants to implement national policies that meet WA purposes, to establish and enforce effective national export control systems, and to provide support, as appropriate, I meeting criteria for membership by non-Participating states.

36. Taking into account the experience of other multilateral export control bodies, Participating States decided to consider, for example, holding seminars for non-participants (whether on behalf of the WA, or on behalf of individual participants at their own expense) to:

a) facilitate achievement of the goals in paragraphs 1.1-1.3 of the General guidelines for Outreach activities (i.e., inform of WA objectives, encourage adoption of national policies consistent with WA objectives, encourage establishment of fully effective export controls);

b) gain a better understanding of non-Participating states approaches to the WA, their export control systems and non-proliferation policies.

37. As regards outreach to other for a relevant to the WA, Participating states agreed that detailed exchanges of information, or other interactions by WA bodies with those for a, would be subject to prior approval by the Plenary. It was agreed that contacts with appropriate regional organisations offered the most promising opportunities.
38. It was also agreed to consider the experience of other multilateral export control bodies with respect to outreach.
39. There was agreement on the use of the criteria for assessing destabilising accumulations as an analytical tool and frame of reference in appropriate bilateral and multilateral contexts.
40. It was also agreed that an information exchange at the political/institutional level with other international for a dealing with similar issues as the WAs, may be developed not only concerning the areas and nature of each others activities to avoid duplication of work, or to facilitate complementarity, but also concerning parallel or even joint actions, after comprehensive coordination and preparation, including in the area of confidentiality.
41. In particular, in order to facilitate such contacts with other multilateral export control bodies, the issue of compatibility of their automated information exchange systems should be considered.

PROCEDURES AND ADMINISTRATION

42. Participating states agreed that intersessional communication means may be used to exchange information, including via the automated system, in order, inter alia, to address exceptional developments that should not be postponed until the next regularly scheduled meeting.
43. In order to help prepare WA meetings, and to facilitate timely submission of papers and elicit initial reactions, other modes of intersessional communication may continue to be employed, as agreed and appropriate, including open-ended meetings, circular letters and sessions with points of contact in Vienna.
44. With regard to the flexibility rules for Chairmanships, Participating states reaffirmed their commitment in the IE that Plenary meeting should be chaired by a Participating state on the basis of annual rotation, and agreed that the Chairmanships of the GWG and the EG would be by annual rotation also. They agreed that the term in office of an EG Chairman could be extended by consensus for one year.
45. On budgetary matters, Participating states recognised that the establishment of

an automated, secure information system will have resource implications which should be met, as far as possible, from within existing resources and contributions.

46. It was also recognised that requests to the Secretariat to undertake increased responsibilities may have resource implications which should be met, as far as possible, from within existing resources and contributions.
47. It was further recognised that budgetary matters should be as transparent as possible.
48. On confidentiality, Participating states agreed that a policy for downgrading WA classified documents should be explored.
49. Whenever possible, and in accordance with national requirements participating states will downgrade the classification of information they exchange.
50. Participating states noted that the Head of the secretariat will develop staff and financial rules, based on the already adopted staff and Financial regulations, for subsequent Plenary approval.

NEXT ASSESSMENT

51. Participating States decided to conduct the next assessment of the overall functioning of the WA in the year 2003.

<부 록 2> 1999 WA LIST OF DUAL-USE GOODS AND TECHNOLOGIES AND MUNITIONS LIST

WA-LIST (99) 1
03-12-99

THE WASSENAAR ARRANGEMENT

ON

EXPORT CONTROLS FOR CONVENTIONAL ARMS

AND

DUAL-USE GOODS AND TECHNOLOGIES

LIST OF DUAL-USE GOODS AND TECHNOLOGIES

AND

MUNITIONS LIST

TABLE OF CONTENTS

These Lists reflect the agreements recorded in Appendix 5 to the Initial Elements, dated 19 December 1995, and all approved amendments, up to and including those approved by the Plenary Meeting held from 1 to 3 December 1999.

WA_LIST(99)1
03-12-99

DUAL-USE LIST

<u>Note</u> Terms in "quotations" are defined terms. Refer to 'Definitions of Terms used in these Lists' annexed to this List.

GENERAL TECHNOLOGY NOTE

The export of "technology" which is "required" for the "development", "production" or "use" of items controlled in the Dual-Use List is controlled according to the provisions in each Category. This "technology" remains under control even when applicable to any uncontrolled item.

Controls do not apply to that "technology" which is the minimum necessary for the installation, operation, maintenance (checking) and repair of those items which are not controlled or whose export has been authorised.

<u>Note</u> WA-EG (00) SEC 24 - Corrigendum *This does not release such "technology" controlled in entries 1.E.2.e. & 1.E.2.f. and 8.E.2.a. & 8.E.2.b.*

Controls do not apply to "technology" "in the public domain", to "basic scientific research" or to the minimum necessary information for patent applications.

GENERAL SOFTWARE NOTE

The Lists do not control "software" which is either:

1. Generally available to the public by being:

   a. Sold from stock at retail selling points without restriction, by means of:
      1. Over-the-counter transactions;

2. Mail order transactions; or
3. Telephone call transactions; and

b. Designed for installation by the user without further substantial support by the supplier; or

Note WA-EG (00) SEC 24 - Corrigendum *Entry 1 of the General Software Note does not release "software" controlled by Category 5 - Part 2.*

2. "In the public domain".

DUAL-USE LIST-CATEGORY 1-ADVANCED MATERIALS

1. A. SYSTEMS, EQUIPMENT AND COMPONENTS

1. A. 1. Components made from fluorinated compounds, as follows:

a. Seals, gaskets, sealants or fuel bladders specially designed for "aircraft" or aerospace use made from more than 50 % by weight of any of the materials controlled by 1.C.9.b. or 1.C.9.c.;

b. Piezoelectric polymers and copolymers made from vinylidene fluoride materials controlled by 1.C.9.a.:
  1. In sheet or film form; and
  2. With a thickness exceeding 200 µm;

c. Seals, gaskets, valve seats, bladders or diaphragms made from fluoroelastomers containing at least one vinylether group as a constitutional unit, specially designed for "aircraft", aerospace or missile use.

1. A. 2. "Composite" structures or laminates, having any of the following:

a. An organic "matrix" and made from materials controlled by 1.C.10.c., 1.C.10.d. or 1.C.10.e.; or

Note 1.A.2.a does not control finished or semi-finished items specially designed for purely civilian applications as follows:
1. Sporting goods;
2. Automotive industry;
3. Machine tool industry;
4. Medical applications.

b. A metal or carbon "matrix" and made from:
  1. Carbon "fibrous or filamentary materials" with:
    a. A specific modulus exceeding 10.15 x 106 m; and
    b. A specific tensile strength exceeding 17.7 x 104 m; or
  2. Materials controlled by 1.C.10.c.

Note 1.A.2.b. does not control finished or semi-finished items specially designed for purely civilian applications as follows:

1. *Sporting goods;*
2. *Automotive industry;*
3. *Machine tool industry;*
4. *Medical applications.*

1. A. 2. b. *Technical Notes*

1. *Specific modulus: Young's modulus in pascals, equivalent to N/m^2 divided by specific weight in N/m^3, measured at a temperature of (296 ± 2) K ((23 ± 2)°C) and a relative humidity of (50 ± 5)%.*
2. *Specific tensile strength: ultimate tensile strength in pascals, equivalent to N/m^2 divided by specific weight in N/m^3, measured at a temperature of (296 ± 2) K((23 ± 2)°C) and a relative humidity of (50 ± 5)%.*

Note 1.A.2. does not control composite structures or laminates made from epoxy resin impregnated carbon "fibrous or filamentary materials" for the repair of aircraft structures or laminates, provided the size does not exceed 1 m^2.

1. A. 3. Manufactures of non-fluorinated polymeric substances controlled by 1.C.8.a.3. in film, sheet, tape or ribbon form:

a. With a thickness exceeding 0.254 mm; or
b. Coated or laminated with carbon, graphite, metals or magnetic substances.

Note 1.A.3. does not control manufactures when coated or laminated with copper and designed for the production of electronic printed circuit boards.

1. A. 4. Protective and detection equipment and components not specially designed for military use, as follows:

a. Gas masks, filter canisters and decontamination equipment therefor designed or modified for defence against biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents and specially designed components therefor;

b. Protective suits, gloves and shoes specially designed or modified for defence against biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents;

c. Nuclear, biological and chemical (NBC) detection systems specially designed or modified for detection or identification of biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents and specially designed components therefor.

Note 1.A.4. does not control :

a. Personal radiation monitoring dosimeters;

b. Equipment limited by design or function to protect against hazards specific to civil industries, such as mining, quarrying, agriculture, pharmaceuticals, medical, veterinary, environmental, waste management, or to the food industry.

1. A. 5. Body armour, and specially designed components therefor, not manufactured to military standards or specifications, nor to their equivalents in performance.

Note 1 1.A.5. does not control individual suits of body armour and accessories therefor, when accompanying their users for his/her own personal protection.

Note 2 1.A.5. does not control body armour designed to provide frontal protection only from both fragment and blast from non-military explosive devices.

1. B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

1. B. 1. Equipment for the production of fibres, prepregs, preforms or "composites" controlled by 1.A.2. or 1.C.10., as follows, and specially designed components and accessories therefor:

a. Filament winding machines of which the motions for positioning, wrapping and winding fibres are coordinated and programmed in three or more axes, specially designed for the manufacture of "composite" structures or laminates from "fibrous or filamentary materials";

b. Tape-laying or tow-placement machines of which the motions for positioning and laying tape, tows or sheets are coordinated and programmed in two or more axes, specially designed for the manufacture of "composite" airframe or missile structures;

c. Multidirectional, multidimensional weaving machines or interlacing machines, including adapters and modification kits, for weaving, interlacing or braiding fibres to manufacture "composite" structures;

Note 1.B.1.c. does not control textile machinery not modified for the above end-uses.

d. Equipment specially designed or adapted for the production of reinforcement fibres, as follows:

1. Equipment for converting polymeric fibres (such as polyacrylonitrile, rayon, pitch or polycarbosilane) into carbon fibres or silicon carbide fibres, including special equipment to strain the fibre during heating;
2. Equipment for the chemical vapour deposition of elements or compounds on heated filamentary substrates to manufacture silicon carbide fibres;
3. Equipment for the wet-spinning of refractory ceramics (such as aluminium oxide);
4. Equipment for converting aluminium containing precursor fibres into alumina fibres by heat treatment;

e. Equipment for producing prepregs controlled by 1.C.10.e. by the hot melt method;

f. Non-destructive inspection equipment capable of inspecting defects three dimensionally, using ultrasonic or X-ray tomography and specially designed for "composite" materials.

1. B. 2. Systems and components therefor, specially designed to avoid contamination and specially designed for producing metal alloys, metal alloy powder or alloyed materials controlled by 1.C.2.a.2., 1.C.2.b. or 1.C.2.c.

1. B. 3. Tools, dies, moulds or fixtures, for "superplastic forming" or "diffusion bonding" titanium or aluminium or their alloys, specially designed for the manufacture of:

a. Airframe or aerospace structures;
b. "Aircraft" or aerospace engines; or
c. Specially designed components for those structures or engines.

1. C. MATERIALS

Technical Note

Metals and alloys

Unless provision to the contrary is made, the words 'metals' and 'alloys' cover crude *and semi-fabricated forms, as follows:*

<u>Crude forms</u>

Anodes, balls, bars (including notched bars and wire bars), billets, blocks, blooms, brickets, cakes, cathodes, crystals, cubes, dice, grains, granules, ingots, lumps, pellets, pigs, powder, rondelles, shot, slabs, slugs, sponge, sticks;

<u>Semi-fabricated forms</u> (whether or not coated, plated, drilled or punched):

a. *Wrought or worked materials fabricated by rolling, drawing, extruding, forging, impact extruding, pressing, graining, atomising, and grinding, i.e.: angles, channels, circles, discs, dust, flakes, foils and leaf, forging, plate, powder, pressings and stampings, ribbons, rings, rods (including bare welding rods, wire rods, and rolled wire), sections, shapes, sheets, strip, pipe and tubes (including tube rounds, squares, and hollows), drawn or extruded wire;*
b. *Cast material produced by casting in sand, die, metal, plaster or other types of moulds, including high pressure castings, sintered forms, and forms made by powder metallurgy.*

The object of the control should not be defeated by the export of non-listed forms alleged to be finished products but representing in reality crude forms or semi-fabricated forms.

1. C. 1. Materials specially designed for use as absorbers of electromagnetic waves, or intrinsically conductive polymers, as follows:

a. Materials for absorbing frequencies exceeding 2 x 10^8 Hz but less than 3 x 10^{12} Hz;

<u>Note 1</u> 1.C.1.a. does not control:

a. Hair type absorbers, constructed of natural or synthetic fibres, with non-magnetic loading to provide absorption;

b. Absorbers having no magnetic loss and whose incident surface is non-planar in shape, including pyramids, cones, wedges and convoluted surfaces;

c. Planar absorbers, having all of the following characteristics:

1. Made from any of the following:

a. Plastic foam materials (flexible or non-flexible) with carbon-loading, or *organic materials, including binders, providing more than 5% echo compared with metal over a bandwidth exceeding ±15% of the centre frequency of the incident energy, and not capable of withstanding temperatures exceeding 450 K (177° C); or*

b. Ceramic materials providing more than 20% echo compared with metal over a bandwidth exceeding ±15% of the centre frequency of the incident energy, and not capable of withstanding temperatures exceeding 800 K (527°C);

Technical Note

Absorption test samples for 1.C.1.a. Note 1.c.1. should be a square at least 5 wavelengths of the centre frequency on a side and positioned in the far field of the radiating element.

2. Tensile strength less than 7 x 10^6 *N/*m^2*; and*

3. Compressive strength less than 14 x 10^6 *N/*m^2*;*

d. Planar absorbers made of sintered ferrite, having:

1. A specific gravity exceeding 4.4; and

2. A maximum operating temperature of 548 K (275°C).

Note 2 Nothing in Note 1 releases magnetic materials to provide absorption when contained in paint.

1. C. 1. b. Materials for absorbing frequencies exceeding 1.5 x 10^{14} Hz but less than 3.7 x 10^{14} Hz and not transparent to visible light;

1. C. 1. c. Intrinsically conductive polymeric materials with a bulk electrical conductivity exceeding 10,000 S/m (Siemens per metre) or a sheet (surface) resistivity of less than 100 ohms/square, based on any of the following polymers:

1. Polyaniline;
2. Polypyrrole;
3. Polythiophene;
4. Poly phenylene-vinylene; or
5. Poly thienylene-vinylene.

Technical Note

Bulk electrical conductivity and sheet (surface) resistivity should be determined *using ASTM D-257 or national equivalents.*

1\. C. 2. Metal alloys, metal alloy powder and alloyed materials, as follows:

<u>Note</u> 1.C.2. does not control metal alloys, metal alloy powder and alloyed materials for coating substrates.

a. Metal alloys, as follows:

1. Nickel or titanium-based alloys in the form of aluminides, as follows, in crude or semi-fabricated forms:

a. Nickel aluminides containing a minimum of 15 weight percent aluminium, a maximum of 38 weight percent aluminium and at least one additional alloying element ;

b. Titanium aluminides containing 10 weight percent or more aluminium and at least one additional alloying element ;

2. Metal alloys, as follows, made from metal alloy powder or particulate material controlled by 1.C.2.b.:

a. Nickel alloys with:

1. A stress-rupture life of 10,000 hours or longer at 923 K (650°C) at a stress of 676 MPa; <u>or</u>
2. A low cycle fatigue life of 10,000 cycles or more at 823 K (550° C) at a maximum stress of 1,095 MPa;

b. Niobium alloys with:

1. A stress-rupture life of 10,000 hours or longer at 1,073 K (800°C) at a stress of 400 MPa; <u>or</u>
2. A low cycle fatigue life of 10,000 cycles or more at 973 K (700°C) at a maximum stress of 700 MPa;

c. Titanium alloys with:

1. A stress-rupture life of 10,000 hours or longer at 723 K (450°C) at a stress of 200 MPa; <u>or</u>
2. A low cycle fatigue life of 10,000 cycles or more at 723 K (450°C) at a maximum stress of 400 MPa;

d. Aluminium alloys with a tensile strength of:

1. 240 MPa or more at 473 K (200°C); <u>or</u>
2. 415 MPa or more at 298 K (25°C);

e. Magnesium alloys with a tensile strength of 345 MPa or more and a corrosion rate of less than 1 mm/year in 3% sodium chloride aqueous solution measured in accordance with ASTM standard G-31 or national equivalents;

1. C. 2. a. _Technical Notes_

1. The metal alloys in 1.C.2.a. are those containing a higher percentage by weight of the stated metal than of any other element.

2. Stress-rupture life should be measured in accordance with ASTM standard E-139 or national equivalents.

3. Low cycle fatigue life should be measured in accordance with ASTM Standard E-606 'Recommended Practice for Constant-Amplitude Low-Cycle Fatigue Testing' or national equivalents. Testing should be axial with an average stress ratio equal to 1 and a stress-concentration factor (Kt) equal to 1. The average stress is defined as maximum stress minus minimum stress divided by maximum stress.

1. C. 2. b. Metal alloy powder or particulate material for materials controlled by 1.C.2.a., as follows:

1. Made from any of the following composition systems:

Technical Note

X in the following equals one or more alloying elements.

a. Nickel alloys (Ni-Al-X, Ni-X-Al) qualified for turbine engine parts or components, i.e. with less than 3 non-metallic particles (introduced during the manufacturing process) larger than 100 μm in 10^9 alloy particles;

b. Niobium alloys (Nb-Al-X or Nb-X-Al, Nb-Si-X or Nb-X-Si, Nb-Ti-X or Nb-X-Ti);

c. Titanium alloys (Ti-Al-X or Ti-X-Al);

d. Aluminium alloys (Al-Mg-X or Al-X-Mg, Al-Zn-X or Al-X-Zn, Al-Fe-X or Al-X-Fe); _or_

e. Magnesium alloys (Mg-Al-X or Mg-X-Al); _and_

2. Made in a controlled environment by any of the following processes:

a. "Vacuum atomisation";

b. "Gas atomisation";

c. "Rotary atomisation";

d. "Splat quenching";

e. "Melt spinning" and "comminution";

f. "Melt extraction" and "comminution"; _or_

g. "Mechanical alloying";

1. C. 2. c. Alloyed materials, in the form of uncomminuted flakes, ribbons or thin rods

produced in a controlled environment by "splat quenching", "melt spinning" or "melt extraction", used in the manufacture of metal alloy powder or particulate material controlled by 1.C.2.b.

1. C. 3. Magnetic metals, of all types and of whatever form, having any of the following characteristics:

a. Initial relative permeability of 120,000 or more and a thickness of 0.05 mm or less;

Technical Note

Measurement of initial permeability must be performed on fully annealed materials.

b. Magnetostrictive alloys, having any of the following characteristics:

1. A saturation magnetostriction of more than 5 x 10-4; or
2. A magnetomechanical coupling factor (k) of more than 0.8; or

c. Amorphous or nanocrystalline alloy strips, having all of the following characteristics:

1. A composition having a minimum of 75 weight percent of iron, cobalt or nickel;
2. A saturation magnetic induction (Bs) of 1.6 T or more; and
3. Any of the following:
   a. A strip thickness of 0.02 mm or less; or
   b. An electrical resistivity of 2 x 10-4 ohm cm or more.

Technical Note

'Nanocrystalline' materials in 1.C.3.c. are those materials having a crystal grain size of 50 nm or less, as determined by X-ray diffraction.

1. C. 4. Uranium titanium alloys or tungsten alloys with a "matrix" based on iron, nickel or copper, having all of the following:

a. A density exceeding 17.5 g/cm3;
b. An elastic limit exceeding 880 MPa;
c. An ultimate tensile strength exceeding 1,270 MPa; and
d. An elongation exceeding 8%.

1. C. 5. "Superconductive" "composite" conductors in lengths exceeding 100 m or with

a mass exceeding 100 g, as follows:

a. Multifilamentary "superconductive" "composite" conductors containing one or more niobium-titanium filaments:

1. Embedded in a "matrix" other than a copper or copper-based mixed "matrix"; <u>or</u>
2. Having a cross-section area less than 0.28 x 10-4 mm2 (6 μm in diameter for circular filaments);

1. C. 5. b. "Superconductive" "composite" conductors consisting of one or more "superconductive" filaments other than niobium-titanium, having all of the following:

1. A "critical temperature" at zero magnetic induction exceeding 9.85 K (-263.31°C) but less than 24 K (-249.16°C);
2. A cross-section area less than 0.28 x 10-4 mm2; <u>and</u>
3. Remaining in the "superconductive" state at a temperature of 4.2 K (-268.96°C) when exposed to a magnetic field corresponding to a magnetic induction of 12 T.

1. C. 6. Fluids and lubricating materials, as follows:

a. Hydraulic fluids containing, as their principal ingredients, any of the following compounds or materials:

1. Synthetic silahydrocarbon oils, having all of the following:

<u>*Technical Note*</u>

*For the purpose of 1.C.6.a.1., silahydrocarbon oils contain exclusively silicon, hydrogen and carbon.*_

a. A flash point exceeding 477 K (204°C);
b. A pour point at 239 K (-34°C) or less;
c. A viscosity index of 75 or more; <u>and</u>
d. A thermal stability at 616 K (343°C); <u>or</u>

2. Chlorofluorocarbons, having all of the following:

<u>*Technical Note*</u>

For the purpose of 1.C.6.a.2., chlorofluorocarbons contain exclusively carbon, fluorine and chlorine.

a. No flash point;
b. An autogenous ignition temperature exceeding 977 K (704°C);
c. A pour point at 219 K (-54°C) or less;
d. A viscosity index of 80 or more; <u>and</u>
e. A boiling point at 473 K (200°C) or higher;

b. Lubricating materials containing, as their principal ingredients, any of the following compounds or materials:
  1. Phenylene or alkylphenylene ethers or thio-ethers, or their mixtures, containing more than two ether or thio-ether functions or mixtures thereof; or
  2. Fluorinated silicone fluids with a kinematic viscosity of less than 5,000 mm2/s (5,000 centistokes) measured at 298 K (25°C);

c. Damping or flotation fluids with a purity exceeding 99.8%, containing less than 25 particles of 200 µm or larger in size per 100 ml and made from at least 85% of any of the following compounds or materials:
  1. Dibromotetrafluoroethane;
  2. Polychlorotrifluoroethylene (oily and waxy modifications only); or
  3. Polybromotrifluoroethylene;

1. C. 6. d. Fluorocarbon electronic cooling fluids, having all of the following characteristics:
  1. Containing 85% by weight or more of any of the following, or mixtures thereof:
    a. Monomeric forms of perfluoropolyalkylether-triazines or perfluoroaliphatic-ethers;
    b. Perfluoroalkylamines;
    c. Perfluorocycloalkanes; or
    d. Perfluoroalkanes;

  2. Density at 298 K (25°C) of 1.5 g/ml or more;
  3. In a liquid state at 273 K (0°C); and
  4. Containing 60% or more by weight of fluorine.

Technical Note

For the purpose of 1.C.6.:

a. Flash point is determined using the Cleveland Open Cup Method described in ASTM D-92 or national equivalents;
b. Pour point is determined using the method described in ASTM D-97 or national equivalents;
c. Viscosity index is determined using the method described in ASTM D-2270 or national equivalents;
d. Thermal stability is determined by the following test procedure or national equivalents:
Twenty ml of the fluid under test is placed in a 46 ml type 317 stainless steel

chamber containing one each of 12.5 mm (nominal) diameter balls of M-10 tool steel, 52100 steel and naval bronze (60% Cu, 39% Zn, 0.75% Sn);

The chamber is purged with nitrogen, sealed at atmospheric pressure and the temperature raised to and maintained at 644 ± 6 K (371 ± 6°C) for six hours;

The specimen will be considered thermally stable if, on completion of the above procedure, all of the following conditions are met:

1. *The loss in weight of each ball is less than 10 mg/mm2 of ball surface;*
2. *The change in original viscosity as determined at 311 K (38°C) is less than 25%; and*
3. *The total acid or base number is less than 0.40;*

e. *Autogenous ignition temperature is determined using the method described in ASTM E-659 or national equivalents.*

1. C. 7. Ceramic base materials, non-"composite" ceramic materials, ceramic-"matrix" "composite" materials and precursor materials, as follows:

a. Base materials of single or complex borides of titanium having total metallic impurities, excluding intentional additions, of less than 5,000 ppm, an average particle size equal to or less than 5 μm and no more than 10% of the particles larger than 10 μm;

b. Non-"composite" ceramic materials in crude or semi-fabricated form, composed of borides of titanium with a density of 98% or more of the theoretical density;

Note 1.C.7.b. does not control abrasives.

c. Ceramic-ceramic "composite" materials with a glass or oxide-"matrix" and reinforced with fibres made from any of the following systems:

1. Si-N;
2. Si-C;
3. Si-Al-O-N; or
4. Si-O-N;

having a specific tensile strength exceeding 12.7 x 103m;

d. Ceramic-ceramic "composite" materials, with or without a continuous metallic phase, incorporating particles, whiskers or fibres, where carbides or nitrides of silicon, zirconium or boron form the "matrix";

e. Precursor materials (i.e., special purpose polymeric or metallo-organic materials) for producing any phase or phases of the materials controlled by 1.C.7.c., as follows:

1. Polydiorganosilanes (for producing silicon carbide);
2. Polysilazanes (for producing silicon nitride);
3. Polycarbosilazanes (for producing ceramics with silicon, carbon and nitrogen components);

f. Ceramic-ceramic "composite" materials with an oxide or glass "matrix" reinforced with continuous fibres from any of the following systems:

1. Al_2O_3; <u>or</u>
2. Si-C-N.

<u>Note</u> 1.C.7.f. does not control "composites" containing fibres from these systems with a fibre tensile strength of less than 700 MPa at 1,273 K (1,000° C) or fibre tensile creep resistance of more than 1% creep strain at 100 MPa load and 1,273 K (1,000° C) for 100 hours.

1\. C. 8. Non-fluorinated polymeric substances, as follows:

a. 1. Bismaleimides;
2. Aromatic polyamide-imides;
3. Aromatic polyimides;
4. Aromatic polyetherimides having a glass transition temperature (Tg) exceeding 513 K (240° C) determined using the dry method described in ASTM D 3418;

<u>Note</u> 1.C.8.a. does not control non-fusible compression moulding powders or moulded forms.

b. Thermoplastic liquid crystal copolymers having a heat distortion temperature exceeding 523 K (250°C) measured according to ASTM D 648, method A, or national equivalents, with a load of 1.82 N/mm^2 and composed of:

1. Any of the following:
   a. Phenylene, biphenylene or naphthalene; <u>or</u>
   b. Methyl, tertiary-butyl or phenyl substituted phenylene, biphenylene or naphthalene; <u>and</u>
2. Any of the following acids:
   a. Terephthalic acid;
   b. 6-hydroxy-2 naphthoic acid; <u>or</u>
   c. 4-hydroxybenzoic acid;

c. Polyarylene ether ketones, as follows:
  1. Polyether ether ketone (PEEK);
  2. Polyether ketone ketone (PEKK);
  3. Polyether ketone (PEK);
  4. Polyether ketone ether ketone ketone (PEKEKK);

d. Polyarylene ketones;

e. Polyarylene sulphides, where the arylene group is biphenylene, triphenylene or combinations thereof;

f. Polybiphenylenethersulphone.

Technical Note
The glass transition temperature (Tg) for 1.C.8. materials is determined using the method described in ASTM D 3418 using the dry method.

1. C. 9. Unprocessed fluorinated compounds, as follows:
  a. Copolymers of vinylidene fluoride having 75% or more beta crystalline structure without stretching;
  b. Fluorinated polyimides containing 10% by weight or more of combined fluorine;
  c. Fluorinated phosphazene elastomers containing 30% by weight or more of combined fluorine.

1. C. 10. "Fibrous or filamentary materials" which may be used in organic "matrix", metallic "matrix" or carbon "matrix" "composite" structures or laminates, as follows:
  a. Organic "fibrous or filamentary materials", having all of the following:
    1. A specific modulus exceeding 12.7 x 106 m; and
    2. A specific tensile strength exceeding 23.5 x 104 m;

Note 1.C.10.a. does not control polyethylene.

  b. Carbon "fibrous or filamentary materials", having all of the following:
    1. A specific modulus exceeding 12.7 x 106 m; and
    2. A specific tensile strength exceeding 23.5 x 104 m;

Technical Note
Properties for materials described in 1.C.10.b. should be determined using SACMA recommended methods SRM 12 to 17, or national equivalent tow tests,

such as Japanese Industrial Standard JIS-R-7601, Paragraph 6.6.2., and based on lot average.

Note 1.C.10.b. does not control fabric made from "fibrous or filamentary materials" for the repair of aircraft structures or laminates, in which the size of individual sheets does not exceed 50 cm x 90 cm.

c. Inorganic "fibrous or filamentary materials", having all of the following:

1. A specific modulus exceeding 2.54 x 106 m; and
2. A melting, softening, decomposition or sublimation point exceeding 1,922 K (1,649°C) in an inert environment;

Note 1.C.10.c. does not control:

1. Discontinuous, multiphase, polycrystalline alumina fibres in chopped fibre or random mat form, containing 3 weight percent or more silica, with a specific modulus of less than 10 x 106 m;

2. Molybdenum and molybdenum alloy fibres;

3. Boron fibres;

4. Discontinuous ceramic fibres with a melting, softening, decomposition or sublimation point lower than 2,043 K (1,770°C) in an inert environment.

d. "Fibrous or filamentary materials":

1. Composed of any of the following:
   a. Polyetherimides controlled by 1.C.8.a; or
   b. Materials controlled by 1.C.8.b. to 1.C.8.f.; or
2. Composed of materials controlled by 1.C.10.d.1.a. or 1.C.10.d.1.b. and "com-mingled" with other fibres controlled by 1.C.10.a., 1.C.10.b. or 1.C.10.c.;

1. C. 10. e. Resin-impregnated or pitch-impregnated fibres (prepregs), metal or carbon-coated fibres (preforms) or "carbon fibre preforms", as follows:

1. Made from "fibrous or filamentary materials" controlled by 1.C.10.a., 1.C.10.b. or 1.C.10.c.;
2. Made from organic or carbon "fibrous or filamentary materials":
   a. With a specific tensile strength exceeding 17.7 x 104 m;
   b. With a specific modulus exceeding 10.15 x 106 m;
   c. Not controlled by 1.C.10.a. or 1.C.10.b.; and
   d. When impregnated with materials controlled by 1.C.8. or 1.C.9.b., having a

glass transition temperature (Tg) exceeding 383 K (110°C) or with phenolic or epoxy resins, having a glass transition temperature (Tg) equal to or exceeding 418 K (145°C).

<u>Notes</u> 1.C.10.e. does not control:

1. *Epoxy resin "matrix" impregnated carbon "fibrous or filamentary materials" (prepregs) for the repair of aircraft structures or laminates, in which the size of individual sheets of prepreg does not exceed 50 cm x 90 cm;*
2. *Prepregs when impregnated with phenolic or epoxy resins having a glass transition temperature (Tg) less than 433 K (160°C) and a cure temperature lower than the glass transition temperature.*

<u>Technical Note</u>

The glass transition temperature (Tg) for 1.C.10.e. materials is determined using the method described in ASTM D 3418 using the dry method. The glass transition temperature for phenolic and epoxy resins is determined using the method described in ASTM D 4065 at a frequency of 1Hz and a heating rate of 2 K (°C) per minute using the dry method.

<u>Technical Notes</u>

1. *Specific modulus: Young's modulus in pascals, equivalent to N/m2 divided by specific weight in N/m3, measured at a temperature of (296 ± 2) K ((23 ± 2)°C) and a relative humidity of (50 ± 5)%.*
2. *Specific tensile strength: ultimate tensile strength in pascals, equivalent to N/m2 divided by specific weight in N/m3, measured at a temperature of (296 ± 2) K ((23 ± 2)°C) and a relative humidity of (50 ± 5)%.*

1\. C. 11. Metals and compounds, as follows:

a. Metals in particle sizes of less than 60 μm whether spherical, atomised, spheroidal, flaked or ground, manufactured from material consisting of 99% or more of zirconium, magnesium and alloys of these;

<u>Technical Note</u>

The natural content of hafnium in the zirconium (typically 2% to 7%) is counted with the zirconium.

<u>Note</u> The metals or alloys listed in 1.C.11.a. are controlled whether or not the metals or alloys are encapsulated in aluminium,

magnesium, zirconium or beryllium.

1. C. 11. b. Boron or boron carbide of 85% purity or higher and a particle size of 60 μm or less;

<u>Note</u> The metals or alloys listed in 1.C.11.b. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.

c. Guanidine nitrate;

d. Nitroguanidine (NQ) (CAS 556-88-7).

1. C. 12. Materials as follows:

<u>Technical Note</u>

These materials are typically used for nuclear heat sources.

a. Plutonium in any form with a plutonium isotopic assay of plutonium-238 of more than 50% by weight;

<u>Note</u> 1.C.12.a. does not control:

1. Shipments with a plutonium content of 1 g or less;

2. Shipments of 3 "effective grams" or less when contained in a sensing component in instruments.

b. "Previously separated" neptunium-237 in any form.

<u>Note</u> 1.C.12.b. does not control shipments with a neptunium-237 content of 1 g or less.

1. D. <u>SOFTWARE</u>

1. D. 1. "Software" specially designed or modified for the "development", "production" or "use" of equipment controlled by 1.B.

1. D. 2. "Software" for the "development" of organic "matrix", metal "matrix" or carbon "matrix" laminates or "composites".

1. E. TECHNOLOGY

1. E. 1. "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 1.A.1.b., 1.A.1.c., 1.A.2. to 1.A.5., 1.B. or 1.C.

1. E. 2. Other "technology", as follows:

a. "Technology" for the "development" or "production" of polybenzothiazoles or polybenzoxazoles;

b. "Technology" for the "development" or "production" of fluoroelastomer compounds containing at least one vinylether monomer;

1. E. 2. c. "Technology" for the design or "production" of the following base materials or non-"composite" ceramic materials:

1. Base materials having all of the following characteristics:

a. Any of the following compositions:

1. Single or complex oxides of zirconium and complex oxides of silicon or aluminium;
2. Single nitrides of boron (cubic crystalline forms);
3. Single or complex carbides of silicon or boron; or
4. Single or complex nitrides of silicon;

b. Total metallic impurities, excluding intentional additions, of less than:

1. 1,000 ppm for single oxides or carbides; or
2. 5,000 ppm for complex compounds or single nitrides; and

c. Being any of the following:

1. Zirconia with an average particle size equal to or less than 1 μm and no more than 10% of the particles larger than 5 μm;
2. Other base materials with an average particle size equal to or less than 5 μm and no more than 10% of the particles larger than 10 μm; or
3. Having all of the following:

a. Platelets with a length to thickness ratio exceeding 5;

b. Whiskers with a length to diameter ratio exceeding 10 for diameters less than 2 μm; and

c. Continuous or chopped fibres less than 10 μm in diameter;

2. Non-"composite" ceramic materials composed of the materials described in 1.E.2.c.1.;

<u>Note</u> 1.E.2.c.2. does not control technology for the design or production of abrasives.

1. E. 2. d. "Technology" for the "production" of aromatic polyamide fibres;

e. "Technology" for the installation, maintenance or repair of materials controlled by 1.C.1.;

f. "Technology" for the repair of "composite" structures, laminates or materials controlled by 1.A.2., 1.C.7.c. or 1.C.7.d.

<u>Note</u> 1.E.2.f. does not control "technology" for the repair of "civil aircraft" structures using carbon "fibrous or filamentary materials" and epoxy resins, contained in aircraft manufacturers' manuals.

2. A. SYSTEMS, EQUIPMENT AND COMPONENTS

*N.B. For quiet running bearings, see Item 9 on the Munitions List.**

2. A. 1. Anti-friction bearings and bearing systems, as follows, and components therefor:

Note 2.A.1. does not control balls with tolerances specified by the manufacturer in accordance with ISO 3290 as grade 5 or worse.

a. Ball bearings and solid roller bearings having tolerances specified by the manufacturer in accordance with ABEC 7, ABEC 7P, ABEC 7T or ISO Standard Class 4 or better (or national equivalents), and having rings, balls or rollers made from monel or beryllium;

Note 2.A.1.a. does not control tapered roller bearings.

b. Other ball bearings and solid roller bearings having tolerances specified by the manufacturer in accordance with ABEC 9, ABEC 9P or ISO Standard Class 2 or better (or national equivalents);

Note 2.A.1.b. does not control tapered roller bearings.

c. Active magnetic bearing systems using any of the following:

1. Materials with flux densities of 2.0 T or greater and yield strengths greater than 414 MPa;
2. All-electromagnetic 3D homopolar bias designs for actuators; or
3. High temperature (450 K (177°C) and above) position sensors.

2. B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

Technical Notes

1. Secondary parallel contouring axes, (e.g., the w-axis on horizontal boring mills or a secondary rotary axis the centre line of which is parallel to the *primary rotary axis) are not counted in the total number of contouring axes. Rotary axes need not rotate over 360°. A rotary axis can be driven by a linear device (e.g., a screw or a rack-and-pinion).*

2. *Axis nomenclature shall be in accordance with International Standard ISO 841, 'Numerical Control Machines - Axis and Motion Nomenclature'.*
3. *For the purposes of this Category a "tilting spindle" is counted as a rotary axis.*
4. *Stated positioning accuracy levels derived from measurements made according to ISO 230/2 (1997) or national equivalents may be used for each machine tool model instead of individual machine tests. Stated positioning accuracy means the accuracy value provided to national licensing authorities as representative of the accuracy of a machine model.*

Technical Note 4 cont'd.

Determination of Stated Values

a. *Select five machines of a model to be evaluated;*
b. *Measure the linear axis accuracies according to ISO 230/2 (1997);*
c. *Determine the A-values for each axis of each machine. The method of calculating the A-value is described in the ISO standard;*
d. *Determine the mean value of the A-value of each axis. This mean value $\bar{A}$ becomes the stated value of each axis for the model ($\bar{A}x$ $\bar{A}y$...);e. Since the Category 2 list refers to each linear axis there will be as many stated values as there are linear axes;*
f. *If any axis of a machine model not controlled by 2.B.1.a. to 2.B.1.c. has a stated accuracy $\bar{A}$ of 5 microns for grinding machines and 6.5 microns for milling and turning machines or better, the builder should be required to reaffirm the accuracy level once every eighteen months.*

2. B. 1. Machine tools, as follows, and any combination thereof, for removing (or cutting) metals, ceramics or "composites", which, according to the manufacturer s technical specification, can be equipped with electronic devices for "numerical control": a. Machine tools for turning, having all of the following characteristics:

1. Positioning accuracy with "all compensations available" equal to or less (better) than 4.5 μm according to ISO 230/2 (1997) or national equivalents along any

linear axis; and

2. Two or more axes which can be coordinated simultaneously for "contouring control";

Note 2.B.1.a. does not control turning machines specially designed for the production of contact lenses.

2. B. 1. b. Machine tools for milling, having any of the following characteristics:

1. a. Positioning accuracy with "all compensations available" equal to or less (better) than 4.5 μm according to ISO 230/2 (1997) or national equivalents along any linear axis; and

   b. Three linear axes plus one rotary axis which can be coordinated simultaneously for "contouring control";

2. Five or more axes which can be coordinated simultaneously for "contouring control"; or

3. A positioning accuracy for jig boring machines, with "all compensations available", equal to or less (better) than 3.0 μm according to ISO 230/2 (1997) or national equivalents along any linear axis;

2. B. 1. c. Machine tools for grinding, having any of the following characteristics:

1. a. Positioning accuracy with "all compensations available" equal to or less (better) than 3.0 μm according to ISO 230/2 (1997) or national equivalents[4] along any linear axis; and

   b. Three or more axes which can be coordinated simultaneously for "contouring control"; or

2. Five or more axes which can be coordinated simultaneously for "contouring control";

Notes 2.B.1.c. does not control grinding machines, as follows:

1. Cylindrical external, internal, and external-internal grinding machines having all the following characteristics:

a. Limited to cylindrical grinding; and

b. Limited to a maximum workpiece capacity of 150 mm outside diameter or length.

2. Machines designed specifically as jig grinders having any of the following characteristics:

a. The c-axis is used to maintain the grinding wheel *normal to the work surface; <u>or</u>*

b. The a-axis is configured to grind barrel cams.

3. Tool or cutter grinding machines limited to the production of tools or cutters.

4. Crank shaft or cam shaft grinding machines.

5. Surface grinders.

2. B. 1. d. Electrical discharge machines (EDM) of the non-wire type which have two or more rotary axes which can be coordinated simultaneously for "contouring control";

e. Machine tools for removing metals, ceramics or "composites":

1. By means of:

a. Water or other liquid jets, including those employing abrasive additives;

b. Electron beam; <u>or</u>

c. "Laser" beam; <u>and</u>

2. Having two or more rotary axes which:

a. Can be coordinated simultaneously for "contouring control"; <u>and</u>

b. Have a positioning accuracy of less (better) than 0.003°;

f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5,000 mm and specially designed components therefor.

2. B. 2. Deleted.

2. B. 3. "Numerically controlled" or manual machine tools, and specially designed components, controls and accessories therefor, specially designed for the shaving, finishing, grinding or honing of hardened (Rc = 40 or more) spur, helical and double-helical gears with a pitch diameter exceeding 1,250 mm and a face width of 15% of pitch diameter or larger finished to a quality of AGMA 14 or better (equivalent to ISO 1328 class 3).

2. B. 4. Hot "isostatic presses", having all of the following, and specially designed components and accessories therefor:

a. A controlled thermal environment within the closed cavity and a chamber cavity with an inside diameter of 406 mm or more; <u>and</u>

b. Any of the following:

1. A maximum working pressure exceeding 207 MPa;
2. A controlled thermal environment exceeding 1,773 K (1,500°C); or
3. A facility for hydrocarbon impregnation and removal of resultant gaseous degradation products.

Technical Note

The inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

*N.B. For specially designed dies, moulds and tooling see Items 1.B.3., 9.B.9. and ML18. of the Munitions List.****

2. B. 5. Equipment specially designed for the deposition, processing and in-process control of inorganic overlays, coatings and surface modifications, as follows, for non-electronic substrates, by processes shown in the Table and associated Notes following 2.E.3.f., and specially designed automated handling, positioning, manipulation and control components therefor:

a. "Stored programme controlled" chemical vapour deposition (CVD) production equipment having all of the following:
1. Process modified for one of the following:
a. Pulsating CVD;
b. Controlled nucleation thermal deposition (CNTD); or
c. Plasma enhanced or plasma assisted CVD; and
2. Any of the following:
a. Incorporating high vacuum (equal to or less than 0.01 Pa) rotating seals; or
b. Incorporating *in situ* coating thickness control;

b. "Stored programme controlled" ion implantation production equipment having beam currents of 5 mA or more;

c. "Stored programme controlled" electron beam physical vapour deposition (EB-PVD) production equipment incorporating power systems rated for over 80 kW, having any of the following:
1. A liquid pool level "laser" control system which regulates precisely the ingots feed rate; or

2. B. 5. c. 2. A computer controlled rate monitor operating on the principle of photoluminescence of the ionised atoms in the evaporant stream to control the deposition rate of a coating containing two or more elements;

d. "Stored programme controlled" plasma spraying production equipment having any of the following characteristics:

1. Operating at reduced pressure controlled atmosphere (equal to or less than 10 kPa measured above and within 300 mm of the gun nozzle exit) in a vacuum chamber capable of evacuation down to 0.01 Pa prior to the spraying process; <u>or</u>
2. Incorporating *in situ* coating thickness control;

e. "Stored programme controlled" sputter deposition production equipment capable of current densities of 0.1 mA/mm2 or higher at a deposition rate of 15 μm/h or more;

f. "Stored programme controlled" cathodic arc deposition production equipment incorporating a grid of electromagnets for steering control of the arc spot on the cathode;

g. "Stored programme controlled" ion plating production equipment allowing for the *in situ* measurement of any of the following:

1. Coating thickness on the substrate and rate control; <u>or</u>
2. Optical characteristics.

<u>Note</u> 2. B.5.a., 2.B.5.b., 2.B.5.e., 2.B.5.f. and 2.B.5.g. do not control chemical vapour deposition, cathodic arc, sputter deposition, ion plating or ion implantation equipment specially designed for cutting or machining tools.

2. B. 6. Dimensional inspection or measuring systems and equipment, as follows:

a. Computer controlled, "numerically controlled" or "stored programme controlled" dimensional inspection machines, having a three dimensional length (volumetric) "measurement uncertainty" equal to or less (better) than (1.7 + L/1,000) μm (L is the measured length in mm) tested according to ISO 10360-2;

b. Linear and angular displacement measuring instruments, as follows:

1. Linear measuring instruments having any of the following:

a. Non-contact type measuring systems with a "resolution" equal to or less (better) than 0.2 μm within a measuring range up to 0.2 mm;

b. Linear voltage differential transformer systems having all of the following characteristics:

1. "Linearity" equal to or less (better) than 0.1% within a measuring range up to 5 mm; <u>and</u>
2. Drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ±1 K; <u>or</u>

2. B. 6. b. 1. c. Measuring systems having all of the following:

1. Containing a "laser"; <u>and</u>
2. Maintaining, for at least 12 hours, over a temperature range of ±1 K around a standard temperature and at a standard pressure, all of the following:
   a. A "resolution" over their full scale of 0.1 μm or less (better); <u>and</u>
   b. A "measurement uncertainty" equal to or less (better) than (0.2 + L/2,000) μm (L is the measured length in mm);

<u>Note</u> 2.B.6.b.1. does not control measuring interferometer systems, without closed or open loop feedback, containing a "laser" to measure slide movement errors of machi-ne-tools, dimensional inspection machines or similar equipment.

2. B. 6. b. 2. Angular measuring instruments having an "angular position deviation" equal to or less (better) than 0.00025°;

<u>Note</u> 2.B.6.b.2. does not control optical instruments, such as autocollimators, using collimated light to detect angular displacement of a mirror.

2. B. 6. c. Equipment for measuring surface irregularities, by measuring optical scatter as a function of angle, with a sensitivity of 0.5 nm or less (better).

<u>Note 1</u> Machine tools which can be used as measuring machines are controlled if they meet or exceed the criteria specified for the machine tool function or the measuring machine function.

<u>Note 2</u> A machine described in 2.B.6. is controlled if it exceeds the control threshold anywhere within its operating range.

2. B. 7. "Robots" having any of the following characteristics and specially designed controllers and "end-effectors" therefor:

a. Capable in real time of full three-dimensional image processing or full three-dimensional scene analysis to generate or modify "programmes" or to generate or modify numerical programme data;

Technical Note

The scene analysis limitation does not include approximation of the third dimension by viewing at a given angle, or limited grey scale interpretation for the perception of depth or texture for the approved tasks (2 1/2 D).

b. Specially designed to comply with national safety standards applicable to explosive munitions environments;

c. Specially designed or rated as radiation-hardened to withstand greater than 5 x 103 Gy (Si) without operational degradation; or

d. Specially designed to operate at altitudes exceeding 30,000 m.

2. B. 8. Assemblies, units or inserts, specially designed for machine tools or for equipment controlled by 2.B.6. or 2.B.7., as follows:

a. Linear position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an overall "accuracy" less (better) than (800 + (600 x L x 10-3)) nm (L equals the effective length in mm);

N.B. For "laser" systems see also Note to 2.B.6.b.1.

b. Rotary position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an "accuracy" less (better) than 0.00025°;

N.B. For "laser" systems see also Note to 2.B.6.b.1.

c. "Compound rotary tables" and "tilting spindles", capable of upgrading, according to the manufacturer's specifications, machine tools to or above the levels specified in 2.B.

2. B. 9. Spin-forming machines and flow-forming machines, which, according to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control and having all of the following:

a. Two or more controlled axes of which at least two can be coordinated simultaneously for "contouring control"; and

b. A roller force more than 60 kN.

Technical Note

Machines combining the function of spin-forming and flow-forming are for the purpose of 2.B.9. regarded as flow-forming machines.

2. C. MATERIALS - None.

2. D. SOFTWARE

1. "Software", other than that controlled by 2.D.2., specially designed or modified for the "development", "production" or "use" of equipment controlled by 2.A. or 2.B.

2. "Software" for electronic devices, even when residing in an electronic device or system, enabling such devices or systems to function as a "numerical control" unit, capable of any of the following:
   a. Coordinating simultaneously more than 4 axes for "contouring control"; or
   b. "Real time processing" of data to modify tool path, feed rate and spindle data, during the machining operation, by any of the following:
      1. Automatic calculation and modification of part program data for machining in two or more axes by means of measuring cycles and access to source data; or
      2. "Adaptive control" with more than one physical variable measured and processed by means of a computing model (strategy) to change one or more machining instructions to optimize the process.

Note 2.D.2. does not control "software" specially designed or modified for the operation of machine tools not controlled by Category 2.

2. E. TECHNOLOGY

2. E. 1. "Technology" according to the General Technology Note for the "development" of equipment or "software" controlled by 2.A., 2.B. or 2.D.

2. E. 2. "Technology" according to the General Technology Note for the "production" of equipment controlled by 2.A. or 2.B.

2. E. 3. Other "technology", as follows:

a. "Technology" for the "development" of interactive graphics as an integrated part in "numerical control" units for preparation or modification of part programmes;

b. "Technology" for metal-working manufacturing processes, as follows:

1. "Technology" for the design of tools, dies or fixtures specially designed for any of the following processes:
   a. "Superplastic forming";
   b. "Diffusion bonding"; or
   c. "Direct-acting hydraulic pressing";
2. Technical data consisting of process methods or parameters as listed below used to control:
   a. "Superplastic forming" of aluminium alloys, titanium alloys or "superalloys":
      1. Surface preparation;
      2. Strain rate;
      3. Temperature;
      4. Pressure;

   b. "Diffusion bonding" of "superalloys" or titanium alloys:
      1. Surface preparation;
      2. Temperature;
      3. Pressure;
   c. "Direct-acting hydraulic pressing" of aluminium alloys or titanium alloys:
      1. Pressure;
      2. Cycle time;
   d. "Hot isostatic densification" of titanium alloys, aluminium alloys or "superalloys":
      1. Temperature;
      2. Pressure;
      3. Cycle time;

2. E. 3. c. "Technology" for the "development" or "production" of hydraulic stretch-forming machines and dies therefor, for the manufacture of airframe structures;

d. "Technology" for the "development" of generators of machine tool instructions (e.g., part programmes) from design data residing inside "numerical control" units;

e. "Technology" for the "development" of integration "software" for incorporation of expert systems for advanced decision support of shop floor operations into "numerical control" units;

f. "Technology" for the application of inorganic overlay coatings or inorganic surface modification coatings (specified in column 3 of the following table) to non-electronic substrates (specified in column 2 of the following table), by processes specified in column 1 of the following table and defined in the Technical Note.

N.B. This Table should be read to control the technology of a particular Coating Process only when the Resultant Coating in column 3 is in a paragraph directly across from the relevant Substrate under column 2. For example, Chemical Vapour Deposition (CVD) coating process technical data are controlled for the application of 'silicides' to 'Carbon-carbon, Ceramic and Metal matrix composites' substrates, but are not controlled for the application of 'silicides' to 'Cemented tungsten carbide (16), Silicon carbide (18)' substrates. In the second case, the Resultant Coating is not listed in the paragraph under column 3 directly across from the paragraph under column 2 listing 'Cemented tungsten carbide (16), Silicon carbide (18)'.

TABLE - DEPOSITION TECHNIQUES

1. Coating Process (1)*	2. Substrate	3. Resultant Coating
A. Chemical Vapour Deposition (CVD)	"Superalloys"	Aluminides for internal passages
	Ceramics (19) and Low-expansion glasses (14)	Silicides Carbides Dielectric layers (15) Diamond Diamond-like carbon (17)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Aluminides

		Alloyed aluminides (2) Boron nitride
	Cemented tungsten carbide (16), Silicon carbide (18)	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15) Diamond Diamond-like carbon (17)
	Sensor window materials (9)	Dielectric layers (15) Diamond Diamond-like carbon (17)

TABLE - DEPOSITION TECHNIQUES

1. Coating Process (1)	2. Substrate	3. Resultant Coating
B. Thermal-Evaporation Physical Vapour Deposition (TE-PVD)		
B.1. Physical Vapour Deposition (PVD): Electron-Beam (EB-PVD)	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5) Modified zirconia (12) Silicides Aluminides Mixtures thereof (4)

Ceramics (19) and Low- Dielectric layers (15)
expansion glasses (14)

Corrosion resistant MCrAlX (5)
steel (7) Modified zirconia (12)
Mixtures thereof (4)

Carbon-carbon, Silicides
Ceramic and Carbides
Metal "matrix" Refractory metals
"composites" Mixtures thereof (4)
Dielectric layers (15)
Boron nitride

Cemented tungsten Carbides
carbide (16), Tungsten
Silicon carbide (18) Mixtures thereof (4)
Dielectric layers (15)

Molybdenum and Dielectric layers (15)
Molybdenum alloys

Beryllium and Dielectric layers (15)
Beryllium alloys Borides
Beryllium

Sensor window Dielectric layers (15)
materials (9)

Titanium alloys (13) Borides
Nitrides

TABLE - DEPOSITION TECHNIQUES

1. Coating Process (1) 2. Substrate 3. Resultant Coating

B.2. Ion assisted resistive Ceramics (19) and Low- Dielectric layers (15)
heating Physical Vapour expansion glasses (14) Diamond-like carbon (17)
Deposition (PVD)
(Ion Plating)
Carbon-carbon, Dielectric layers (15)
Ceramic and Metal
"matrix" "composites"

Cemented tungsten Dielectric layers (15)
carbide (16),
Silicon carbide

Molybdenum and
Molybdenum alloys Dielectric layers (15)

Beryllium and
Beryllium alloys Dielectric layers (15)

Sensor window Dielectric layers (15)
materials (9) Diamond-like carbon (17)

B.3. Physical Vapour Ceramics (19) and Low- Silicides
Deposition (PVD): expansion glasses (14) Dielectric layers (15)
"Laser" Vaporization Diamond-like carbon (17)

Carbon-carbon, Dielectric layers (15)
Ceramic and Metal
"matrix" "composites"

Cemented tungsten Dielectric layers (15)
carbide (16),
Silicon carbide

Molybdenum and Dielectric layers (15)
Molybdenum alloys

Beryllium and Dielectric layers (15)
Beryllium alloys

Sensor window Dielectric layers (15)
materials (9) Diamond-like carbon

TABLE - DEPOSITION TECHNIQUES

1. <u>Coating Process</u> (1) 2. <u>Substrate</u> 3. <u>Resultant Coating</u>

B.4. Physical Vapour "Superalloys" Alloyed silicides
Deposition (PVD): Alloyed aluminides (2)
Cathodic Arc Discharge MCrAlX (5)

Polymers (11) and Borides
Organic "matrix" Carbides
"composites" Nitrides
Diamond-like carbon (17)

C. Pack cementation Carbon-carbon, Silicides
(see A above for Ceramic and Carbides
out-of-pack Metal "matrix" Mixtures thereof (4)
cementation) (10) "composites"

Titanium alloys (13) Silicides
Aluminides
Alloyed aluminides (2)

Refractory metals Silicides
and alloys (8) Oxides

D. Plasma spraying "Superalloys" MCrAlX (5)

Modified zirconia (12)

Mixtures thereof (4)

Abradable Nickel-Graphite

Abradable materials

containing Ni-Cr-Al

Abradable Al-Si-Polyester

Alloyed aluminides (2)

Aluminium alloys (6) MCrAlX (5)

Modified zirconia (12)

Silicides

Mixtures thereof (4)

Refractory metals Aluminides

and alloys (8) Silicides

Carbides

TABLE - DEPOSITION TECHNIQUES

1. Coating Process (1) 2. Substrate 3. Resultant Coating

D. (continued) Corrosion resistant MCrAlX (5)

steel (7) Modified zirconia (12)

Mixtures thereof (4)

Titanium alloys (13) Carbides

Aluminides

Silicides

Alloyed aluminides (2)

Abradable Nickel-Graphite

Abradable materials

containing Ni-Cr-Al

Abradable Al-Si-Polyester

E. Slurry Deposition Refractory metals Fused silicides
and alloys (8) Fused aluminides
except for resistance
heating elements

Carbon-carbon, Silicides
Ceramic and Carbides
Metal "matrix" Mixtures thereof (4)
"composites"

F. Sputter Deposition "Superalloys" Alloyed silicides
Alloyed aluminides (2)
Noble metal modified
aluminides (3)
MCrAlX (5)
Modified zirconia (12)
Platinum
Mixtures thereof (4)

Ceramics and Low- Silicides
expansion glasses (14) Platinum
Mixtures thereof (4)
Dielectic layers (15)
Diamond-like carbon (17)

TABLE - DEPOSITION TECHNIQUES

1. Coating Process (1) 2. Substrate 3. Resultant Coating

F. (continued) Titanium alloys (13) Borides
Nitrides
Oxides
Silicides
Aluminides
Alloyed aluminides (2)
Carbides

Carbon-carbon, Silicides
Ceramic and Metal Carbides
"matrix" "composites" Refractory metals
Mixtures thereof (4)
Dielectric layers (15)
Boron nitride

Cemented tungsten Carbides
carbide (16), Tungsten
Silicon carbide (18) Mixtures thereof (4)
Dielectric layers (15)
Boron nitride

Molybdenum and
Molybdenum alloys Dielectric layers (15)

Beryllium and Borides
Beryllium alloys Dielectric layers (15)
Beryllium

Sensor window Dielectric layers (15)
materials (9) Diamond-like carbon (17)

Refractory metals Aluminides
and alloys (8) Silicides
Oxides
Carbides

TABLE - DEPOSITION TECHNIQUES

1. Coating Process (1) 2. Substrate 3. Resultant Coating

G. Ion Implantation High temperature Additions of
bearing steels Chromium

Tantalum or
Niobium (Columbium)

Titanium alloys (13) Borides
Nitrides

Beryllium and Borides
Beryllium alloys

Cemented tungsten Carbides
carbide (16) Nitrides

TABLE - DEPOSITION TECHNIQUES - NOTES

1. The term 'coating process' includes coating repair and refurbishing as well as original coating.

2. The term 'alloyed aluminide coating' includes single or multiple-step coatings in which an element or elements are deposited prior to or during application of the aluminide coating, even if these elements are deposited by another coating process. It does not, however, include the multiple use of single-step pack cementation processes to achieve alloyed aluminides.

3. The term 'noble metal modified aluminide' coating includes multiple-step coatings in which the noble metal or noble metals are laid down by some other coating process prior to application of the aluminide coating.

4. The term 'mixtures thereof' includes infiltrated material, graded compositions, co-deposits and multilayer deposits and are obtained by one or more of the coating processes specified in the Table.

5. 'MCrAlX' refers to a coating alloy where M equals cobalt, iron, nickel or combinations thereof and X equals hafnium, yttrium, silicon, tantalum in any amount or other intentional additions over 0.01 weight percent in various proportions and

combinations, except:

a. CoCrAlY coatings which contain less than 22 weight percent of chromium, less than 7 weight percent of aluminium and less than 2 weight percent of yttrium;
b. CoCrAlY coatings which contain 22 to 24 weight percent of chromium, 10 to 12 weight percent of aluminium and 0.5 to 0.7 weight percent of yttrium; or
c. NiCrAlY coatings which contain 21 to 23 weight percent of chromium, 10 to 12 weight percent of aluminium and 0.9 to1.1 weight percent of yttrium.

6. The term 'aluminium alloys' refers to alloys having an ultimate tensile strength of 190 MPa or more measured at 293 K (20°C).

7. The term 'corrosion resistant steel' refers to AISI (American Iron and Steel Institute) 300 series or equivalent national standard steels.

8. 'Refractory metals and alloys' include the following metals and their alloys: niobium (columbium), molybdenum, tungsten and tantalum.

9. 'Sensor window materials', as follows: alumina, silicon, germanium, zinc sulphide, zinc selenide, gallium arsenide, diamond, gallium phosphide, sapphire and the following metal halides: sensor window materials of more than 40 mm diameter for zirconium fluoride and hafnium fluoride.

10. "Technology" for single-step pack cementation of solid airfoils is not controlled by Category 2.

TABLE - DEPOSITION TECHNIQUES - NOTES

11. 'Polymers', as follows: polyimide, polyester, polysulphide, polycarbonates and polyurethanes.

12. 'Modified zirconia' refers to additions of other metal oxides (e.g., calcia, magnesia, yttria, hafnia, rare earth oxides) to zirconia in order to stabilise certain crystallographic phases and phase compositions. Thermal barrier coatings made of zirconia, modified with calcia or magnesia by mixing or fusion, are not controlled.

13. 'Titanium alloys' refers only to aerospace alloys having an ultimate tensile strength

of 900 MPa or more measured at 293 K (20°C).

14. 'Low-expansion glasses' refers to glasses which have a coefficient of thermal expansion of 1 x 10-7 K-1 or less measured at 293 K (20°C).

15. 'Dielectric layers' are coatings constructed of multi-layers of insulator materials in which the interference properties of a design composed of materials of various refractive indices are used to reflect, transmit or absorb various wavelength bands. Dielectric layers refers to more than four dielectric layers or dielectric/metal "composite" layers.

16. 'Cemented tungsten carbide' does not include cutting and forming tool materials consisting of tungsten carbide/(cobalt, nickel), titanium carbide/(cobalt, nickel), chromium carbide/nickel-chromium and chromium carbide/nickel.

17. "Technology" specially designed to deposit diamond-like carbon on any of the following is not controlled:
    magnetic disk drives and heads, polycarbonate eyeglasses, equipment for the manufacture of disposables, bakery equipment, valves for faucets, acoustic diaphragms for speakers, engine parts for automobiles, cutting tools, punching-pressing dies, high quality lenses designed for cameras or telescopes, office automation equipment, microphones or medical devices.

18. 'Silicon carbide' does not include cutting and forming tool materials.

19. Ceramic substrates, as used in this entry, does not include ceramic materials containing 5% by weight, or greater, clay or cement content, either as separate constituents or in combination.

TABLE - DEPOSITION TECHNIQUES - TECHNICAL NOTE

Processes specified in Column 1 of the Table are defined as follows:

a. Chemical Vapour Deposition (CVD) is an overlay coating or surface modification coating process wherein a metal, alloy, "composite", dielectric or ceramic is deposited upon a heated substrate. Gaseous reactants are decomposed or combined in the vicinity of a substrate resulting in the deposition of the desired elemental, alloy or compound material on the substrate. Energy for this decomposition or chemical reaction process may be provided by the heat of the substrate, a glow discharge plasma, or "laser" irradiation.

N.B.1 CVD includes the following processes: directed gas flow out-of-pack deposition, pulsating CVD, controlled nucleation thermal deposition (CNTD), plasma enhanced or plasma assisted CVD processes.
N.B.2 Pack denotes a substrate immersed in a powder mixture.
N.B.3 The gaseous reactants used in the out-of-pack process are produced using the same basic reactions and parameters as the pack cementation process, except that the substrate to be coated is not in contact with the powder mixture.

b. Thermal Evaporation-Physical Vapour Deposition (TE-PVD) is an overlay coating process conducted in a vacuum with a pressure less than 0.1 Pa wherein a source of thermal energy is used to vaporize the coating material. This process results in the condensation, or deposition, of the evaporated species onto appropriately positioned substrates.

The addition of gases to the vacuum chamber during the coating process to synthesize compound coatings is an ordinary modification of the process.

The use of ion or electron beams, or plasma, to activate or assist the coating's deposition is also a common modification in this technique. The use of monitors to provide in-process measurement of optical characteristics and thickness of coatings can be a feature of these processes.

Specific TE-PVD processes are as follows:

1. Electron Beam PVD uses an electron beam to heat and evaporate the material which forms the coating;
2. Ion Assisted Resistive Heating PVD employs electrically resistive heating sources in combination with impinging ion beam(s) to produce a controlled and uniform flux of evaporated coating species;
3. "Laser" Vaporization uses either pulsed or continuous wave "laser" beams to vaporize the material which forms the coating;

TABLE - DEPOSITION TECHNIQUES - TECHNICAL NOTE

Processes specified in Column 1 of the Table - continued:

b. 4. Cathodic Arc Deposition employs a consumable cathode of the material which forms the coating and has an arc discharge established on the surface by a momentary contact of a ground trigger. Controlled motion of arcing erodes the cathode surface creating a highly ionized plasma. The anode can be either a cone attached to the periphery of the cathode, through an insulator, or the chamber. Substrate biasing is used for non line-of-sight deposition.

N.B. This definition does not include random cathodic arc deposition with non-biased substrates.

5. Ion Plating is a special modification of a general TE-PVD process in which a plasma or an ion source is used to ionize the species to be deposited, and a negative bias is applied to the substrate in order to facilitate the extraction of the species from the plasma. The introduction of reactive species, evaporation of solids within the process chamber, and the use of monitors to provide in-process measurement of optical characteristics and thicknesses of coatings are ordinary modifications of the process.

c. Pack Cementation is a surface modification coating or overlay coating process wherein a substrate is immersed in a powder mixture (a pack), that consists of:

1. The metallic powders that are to be deposited (usually aluminium, chromium, silicon or combinations thereof);
2. An activator (normally a halide salt); and
3. An inert powder, most frequently alumina.

The substrate and powder mixture is contained within a retort which is heated to between 1,030 K (757°C) and 1,375 K (1,102°C) for sufficient time to deposit the coating.

d. Plasma Spraying is an overlay coating process wherein a gun (spray torch) which produces and controls a plasma accepts powder or wire coating materials, melts them and propels them towards a substrate, whereon an integrally bonded coating is formed. Plasma spraying constitutes either low pressure plasma spraying or high velocity plasma spraying.

N.B.1 Low pressure means less than ambient atmospheric pressure.
N.B.2 High velocity refers to nozzle-exit gas velocity exceeding 750 m/s calculated at 293 K (20°C) at 0.1 MPa.

e. Slurry Deposition is a surface modification coating or overlay coating process wherein a metallic or ceramic powder with an organic binder is suspended in a liquid and is applied to a substrate by either spraying, dipping or painting, subsequent air or oven drying, and heat treatment to obtain the desired coating.

TABLE - DEPOSITION TECHNIQUES - TECHNICAL NOTE

Processes specified in Column 1 of the Table - continued:

f. Sputter Deposition is an overlay coating process based on a momentum transfer phenomenon, wherein positive ions are accelerated by an electric field towards the surface of a target (coating material). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on an appropriately positioned substrate.

N.B.1 The Table refers only to triode, magnetron or reactive sputter deposition which is used to increase adhesion of the coating and rate of deposition and to radio frequency (RF) augmented sputter deposition used to permit vaporisation of non-metallic coating materials.
N.B.2 Low-energy ion beams (less than 5 keV) can be used to activate the deposition.

g. Ion Implantation is a surface modification coating process in which the element to be alloyed is ionized, accelerated through a potential gradient and implanted into the surface region of the substrate. This includes processes in which ion implantation is performed simultaneously with electron beam physical vapour deposition or sputter deposition.

TABLE - DEPOSITION TECHNIQUES - STATEMENT OF UNDERSTANDING

It is understood that the following technical information, accompanying the table of deposition techniques, is for use as appropriate.

1. "Technology" for pretreatments of the substrates listed in the Table, as follows:
   a. Chemical stripping and cleaning bath cycle parameters, as follows:
      1. Bath composition
         a. For the removal of old or defective coatings, corrosion product or foreign deposits;
         b. For preparation of virgin substrates;
      2. Time in bath;
      3. Temperature of bath;
      4. Number and sequences of wash cycles;
   b. Visual and macroscopic criteria for acceptance of the cleaned part;
   c. Heat treatment cycle parameters, as follows:
      1. Atmosphere parameters, as follows:
         a. Composition of the atmosphere;
         b. Pressure of the atmosphere;
      2. Temperature for heat treatment;
      3. Time of heat treatment;
   d. Substrate surface preparation parameters, as follows:
      1. Grit blasting parameters, as follows:
         a. Grit composition;
         b. Grit size and shape;
         c. Grit velocity;
      2. Time and sequence of cleaning cycle after grit blast;
      3. Surface finish parameters;
      4. Application of binders to promote adhesion;
   e. Masking technique parameters, as follows:
      1. Material of mask;
      2. Location of mask;

2. "Technology" for in situ quality assurance techniques for evaluation of the coating processes listed in the Table, as follows:
   a. Atmosphere parameters, as follows:
      1. Composition of the atmosphere;
      2. Pressure of the atmosphere;

b. Time parameters;
c. Temperature parameters;
d. Thickness parameters;
e. Index of refraction parameters;
f. Control of composition;

3. "Technology" for post deposition treatments of the coated substrates listed in the Table, as follows:
   a. Shot peening parameters, as follows:
      1. Shot composition;
      2. Shot size;
      3. Shot velocity;

3. b. Post shot peening cleaning parameters;
   c. Heat treatment cycle parameters, as follows:
      1. Atmosphere parameters, as follows:
         a. Composition of the atmosphere;
         b. Pressure of the atmosphere;
      2. Time-temperature cycles;
         d. Post heat treatment visual and macroscopic criteria for acceptance of the coated substrates;

4. "Technology" for quality assurance techniques for the evaluation of the coated substrates listed in the Table, as follows:
   a. Statistical sampling criteria;
   b. Microscopic criteria for:
      1. Magnification;
      2. Coating thickness uniformity;
      3. Coating integrity;
      4. Coating composition;
      5. Coating and substrates bonding;
      6. Microstructural uniformity;
   c. Criteria for optical properties assessment (measured as a function of wavelength):
      1. Reflectance;
      2. Transmission;

3. Absorption;
4. Scatter;

5. "Technology" and parameters related to specific coating and surface modification processes listed in the Table, as follows:
   a. For Chemical Vapour Deposition (CVD):
      1. Coating source composition and formulation;
      2. Carrier gas composition;
      3. Substrate temperature;
      4. Time-temperature-pressure cycles;
      5. Gas control and part manipulation;

   b. For Thermal Evaporation - Physical Vapour Deposition (PVD):
      1. Ingot or coating material source composition;
      2. Substrate temperature;
      3. Reactive gas composition;
      4. Ingot feed rate or material vaporisation rate;
      5. Time-temperature-pressure cycles;
      6. Beam and part manipulation;
      7. "Laser" parameters, as follows:
         a. Wave length;
         b. Power density;
         c. Pulse length;
         d. Repetition ratio;
         e. Source;

5. c. For Pack Cementation:
      1. Pack composition and formulation;
      2. Carrier gas composition;
      3. Time-temperature-pressure cycles;

   d. For Plasma Spraying:
      1. Powder composition, preparation and size distributions;
      2. Feed gas composition and parameters;
      3. Substrate temperature;
      4. Gun power parameters;
      5. Spray distance;

6. Spray angle;
7. Cover gas composition, pressure and flow rates;
8. Gun control and part manipulation;

e. For Sputter Deposition:
1. Target composition and fabrication;
2. Geometrical positioning of part and target;
3. Reactive gas composition;
4. Electrical bias;
5. Time-temperature-pressure cycles;
6. Triode power;
7. Part manipulation;

f. For Ion Implantation:
1. Beam control and part manipulation;
2. Ion source design details;
3. Control techniques for ion beam and deposition rate parameters;
4. Time-temperature-pressure cycles;

g. For Ion Plating:
1. Beam control and part manipulation;
2. Ion source design details;
3. Control techniques for ion beam and deposition rate parameters;
4. Time-temperature-pressure cycles;
5. Coating material feed rate and vaporisation rate;
6. Substrate temperature;
7. Substrate bias parameters.

DUAL-USE LIST-CATEGORY 3-ELECTRONICS

3. A. SYSTEMS, EQUIPMENT AND COMPONENTS

Note 1 The control status of equipment and components described in 3.A., other than those described in 3.A.1.a.3. to 3.A.1.a.10. or 3.A.1.a.12., which are specially designed for or which have the same functional characteristics as other equipment is determined by the control status of the other equipment.

Note 2 The control status of integrated circuits described in 3.A.1.a.3. to 3.A.1.a.9. or 3.A.1.a.12. which are unalterably programmed or designed for a specific function for another equipment is determined by the control status of the other equipment.

N.B. When the manufacturer or applicant cannot determine the control status of the other equipment, the control status of the integrated circuits is determined in 3.A.1.a.3. to 3.A.1.a.9. and 3.A.1.a.12.

If the integrated circuit is a silicon-based "microcomputer microcircuit" or microcontroller microcircuit described in 3.A.1.a.3. having an operand (data) word length of 8 bit or less, the control status of the integrated circuit is determined in 3.A.1.a.3.

3. A. 1. Electronic components, as follows:

a. General purpose integrated circuits, as follows:

Note 1 The control status of wafers (finished or unfinished), in which the function has been determined, is to be evaluated against the parameters of 3.A.1.a.

Note 2 Integrated circuits include the following types:

"Monolithic integrated circuits";
"Hybrid integrated circuits";
"Multichip integrated circuits";
"Film type integrated circuits", including silicon-on-sapphire integrated circuits;
"Optical integrated circuits".

3. A. 1. a. 1. Integrated circuits, designed or rated as radiation hardened to withstand any of the following:

a. A total dose of 5 x 103 Gy (Si) or higher; or
b. A dose rate upset of 5 x 106 Gy (Si)/s or higher;

3. A. 1. a. 2. "Microprocessor microcircuits", "microcomputer microcircuits", microcontroller microcircuits, storage integrated circuits manufactured from a compound semiconductor, analogue-to-digital converters, digital-to-analogue converters, electro-optical or "optical integrated circuits" designed for "signal processing", field programmable logic devices, neural network integrated circuits, custom integrated circuits for which either the function is unknown or the control status of the equipment in which the integrated circuit will be used is unknown, Fast Fourier Transform (FFT) processors, electrical erasable programmable read-only memories (EEPROMs), flash memories or static random-access memories (SRAMs), having any of the following:

a. Rated for operation at an ambient temperature above 398 K (+125°C);
b. Rated for operation at an ambient temperature below 218 K (-55°C); or
c. Rated for operation over the entire ambient temperature range from 218 K (-55°C) to 398 K (+125°C);

Note 3.A.1.a.2. does not apply to integrated circuits for civil automobile or railway train applications.

3. A. 1. a. 3. "Microprocessor microcircuits", "micro-computer microcircuits" and micro-controller microcircuits, having any of the following characteristics:

Note 3.A.1.a.3. includes digital signal processors, digital array processors and digital coprocessors.

a. A "composite theoretical performance" ("CTP") of 3,500 million theoretical operations per second (Mtops) or more and an arithmetic logic unit with an access width of 32 bit or more;

b. Manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz; or

c. More than one data or instruction bus or serial communication port for external interconnection in a parallel processor with a transfer rate exceeding 2.5 Mbyte/s;

3. A. 1. a. 4. Storage integrated circuits manufactured from a compound semiconductor;

3. A. 1. a. 5. Analogue-to-digital and digital-to-analogue converter integrated circuits, as follows:

a. Analogue-to-digital converters having any of the following:

1. A resolution of 8 bit or more, but less than 12 bit, with a total conversion time of less than 10 ns;
2. A resolution of 12 bit with a total conversion time of less than 200 ns; or
3. A resolution of more than 12 bit with a total conversion time of less than 2 μs;

b. Digital-to-analogue converters with a resolution of 12 bit or more, and a "settling time" of less than 10 ns;

Technical Note

1. A resolution of n bit corresponds to a quantisation of 2^n levels.

2. Total conversion time is the inverse of the sample rate.

3. A. 1. a. 6. Electro-optical and "optical integrated circuits" designed for "signal processing" having all of the following:

a. One or more than one internal "laser" diode;

b. One or more than one internal light detecting element; and

c. Optical waveguides;

3. A. 1. a. 7. Field programmable logic devices having any of the following:

a. An equivalent usable gate count of more than 30,000 (2 input gates);

b. A typical "basic gate propagation delay time" of less than 0.4 ns; or

c. A toggle frequency exceeding 133 MHz;

Note 3.A.1.a.7.includes:
- Simple Programmable Logic Devices (SPLDs)
- Complex Programmable Logic Devices (CPLDs)
- Field Programmable Gate Arrays (FPGAs)
- Field Programmable Logic Arrays (FPLAs)
- Field Programmable Interconnects (FPICs)

N.B. Field programmable logic devices are also known as field programmable gate or field programmable logic arrays.

3. A. 1. a. 8. Deleted

3. A. 1. a. 9. Neural network integrated circuits;

3. A. 1. a. 10. Custom integrated circuits for which the function is unknown, or the control status of the equipment in which the integrated circuits will be used is unknown to the manufacturer, having any of the following:

a. More than 208 terminals;
b. A typical "basic gate propagation delay time" of less than 0.35 ns; or
c. An operating frequency exceeding 3 GHz;

3. A. 1. a. 11. Digital integrated circuits, other than those described in 3.A.1.a.3 to 3.A.1.a.10. and 3.A.1.a.12., based upon any compound semiconductor and having any of the following:

a. An equivalent gate count of more than 3000 (2 input gates); or
b. A toggle frequency exceeding 1.2 GHz;

3. A. 1. a. 12. Fast Fourier Transform (FFT) processors having any of the following:

a. A rated execution time for a 1,024 point complex FFT of less than 1 ms;
b. A rated execution time for an N-point complex FFT of other than 1,024 points of less than N log2 N /10,240 ms, where N is the number of points; or
c. A butterfly throughput of more than 5.12 MHz;

3. A. 1. b. Microwave or millimetre wave components, as follows:

1. Electronic vacuum tubes and cathodes, as follows:

Note 3.A.1.b.1. does not control tubes designed or rated to operate in the ITU allocated bands at frequencies not *exceeding 31 GHz.*

a. Travelling wave tubes, pulsed or continuous wave, as follows:

1. Operating at frequencies higher than 31 GHz;
2. Having a cathode heater element with a turn on time to rated RF power of less than 3 seconds;
3. Coupled cavity tubes, or derivatives thereof, with an "instantaneous bandwidth" of more than 7% or a peak power exceeding 2.5 kW;
4. Helix tubes, or derivatives thereof, with any of the following characteristics:
   a. An "instantaneous bandwidth" of more than one octave, and average power (expressed in kW) times frequency (expressed in GHz) of more than 0.5;
   b. An "instantaneous bandwidth" of one octave or less, and average power (expressed in kW) times frequency (expressed in GHz) of more than 1; <u>or</u>
   c. Being"space qualified";

b. Crossed-field amplifier tubes with a gain of more than 17 dB;

c. Impregnated cathodes designed for electronic tubes producing a continuous emission current density at rated operating conditions exceeding 5 A/cm²;

3. A. 1. b. 2. Microwave integrated circuits or modules having all of the following:

a. Containing "monolithic integrated circuits"; <u>and</u>

b. Operating at frequencies exceeding 3 GHz;

<u>Note</u> 3.A.1.b.2. does not control circuits or modules for equipment designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.

3. A. 1. b. 3. Microwave transistors rated for operation at frequencies exceeding 31 GHz;

4. Microwave solid state amplifiers, having any of the following:

a. Operating frequencies exceeding 10.5 GHz and an "instantaneous bandwidth" of more than half an octave; <u>or</u>

b. Operating frequencies exceeding 31 GHz;

5. Electronically or magnetically tunable band-pass or band-stop filters having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band (fmax/fmin) in less than 10 μs having any of the following:

a. A band-pass bandwidth of more than 0.5% of centre frequency; <u>or</u>

b. A band-stop bandwidth of less than 0.5% of centre frequency;

6. Microwave assemblies capable of operating at frequencies exceeding 31 GHz;

7. Mixers and converters designed to extend the frequency range of equipment described in 3.A.2.c., 3.A.2.e. or 3.A.2.f. beyond the limits stated therein;

8. Microwave power amplifiers containing tubes controlled by 3.A.1.b. and having all of the following:
  a. Operating frequencies above 3 GHz;
  b. An average output power density exceeding 80 W/kg; and
  c. A volume of less than 400 cm^3;

Note 3.A.1.b.8. does not control equipment designed or rated for operation in an ITU allocated band.

3. A. 1. c. Acoustic wave devices, as follows, and specially designed components therefor:

1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices (i.e., "signal processing" devices employing elastic waves in materials), having any of the following:
  a. A carrier frequency exceeding 2.5 GHz;
  b. A carrier frequency exceeding 1 GHz, but not exceeding 2.5 GHz, and having any of the following:
    1. A frequency side-lobe rejection exceeding 55 dB;
    2. A product of the maximum delay time and the bandwidth (time in μs and bandwidth in MHz) of more than 100;
    3. A bandwidth greater than 250 MHz; or
    4. A dispersive delay of more than 10 μs; or

3. A. 1. c. 1. c. A carrier frequency of 1 GHz or less, having any of the following:
    1. A product of the maximum delay time and the bandwidth (time in μs and bandwidth in MHz) of more than 100;
    2. A dispersive delay of more than 10 μs; or
    3. A frequency side-lobe rejection exceeding 55 dB and a bandwidth greater than 50 MHz;
2. Bulk (volume) acoustic wave devices (i.e., "signal processing" devices employing

elastic waves) which permit the direct processing of signals at frequencies exceeding 1 GHz;

3. Acoustic-optic "signal processing" devices employing interaction between acoustic waves (bulk wave or surface wave) and light waves which permit the direct processing of signals or images, including spectral analysis, correlation or convolution;

3. A. 1. d. Electronic devices and circuits containing components, manufactured from "superconductive" materials specially designed for operation at temperatures below the "critical temperature" of at least one of the "superconductive" constituents, with any of the following:

1. Current switching for digital circuits using "superconductive" gates with a product of delay time per gate (in seconds) and power dissipation per gate (in watts) of less than 10-14 J; <u>or</u>
2. Frequency selection at all frequencies using resonant circuits with Q values exceeding 10,000;

3. A. 1. e. High energy devices, as follows:

1. Batteries and photovoltaic arrays, as follows:

<u>Note</u> 3.A.1.e.1. does not control batteries with volumes equal to or less than 27 cm^3 (e.g., standard C-cells or R14 batteries).

a. Primary cells and batteries having an energy density exceeding 480 Wh/kg and rated for operation in the temperature range from below 243 K (-30°C) to above 343 K (70°C);
b. Rechargeable cells and batteries having an energy density exceeding 150 Wh/kg after 75 charge/discharge cycles at a discharge current equal to C/5 hours (C being the nominal capacity in ampere hours) when operating in the temperature range from below 253 K (-20°C) to above 333 K (60°C);

<u>Technical Note</u>

Energy density is obtained by multiplying the average power in watts (average voltage in volts times average current in amperes) by the duration of the discharge in hours to 75% of the open circuit voltage divided by the total mass of the cell (or battery) in kg.

3. A. 1. e. 1. c. "Space qualified" and radiation hardened photovoltaic arrays with a specific power exceeding 160 W/m^2 at an operating temperature of 301 K (28°C) under a tungsten illumination of 1 kW/m^2 at 2,800 K (2,527°C);

2. High energy storage capacitors, as follows:

a. Capacitors with a repetition rate of less than 10 Hz (single shot capacitors) having all of the following:
1. A voltage rating equal to or more than 5 kV;
2. An energy density equal to or more than 250 J/kg; <u>and</u>
3. A total energy equal to or more 25 kJ;

b. Capacitors with a repetition rate of 10 Hz or more (repetition rated capacitors) having all of the following:
1. A voltage rating equal to or more than 5 kV;
2. An energy density equal to or more than 50 J/kg;
3. A total energy equal to or more than 100 J; <u>and</u>
4. A charge/discharge cycle life equal to or more than 10,000;

3. "Superconductive" electromagnets and solenoids specially designed to be fully charged or discharged in less than one second, having all of the following:

<u>Note</u> 3.A.1.e.3. does not control "superconductive" electromagnets or solenoids specially designed for Magnetic Resonance Imaging (MRI) medical equipment.

a. Energy delivered during the discharge exceeding 10 kJ in the first second;
b. Inner diameter of the current carrying windings of more than 250 mm; <u>and</u>
c. Rated for a magnetic induction of more than 8 T or "overall current density" in the winding of more than 300 A/mm2;

3. A. 1. f. Rotary input type shaft absolute position encoders having any of the following:
1. A resolution of better than 1 part in 265,000 (18 bit resolution) of full scale; <u>or</u>
2. An accuracy better than ± 2.5 seconds of arc.

3. A. 2. General purpose electronic equipment, as follows:

a. Recording equipment, as follows, and specially designed test tape therefor:

1. Analogue instrumentation magnetic tape recorders, including those permitting the recording of digital signals (e.g., using a high density digital recording (HDDR) module), having any of the following:

a. A bandwidth exceeding 4 MHz per electronic channel or track;

b. A bandwidth exceeding 2 MHz per electronic channel or track and having more than 42 tracks; or

3. A. 2. a. 1. c. A time displacement (base) error, measured in accordance with applicable IRIG or EIA documents, of less than ± 0.1 μs;

Note Analogue magnetic tape recorders specially designed for civilian video purposes are not considered to be instrumentation tape recorders.

3. A. 2. a. 2. Digital video magnetic tape recorders having a maximum digital interface transfer rate exceeding 360 Mbit/s;

Note 3.A.2.a.2. does not control digital video magnetic tape recorders specially designed for television recording using a signal format, which may include a compressed signal format, standardised or recommended by the ITU, the IEC, the SMPTE, the EBU or the IEEE for civil television applications.

3. Digital instrumentation magnetic tape data recorders employing helical scan techniques or fixed head techniques, having any of the following:

a. A maximum digital interface transfer rate exceeding 175 Mbit/s; or

b. Being "space qualified";

Note 3.A.2.a.3 does not control analogue magnetic tape recorders equipped with HDDR conversion electronics and configured to record only digital data.

4. Equipment, having a maximum digital interface transfer rate exceeding 175 Mbit/s, designed to convert digital video magnetic tape recorders for use as digital instrumentation data recorders;

5. Waveform digitisers and transient recorders having all of the following:

a. Digitising rates equal to or more than 200 million samples per second and a resolution of 10 bits or more; and

b. A continuous throughput of 2 Gbit/s or more;

Technical Note

For those instruments with a parallel bus architecture, the continuous throughput rate is the highest word rate multiplied by the number of bits in a word.

Continuous throughput is the fastest data rate the instrument can output to mass storage without the loss of any information whilst sustaining the sampling rate and analogue-to-digital conversion.

3. A. 2. b. "Frequency synthesiser" "electronic assemblies" having a "frequency switching time" from one selected frequency to another of less than 1 ms;

3. A. 2. c. "Signal analysers", as follows:

1. "Signal analysers" capable of analysing frequencies exceeding 31 GHz;
2. "Dynamic signal analysers" having a "real-time bandwidth" exceeding 25.6 kHz;

Note 3.A.2.c.2. does not control those "dynamic signal analysers" using only constant percentage bandwidth filters (also known as octave or fractional octave filters).

d. Frequency synthesised signal generators producing output frequencies, the accuracy and short term and long term stability of which are controlled, derived from or disciplined by the internal master frequency, and having any of the following:

1. A maximum synthesised frequency exceeding 31 GHz;
2. A "frequency switching time" from one selected frequency to another of less than 1 ms; or
3. A single sideband (SSB) phase noise better than -(126 + 20 log10F - 20 log10f) in dBc/Hz, where F is the off-set from the operating frequency in Hz and f is the operating frequency in MHz;

Note 3.A.2.d. does not control equipment in which the output frequency is either produced by the addition or subtraction of two or more crystal oscillator frequencies, or by an addition or subtraction followed by a multiplication of the result.

e. Network analysers with a maximum operating frequency exceeding 40 GHz;

f. Microwave test receivers having all of the following:

1. A maximum operating frequency exceeding 40 GHz; and
2. Being capable of measuring amplitude and phase simultaneously;

g. Atomic frequency standards having any of the following:

1. Long-term stability (aging) less (better) than 1 x 10-11/month; or
2. Being "space qualified".

Note 3.A.2.g.1. does not control non-"space qualified" rubidium standards.

3. B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

3. B. 1. Equipment for the manufacturing of semiconductor devices or materials, as follows, and specially designed components and accessories therefor:

a. "Stored programme controlled" equipment designed for epitaxial growth, as follows:

1. Equipment capable of producing a layer thickness uniform to less than ± 2.5% across a distance of 75 mm or more;
2. Metal organic chemical vapour deposition (MOCVD) reactors specially designed for compound semiconductor crystal growth by the chemical reaction between materials controlled by 3.C.3 or 3.C.4.;
3. Molecular beam epitaxial growth equipment using gas or solid sources;

3. B. 1. b. "Stored programme controlled" equipment designed for ion implantation, having any of the following:

1. A beam energy (accelerating voltage) exceeding 1 MeV;
2. Being specially designed and optimised to operate at a beam energy (accelerating voltage) of less than 2 keV;
3. Direct write capability; or
4. Being capable of high energy oxygen implant into a heated semiconductor material "substrate";

3. B. 1. c. "Stored programme controlled" anisotropic plasma dry etching equipment, as follows:

1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:
   a. Magnetic confinement; or
   b. Electron cyclotron resonance (ECR);
2. Equipment specially designed for equipment controlled by 3.B.1.e. and having

any of the following:

a. Magnetic confinement; <u>or</u>

b. ECR;

3. B. 1. d. "Stored programme controlled" plasma enhanced CVD equipment, as follows:

1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:

a. Magnetic confinement; <u>or</u>

b. ECR;

2. Equipment specially designed for equipment controlled by 3.B.1.e. and having any of the following:

a. Magnetic confinement; <u>or</u>

b. ECR;

3. B. 1. e. "Stored programme controlled" automatic loading multi-chamber central wafer handling systems, having all of the following:

1. Interfaces for wafer input and output, to which more than two pieces of semi-conductor processing equipment are to be connected; <u>and</u>

2. Designed to form an integrated system in a vacuum environment for sequential multiple wafer processing;

<u>Note</u> 3.B.1.e. does not control automatic robotic wafer handling systems not designed to operate in a vacuum environment.

3. B. 1. f. "Stored programme controlled" lithography equipment, as follows:

1. Align and expose step and repeat (direct step on wafer) or step and scan (scanner) equipment for wafer processing using photo-optical or X-ray methods, having any of the following:

a. A light source wavelength shorter than 350 nm; <u>or</u>

b. Capable of producing a pattern with a minimum resolvable feature size of 0.5 µm or less;

<u>Technical Note</u>

The minimum resolvable feature size is calculated by the following formula:

$$MRF = \frac{\textit{(an exposure light source wavelength in } \mu m\textit{) x (Kfactor)}}{\textit{numerical aperture}}$$

where the K factor = 0.7.
MRF = minimum resolvable feature size.

3. B. 1. f. 2. Equipment specially designed for mask making or semiconductor device processing using deflected focussed electron beam, ion beam or "laser" beam, having any of the following:
a. A spot size smaller than 0.2 μm;
b. Being capable of producing a pattern with a feature size of less than 1 μm; <u>or</u>
c. An overlay accuracy of better than ± 0.20 μm (3 sigma);

g. Masks and reticles designed for integrated circuits controlled by 3.A.1.;

h. Multi-layer masks with a phase shift layer.

3. B. 2. "Stored programme controlled" test equipment, specially designed for testing finished or unfinished semiconductor devices, as follows, and specially designed components and accessories therefor:
a. For testing S-parameters of transistor devices at frequencies exceeding 31 GHz;
b. For testing integrated circuits capable of performing functional (truth table) testing at a pattern rate of more than 333 MHz;

<u>Note</u> 3.B.2.b. does not control test equipment specially designed for testing:

1. *"Electronic assemblies" or a class of "electronic assemblies" for home or entertainment applications;*
2. *Uncontrolled electronic components, "electronic assemblies" or integrated circuits.*

<u>Technical Note</u>

For the purpose of this entry, pattern rate is defined as the maximum frequency of digital operation of a tester. It is therefore equivalent to the highest data rate that a tester can provide in non-multiplexed mode. It is also referred to as test speed, maximum digital frequency or maximum digital speed.

3. B. 2. c. For testing microwave integrated circuits controlled by 3.A.1.b.2.;

3. C. MATERIALS

3. C. 1. Hetero-epitaxial materials consisting of a "substrate" having stacked epitaxially grown multiple layers of any of the following:

a. Silicon;

b. Germanium; <u>or</u>

c. III/V compounds of gallium or indium.

<u>Technical Note</u>

III/V compounds are polycrystalline or binary or complex monocrystalline products consisting of elements of groups IIIA and VA of Mendeleyev's periodic classification table (e.g., gallium arsenide, gallium-aluminium arsenide, indium phosphide).

3. C. 2. Resist materials, as follows, and "substrates" coated with controlled resists:

a. Positive resists designed for semiconductor lithography specially adjusted (optimised) for use at wavelengths below 350 nm ;

b. All resists designed for use with electron beams or ion beams, with a sensitivity of 0.01 µcoulomb/mm2 or better;

c. All resists designed for use with X-rays, with a sensitivity of 2.5 mJ/mm2 or better;

d. All resists optimised for surface imaging technologies, including silylated resists.

<u>Technical Note</u>

Silylation techniques are defined as processes incorporating oxidation of the resist surface to enhance performance for both wet and dry developing.

3. C. 3. Organo-inorganic compounds, as follows:

a. Organo-metallic compounds of aluminium, gallium or indium having a purity (metal basis) better than 99.999%;

b. Organo-arsenic, organo-antimony and organo-phosphorus compounds having a purity (inorganic element basis) better than 99.999%.

<u>Note</u> 3.C.3. only controls compounds whose metallic, partly metallic or non-metallic element is directly linked to carbon in the organic part of the molecule.

3. C. 4. Hydrides of phosphorus, arsenic or antimony, having a purity better than 99.999%, even diluted in inert gases or hydrogen.

<u>Note</u> 3.C.4. does not control hydrides containing 20% molar or more of inert gases or hydrogen.

3. D. SOFTWARE

3. D. 1. "Software" specially designed for the "development" or "production" of equipment controlled by 3.A.1.b. to 3.A.2.g. or 3.B.

3. D. 2. "Software" specially designed for the "use" of "stored programme controlled" equipment controlled by 3.B.

3. D. 3. Computer-aided-design (CAD) "software" designed for semiconductor devices or integrated circuits, having any of the following:

a. Design rules or circuit verification rules;
b. Simulation of the physically laid out circuits; or
c. Lithographic processing simulators for design.

Technical Note

A lithographic processing simulator is a "software" package used in the design phase to define the sequence of lithographic, etching and deposition steps for translating masking patterns into specific topographical patterns in conductors, dielectrics or semiconductor material.

Note 1 3.D.3. does not control "software" specially designed for schematic entry, logic simulation, placing and routing, layout verification or pattern generation tape.
Note 2 Libraries, design attributes or associated data for the design of semiconductor devices or integrated circuits are considered as "technology".

3. E. TECHNOLOGY

3. E. 1. "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 3.A, 3.B or 3.C;

3. E. 2. Other "technology" for the "development" or "production" of:

a. Vacuum microelectronic devices;
b. Hetero-structure semiconductor devices such as high electron mobility transistors (HEMT), hetero-bipolar transistors (HBT), quantum well and super lattice devices;
c. "Superconductive" electronic devices;
d. Substrates of films of diamond for electronic components;

e. Substrates of silicon-on-insulator (SOI) for integrated circuits in which the insulator is silicon dioxide;

f. Substrates of silicon carbide for electronic components.

g. "Technology" according to the General Technology Note other than that controlled in 3.E.1. for the "development" or "production" of "microprocessor microcircuits", "micro-computer microcircuits" and microcontroller microcircuits having a "composite theoretical performance" ("CTP") of 530 million theoretical operations per second (Mtops) or more and an arithmetic logic unit with an access width of 32 bits or more.

Note 3.E.1. and 3.E.2.g. do not control "technology" for the "development" or "production" of:

a. Microwave transistors operating at frequencies below 31 GHz;

b. Integrated circuits controlled by 3.A.1.a.3. to 3.A.1.a.12., having all of the following:

1. Using "technology" of 0.7 μm or more; and

2. Not incorporating multi-layer structures.

Technical Note

The term multi-layer structures in Note b.2. above does not include devices incorporating a maximum of two metal layers and two polysilicon layers.

4. COMPUTERS

Note 1 Computers, related equipment and "software" performing telecommunications or "local area network" functions must also be evaluated against the performance characteristics of Category 5, Part 1 (Telecommunications).

Note 2 Control units which directly interconnect the buses or channels of central processing units, "main storage" or disk controllers are not regarded as telecommunications equipment described in Category 5, Part 1 (Telecommunications).

N.B. For the control status of "software" specially designed for packet switching, see Category 5.D.1. (Telecommunications).

Note 3 Computers, related equipment and "software" performing cryptographic, cryptanalytic, certifiable multi-level security or certifiable user isolation functions, or which limit electromagnetic compatibility (EMC), must also be evaluated against the performance characteristics in Category 5, Part 2 ("Information Security").

4. A. SYSTEMS, EQUIPMENT AND COMPONENTS

4. A. 1. Electronic computers and related equipment, as follows, and "electronic assemblies" and specially designed components therefor:

a. Specially designed to have any of the following characteristics:

1. Rated for operation at an ambient temperature below 228 K (-45°C) or above 358 K (85°C);

Note 4.A.1.a.1. does not apply to computers specially designed for civil automobile or railway train applications.

2. Radiation hardened to exceed any of the following specifications:

a. Total Dose 5 x 103 Gy (Si);

b. Dose Rate Upset 5 x 106 Gy (Si)/sec; or

c. Single Event Upset 1 x 10-7 Error/bit/day;

b. Having characteristics or performing functions exceeding the limits in Category 5, Part 2 ("Information Security").

Note 4.A.1.b. does not control electronic computers and related equipment when accompanying their user for the user's personal use.

4. A. 2. "Hybrid computers", as follows, and "electronic assemblies" and specially designed components therefor:

a. Containing "digital computers" controlled by 4.A.3.;

b. Containing analogue-to-digital converters having all of the following characteristics:

1. 32 channels or more; and

2. A resolution of 14 bits (plus sign bit) or more with a conversion rate of 200,000 conversions/s or more.

4. A. 3. "Digital computers", "electronic assemblies", and related equipment therefor, as follows, and specially designed components therefor:

Note 1 4.A.3. includes the following:

a. Vector processors;

b. Array processors;

c. Digital signal processors;

d. Logic processors;

e. Equipment designed for "image enhancement";

f. Equipment designed for "signal processing".

Note 2 The control status of the "digital computers" and related equipment described in 4.A.3 is determined by the control status of other equipment or systems provided:

a. The "digital computers" or related equipment are essential for the operation of the other equipment or systems;

b. The "digital computers" or related equipment are not a "principal element" of the other equipment or systems; and

N.B.1 The control status of "signal processing" or "image enhancement" equipment *specially designed for other equipment with functions limited to those required for the other equipment is determined by the control status of the other equipment even if it exceeds the "principal element" criterion.*

N.B.2 For the control status of "digital computers" or related equipment for telecommunications equipment, see Category 5, Part 1 (Telecommunications).

c. The "technology" for the "digital computers" and related equipment is determined by 4.E.

4\. A. 3. a. Designed or modified for "fault tolerance";

Note For the purposes of 4.A.3.a., "digital computers" and related equipment are not considered to be designed or modified for "fault tolerance" if they utilise any of the following:

1. *Error detection or correction algorithms in "main storage";*
2. *The interconnection of two "digital computers" so that, if the active central processing unit fails, an idling but mirroring central processing unit can continue the system's functioning;*
3. *The interconnection of two central processing units by data channels or by using shared storage to permit one central processing unit to perform other work until the second central processing unit fails, at which time the first central processing unit takes over in order to continue the system's functioning; or*
4. *The synchronisation of two central processing units by "software" so that one central processing unit recognises when the other central processing unit fails and recovers tasks from the failing unit.*

4\. A. 3. b. "Digital computers" having a "composite theoretical performance" ("CTP") exceeding 6,500 Mtops;

c. "Electronic assemblies" specially designed or modified for enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 4.A.3.b.;

Note 1 4.A.3.c. applies only to "electronic assemblies" and programmable interconnections not exceeding the limit in 4.A.3.b. when shipped *as unintegrated "electronic assemblies". It does not apply to "electronic assemblies" inherently limited by nature of their design for use as related equipment controlled by 4.A.3.d., or 4.A.3.e.*

Note 2 4.A.3.c. does not control "electronic assemblies" specially designed for a product or family of products whose maximum configuration does not exceed the limit of 4.A.3.b.

d. Graphics accelerators and graphics coprocessors exceeding a "three dimensional Vector Rate" of 3,000,000;

e. Equipment performing analogue-to-digital conversions exceeding the limits in 3.A.1.a.5;

f. Deleted;

g. Equipment specially designed to provide external interconnection of "digital computers" or associated equipment which allows communications at data rates exceeding 80 Mbyte/s.

Note 4.A.3.g. does not control internal interconnection equipment (e.g., backplanes, buses), passive interconnection equipment, "network access controllers" or "communications channel controllers".

4. A. 4. Computers, as follows, and specially designed related equipment, "electronic assemblies" and components therefor:

a. "Systolic array computers";
b. "Neural computers";
c. "Optical computers".

4. B. TEST, INSPECTION AND PRODUCTION EQUIPMENT - None

4. C. MATERIALS None

4. D. SOFTWARE

Note The control status of "software" for the "development", "production", or "use" of equipment described in other Categories is dealt with in the appropriate Category. The control status of "software" for equipment described in this Category is dealt with herein.

4. D. 1. "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" controlled by 4.A. or 4.D.

2. "Software" specially designed or modified to support "technology" controlled by 4.E.

3. Specific "software", as follows:

a. Operating system "software", "software" development tools and compilers specially designed for "multi-data-stream processing" equipment, in "source code";

b. "Expert systems" or "software" for "expert system" inference engines providing both:
1. Time dependent rules; and
2. Primitives to handle the time characteristics of the rules and the facts;

c. "Software" having characteristics or performing functions exceeding the limits in Category 5, Part 2 ("Information Security");

Note 4.D.3.c. does not control "software" when accompanying its user for the user's personal use.

d. Operating systems specially designed for "real time processing" equipment which guarantees a "global interrupt latency time" of less than 20 μs.

4. E. TECHNOLOGY

4. E. 1. "Technology" according to the General Technology Note, for the "development", "production" or "use" of equipment or "software" controlled by 4.A. or 4.D.

TECHNICAL NOTE ON "COMPOSITE THEORETICAL PERFORMANCE" ("CTP")

Abbreviations used in this Technical Note

"CE" "computing element" (typically an arithmetic logical unit)
FP floating point
XP fixed point
t execution time
XOR exclusive OR
CPU central processing unit
TP theoretical performance (of a single "CE")
"CTP" "composite theoretical performance" (multiple "CEs")
R effective calculating rate
WL word length
L word length adjustment
* multiply
Execution time 't' is expressed in microseconds, TP and "CTP" are expressed in millions of theoretical operations per second (Mtops) and WL is expressed in bits.

Outline of "CTP" calculation method

"CTP" is a measure of computational performance given in Mtops. In calculating the "CTP" of an aggregation of "CEs" the following three steps are required:

1. Calculate the effective calculating rate R for each "CE";
2. Apply the word length adjustment (L) to the effective calculating rate (R), resulting in a Theoretical Performance (TP) for each "CE";
3. If there is more than one "CE", combine the TPs, resulting in a "CTP" for the aggregation.

Details for these steps are given in the following sections.

Note 1 For aggregations of multiple "CEs" which have both shared and unshared memory subsystems, the calculation of "CTP" is completed hierarchically, in two steps: first, aggregate the groups of "CEs" sharing memory; second, calculate the "CTP" of the groups using the calculation method for multiple "CEs" not sharing memory.

Note 2 "CEs" that are limited to input/output and peripheral functions (e.g., disk drive, communication and video display controllers) are not aggregated into the "CTP" calculation.

TECHNICAL NOTE ON "CTP"

The following table shows the method of calculating the Effective Calculating Rate R for each "CE":

Step 1: The effective calculating rate R

For "CEs" Implementing: Note Every "CE" must be evaluated independently.	Effective calculating Rate, R
XP only (R_{xp})	$\frac{1}{3*(t_{xp\ add})}$ if no add is implemented use: $\frac{1}{(t_{xp\ mult})}$ If neither add nor multiply is implemented use the fastest available arithmetic operation as follows: $\frac{1}{3*t_{xp}}$ See Notes X & Z
FP only (R_{fp})	$\max \frac{1}{t_{fp\ add}}, \frac{1}{t_{fp\ mult}}$ See Notes X & Y
Both FP and XP (R)	Calculate both R_{xp}, R_{fp}
For simple logic processors not implementing any of the specified arithmetic operations.	$\frac{1}{3*t_{log}}$ Where t_{log} is the execute time of the XOR, or for logic hardware not implementing the XOR, the fastest simple logic operation. See Notes X & Z

For special logic processors not using any of the specified arithmetic or logic operations.	R = R' * WL/64 Where R' is the number of results per second, WL is the number of bits upon which the logic operation occurs, and 64 is a factor to normalize to a 64 bit operation.

TECHNICAL NOTE ON "CTP"

Note W For a pipelined "CE" capable of executing up to one arithmetic or logic operation every clock cycle after the pipeline is full, a pipelined rate can be established. The effective calculating rate (R) for such a "CE" is the faster of the pipelined rate or non-pipelined execution rate.

Note X For a "CE" which performs multiple operations of a specific type in a single cycle (e.g., two additions per cycle or two identical logic operations per cycle), the execution time t is given by:

"CEs" which perform different types of arithmetic or logic operations in a single machine cycle are to be treated as multiple separate "CEs" performing simultaneously (e.g., a "CE" performing an addition and a multiplication in one cycle is to be treated as two "CEs", the first performing an addition in one cycle and the second performing a multiplication in one cycle).

If a single "CE" has both scalar function and vector function, use the shorter execution time value.

Note Y For the "CE" that does not implement FP add or FP multiply, but that performs FP divide:

If the "CE" implements FP reciprocal but not FP add, FP multiply or FP divide, then

If none of the specified instructions is implemented, the effective FP rate is 0.

Note Z In simple logic operations, a single instruction performs a single logic manipulation of no more than two operands of given lengths.

In complex logic operations, a single instruction performs multiple logic manipulations to produce one or more results from two or more operands.

TECHNICAL NOTE ON "CTP"

Note Z

Rates should be calculated for all supported operand lengths considering both pipelined operations (if supported), and non-pipelined operations using the fastest executing instruction for each operand length based on:

1. Pipelined or register-to-register operations. Exclude extraordinarily short execution times generated for operations on a predetermined operand or operands (for example, multiplication by 0 or 1). If no register-to-register operations are implemented, continue with (2).
2. The faster of register-to-memory or memory-to-register operations; if these also do not exist, then continue with (3).
3. Memory-to-memory.

In each case above, use the shortest execution time certified by the manufacturer.

Step 2: TP for each supported operand length WL

Adjust the effective rate R (or R') by the word length adjustment L as follows:

$$TP = R * L,$$
$$\text{where } L = (1/3 + WL/96)$$

Note The word length WL used in these calculations is the operand length in bits. (If an operation uses operands of different lengths, select the largest word length.)

The combination of a mantissa ALU and an exponent ALU of a floating point processor or unit is considered to be one "CE" with a Word Length (WL) equal to the number of bits in the data representation (typically 32 or 64) for purposes of the "CTP" calculation.

This adjustment is not applied to specialized logic processors which do not use XOR instructions. In this case TP = R.

Select the maximum resulting value of TP for:

Each XP-only "CE" (Rxp);
Each FP-only "CE" (Rfp);
Each combined FP and XP "CE" (R);
Each simple logic processor not implementing any of the specified arithmetic operations; and
Each special logic processor not using any of the specified arithmetic or logic operations.

TECHNICAL NOTE ON "CTP"

Step 3: "CTP" for aggregations of "CEs", including CPUs.

For a CPU with a single "CE",

"CTP" = TP

(for "CEs" performing both fixed and floating point operations
TP = max (TPfp, TPxp))

"CTP" for aggregations of multiple "CEs" operating simultaneously is calculated as follows:

Note 1 For aggregations that do not allow all of the "CEs" to run simultaneously, the possible combination of "CEs" that provides the largest "CTP" should be used. The TP of each contributing "CE" is to be calculated at its maximum value theoretically possible before the "CTP" of the combination is derived.

N.B. To determine the possible combinations of simultaneously operating "CEs", generate an instruction sequence that initiates operations in multiple "CEs", beginning with the slowest "CE" (the one needing the largest number of cycles to complete its operation) and ending with the fastest "CE". At each cycle of the sequence, the combination of "CEs" that are in operation during that cycle is a possible combination. The instruction sequence must take into account all hardware and/or architectural constraints on overlapping operations.

Note 2 A single integrated circuit chip or board assembly may contain multiple "CEs".

Note 3 Simultaneous operations are assumed to exist when the computer manufacturer claims concurrent, parallel or simultaneous operation or execution in a manual or brochure for the computer.

Note 4 "CTP" values are not to be aggregated for "CE" combinations (inter)connected by "Local Area Networks", Wide Area Networks, I/O shared connections/devices, I/O controllers and any communication interconnection implemented by software.

TECHNICAL NOTE ON "CTP"

Note 5 "CTP" values must be aggregated for multiple "CEs" specially designed to enhance performance by aggregation, operating simultaneously and sharing memory, or multiple memory/"CE"- combinations operating simultaneously utilising specially designed hardware.

This aggregation does not apply to "electronic assemblies" described in 4.A.3.c.

"CTP" = TP1 + C2 * TP2 + ... + Cn * TP n,

where the TPs are ordered by value, with TP1 being the highest, TP2 being the second highest, ..., and TPn being the lowest. Ci is a coefficient determined by the strength of the interconnection between "CEs", as follows:

For multiple "CEs" operating simultaneously and sharing memory:

$$C2 = C3 = C4 = ... = Cn = 0.75$$

Note 1 When the "CTP" calculated by the above method does not exceed 194 Mtops, the following formula may be used to calculate Ci:

$(i = 2, \ldots, n)$

where m = the number of "CEs" or groups of "CEs" sharing access.

provided:

1. The TPi of each "CE" or group of "CEs" does not exceed 30 Mtops;
2. The "CEs" or groups of "CEs" share access to main memory (excluding cache memory) over a single channel; and
3. Only one "CE" or group of "CEs" can have use of the channel at any given time.

N.B. This does not apply to items controlled under Category 3.

Note 2 "CEs" share memory if they access a common segment of solid state memory. This memory may include cache memory, main memory or other internal memory. Peripheral memory devices such as disk drives, tape drives or RAM disks are not included.

TECHNICAL NOTE ON "CTP"

For Multiple "CEs" or groups of "CEs" not sharing memory, interconnected by one or more data channels:

$$
\begin{aligned}
C_i &= 0.75 * k_i \quad (i = 2, \ldots, 32) \quad \text{(see Note below)} \\
&= 0.60 * k_i \quad (i = 33, \ldots, 64) \\
&= 0.45 * k_i \quad (i = 65, \ldots, 256) \\
&= 0.30 * k_i \quad (i > 256)
\end{aligned}
$$

The value of Ci is based on the number of "CEs", not the number of nodes.

where ki = min (Si/Kr, 1), and

Kr = normalizing factor of 20 MByte/s.

Si = sum of the maximum data rates (in units of MByte/s) for all data channels connected to the ith "CE" or group of "CEs" sharing memory.

When calculating a Ci for a group of "CEs", the number of the first "CE" in a group determines the proper limit for C_i. For example, in an aggregation of groups consisting of 3 "CEs" each, the 22nd group will contain "CE"64, "CE"65 and "CE"66. The proper limit for C_i for this group is 0.60.

Aggregation (of "CEs" or groups of "CEs") should be from the fastest-to-slowest; i.e.:

$TP_1 \geq TP_2 \geq .... \geq TP_n$, and

in the case of $TP_i = TP_{i+1}$, from the largest to smallest; i.e.:

$C_i \geq C_{i+1}$

Note The k_i factor is not to be applied to "CEs" 2 to 12 if the TP_i of the "CE" or group of "CEs" is more than 50 Mtops; i.e., C_i for "CEs" 2 to 12 is 0.75.

Part 1 - TELECOMMUNICATIONS

Note 1 The control status of components, "lasers", test and "production" equipment and "software" therefor which are specially designed for telecommunications equipment or systems is determined in Category 5, Part 1.

Note 2 "Digital computers", related equipment or "software", when essential for the operation and support of telecommunications equipment described in this Category, are regarded as specially designed components, provided they are the standard models customarily supplied by the manufacturer. This includes operation, administration, maintenance, engineering or billing computer systems.

5. A. 1. SYSTEMS, EQUIPMENT AND COMPONENTS

a. Any type of telecommunications equipment having any of the following characteristics, functions or features:

1. Specially designed to withstand transitory electronic effects or electromagnetic pulse effects, both arising from a nuclear explosion;
2. Specially hardened to withstand gamma, neutron or ion radiation; or
3. Specially designed to operate outside the temperature range from 218 K (-55°C) to 397 K (124°C).

Note 5.A.1.a.3. applies only to electronic equipment.

Note 5.A.1.a.2. and 5.A.1.a.3. do not control equipment designed or modified for use on board satellites.

5. A. 1. b. Telecommunication transmission equipment and systems, and specially designed components and accessories therefor, having any of the following

characteristics, functions or features:

1. Being underwater communications systems having any of the following characteristics:
   a. An acoustic carrier frequency outside the range from 20 kHz to 60 kHz;
   b. Using an electromagnetic carrier frequency below 30 kHz; <u>or</u>
   c. Using electronic beam steering techniques;

5. A. 1. b. 2. Being radio equipment operating in the 1.5 MHz to 87.5 MHz band and having any of the following characteristics:
   a. Incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal; <u>or</u>
   b. Having all of the following:
      1. Automatically predicting and selecting frequencies and "total digital transfer rates" per channel to optimise the transmission; <u>and</u>
      2. Incorporating a linear power amplifier configuration having a capability to support multiple signals simultaneously at an output power of 1 kW or more in the 1.5 MHz to 30 MHz frequency range or 250 W or more in the 30 MHz to 87.5 MHz frequency range, over an "instantaneous bandwidth" of one octave or more and with an output harmonic and distortion content of better than -80 dB;

5. A. 1. b. 3. Being radio equipment employing "spread spectrum" techniques, including "frequency hopping" techniques, having any of the following characteristics:
   a. User programmable spreading codes; <u>or</u>
   b. A total transmitted bandwidth which is 100 or more times the bandwidth of any one information channel and in excess of 50 kHz;

<u>Note</u> 5.A.1.b.3.b. does not control radio equipment specially designed for use with civil cellular radio-communications systems.

<u>Note</u> 5.A.1.b.3. does not control equipment designed to operate at an output power of 1.0 Watt or less.

5. A. 1. b. 4. Being digitally controlled radio receivers having all of the following:
   a. More than 1,000 channels;
   b. A "frequency switching time" of less than 1 ms;

c. Automatic searching or scanning of a part of the electromagnetic spectrum; and

d. Identification of the received signals or the type of transmitter; or

Note 5.A.1.b.4. does not control radio equipment specially designed for use with civil cellular radio-communications systems.

5. A. 1. b. 5. Employing functions of digital "signal processing" to provide voice coding at rates of less than 2,400 bit/s.

5. A. 1. c. Optical fibre communication cables, optical fibres and accessories, as follows:

1. Optical fibres of more than 500 m in length, specified by the manufacturer as being capable of withstanding a proof test tensile stress of 2 x 109 N/m2 or more;

Technical Note

Proof Test: on-line or off-line production screen testing that dynamically applies a prescribed tensile stress over a 0.5 to 3 m length of fibre at a running rate of 2 to 5 m/s while passing between capstans approximately 150 mm in diameter. The ambient temperature is a nominal 293 K and relative humidity 40%. Equivalent national standards may be used for executing the proof test.

2. Optical fibre cables and accessories designed for underwater use.

Note 5.A.1.c.2. does not control standard civil telecommunication cables and accessories.

N.B.1 For underwater umbilical cables, and connectors therefor, see 8.A.2.a.3.

N.B.2 For fibre-optic hull penetrators or connectors, see 8.A.2.c.

5. A. 1. d. "Electronically steerable phased array antennae" operating above 31 GHz.

Note 5.A.1.d. does not control "electronically steerable phased array antennae" for landing systems with instruments meeting ICAO standards covering microwave landing systems (MLS).

5. B. 1. TEST, INSPECTION AND PRODUCTION EQUIPMENT

5. B. 1. a. Equipment and specially designed components or accessories therefor, specially designed for the "development", "production" or "use" of equipment, functions or features controlled by Category 5 - Part 1.

Note 5.B.1.a. does not control optical fibre characterization equipment not using semiconductor "lasers".

5. B. 1. b. Equipment and specially designed components or accessories therefor, specially designed for the "development" of any of the following telecommunication transmission or "stored programme controlled" switching equipment:

1. Equipment employing digital techniques, including "Asynchronous Transfer Mode" ("ATM"), designed to operate at a "total digital transfer rate" exceeding 1.5 Gbit/s;

5. B. 1. b. 2. Equipment employing a "laser" and having any of the following:

a. A transmission wavelength exceeding 1750 nm;

b. Performing "optical amplification";

c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques); or

d. Employing analogue techniques and having a bandwidth exceeding 2.5 GHz;

Note 5.B.1.b.2.d. does not control equipment specially designed for the "development" of commercial TV systems.

3. Equipment employing "optical switching";

4. Radio equipment employing quadrature-amplitude-modulation (QAM) techniques above level 128; or

5. Equipment employing "common channel signalling" operating in either non-associated or quasi- associated mode of operation.

5. C. 1. MATERIALS - None

5. D. 1. <u>SOFTWARE</u>

5. D. 1. a. "Software" specially designed or modified for the "development", "production" or "use" of equipment, functions or features controlled by Category 5 - Part 1.

b. "Software" specially designed or modified to support "technology" controlled by 5.E.1.

c. Specific "software" as follows:

1. "Software" specially designed or modified to provide characteristics, functions or features of equipment controlled by 5.A.1. or 5.B.1.;
2. "Software" which provides the capability of recovering "source code" of telecommunications "software" controlled by 5.D.1.;
3. "Software", other than in machine-executable form, specially designed for "dynamic adaptive routing".

5. D. 1. d. "Software" specially designed or modified for the "development" of any of the following telecommunication transmission or "stored programme controlled" switching equipment:

1. Equipment employing digital techniques, including "Asynchronous Transfer Mode" ("ATM"), designed to operate at a "total digital transfer rate" exceeding 1.5 Gbit/s;
2. Equipment employing a "laser" and having any of the following:
   a. A transmission wavelength exceeding 1750 nm; <u>or</u>
   b. Employing analogue techniques and having a bandwidth exceeding 2.5 GHz;

<u>Note</u> 5.D.1.d.2.b. does not control "software" specially designed or modified for the "development" of commercial TV systems.

3. Equipment employing "optical switching"; <u>or</u>

4. Radio equipment employing quadrature-amplitude-modulation (QAM) techniques above level 128.

5. E. 1. <u>TECHNOLOGY</u>

5. E. 1. a. "Technology" according to the General Technology Note for the "development", "production" or "use" (excluding operation) of equipment, functions or features or "software" controlled by Category 5 - Part 1.

b. Specific "technologies", as follows:

1. "Required" "technology" for the "development" or "production" of telecommunications equipment specially designed to be used on board satellites;
2. "Technology" for the "development" or "use" of "laser" communication techniques with the capability of automatically acquiring and tracking signals and maintaining communications through exoatmosphere or sub-surface (water) media;
3. "Technology" for the "development" of digital cellular radio systems;
4. "Technology" for the "development" of "spread spectrum" techniques, including "frequency hopping" techniques.

c. "Technology" according to the General Technology Note for the "development" or "production" of any of the following telecommunication transmission or "stored programme controlled" switching equipment, functions or features:

1. Equipment employing digital techniques, including "Asynchronous Transfer Mode" ("ATM"), designed to operate at a "total digital transfer rate" exceeding 1.5 Gbit/s;
2. Equipment employing a "laser" and having any of the following:
   a. A transmission wavelength exceeding 1750 nm;
   b. Performing "optical amplification" using praseodymium-doped fluoride fibre amplifiers (PDFFA);

5. E. 1. c. 2. c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques);

d. Employing wavelength division multiplexing techniques exceeding 8 optical carriers in a single optical window; <u>or</u>

e. Employing analogue techniques and having a bandwidth exceeding 2.5 GHz;

<u>Note</u> 5.E.1.c.2.e. does not control "technology" for the "development" or "production" of commercial TV systems.

3. Equipment employing "optical switching";

4. Radio equipment having any of the following:
   a. Quadrature-amplitude-modulation (QAM) techniques above level 128; <u>or</u>
   b. Operating at input or output frequencies exceeding 31 GHz; <u>or</u>

      <u>Note</u> 5.E.1.c.4.b. does not control "technology" for the "development" or "production" of equipment designed or modified for operation in any ITU allocated band.

5. Equipment employing "common channel signalling" operating in either non-associated or quasi- associated mode of operation.

Part 2 - "INFORMATION SECURITY"

Note 1 The control status of "information security" equipment, "software", systems, application specific "electronic assemblies", modules, integrated circuits, components or functions is determined in Category 5, Part 2 even if they are components or "electronic assemblies" of other equipment.

Note 2 Category 5 Part 2 does not control products when accompanying their user for the user's personal use.

Note 3 Cryptography Note

5.A.2. and 5.D.2. do not control items that meet all of the following:

a. Generally available to the public by being sold, without restriction, from stock at retail selling points by means of any of the following:

1. *Over-the-counter transactions;*
2. *Mail order transactions;*
3. *Electronic transactions; or*
4. *Telephone call transactions;*

b. The cryptographic functionality cannot easily be changed by the user;

c. Designed for installation by the user without further substantial support by the supplier;

d. Does not contain a "symmetric algorithm" employing a key length exceeding 64 bits; and

e. When necessary, details of the items are accessible and will be provided, upon request, to the appropriate authority in the exporter's country in order to ascertain compliance with conditions described in paragraphs a. to d. above.

Technical Note

In Category 5 - Part 2, parity bits are not included in the key length.

5. A. 2. SYSTEMS, EQUIPMENT AND COMPONENTS

a. Systems, equipment, application specific "electronic assemblies", modules and integrated circuits for "information security", as follows, and other specially designed components therefor:

N.B. For the control of global navigation satellite systems receiving equipment containing or employing decryption (i.e. GPS or GLONASS), see 7.A.5.

5. A. 2. a. 1. Designed or modified to use "cryptography" employing digital techniques performing any cryptographic function other than authentication or digital signature having any of the following:

Technical Notes

1. *Authentication and digital signature functions include their associated key management function.*
2. *Authentication includes all aspects of access control where there is no encryption of files or text except as directly related to the protection of passwords, Personal Identification Numbers (PINs) or similar data to prevent unauthorised access.*
3. *"Cryptography" does not include "fixed" data compression or coding techniques.*

Note 5.A.2.a.1. includes equipment designed or modified to use "cryptography" employing analogue principles when implemented with digital techniques.

5. A. 2. a. 1. a. A "symmetric algorithm" employing a key length in excess of 56 bits; or

b. An "asymmetric algorithm" where the security of the algorithm is based on any of the following:

1. Factorisation of integers in excess of 512 bits (e.g., RSA);
2. Computation of discrete logarithms in a multiplicative group of a finite field of size greater than 512 bits (e.g., Diffie-Hellman over Z/pZ); or
3. Discrete logarithms in a group other than mentioned in 5.A.2.a.1.b.2. in excess of 112 bits (e.g., Diffie-Hellman over an elliptic curve);

2. Designed or modified to perform cryptanalytic functions;

3. Deleted;

4. Specially designed or modified to reduce the compromising emanations of information-bearing signals beyond what is necessary for health, safety or electromagnetic interference standards;

5. Designed or modified to use cryptographic techniques to generate the spreading code for "spread spectrum" systems, including the hopping code for "frequency hopping" systems;

6. Designed or modified to provide certified or certifiable "multilevel security" or user isolation at a level exceeding Class B2 of the Trusted Computer System Evaluation Criteria (TCSEC) or equivalent;

7. Communications cable systems designed or modified using mechanical, electrical or electronic means to detect surreptitious intrusion.

Note 5.A.2. does not control:

a. "Personalised smart cards" where the cryptographic capability is restricted for use in equipment or systems excluded from control under entries b. to f. of this Note. If a "personalised smart card" has multiple functions, the control status of each function is assessed individually.

b. Receiving equipment for radio broadcast, pay television or similar restricted audience broadcast of the consumer type, without digital encryption except that exclusively used for sending the billing or programme-related information back to the broadcast providers;

c. Equipment where the cryptographic capability is not user-accessible and which is specially designed and limited to allow any of the following:

1. Execution of copy-protected software;
2. Access to any of the following:
a. Copy-protected read-only media; or
b. Information stored in encrypted form on media (e.g. in connection with the protection of intellectual property rights) when the media is offered for sale in identical sets to the public; or
3. One-time copying of copyright protected audio/video data.

d. Cryptographic equipment specially designed and limited for banking use or money transactions;

Technical Note

'Money transactions' in 5.A.2. Note d. includes the collection and settlement of fares or credit functions.

e. Portable or mobile radiotelephones for civil use (e.g., for use with commercial civil cellular radiocommunications systems) that are not capable of end-to-end encryption;

f. Cordless telephone equipment not capable of end-to-end encryption where the maximum effective range of unboosted cordless operation (i.e., a single, unrelayed hop between terminal and home basestation) is less than 400 metres according to the manufacturer's specifications.

5. B. 2. TEST, INSPECTION AND PRODUCTION EQUIPMENT

a. Equipment specially designed for:

1. The "development" of equipment or functions controlled by Category 5 - Part 2, including measuring or test equipment;
2. The "production" of equipment or functions controlled by Category 5 - Part 2, including measuring, test, repair or production equipment.

b. Measuring equipment specially designed to evaluate and validate the "information security" functions controlled by 5.A.2. or 5.D.2.

5. C. 2. MATERIALS - None

5. D. 2. SOFTWARE

a. "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" controlled by Category 5 - Part 2;
b. "Software" specially designed or modified to support "technology" controlled by 5.E.2.;
c. Specific "software", as follows:
  1. "Software" having the characteristics, or performing or simulating the functions of the equipment controlled by 5.A.2. or 5.B.2.;
  2. "Software" to certify "software" controlled by 5.D.2.c.1.

Note 5.D.2. does not control:
a. "Software" required for the "use" of equipment excluded from control under the Note to 5.A.2.;
b. "Software" providing any of the functions of equipment excluded from control under the Note to 5.A.2.

5. E. 2. TECHNOLOGY

a. "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment or "software" controlled by Category 5 - Part 2.

DUAL-USE LIST-CATEGORY 6-SENSORS AND "LASERS"

6. A. <u>SYSTEMS, EQUIPMENT AND COMPONENTS</u>

6. A. 1. <u>ACOUSTICS</u>

6. A. 1. a. Marine acoustic systems, equipment and specially designed components therefor, as follows:

6. A. 1. a. 1. Active (transmitting or transmitting-and-receiving) systems, equipment and specially designed components therefor, as follows:

<u>Note</u> 6.A.1.a.1. does not control:

a. Depth sounders operating vertically below the apparatus, not including a scanning function exceeding ± 20°, and limited to measuring the depth of water, the distance of submerged or buried objects or fish finding;

b. Acoustic beacons, as follows:

1. Acoustic emergency beacons;

2. Pingers specially designed for relocating or returning to an underwater position.

6. A. 1. a. 1. a. Wide-swath bathymetric survey systems designed for sea bed topographic mapping, having all of the following:

1. Being designed to take measurements at an angle exceeding 20° from the vertical;
2. Being designed to measure depths exceeding 600 m below the water surface; <u>and</u>
3. Being designed to provide any of the following:

a. Incorporation of multiple beams any of which is less than 1.9°; <u>or</u>

b. Data accuracies of better than 0.3% of water depth across the swath averaged over the individual measurements within the swath;

6. A. 1. a. 1. b. Object detection or location systems having any of the following:

1. A transmitting frequency below 10 kHz;
2. Sound pressure level exceeding 224 dB (reference 1 μPa at 1 m) for

equipment with an operating frequency in the band from 10 kHz to 24 kHz inclusive;

3. Sound pressure level exceeding 235 dB (reference 1 μPa at 1 m) for equipment with an operating frequency in the band between 24 kHz and 30 kHz;
4. Forming beams of less than 1° on any axis and having an operating frequency of less than 100 kHz;
5. Designed to operate with an unambiguous display range exceeding 5,120 m; or
6. Designed to withstand pressure during normal operation at depths exceeding 1,000 m and having transducers with any of the following:

a. Dynamic compensation for pressure; or

b. Incorporating other than lead zirconate titanate as the transduction element;

6. A. 1. a. 1. c. Acoustic projectors, including transducers, incorporating piezoelectric, magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination, having any of the following:

Note 1 The control status of acoustic projectors, including transducers, specially designed for other equipment is determined by the control status of the other equipment.

Note 2 6.A.1.a.1.c. does not control electronic sources which direct the sound vertically only, or mechanical (e.g., air gun or vapour-shock gun) or chemical (e.g., explosive) sources.

6. A. 1. a. 1. c. 1. An instantaneous radiated acoustic power density exceeding 0.01 mW/mm2/Hz for devices operating at frequencies below 10 kHz;

2. A continuously radiated acoustic power density exceeding 0.001 mW/mm2/Hz for devices operating at frequencies below 10 kHz; or

Technical Note

Acoustic power density is obtained by dividing the output acoustic power by the product of the area of the radiating surface and the frequency of operation.

3. Side-lobe suppression exceeding 22 dB;

6. A. 1. a. 1. d. Acoustic systems, equipment and specially designed components for determining the position of surface vessels or underwater vehicles designed to operate at a range exceeding 1,000 m with a positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1,000 m;

Note 6.A.1.a.1.d. includes:

a. Equipment using coherent "signal processing" between two or more beacons and the hydrophone unit carried by the surface vessel or underwater vehicle;

b. Equipment capable of automatically correcting speed-of-sound propagation errors for calculation of a point.

6. A. 1. a. 2. Passive (receiving, whether or not related in normal application to separate active equipment) systems, equipment and specially designed components therefor, as follows:

a. Hydrophones having any of the following characteristics:

Note The control status of hydrophones specially designed for other equipment is determined by the control status of the other equipment.

1. Incorporating continuous flexible sensors or assemblies of discrete sensor elements with either a diameter or length less than 20 mm and with a separation between elements of less than 20 mm;
2. Having any of the following sensing elements:
   a. Optical fibres;
   b. Piezoelectric polymers; or
   c. Flexible piezoelectric ceramic materials;
3. A hydrophone sensitivity better than -180 dB at any depth with no acceleration compensation;
4. When designed to operate at depths exceeding 35 m with acceleration compensation; or
5. Designed for operation at depths exceeding 1,000 m;

Technical Note

Hydrophone sensitivity is defined as twenty times the logarithm to the base 10 of the ratio of rms output voltage to a 1 V rms reference, when the hydrophone sensor, without a pre-amplifier, is placed in a plane wave acoustic field with an rms pressure of 1 μPa. For example, a hydrophone of -160 dB (reference 1 V per μPa) would yield an output voltage of 10-8 V in such a field, while one of -180 dB sensitivity would yield only 10-9 V output. Thus, -160 dB is better than -180 dB.

6. A. 1. a. 2. b. Towed acoustic hydrophone arrays having any of the following:

1. Hydrophone group spacing of less than 12.5 m;
2. Designed or able to be modified to operate at depths exceeding 35 m;

Technical Note

'Able to be modified' in 6.A.1.a.2.b.2. means having provisions to allow a change of the wiring or interconnections to alter hydrophone group spacing or operating depth limits. These provisions are: spare wiring exceeding 10% of the number of wires, hydrophone group spacing adjustment blocks or internal depth limiting devices that are adjustable or that control more than one hydrophone group.

6. A. 1. a. 2. b. 3. Heading sensors controlled by 6.A.1.a.2.d.;

4. Longitudinally reinforced array hoses;
5. An assembled array of less than 40 mm in diameter;
6. Multiplexed hydrophone group signals designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; or
7. Hydrophone characteristics specified in 6.A.1.a.2.a.;

6. A. 1. a. 2. c. Processing equipment, specially designed for towed acoustic hydrophone arrays, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

6. A. 1. a. 2. d. Heading sensors having all of the following:

1. An accuracy of better than ± 0.5°; and
2. Designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m;

6. A. 1. a. 2. e. Bottom or bay cable systems having any of the following:

1. Incorporating hydrophones specified in 6.A.1.a.2.a.; <u>or</u>
2. Incorporating multiplexed hydrophone group signal modules having all of the following characteristics:
   a. Designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; <u>and</u>
   b. Capable of being operationally interchanged with towed acoustic hydrophone array modules;

f. Processing equipment, specially designed for bottom or bay cable systems, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

6. A. 1. b. Correlation-velocity sonar log equipment designed to measure the horizontal speed of the equipment carrier relative to the sea bed at distances between the carrier and the sea bed exceeding 500 m.

6. A. 2. <u>OPTICAL SENSORS</u>

a. Optical detectors, as follows:

<u>Note</u> 6.A.2.a. does not control germanium or silicon photodevices.

1. "Space-qualified" solid-state detectors, as follows:

a. "Space-qualified" solid-state detectors, having all of the following:
1. A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; <u>and</u>
2. A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;

b. "Space-qualified" solid-state detectors, having all of the following:
1. A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; <u>and</u>
2. A response "time constant" of 95 ns or less;

c. "Space-qualified" solid-state detectors having a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

6. A. 2. a. 2. Image intensifier tubes and specially designed components therefor, as follows:

a. Image intensifier tubes having all of the following:

1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;
2. A microchannel plate for electron image amplification with a hole pitch (centre-to-centre spacing) of 15 μm or less; <u>and</u>

3. Photocathodes, as follows:

a. S-20, S-25 or multialkali photocathodes with a luminous sensitivity exceeding 240 μA/lm;

b. GaAs or GaInAs photocathodes;

c. Other III-V compound semiconductor photocathodes;

<u>Note</u> 6.A.2.a.2.a.3.c. does not control compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.

b. Specially designed components, as follows:

1. Microchannel plates having a hole pitch (centre-to-centre spacing) of 15 μm or less;
2. GaAs or GaInAs photocathodes;
3. Other III-V compound semiconductor photocathodes;

<u>Note</u> 6.A.2.a.2.b.3. does not control compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.

6. A. 2. a. 3. Non-"space-qualified" "focal plane arrays", as follows:

<u>Technical Note</u>

Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays".

<u>Note 1</u> 6.A.2.a.3. includes photoconductive arrays and photovoltaic arrays.

<u>Note 2</u> 6.A.2.a.3. does not control:

a. Silicon "focal plane arrays";

b. Multi-element (not to exceed 16 elements) encapsulated photoconductive cells using either lead sulphide or lead selenide;

c. Pyroelectric detectors using any of the following:

1. Triglycine sulphate and variants;

2. Lead-lanthanum-zirconium titanate and variants;

3. Lithium tantalate;

4. Polyvinylidene fluoride and variants; or

5. Strontium barium niobate and variants.

6. A. 2. a. 3. a. Non-"space-qualified" "focal plane arrays", having all of the following:

1. Individual elements with a peak response within the wavelength range exceeding 900 nm but not exceeding 1,050 nm; and
2. A response "time constant" of less than 0.5 ns;

b. Non-"space-qualified" "focal plane arrays", having all of the following:

1. Individual elements with a peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,200 nm; and
2. A response "time constant" of 95 ns or less;

c. Non-"space-qualified" "focal plane arrays", having individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm.

6. A. 2 b. "Monospectral imaging sensors" and "multispectral imaging sensors" designed for remote sensing applications, having any of the following:

1. An Instantaneous-Field-Of-View (IFOV) of less than 200 μr (microradians); or
2. Being specified for operation in the wavelength range exceeding 400 nm but not exceeding 30,000 nm and having all the following;

a. Providing output imaging data in digital format; and

b. Being any of the following:

1. "Space-qualified"; or
2. Designed for airborne operation, using other than silicon detectors, and having an IFOV of less than 2.5 mr (milliradians).

6. A. 2 c. Direct view imaging equipment operating in the visible or infrared spectrum, incorporating any of the following:

1. Image intensifier tubes having the characteristics listed in 6.A.2.a.2.a.; or

2. "Focal plane arrays" having the characteristics listed in 6.A.2.a.3.

Technical Note

'Direct view' refers to imaging equipment, operating in the visible or infrared spectrum, that presents a visual image to a human observer without converting the image into an electronic signal for television display, and that cannot record or store the image photographically, electronically or by any other means.

Note 6.A.2.c. does not control the following equipment incorporating other than GaAs or GaInAs photocathodes:

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Medical equipment;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Flame detectors for industrial furnaces;

e. Equipment specially designed for laboratory use.

6. A. 2. d. Special support components for optical sensors, as follows:

1. "Space-qualified" cryocoolers;
2. Non-"space-qualified" cryocoolers, having a cooling source temperature below 218 K (-55°C), as follows:
   a. Closed cycle type with a specified Mean-Time-To-Failure (MTTF), or Mean-Time-Between-Failures (MTBF), exceeding 2,500 hours;
   b. Joule-Thomson (JT) self-regulating minicoolers having bore (outside) diameters of less than 8 mm;
3. Optical sensing fibres specially fabricated either compositionally or structurally, or modified by coating, to be acoustically, thermally, inertially, electromagnetically or nuclear radiation sensitive.

e. "Space qualified" "focal plane arrays" having more than 2,048 elements per array and having a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm.

6. A. 3. CAMERAS

N.B. For cameras specially designed or modified for underwater use, see 8.A.2.d. and

8.A.2.e.

6. A. 3. a. Instrumentation cameras, as follows:

Note Instrumentation cameras, controlled by 6.A.3.a.3. to 6.A.3.a.5., with modular structures should be evaluated by their maximum capability, using "electronic assemblies" available according to the camera manufacturer's specifications.

1. High-speed cinema recording cameras using any film format from 8 mm to 16 mm inclusive, in which the film is continuously advanced throughout the recording period, and that are capable of recording at framing rates exceeding 13,150 frames/s;

   Note 6.A.3.a.1. does not control cinema recording cameras designed for civil purposes.

2. Mechanical high speed cameras, in which the film does not move, capable of recording at rates exceeding 1,000,000 frames/s for the full framing height of 35 mm film, or at proportionately higher rates for lesser frame heights, or at proportionately lower rates for greater frame heights;
3. Mechanical or electronic streak cameras having writing speeds exceeding 10 mm/μs;
4. Electronic framing cameras having a speed exceeding 1,000,000 frames/s;
5. Electronic cameras, having all of the following:
   a. An electronic shutter speed (gating capability) of less than 1 μs per full frame; and
   b. A read out time allowing a framing rate of more than 125 full frames per second.

6. A. 3. b. Imaging cameras, as follows:

Note 6.A.3.b. does not control television or video cameras specially designed for television broadcasting.

1. Video cameras incorporating solid state sensors, having any of the following:
   a. More than 4 x 106 "active pixels" per solid state array for monochrome (black and white) cameras;
   b. More than 4 x 106 "active pixels" per solid state array for colour cameras incorporating three solid state arrays; or
   c. More than 12 x 106 "active pixels" for solid state array colour cameras incor-

porating one solid state array;

2. Scanning cameras and scanning camera systems, having all of the following:
   a. Linear detector arrays with more than 8,192 elements per array; <u>and</u>
   b. Mechanical scanning in one direction;

6. A. 3. b. 3. Imaging cameras incorporating image intensifier tubes having the characteristics listed in 6.A.2.a.2.a.;

4. Imaging cameras incorporating "focal plane arrays" having the characteristics listed in 6.A.2.a.3.

   <u>Note</u> 6.A.3.b.4 does not control imaging cameras incorporating linear "focal plane arrays" with twelve elements or fewer, not employing time-delay-and-integration within the element, designed for any of the following:
   a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;
   b. Industrial equipment used for inspection or monitoring of heat flows in buildings, equipment or industrial processes;
   c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;
   d. Equipment specially designed for laboratory use; <u>or</u>
   e. Medical equipment.

6. A. 4. <u>OPTICS</u>

a. Optical mirrors (reflectors), as follows:

1. "Deformable mirrors" having either continuous or multi-element surfaces, and specially designed components therefor, capable of dynamically repositioning portions of the surface of the mirror at rates exceeding 100 Hz;

2. Lightweight monolithic mirrors having an average "equivalent density" of less than 30 kg/m2 and a total mass exceeding 10 kg;

3. Lightweight "composite" or foam mirror structures having an average "equivalent density" of less than 30 kg/m2 and a total mass exceeding 2 kg;

4. Beam steering mirrors more than 100 mm in diameter or length of major axis, which maintain a flatness of lambda/2 or better (lambda is equal to 633 nm) having a control bandwidth exceeding 100 Hz.

6. A. 4. b. Optical components made from zinc selenide (ZnSe) or zinc sulphide (ZnS) with transmission in the wavelength range exceeding 3,000 nm but not exceeding 25,000 nm and having any of the following:

1. Exceeding 100 cm3 in volume; or
2. Exceeding 80 mm in diameter or length of major axis and 20 mm in thickness (depth).

6. A. 4. c. "Space-qualified" components for optical systems, as follows:

1. Lightweighted to less than 20% "equivalent density" compared with a solid blank of the same aperture and thickness;
2. Raw substrates, processed substrates having surface coatings (single-layer or multi-layer, metallic or dielectric, conducting, semiconducting or insulating) or having protective films;
3. Segments or assemblies of mirrors designed to be assembled in space into an optical system with a collecting aperture equivalent to or larger than a single optic 1 m in diameter;
4. Manufactured from "composite" materials having a coefficient of linear thermal expansion equal to or less than 5 x 10-6 in any coordinate direction.

6. A. 4. d. Optical control equipment, as follows:

1. Specially designed to maintain the surface figure or orientation of the "space-qualified" components controlled by 6.A.4.c.1. or 6.A.4.c.3.;
2. Having steering, tracking, stabilisation or resonator alignment bandwidths equal to or more than 100 Hz and an accuracy of 10 μr (microradians) or less;
3. Gimbals having all of the following:
   a. A maximum slew exceeding 5°;
   b. A bandwidth of 100 Hz or more;
   c. Angular pointing errors of 200 μr (microradians) or less; and
   d. Having any of the following:
      1. Exceeding 0.15 m but not exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 2 r (radians)/s2; or
      2. Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding

      0.5 r (radians)/s2;

4. Specially designed to maintain the alignment of phased array or phased segment mirror systems consisting of mirrors with a segment diameter or major axis length of 1 m or more.

6. A. 4. e. Aspheric optical elements having all of the following characteristics:

1. The largest dimension of the optical-aperture is greater than 400 mm;
2. The surface roughness is less than 1 nm (rms) for sampling lengths equal to or greater than 1 mm; and
3. The coefficient of linear thermal expansion s absolute magnitude is less than $3x10^{-6}$/K at 25 ° C;

Technical Notes

1. An 'aspheric optical element' is any element used in an optical system whose imaging surface or surfaces are designed to depart from the shape of an ideal sphere.

2. Manufacturers are not required to measure the surface roughness listed in 6.A.4.e.2. unless the optical element was designed or manufactured with the intent to meet, or exceed, the control parameter.

Note 6.A.4.e. does not control aspheric optical elements having any of the following:

a. A largest optical-aperture dimension less than 1 m and a focal length to aperture ratio equal to or greater than 4.5:1;

b. A largest optical-aperture dimension equal to or greater than 1 m and a focal length to aperture ratio equal to or greater than 7:1;

c. Being designed as Fresnel, flyeye, stripe, prism or diffractive optical elements;

d. Being fabricated from borosilicate glass having a coefficient of linear thermal expansion greater than $2.5x10^{-6}$ /K at 25 °C; or

e. Being an x-ray optical element having inner mirror capabilities (e.g. tube-type mirrors).

N.B. For aspheric optical elements specially designed for lithography equipment, see Item 3.B.1.

LASERS

6. A. 5. "Lasers", components and optical equipment, as follows:

Note 1 Pulsed "lasers" include those that run in a continuous wave (CW) mode with pulses superimposed.

Note 2 Pulse-excited "lasers" include those that run in a continuously excited mode with pulse excitation superimposed.

Note 3 The control status of Raman "lasers" is determined by the parameters of the pumping source "lasers". The pumping source "lasers" can be any of the "lasers" described below.

6. A. 5. a. Gas "lasers", as follows:

1. Excimer "lasers", having any of the following:
   - a. An output wavelength not exceeding 150 nm and having any of the following:
     1. An output energy exceeding 50 mJ per pulse; or
     2. An average or CW output power exceeding 1 W;
   - b. An output wavelength exceeding 150 nm but not exceeding 190 nm and having any of the following:
     1. An output energy exceeding 1.5 J per pulse; or
     2. An average or CW output power exceeding 120 W;
   - c. An output wavelength exceeding 190 nm but not exceeding 360 nm and having any of the following:
     1. An output energy exceeding 10 J per pulse; or
     2. An average or CW output power exceeding 500 W; or
   - d. An output wavelength exceeding 360 nm and having any of the following:
     1. An output energy exceeding 1.5 J per pulse; or
     2. An average or CW output power exceeding 30 W;

N.B. For excimer "lasers" specially designed for lithography equipment, see 3.B.1.

6. A. 5. a. 2. Metal vapour "lasers", as follows:

- a. Copper (Cu) "lasers" having an average or CW output power exceeding 20 W;
- b. Gold (Au) "lasers" having an average or CW output power exceeding 5 W;
- c. Sodium (Na) "lasers" having an output power exceeding 5 W;
- d. Barium (Ba) "lasers" having an average or CW output power exceeding 2 W;

6. A. 5. a. 3. Carbon monoxide (CO) "lasers" having any of the following:

a. An output energy exceeding 2 J per pulse and a pulsed "peak power" exceeding 5 kW; <u>or</u>

b. An average or CW output power exceeding 5 kW;

6. A. 5. a. 4. Carbon dioxide (CO_2) "lasers" having any of the following:

a. A CW output power exceeding 15 kW;

b. A pulsed output having a "pulse duration" exceeding 10 μs and having any of the following:

1. An average output power exceeding 10 kW; <u>or</u>
2. A pulsed "peak power" exceeding 100 kW; <u>or</u>

c. A pulsed output having a "pulse duration" equal to or less than 10 μs; and having any of the following:

1. A pulse energy exceeding 5 J per pulse; <u>or</u>
2. An average output power exceeding 2.5 kW;

6. A. 5. a. 5. "Chemical lasers", as follows:

a. Hydrogen Fluoride (HF) "lasers";

b. Deuterium Fluoride (DF) "lasers";

c. "Transfer lasers", as follows:

1. Oxygen Iodine (O_2-I) "lasers";
2. Deuterium Fluoride-Carbon dioxide (DF-CO_2) "lasers";

6. A. 5. a. 6. Krypton ion or argon ion "lasers" having any of the following:

a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 50 W; <u>or</u>

b. An average or CW output power exceeding 50 W;

6. A. 5. a. 7. Other gas "lasers", having any of the following:

<u>Note</u> 6.A.5.a.7. does not control nitrogen "lasers".

a. An output wavelength not exceeding 150 nm and having any of the following:

1. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; <u>or</u>
2. An average or CW output power exceeding 1 W;

6. A. 5. a. 7. b. An output wavelength exceeding 150 nm but not exceeding 800 nm

and having any of the following:

1. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 30 W; or
2. An average or CW output power exceeding 30 W;

c. An output wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:

1. An output energy exceeding 0.25 J per pulse and a pulsed "peak power" exceeding 10 W; or
2. An average or CW output power exceeding 10 W; or

d. An output wavelength exceeding 1,400 nm and an average or CW output power exceeding 1 W.

6. A. 5. b. Semiconductor "lasers", having a wavelength of less than 950 nm or more than 2000 nm, as follows:

1. Individual single-transverse mode semiconductor "lasers" having an average or CW output power exceeding 100 mW;
2. Individual, multiple-transverse mode semiconductor "lasers" and arrays of individual semiconductor "lasers", having any of the following:

a. An output energy exceeding 500 μJ per pulse and a pulsed "peak power" exceeding 10 W; or

b. An average or CW output power exceeding 10 W.

Technical Note

Semiconductor "lasers" are commonly called "laser" diodes.

Note 1 6.A.5.b. includes semiconductor "lasers" having optical output connectors (e.g. fibre optic pigtails).

Note 2 The control status of semiconductor "lasers" specially designed for other equipment is determined by the control status of the other equipment.

6. A. 5. c. Solid state "lasers", as follows:

1. "Tunable" "lasers" having any of the following:

Note 6.A.5.c.1. includes titanium - sapphire(Ti: Al2O3), thulium - YAG (Tm: YAG), thulium - YSGG (Tm: YSGG), alexandrite (Cr: BeAl2O4) and colour centre "lasers".

a. An output wavelength less than 600 nm and having any of the following:

1. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or

2. An average or CW output power exceeding 1 W;

b. An output wavelength of 600 nm or more but not exceeding 1,400 nm and having any of the following:

1. An output energy exceeding 1 J per pulse and a pulsed "peak power" exceeding 20 W; or

2. An average or CW output power exceeding 20 W; or

c. An output wavelength exceeding 1,400 nm and having any of the following:

1. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or

2. An average or CW output power exceeding 1 W;

6. A. 5. c. 2. Non-"tunable" "lasers", as follows:

Note 6.A.5.c.2. includes atomic transition solid state "lasers".

a. Neodymium glass "lasers", as follows:

1. "Q-switched lasers" having any of the following:

a. An output energy exceeding 20 J but not exceeding 50 J per pulse and an average output power exceeding 10 W; or

b. An output energy exceeding 50 J per pulse;

2. Non-"Q-switched lasers" having any of the following:

a. An output energy exceeding 50 J but not exceeding 100 J per pulse and an average output power exceeding 20 W; or

b. An output energy exceeding 100 J per pulse;

6. A. 5. c. 2. b. Neodymium-doped (other than glass) "lasers", having an output wavelength exceeding 1,000 nm but not exceeding 1,100 nm, as follows:

N.B. For neodymium-doped (other than glass) "lasers" having an output wavelength not exceeding 1,000 nm or exceeding 1,100 nm, see 6.A.5.c.2.c.

1. Pulse-excited, mode-locked, "Q-switched lasers" having a "pulse duration" of less than 1 ns and having any of the following:

a. A "peak power" exceeding 5 GW;

b. An average output power exceeding 10 W; or

c. A pulsed energy exceeding 0.1 J;

2. Pulse-excited, "Q-switched lasers" having a pulse duration equal to or more than 1 ns, and having any of the following:

a. A single-transverse mode output having:

1. A "peak power" exceeding 100 MW;

2. An average output power exceeding 20 W; or

3. A pulsed energy exceeding 2 J; or

b. A multiple-transverse mode output having:

1. A "peak power" exceeding 400 MW;

2. An average output power exceeding 2 kW; or

3. A pulsed energy exceeding 2 J;

3. Pulse-excited, non-"Q-switched lasers", having:

a. A single-transverse mode output having:

1. A "peak power" exceeding 500 kW; or

2. An average output power exceeding 150 W; or

b. A multiple-transverse mode output having:

1. A "peak power" exceeding 1 MW; or

2. An average power exceeding 2 kW;

6. A. 5. c. 2. b. 4. Continuously excited "lasers" having:

a. A single-transverse mode output having:

1. A "peak power" exceeding 500 kW; or

2. An average or CW output power exceeding 150 W; or

b. A multiple-transverse mode output having:

1. A "peak power" exceeding 1 MW; or

2. An average or CW output power exceeding 2 kW;

6. A. 5. c. 2. c. Other non-"tunable" "lasers", having any of the following:

1. A wavelength less than 150 nm and having any of the following:

a. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or

b. An average or CW output power exceeding 1 W;

2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:

a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 30 W; or

b. An average or CW output power exceeding 30 W;

3. A wavelength exceeding 800 nm but not exceeding 1,400 nm, as follows:
  a. "Q-switched lasers" having:
    1. An output energy exceeding 0.5 J per pulse and a pulsed "peak power" exceeding 50 W; or
    2. An average output power exceeding:
      a. 10 W for single-transverse mode "lasers";
      b. 30 W for multiple-transverse mode "lasers";
  b. Non-"Q-switched lasers" having:
    1. An output energy exceeding 2 J per pulse and a pulsed "peak power" exceeding 50 W; or
    2. An average or CW output power exceeding 50 W; or

4. A wavelength exceeding 1,400 nm and having any of the following:
  a. An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
  b. An average or CW output power exceeding 1 W;

6. A. 5. d. Dye and other liquid "lasers", having any of the following:
  1. A wavelength less than 150 nm and:
    a. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
    b. An average or CW output power exceeding 1 W;

6. A. 5. d. 2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:
    a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 20 W;
    b. An average or CW output power exceeding 20 W; or
    c. A pulsed single longitudinal mode oscillator having an average output power exceeding 1 W and a repetition rate exceeding 1 kHz if the "pulse duration" is less than 100 ns;

  3. A wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:
    a. An output energy exceeding 0.5 J per pulse and a pulsed "peak power" exceeding 10 W; or
    b. An average or CW output power exceeding 10 W; or

4. A wavelength exceeding 1,400 nm and having any of the following:
   a. An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; or
   b. An average or CW output power exceeding 1 W;

6. A. 5. e. Components, as follows:
   1. Mirrors cooled either by active cooling or by heat pipe cooling;

   Technical Note

   Active cooling is a cooling technique for optical components using flowing fluids within the subsurface (nominally less than 1 mm below the optical surface) of the optical component to remove heat from the optic.

   2. Optical mirrors or transmissive or partially transmissive optical or electro-optical components specially designed for use with controlled "lasers";

6. A. 5. f. Optical equipment, as follows:

   *N.B. For shared aperture optical elements, capable of operating in "Super-High Power Laser" ("SHPL") applications, see Item 23. Note 2. d. on the Munitions List.**

   1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront having any of the following:
   a. Frame rates equal to or more than 100 Hz and phase discrimination of at least 5% of the beam's wavelength; or
   b. Frame rates equal to or more than 1,000 Hz and phase discrimination of at least 20% of the beam's wavelength;

6. A. 5. f. 2. "Laser" diagnostic equipment capable of measuring "SHPL" system angular beam steering errors of equal to or less than 10 μrad;
   3. Optical equipment and components specially designed for a phased-array "SHPL" system for coherent beam combination to an accuracy of lambda/10 at the designed wavelength, or 0.1 μm, whichever is the smaller;
   4. Projection telescopes specially designed for use with "SHPL" systems.

MAGNETOMETERS

6. A. 6. "Magnetometers", "magnetic gradiometers", "intrinsic magnetic gradiometers" and compensation systems, and specially designed components therefor, as follows:

Note 6.A.6. does not control instruments specially designed for biomagnetic measurements for medical diagnostics.

a. "Magnetometers" using "superconductive", optically pumped or nuclear precession (proton/Overhauser) "technology" having a "noise level" (sensitivity) lower (better) than 0.05 nT rms per square root Hz;

b. Induction coil "magnetometers" having a "noise level" (sensitivity) lower (better) than any of the following:
  1. 0.05 nT rms/square root Hz at frequencies of less than 1 Hz;
  2. 1 x 10-3 nT rms/square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; or
  3. 1 x 10-4 nT rms/square root Hz at frequencies exceeding 10 Hz;

c. Fibre optic "magnetometers" having a "noise level" (sensitivity) lower (better) than 1 nT rms per square root Hz;

d. "Magnetic gradiometers" using multiple "magnetometers" controlled by 6.A.6.a., 6.A.6.b. or 6.A.6.c.;

e. Fibre optic "intrinsic magnetic gradiometers" having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.3 nT/m rms per square root Hz;

f. "Intrinsic magnetic gradiometers", using "technology" other than fibre-optic "technology", having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.015 nT/m rms per square root Hz;

g. Magnetic compensation systems for magnetic sensors designed for operation on mobile platforms;

6. A. 6. h. "Superconductive" electromagnetic sensors, containing components manufactured from "superconductive" materials and having all of the following:
  1. Being designed for operation at temperatures below the "critical temperature" of at least one of their "superconductive" constituents (including Josephson effect devices or "superconductive" quantum interference devices (SQUIDS));
  2. Being designed for sensing electromagnetic field variations at frequencies of 1 kHz or less; and:

3. Having any of the following characteristics:

a. Incorporating thin-film SQUIDS with a minimum feature size of less than 2 μm and with associated input and output coupling circuits;

b. Designed to operate with a magnetic field slew rate exceeding 1 x 106 magnetic flux quanta per second;

c. Designed to function without magnetic shielding in the earth's ambient magnetic field; or

d. Having a temperature coefficient less (smaller) than 0.1 magnetic flux quantum/K.

GRAVIMETERS

6. A. 7. Gravity meters (gravimeters) and gravity gradiometers, as follows:

a. Gravity meters designed or modified for ground use having a static accuracy of less (better) than 10 μgal;

Note 6.A.7.a. does not control ground gravity meters of the quartz element (Worden) type.

b. Gravity meters designed for mobile platforms, having all of the following:

1. A static accuracy of less (better) than 0.7 mgal; and
2. An in-service (operational) accuracy of less (better) than 0.7 mgal having a time-to-steady-state registration of less than 2 minutes under any combination of attendant corrective compensations and motional influences;

c. Gravity gradiometers.

RADAR

6. A. 8. Radar systems, equipment and assemblies having any of the following characteristics, and specially designed components therefor:

Note 6.A.8. does not control:

a. Secondary surveillance radar (SSR);

b. Car radar designed for collision prevention;

c. Displays or monitors used for air traffic control (ATC) having no more than 12 resolvable elements per mm;

d. Meteorological (weather) radar.

6. A. 8. a. Operating at frequencies from 40 GHz to 230 GHz and having an average output power exceeding 100 mW;

b. Having a tunable bandwidth exceeding ± 6.25% of the centre operating frequency;

Technical Note

The centre operating frequency equals one half of the sum of the highest plus the lowest specified operating frequencies.

c. Capable of operating simultaneously on more than two carrier frequencies;

d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or sidelooking airborne (SLAR) radar mode;

e. Incorporating "electronically steerable phased array antennae";

f. Capable of heightfinding non-cooperative targets;

Note 6.A.8.f. does not control precision approach radar (PAR) equipment conforming to ICAO standards.

g. Specially designed for airborne (balloon or airframe mounted) operation and having Doppler "signal processing" for the detection of moving targets;

h. Employing processing of radar signals using any of the following:

1. "Radar spread spectrum" techniques; or
2. "Radar frequency agility" techniques;

i. Providing ground-based operation with a maximum "instrumented range" exceeding 185 km;

Note 6.A.8.i. does not control:

a. Fishing ground surveillance radar;

b. Ground radar equipment specially designed for enroute air traffic control, provided that all the following conditions are met:

1. It has a maximum "instrumented range" of 500 km or less;

2. It is configured so that radar target data can be transmitted only one way from the radar site to one or *more civil ATC centres;*

3. It contains no provisions for remote control of the radar scan rate from the enroute ATC centre; and

4. It is to be permanently installed.

c. Weather balloon tracking radars.

6. A. 8. j. Being "laser" radar or Light Detection and Ranging (LIDAR) equipment, having any of the following:

1. "Space-qualified"; or
2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20 μr (microradians);

Note 6.A.8.j. does not control LIDAR equipment specially designed for surveying or for meteorological observation.

k. Having "signal processing" sub-systems using "pulse compression", with any of the following:

1. A "pulse compression" ratio exceeding 150; or
2. A pulse width of less than 200 ns; or

l. Having data processing sub-systems with any of the following:

1. "Automatic target tracking" providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage;

   Note 6.A.8.l.1. does not control conflict alert capability in ATC systems, or marine or harbour radar.

2. Calculation of target velocity from primary radar having non-periodic (variable) scanning rates;
3. Processing for automatic pattern recognition (feature extraction) and comparison with target characteristic data bases (waveforms or imagery) to identify or classify targets; or
4. Superposition and correlation, or fusion, of target data from two or more "geographically dispersed" and "interconnected radar sensors" to enhance and discriminate targets.

   Note 6.A.8.l.4. does not control systems, equipment and assemblies used for marine traffic control.

6. B. <u>TEST, INSPECTION AND PRODUCTION EQUIPMENT</u>

6. B. 1. <u>ACOUSTICS</u> - None

6. B. 2. <u>OPTICAL SENSORS</u> - None

6. B. 3. <u>CAMERAS</u> - None

<u>OPTICS</u>

6. B. 4. Optical equipment, as follows:

a. Equipment for measuring absolute reflectance to an accuracy of ± 0.1% of the reflectance value;

b. Equipment other than optical surface scattering measurement equipment, having an unobscured aperture of more than 10 cm, specially designed for the non-contact optical measurement of a non-planar optical surface figure (profile) to an "accuracy" of 2 nm or less (better) against the required profile.

<u>Note</u> 6.B.4. does not control microscopes.

6. B. 5. <u>LASERS</u> - None

6. B. 6. <u>MAGNETOMETERS</u> - None

<u>GRAVIMETERS</u>

6. B. 7. Equipment to produce, align and calibrate land-based gravity meters with a static accuracy of better than 0.1 mgal.

<u>RADAR</u>

6. B. 8. Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor.

6. C. MATERIALS

6. C. 1. ACOUSTICS - None

OPTICAL SENSORS

6. C. 2. Optical sensor materials, as follows:

a. Elemental tellurium (Te) of purity levels of 99.9995% or more;

b. Single crystals of cadmium zinc telluride (CdZnTe), with zinc content of less than 6% by weight, or cadmium telluride (CdTe), or mercury cadmium telluride (HgCdTe) of any purity level, including epitaxial wafers thereof.

6. C. 3. CAMERAS - None

OPTICS

6. C. 4. Optical materials, as follows:

a. Zinc selenide (ZnSe) and zinc sulphide (ZnS) "substrate blanks" produced by the chemical vapour deposition process, having any of the following:
1. A volume greater than 100 cm3; or
2. A diameter greater than 80 mm having a thickness of 20 mm or more;

b. Boules of the following electro-optic materials:
1. Potassium titanyl arsenate (KTA);
2. Silver gallium selenide (AgGaSe2);
3. Thallium arsenic selenide (Tl3AsSe3, also known as TAS);

c. Non-linear optical materials, having all of the following:
1. Third order susceptibility (chi 3) of 10-6 m2/V2 or more; and
2. A response time of less than 1 ms;

d. "Substrate blanks" of silicon carbide or beryllium beryllium (Be/Be) deposited materials exceeding 300 mm in diameter or major axis length;

e. Glass, including fused silica, phosphate glass, fluorophosphate glass, zirconium fluoride (ZrF_4) and hafnium fluoride (HfF_4), having all of the following:

1. A hydroxyl ion (OH^-) concentration of less than 5 ppm;
2. Integrated metallic purity levels of less than 1 ppm; and
3. High homogeneity (index of refraction variance) less than 5×10^{-6};

f. Synthetically produced diamond material with an absorption of less than 10^{-5} cm^{-1} for wavelengths exceeding 200 nm but not exceeding 14,000 nm.

LASERS

6. C. 5. Synthetic crystalline "laser" host material in unfinished form, as follows:

a. Titanium doped sapphire;

b. Alexandrite.

6. C. 6. MAGNETOMETERS - None

6. C. 7. GRAVIMETERS - None

6. C. 8. RADAR - None.

6. D. SOFTWARE

1. "Software" specially designed for the "development" or "production" of equipment controlled by 6.A.4, 6.A.5., 6.A.8 or 6.B.8.

2. "Software" specially designed for the "use" of equipment controlled by 6.A.2.b., 6.A.8 or 6.B.8.

3. Other "software", as follows:

ACOUSTICS

6. D. 3. a. "Software", as follows:

1. "Software" specially designed for acoustic beam forming for the "real time pro-

cessing" of acoustic data for passive reception using towed hydrophone arrays;

2. "Source code" for the "real time processing" of acoustic data for passive reception using towed hydrophone arrays;
3. "Software" specially designed for acoustic beam forming for the "real time processing" of acoustic data for passive reception using bottom or bay cable systems;
4. "Source code" for the "real time processing" of acoustic data for passive reception using bottom or bay cable systems;

6. D. 3. b. OPTICAL SENSORS - None

c. CAMERAS - None

d. OPTICS - None

e. LASERS - None

MAGNETOMETERS

6. D. 3. f. "Software", as follows:

1. "Software" specially designed for magnetic compensation systems for magnetic sensors designed to operate on mobile platforms;
2. "Software" specially designed for magnetic anomaly detection on mobile platforms;

GRAVIMETERS

6. D. 3. g. "Software" specially designed to correct motional influences of gravity meters or gravity gradiometers;

RADAR

6. D. 3. h. "Software", as follows:

1. Air Traffic Control "software" application "programmes" hosted on general pur-

pose computers located at Air Traffic Control centres and capable of any of the following:

a. Processing and displaying more than 150 simultaneous "system tracks"; <u>or</u>

b. Accepting radar target data from more than four primary radars;

2. "Software" for the design or "production" of radomes which:

a. Are specially designed to protect the "electronically steerable phased array antennae" controlled by 6.A.8.e.; <u>and</u>

b. Result in an antenna pattern having an 'average side lobe level' more than 40 dB below the peak of the main beam level.

<u>Technical Note</u>

'Average side lobe level' in 6.D.3.h.2.b. is measured over the entire array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam.

6. E. <u>TECHNOLOGY</u>

6. E. 1. "Technology" according to the General Technology Note for the "development" of equipment, materials or "software" controlled by 6.A., 6.B., 6.C. or 6.D.

6. E. 2. "Technology" according to the General Technology Note for the "production" of equipment or materials controlled by 6.A., 6.B. or 6.C.

6. E. 3. Other "technology", as follows:

a. <u>ACOUSTICS</u> - None

b. <u>OPTICAL SENSORS</u> - None

c. <u>CAMERAS</u> - None

<u>OPTICS</u>

6. E. 3. d. "Technology", as follows:

1. Optical surface coating and treatment "technology" "required" to achieve uniformity of 99.5% or better for optical coatings 500 mm or more in diameter or major axis length and with a total loss (absorption and scatter) of less than 5 x

10-3;

N.B. See also 2.E.3.f.

2. Optical fabrication "technology" using single point diamond turning techniques to produce surface finish accuracies of better than 10 nm rms on non-planar surfaces exceeding 0.5 m2;

LASERS

e. "Technology" "required" for the "development", "production" or "use" of specially designed diagnostic instruments or targets in test facilities for "SHPL" testing or testing or evaluation of materials irradiated by "SHPL" beams;

MAGNETOMETERS

6. E. 3. f. "Technology" "required" for the "development" or "production" of fluxgate "magnetometers" or fluxgate "magnetometer" systems, having any of the following:

1. A "noise level" of less than 0.05 nT rms per square root Hz at frequencies of less than 1 Hz; or

2. A "noise level" of less than 1 x 10-3 nT rms per square root Hz at frequencies of 1 Hz or more.

g. GRAVIMETERS - None

h. RADAR - None

DUAL-USE LIST-CATEGORY 7-NAVIGATION AND AVIONICS

7\. A. SYSTEMS, EQUIPMENT AND COMPONENTS

N.B.1 For automatic pilots for underwater vehicles, see Category 8.
For radar, see Category 6.
*N.B.2 For inertial navigation equipment for ships or submersibles, see Item 9.e. on the Munitions List.**

7\. A. 1. Accelerometers designed for use in inertial navigation or guidance systems and having any of the following characteristics, and specially designed components therefor:

a. A "bias" "stability" of less (better) than 130 micro g with respect to a fixed calibration value over a period of one year;
b. A "scale factor" "stability" of less (better) than 130 ppm with respect to a fixed calibration value over a period of one year; or
c. Specified to function at linear acceleration levels exceeding 100 g.

7\. A. 2. Gyros having any of the following characteristics, and specially designed components therefor:

a. A "drift rate" "stability", when measured in a 1 g environment over a period of three months and with respect to a fixed calibration value, of:
 1. Less (better) than 0.1° per hour when specified to function at linear acceleration levels below 10 g; or
 2. Less (better) than 0.5° per hour when specified to function at linear acceleration levels from 10 g to 100 g inclusive; or
b. Specified to function at linear acceleration levels exceeding 100 g.

7\. A. 3. Inertial navigation systems (gimballed or strapdown) and inertial equipment designed for "aircraft", land vehicle or "spacecraft" for attitude, guidance or control having any of the following characteristics, and specially designed components therefor:

a. Navigation error (free inertial) subsequent to normal alignment of 0.8 nautical mile per hour (50% Circular Error Probable (CEP)) or less (better); or

b. Specified to function at linear acceleration levels exceeding 10 g.

Note 1 The parameters of 7.A.3.a. are applicable with any of the following environmental conditions:

1. *Input random vibration with an overall magnitude of 7.7 g rms in the first half hour and a total test duration of one and one half hour per axis in each of the three perpendicular axes, when the random vibration meets the following:*
   a. *A constant power spectral density (PSD) value of 0.04 g2/Hz over a frequency interval of 15 to 1,000 Hz; and*
   b. *The PSD attenuates with frequency from 0.04 g2/Hz to 0.01 g2/Hz over a frequency interval from 1,000 to 2,000 Hz; or*
2. *A roll and yaw rate of equal to or more than +2.62 radian/s (150 deg/s); or*
3. *According to national standards equivalent to 1. or 2. above.*

Note 2 7.A.3. does not control inertial navigation systems which are certified for use on "civil aircraft" by civil authorities of a participating state.

7. A. 4. Gyro-astro compasses, and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites, with an azimuth accuracy of equal to or less (better) than 5 seconds of arc.

7. A. 5. Global navigation satellite systems (i.e., GPS or GLONASS) receiving equipment having any of the following characteristics, and specially designed components therefor:

a. Employing decryption; or

b. A null-steerable antenna.

7. A. 6. Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive, having any of the following characteristics:

a. "Power management"; or

b. Using phase shift key modulation.

7. A. 7. Direction finding equipment operating at frequencies above 30 MHz and having all of the following characteristics, and specially designed components therefor:

a. "Instantaneous bandwidth" of 1 MHz or more;

b. Parallel processing of more than 100 frequency channels; and
c. Processing rate of more than 1,000 direction finding results per second and per frequency channel.

7. B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

7. B. 1. Test, calibration or alignment equipment specially designed for equipment controlled by 7.A.

Note 7.B.1. does not control test, calibration or alignment equipment for Maintenance Level I or Maintenance Level II.

Technical Notes

1. Maintenance Level I

The failure of an inertial navigation unit is detected on the aircraft by indications from the control and display unit (CDU) or by the status message from the corresponding sub-system. By following the manufacturer's manual, the cause of the failure may be localised at the level of the malfunctioning line replaceable unit (LRU). The operator then removes the LRU and replaces it with a spare.

2. Maintenance Level II

The defective LRU is sent to the maintenance workshop (the manufacturer's or that of the operator responsible for level II maintenance). At the maintenance workshop, the malfunctioning LRU is tested by various appropriate means to verify and localise the defective shop replaceable assembly (SRA) module responsible for the failure. This SRA is removed and replaced by an operative spare. The defective SRA (or possibly the complete LRU) is then shipped to the manufacturer. Maintenance Level II does not include the removal of controlled accelerometers or gyro sensors from the SRA.

7. B. 2. Equipment, as follows, specially designed to characterize mirrors for ring "laser" gyros:

a. Scatterometers having a measurement accuracy of 10 ppm or less (better);
b. Profilometers having a measurement accuracy of 0.5 nm (5 angstrom) or less (better).

7. B. 3. Equipment specially designed for the "production" of equipment controlled by 7.A.

<u>Note</u> 7.B.3 includes:

a. Gyro tuning test stations;

b. Gyro dynamic balance stations;

c. Gyro run-in/motor test stations;

d. Gyro evacuation and fill stations;

e. Centrifuge fixtures for gyro bearings;

f. Accelerometer axis align stations.

7. C. MATERIALS - None

7. D. <u>SOFTWARE</u>

7. D. 1. "Software" specially designed or modified for the "development" or "production" of equipment controlled by 7.A. or 7.B.

2. "Source code" for the "use" of any inertial navigation equipment, including inertial equipment not controlled by 7.A.3. or 7.A.4., or Attitude and Heading Reference Systems (AHRS).

<u>Note</u> 7.D.2. does not control "source code" for the "use" of gimballed AHRS.

<u>Technical Note</u>

AHRS generally differ from inertial navigation systems (INS) in that an AHRS provides attitude and heading information and normally does not provide the acceleration, velocity and position information associated with an INS.

3. Other "software", as follows:

a. "Software" specially designed or modified to improve the operational performance or reduce the navigational error of systems to the levels specified in 7.A.3. or 7.A.4.;

b. "Source code" for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the level specified in 7.A.3. by continuously combining inertial data with any of the following navigation data:

1. Doppler radar velocity;

2. Global navigation satellite systems (i.e., GPS or GLONASS) reference data; or
3. Terrain data from data bases;

c. "Source code" for integrated avionics or mission systems which combine sensor data and employ "expert systems";

d. "Source code" for the "development" of any of the following:
1. Digital flight management systems for "total control of flight";
2. Integrated propulsion and flight control systems;
3. Fly-by-wire or fly-by-light control systems;
4. Fault-tolerant or self-reconfiguring "active flight control systems";
5. Airborne automatic direction finding equipment;
6. Air data systems based on surface static data; or
7. Raster-type head-up displays or three dimensional displays;

e. Computer-aided-design (CAD) "software" specially designed for the "development" of "active flight control systems", helicopter multi-axis fly-by-wire or fly-by-light controllers or helicopter "circulation controlled anti-torque or circulation-controlled direction control systems" whose "technology" is controlled in 7.E.4.b., 7.E.4.c.1. or 7.E.4.c.2.

7. E. TECHNOLOGY

1. "Technology" according to the General Technology Note for the "development" of equipment or "software" controlled by 7.A., 7.B. or 7.D.

2. "Technology" according to the General Technology Note for the "production" of equipment controlled by 7.A. or 7.B.

3. "Technology" according to the General Technology Note for the repair, refurbishing or overhaul of equipment controlled by 7.A.1. to 7.A.4.

Note 7.E.3. does not control maintenance "technology" directly associated with calibration, removal or replacement of damaged or unserviceable LRUs and SRAs of a "civil aircraft" as described in Maintenance Level I or Maintenance Level II.

N.B. See Technical Notes to 7.B.1.

7. E. 4. Other "technology", as follows:

a. "Technology" for the "development" or "production" of:

1. Airborne automatic direction finding equipment operating at frequencies exceeding 5 MHz;
2. Air data systems based on surface static data only, i.e., which dispense with conventional air data probes;
3. Raster-type head-up displays or three dimensional displays for "aircraft";
4. Inertial navigation systems or gyro-astro compasses containing accelerometers or gyros controlled by 7.A.1. or 7.A.2.;
5. Electric actuators (i.e., electromechanical, electrohydrostatic and integrated actuator package) specially designed for "primary flight control";
6. "Flight control optical sensor array" specially designed for implementing "active flight control systems";

7. E. 4. b. "Development" "technology", as follows, for "active flight control systems" (including fly-by-wire or fly-by-light):

1. Configuration design for interconnecting multiple microelectronic processing elements (on-board computers) to achieve "real time processing" for control law implementation;
2. Control law compensation for sensor location or dynamic airframe loads, i.e., compensation for sensor vibration environment or for variation of sensor location from the centre of gravity;
3. Electronic management of data redundancy or systems redundancy for fault detection, fault tolerance, fault isolation or reconfiguration;

Note 7.E.4.b.3. does not control" technology" for the design of physical redundancy.

7. E. 4. b. 4. Flight controls which permit inflight reconfiguration of force and moment controls for real time autonomous air vehicle control;

5. Integration of digital flight control, navigation and propulsion control data into a digital flight management system for "total control of flight";

Note 7.E.4.b.5. does not control:

1. "Development" "technology" for integration of digital flight control, navigation and propulsion control data into a digital flight management system for "flight *path optimisation";*

2. *"Development" "technology" for "aircraft" flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.*

6. Full authority digital flight control or multisensor mission management systems employing "expert systems";

N.B. For "technology" for Full Authority Digital Engine Control ("FADEC"), see 9.E.3.a.9.

7. E. 4. c. "Technology" for the "development" of helicopter systems, as follows:

1. Multi-axis fly-by-wire or fly-by-light controllers which combine the functions of at least two of the following into one controlling element:
   a. Collective controls;
   b. Cyclic controls;
   c. Yaw controls;
2. "Circulation-controlled anti-torque or circulation-controlled directional control systems";
3. Rotor blades incorporating "variable geometry airfoils" for use in systems using individual blade control.

8. A. SYSTEMS, EQUIPMENT AND COMPONENTS

8. A. 1. Submersible vehicles and surface vessels, as follows:

N.B. For the control status of equipment for submersible vehicles, see:
Category 5, Part 2 "Information Security" for encrypted communication equipment;
Category 6 for sensors;
Categories 7 and 8 for navigation equipment;
Category 8.A. for underwater equipment.

8. A. 1. a. Manned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m;

8. A. 1. b. Manned, untethered submersible vehicles, having any of the following:

1. Designed to operate autonomously and having a lifting capacity of all the following:
   a. 10% or more of their weight in air; and
   b. 15 kN or more;

2. Designed to operate at depths exceeding 1,000 m; or

3. Having all of the following:
   a. Designed to carry a crew of 4 or more;
   b. Designed to operate autonomously for 10 hours or more;
   c. Having a range of 25 nautical miles or more; and
   d. Having a length of 21 m or less;

Technical Notes

1. For the purposes of 8.A.1.b., operate autonomously means fully submerged, *without snorkel, all systems working and cruising at minimum speed at which the submersible can safely control its depth dynamically by using its depth planes only, with no need for a support vessel or support base on the surface, sea-bed or shore, and containing a propulsion system for submerged or surface use.*

2. *For the purposes of 8.A.1.b., range means half the maximum distance a submersible vehicle can cover.*

8\. A. 1. c. Unmanned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m, having any of the following:

1. Designed for self-propelled manoeuvre using propulsion motors or thrusters controlled by 8.A.2.a.2.; or
2. Having a fibre optic data link;

8\. A. 1. d. Unmanned, untethered submersible vehicles**,** having any of the following:

1. Designed for deciding a course relative to any geographical reference without real-time human assistance;
2. Having an acoustic data or command link; or
3. Having a fibre optic data or command link exceeding 1,000 m;

8\. A. 1. e. Ocean salvage systems with a lifting capacity exceeding 5 MN for salvaging objects from depths exceeding 250 m and having any of the following:

1. Dynamic positioning systems capable of position keeping within 20 m of a given point provided by the navigation system; or
2. Seafloor navigation and navigation integration systems for depths exceeding 1,000 m with positioning accuracies to within 10 m of a predetermined point;

8\. A. 1. f. Surface-effect vehicles (fully skirted variety) having all of the following characteristics:

1. a maximum design speed, fully loaded, exceeding 30 knots in a significant wave height of 1.25 m (Sea State 3) or more;
2. a cushion pressure exceeding 3,830 Pa; and
3. a light-ship-to-full-load displacement ratio of less than 0.70;

8. A. 1. g. Surface-effect vehicles (rigid sidewalls) with a maximum design speed, fully loaded, exceeding 40 knots in a significant wave height of 3.25 m (Sea State 5) or more;

8. A. 1. h. Hydrofoil vessels with active systems for automatically controlling foil systems, with a maximum design speed, fully loaded, of 40 knots or more in a significant wave height of 3.25 m (Sea State 5) or more;

8. A. 1. i. Small waterplane area vessels having any of the following:

1. A full load displacement exceeding 500 tonnes with a maximum design speed, fully loaded, exceeding 35 knots in a significant wave height of 3.25 m (Sea State 5) or more; <u>or</u>
2. A full load displacement exceeding 1,500 tonnes with a maximum design speed, fully loaded, exceeding 25 knots in a significant wave height of 4 m (Sea State 6) or more.

<u>Technical Note</u>

A small waterplane area vessel is defined by the following formula: waterplane area at an operational design draft less than 2x (displaced volume at the operational design draft)2/3.

8. A. 2. Systems and equipment, as follows:

<u>N.B.</u> For underwater communications systems, see Category 5, Part 1 - Telecommunications.

8. A. 2. a. Systems and equipment, specially designed or modified for submersible vehicles, designed to operate at depths exceeding 1,000 m, as follows:

1. Pressure housings or pressure hulls with a maximum inside chamber diameter exceeding 1.5 m;
2. Direct current propulsion motors or thrusters;
3. Umbilical cables, and connectors therefor, using optical fibre and having synthetic strength members;

8. A. 2. b. Systems specially designed or modified for the automated control of the motion of submersible vehicles controlled by 8.A.1. using navigation data and having closed loop servo-controls:

1. Enabling a vehicle to move within 10 m of a predetermined point in the water

column;

2. Maintaining the position of the vehicle within 10 m of a predetermined point in the water column; or
3. Maintaining the position of the vehicle within 10 m while following a cable on or under the seabed;

8. A. 2. c. Fibre optic hull penetrators or connectors;

8. A. 2. d. Underwater vision systems, as follows:

1. Television systems and television cameras, as follows:
   a. Television systems (comprising camera, monitoring and signal transmission equipment) having a limiting resolution when measured in air of more than 800 lines and specially designed or modified for remote operation with a submersible vehicle;_
   b. Underwater television cameras having a limiting resolution when measured in air of more than 1,100 lines;
   c. Low light level television cameras specially designed or modified for underwater use containing all of the following:
      1. Image intensifier tubes controlled by 6.A.2.a.2.a.; and
      2. More than 150,000 "active pixels" per solid state area array;

Technical Note

Limiting resolution in television is a measure of horizontal resolution usually expressed in terms of the maximum number of lines per picture height discriminated on a test chart, using IEEE Standard 208/1960 or any equivalent standard.

8. A. 2. d. 2. Systems, specially designed or modified for remote operation with an underwater vehicle, employing techniques to minimise the effects of back scatter, including range-gated illuminators or "laser" systems;

8. A. 2. e. Photographic still cameras specially designed or modified for underwater use below 150 m having a film format of 35 mm or larger, and having any of the following:

1. Annotation of the film with data provided by a source external to the camera;
2. Automatic back focal distance correction; or
3. Automatic compensation control specially designed to permit an underwater

camera housing to be usable at depths exceeding 1,000 m;

8. A. 2. f. Electronic imaging systems, specially designed or modified for underwater use, capable of storing digitally more than 50 exposed images;

8. A. 2. g. Light systems, as follows, specially designed or modified for underwater use:

1. Stroboscopic light systems capable of a light output energy of more than 300 J per flash and a flash rate of more than 5 flashes per second;
2. Argon arc light systems specially designed for use below 1,000 m;

8. A. 2. h. "Robots" specially designed for underwater use, controlled by using a dedicated "stored programme controlled" computer**,** having any of the following:

1. Systems that control the "robot" using information from sensors which measure force or torque applied to an external object, distance to an external object, or tactile sense between the "robot" and an external object; <u>or</u>
2. The ability to exert a force of 250 N or more or a torque of 250 Nm or more and using titanium based alloys or "fibrous or filamentary" "composite" materials in their structural members;

8. A. 2. i. Remotely controlled articulated manipulators specially designed or modified for use with submersible vehicles, having any of the following:

1. Systems which control the manipulator using the information from sensors which measure the torque or force applied to an external object, or tactile sense between the manipulator and an external object; <u>or</u>
2. Controlled by proportional master-slave techniques or by using a dedicated "stored programme controlled" computer, and having 5 degrees of freedom of movement or more;

<u>Note</u> Only functions having proportional control using positional feedback or by using a dedicated "stored programme controlled" computer are counted when determining the number of degrees of freedom of movement.

8. A. 2. j. Air independent power systems, specially designed for underwater use, as follows:

1. Brayton or Rankine cycle engine air independent power systems having any of the following:
   a. Chemical scrubber or absorber systems specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;
   b. Systems specially designed to use a monoatomic gas;
   c. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; or
   d. Systems specially designed:
      1. To pressurise the products of reaction or for fuel reformation;
      2. To store the products of the reaction; and
      3. To discharge the products of the reaction against a pressure of 100 kPa or more;

8. A. 2. j. 2. Diesel cycle engine air independent systems, having all of the following:
   a. Chemical scrubber or absorber systems specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;
   b. Systems specially designed to use a monoatomic gas;
   c. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; and
   d. Specially designed exhaust systems that do not exhaust continuously the products of combustion;

8. A. 2. j. 3. Fuel cell air independent power systems with an output exceeding 2 kW having any of the following:
   a. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; or
   b. Systems specially designed:
      1. To pressurise the products of reaction or for fuel reformation;
      2. To store the products of the reaction; and
      3. To discharge the products of the reaction against a pressure of 100 kPa or more;

8. A. 2. j. 4. Stirling cycle engine air independent power systems, having all of the following:

a. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; and

b. Specially designed exhaust systems which discharge the products of combustion against a pressure of 100 kPa or more;

8. A. 2. k. Skirts, seals and fingers, having any of the following:

1. Designed for cushion pressures of 3,830 Pa or more, operating in a significant wave height of 1.25 m (Sea State 3) or more and specially designed for surface effect vehicles (fully skirted variety) controlled by 8.A.1.f.; or

2. Designed for cushion pressures of 6,224 Pa or more, operating in a significant wave height of 3.25 m (Sea State 5) or more and specially designed for surface effect vehicles (rigid sidewalls) controlled by 8.A.1.g.;

8. A. 2. l. Lift fans rated at more than 400 kW specially designed for surface effect vehicles controlled by 8.A.1.f. or 8.A.1.g.;

8. A. 2. m. Fully submerged subcavitating or supercavitating hydrofoils specially designed for vessels controlled by 8.A.1.h.;

8. A. 2. n. Active systems specially designed or modified to control automatically the sea-induced motion of vehicles or vessels controlled by 8.A.1.f., 8.A.1.g., 8.A.1.h. or 8.A.1.i.;

8. A. 2. o. Propellers, power transmission systems, power generation systems and noise reduction systems, as follows:

1. Water-screw propeller or power transmission systems, as follows, specially designed for surface effect vehicles (fully skirted or rigid sidewall variety), hydrofoils or small waterplane area vessels controlled by 8.A.1.f., 8.A.1.g., .8.A.1.h. or 8.A.1.i.:

a. Supercavitating, super-ventilated, partially-submerged or surface piercing propellers rated at more than 7.5 MW;

b. Contrarotating propeller systems rated at more than 15 MW;

c. Systems employing pre-swirl or post-swirl techniques for smoothing the flow into a propeller;

d. Light-weight, high capacity (K factor exceeding 300) reduction gearing;

e. Power transmission shaft systems, incorporating "composite" material components, capable of transmitting more than 1 MW;

8. A. 2. o. 2. Water-screw propeller, power generation systems or transmission systems designed for use on vessels, as follows:

a. Controllable-pitch propellers and hub assemblies rated at more than 30 MW;
b. Internally liquid-cooled electric propulsion engines with a power output exceeding 2.5 MW;
c. "Superconductive" propulsion engines, or permanent magnet electric propulsion engines, with a power output exceeding 0.1 MW;
d. Power transmission shaft systems, incorporating "composite" material components, capable of transmitting more than 2 MW;
e. Ventilated or base-ventilated propeller systems rated at more than 2.5 MW;

8. A. 2. o. 3. Noise reduction systems designed for use on vessels of 1,000 tonnes displacement or more, as follows:

a. Systems that attenuate underwater noise at frequencies below 500 Hz and consist of compound acoustic mounts for the acoustic isolation of diesel engines, diesel generator sets, gas turbines, gas turbine generator sets, propulsion motors or propulsion reduction gears, specially designed for sound or vibration isolation, having an intermediate mass exceeding 30% of the equipment to be mounted;
b. Active noise reduction or cancellation systems, or magnetic bearings, specially designed for power transmission systems, and incorporating electronic control systems capable of actively reducing equipment vibration by the generation of anti-noise or anti-vibration signals directly to the source;

8. A. 2. p. Pumpjet propulsion systems having a power output exceeding 2.5 MW using divergent nozzle and flow conditioning vane techniques to improve propulsive efficiency or reduce propulsion-generated underwater-radiated noise;

8. A. 2. q. Self-contained, closed or semi-closed circuit (rebreathing) diving and underwater swimming apparatus.

Note 8.A.2.q. does not control an individual apparatus for personal use when accompanying its user.

8. B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

8. B. 1. Water tunnels, having a background noise of less than 100 dB (reference 1 μPa, 1 Hz) in the frequency range from 0 to 500 Hz, designed for measuring acoustic fields generated by a hydro-flow around propulsion system models.

8. C. MATERIALS

8. C. 1. Syntactic foam designed for underwater use, having all of the following:
   a. Designed for marine depths exceeding 1,000 m; and
   b. A density less than 561 kg/m3.

Technical Note
Syntactic foam consists of hollow spheres of plastic or glass embedded in a resin matrix.

8. D. SOFTWARE

8. D. 1. "Software" specially designed or modified for the "development", "production" or "use" of equipment or materials controlled by 8.A., 8.B. or 8.C.

8. D. 2. Specific "software" specially designed or modified for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction.

8. E. TECHNOLOGY

8. E. 1. "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 8.A., 8.B. or 8.C.

8. E. 2. Other "technology", as follows:
   a. "Technology" for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction;
   b. "Technology" for the overhaul or refurbishing of equipment controlled by 8.A.1., 8.A.2.b., 8.A.2.j., 8.A.2.o. or 8.A.2.p.

9. A. SYSTEMS, EQUIPMENT AND COMPONENTS

*N.B. For propulsion systems designed or rated against neutron or transient ionizing radiation, see the Munitions List.**

9. A. 1. Aero gas turbine engines incorporating any of the "technologies" controlled by 9.E.3.a., as follows:

a. Not certified for the specific "civil aircraft" for which they are intended;

Note For the purpose of the "civil aircraft" certification process, a number of up to 16 civil certified engines, assemblies or components including spares, is considered appropriate.

b. Not certified for civil use by the aviation authorities in a participating state;

c. Designed to cruise at speeds exceeding Mach 1.2 for more than thirty minutes.

9. A. 2. Marine gas turbine engines with an ISO standard continuous power rating of 24,245 kW or more and a specific fuel consumption not exceeding 0.219 kg/kWh in the power range from 35 to 100%, and specially designed assemblies and components therefor.

Note The term 'marine gas turbine engines' includes those industrial, or aero-derivative, gas turbine engines adapted for a ship's electric power generation or propulsion.

9. A. 3. Specially designed assemblies and components, incorporating any of the "technologies" controlled by 9.E.3.a., for the following gas turbine engine propulsion systems:

a. Controlled by 9.A.1.;

b. Whose design or production origins are either non-participating states or unknown to the manufacturer.

9. A. 4. Space launch vehicles and "spacecraft".

Note 9.A.4. does not control payloads.

N.B. For the control status of products contained in "spacecraft" payloads, see the appropriate Categories.

9. A. 5. Liquid rocket propulsion systems containing any of the systems or components controlled by 9.A.6.

9. A. 6. Systems and components specially designed for liquid rocket propulsion systems, as follows:

a. Cryogenic refrigerators, flightweight dewars, cryogenic heat pipes or cryogenic systems specially designed for use in space vehicles and capable of restricting cryogenic fluid losses to less than 30% per year;

9. A. 6. b. Cryogenic containers or closed-cycle refrigeration systems capable of providing temperatures of 100 K (-173°C) or less for "aircraft" capable of sustained flight at speeds exceeding Mach 3, launch vehicles or "spacecraft";

c. Slush hydrogen storage or transfer systems;

d. High pressure (exceeding 17.5 MPa) turbo pumps, pump components or their associated gas generator or expander cycle turbine drive systems;

e. High-pressure (exceeding 10.6 MPa) thrust chambers and nozzles therefor;

f. Propellant storage systems using the principle of capillary containment or positive expulsion (i.e., with flexible bladders);

g. Liquid propellant injectors, with individual orifices of 0.381 mm or smaller in diameter (an area of 1.14×10^{-3} cm^2 or smaller for non-circular orifices) specially designed for liquid rocket engines;

h. One-piece carbon-carbon thrust chambers or one-piece carbon-carbon exit cones with densities exceeding 1.4 g/cm^3 and tensile strengths exceeding 48 MPa.

9. A. 7. Solid rocket propulsion systems with any of the following:

a. Total impulse capacity exceeding 1.1 MNs;

b. Specific impulse of 2.4 kNs/kg or more when the nozzle flow is expanded to ambient sea level conditions for an adjusted chamber pressure of 7 MPa;

c. Stage mass fractions exceeding 88% and propellant solid loadings exceeding 86%;

d. Any of the components controlled by 9.A.8.; or

e. Insulation and propellant bonding systems using direct-bonded motor designs to provide a strong mechanical bond or a barrier to chemical migration between the solid propellant and case insulation material.

Technical Note

For the purposes of 9.A.7.e., a strong mechanical bond means bond strength equal to or more than propellant strength.

9. A. 8. Components, as follows, specially designed for solid rocket propulsion systems:

a. Insulation and propellant bonding systems using liners to provide a strong mechanical bond or a barrier to chemical migration between the solid propellant and case insulation material;

Technical Note

For the purposes of 9.A.8.a., a strong mechanical bond means bond strength equal to or more than propellant strength.

b. Filament-wound "composite" motor cases exceeding 0.61 m in diameter or having structural efficiency ratios (PV/W) exceeding 25 km.

Technical Note

The structural efficiency ratio (PV/W) is the burst pressure (P) multiplied by the vessel volume (V) divided by the total pressure vessel weight (W).

c. Nozzles with thrust levels exceeding 45 kN or nozzle throat erosion rates of less than 0.075 mm/s;

d. Movable nozzle or secondary fluid injection thrust vector control systems capable of any of the following:

1. Omni-axial movement exceeding ± 5°;
2. Angular vector rotations of 20°/s or more; or
3. Angular vector accelerations of 40°/s2 or more.

9. A. 9. Hybrid rocket propulsion systems with:

a. Total impulse capacity exceeding 1.1 MNs; or

b. Thrust levels exceeding 220 kN in vacuum exit conditions.

9. A. 10. Specially designed components, systems and structures for launch vehicles, launch vehicle propulsion systems or "spacecraft", as follows:

a. Components and structures each exceeding 10 kg, specially designed for launch vehicles manufactured using metal "matrix", "composite", organic "composite", ceramic "matrix" or intermetallic reinforced materials controlled by 1.C.7. or 1.C.10.;

Note The weight cut-off is not relevant for nose cones.

b. Components and structures specially designed for launch vehicle propulsion systems controlled by 9.A.5 to 9.A.9. manufactured using metal matrix, composite, organic composite, ceramic matrix or intermetallic reinforced materials controlled by 1.C.7. or 1.C.10.;

c. Structural components and isolation systems specially designed to control actively the dynamic response or distortion of "spacecraft" structures;

d. Pulsed liquid rocket engines with thrust-to-weight ratios equal to or more than 1 kN/kg and a response time (the time required to achieve 90% of total rated thrust from start-up) of less than 30 ms.

9. A. 11. Ramjet, scramjet or combined cycle engines and specially designed components therefor.

9. B. <u>TEST, INSPECTION AND PRODUCTION EQUIPMENT</u>

9. B. 1. Specially designed equipment, tooling and fixtures, as follows, for manufacturing or measuring gas turbine blades, vanes or tip shroud castings:

a. Directional solidification or single crystal casting equipment;

b. Ceramic cores or shells.

9. B. 2. On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for the "development" of gas turbine engines, assemblies or components incorporating "technologies" controlled by 9.E.3.a.

9. B. 3. Equipment specially designed for the "production" or test of gas turbine brush seals designed to operate at tip speeds exceeding 335 m/s, and temperatures in excess of 773 K (500°C), and specially designed components or accessories therefor.

9. B. 4. Tools, dies or fixtures for the solid state joining of "superalloy", titanium or intermetallic airfoil-to-disk combinations described in 9.E.3.a.3. or 9.E.3.a.6. for gas turbines.

9. B. 5. On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for use with any of the following wind tunnels or devices:

a. Wind tunnels designed for speeds of Mach 1.2 or more, except those specially designed for educational purposes and having a test section size (measured laterally) of less than 250 mm;

<u>Technical Note</u>

Test section size: the diameter of the circle, or the side of the square, or the longest side of the rectangle, at the largest test section location.

b. Devices for simulating flow-environments at speeds exceeding Mach 5, including hot-shot tunnels, plasma arc tunnels, shock tubes, shock tunnels, gas tunnels and light gas guns; <u>or</u>

c. Wind tunnels or devices, other than two-dimensional sections, capable of simulating Reynolds number flows exceeding 25 x 106.

9. B. 6. Acoustic vibration test equipment capable of producing sound pressure levels of 160 dB or more (referenced to 20 Pa) with a rated output of 4 kW or more at a test cell temperature exceeding 1,273 K (1,000°C), and specially designed quartz heaters therefor.

9. B. 7. Equipment specially designed for inspecting the integrity of rocket motors using non-destructive test (NDT) techniques other than planar X-ray or basic physical or chemical analysis.

9. B. 8. Transducers specially designed for the direct measurement of the wall skin friction of the test flow with a stagnation temperature exceeding 833 K (560°C).

9. B. 9. Tooling specially designed for producing turbine engine powder metallurgy rotor components capable of operating at stress levels of 60% of ultimate tensile strength (UTS) or more and metal temperatures of 873 K (600°C) or more.

9. C. <u>MATERIALS</u> - None

9. D. <u>SOFTWARE</u>

9. D. 1. "Software" specially designed or modified for the "development" of equipment or "technology" controlled by 9.A., 9.B. or 9.E.3.

9. D. 2. "Software" specially designed or modified for the "production" of equipment controlled by 9.A. or 9.B.

9. D. 3. "Software" specially designed or modified for the "use" of full authority digital electronic engine controls (FADEC) for propulsion systems controlled by 9.A. or equipment controlled by 9.B., as follows:

a. "Software" in digital electronic controls for propulsion systems, aerospace test facilities or air breathing aero-engine test facilities;

b. Fault-tolerant "software" used in "FADEC" systems for propulsion systems and associated test facilities.

9. D. 4. Other "software", as follows:

a. 2D or 3D viscous "software" validated with wind tunnel or flight test data required for detailed engine flow modelling;

b. "Software" for testing aero gas turbine engines, assemblies or components, specially designed to collect, reduce and analyse data in real time, and capable of feedback control, including the dynamic adjustment of test articles or test conditions, as the test is in progress;

c. "Software" specially designed to control directional solidification or single crystal casting;

d. "Software" in "source code", "object code" or machine code required for the "use" of active compensating systems for rotor blade tip clearance control.

Note 9.D.4.d. does not control "software" embedded in uncontrolled equipment or required for maintenance activities associated with the calibration or repair or updates to the active compensating clearance control system.

9. E. TECHNOLOGY

9. E. 1. "Technology" according to the General Technology Note for the "development" of equipment or "software" controlled by 9.A.1.c., 9.A.4. to 9.A.11., 9.B. or 9.D.

9. E. 2. "Technology" according to the General Technology Note for the "production" of equipment controlled by 9.A.1.c., 9.A.4. to 9.A.11. or 9.B.

N.B. For "technology" for the repair of controlled structures, laminates or materials, see 1.E.2.f.

Note "Development" or "production" "technology" controlled by 9.E. for gas turbine engines remains controlled when used as "use" "technology" for repair, *rebuild and overhaul. Excluded from control are: technical data, drawings or documentation for maintenance activities directly associated with calibration, removal or replacement of damaged or unserviceable line replaceable units, including replacement of whole engines or engine modules.*

9. E. 3. Other "technology", as follows:

a. "Technology" "required" for the "development" or "production" of any of the following gas turbine engine components or systems:

1. Gas turbine blades, vanes or tip shrouds made from directionally solidified (DS) or single crystal (SC) alloys having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1,000°C) at a stress of 200 MPa, based on the average property values;
2. Multiple domed combustors operating at average burner outlet temperatures exceeding 1,813 K (1,540°C) or combustors incorporating thermally decoupled combustion liners, non-metallic liners or non-metallic shells;

9. E. 3. a. 3. Components manufactured from any of the following:

a. Organic "composite" materials designed to operate above 588 K (315°C);

b. Metal "matrix" "composite", ceramic "matrix", intermetallic or intermetallic reinforced materials controlled by 1.C.7.; <u>or</u>

c. "Composite" material controlled by 1.C.10. and manufactured with resins controlled by 1.C.8.

4. Uncooled turbine blades, vanes, tip-shrouds or other components designed to operate at gas path temperatures of 1,323 K (1,050°C) or more;
5. Cooled turbine blades, vanes or tip-shrouds, other than those described in 9.E.3.a.1., exposed to gas path temperatures of 1,643 K (1,370°C) or more;
6. Airfoil-to-disk blade combinations using solid state joining;
7. Gas turbine engine components using "diffusion bonding" "technology" controlled by 2.E.3.b.;
8. Damage tolerant gas turbine engine rotating components using powder metallurgy materials controlled by 1.C.2.b.;
9. "FADEC" for gas turbine and combined cycle engines and their related diagnostic components, sensors and specially designed components;
10. Adjustable flow path geometry and associated control systems for:

a. Gas generator turbines;

b. Fan or power turbines;

c. Propelling nozzles; <u>or</u>

Note 1 *Adjustable flow path geometry and associated control systems in 9.E.3.a.10. do not include inlet guide vanes, variable pitch fans, variable stators or bleed valves for compressors.*

Note 2 *9.E.3.a.10. does not control "development" or "production" "technology" for adjustable flow path geometry for reverse thrust.*

11. Wide chord hollow fan blades without part-span support;

9. E. 3. b. "Technology" "required" for the "development" or "production" of any of the following:

1. Wind tunnel aero-models equipped with non-intrusive sensors capable of transmitting data from the sensors to the data acquisition system; or
2. "Composite" propeller blades or propfans capable of absorbing more than 2,000 kW at flight speeds exceeding Mach 0.55;

9. E. 3. c. "Technology" "required" for the "development" or "production" of gas turbine engine components using "laser", water jet**,** ECM or EDM hole drilling processes to produce holes having any of the following sets of characteristics:

1. All of the following:
   a. Depths more than four times their diameter;
   b. Diameters less than 0.76 mm; and
   c. Incidence angles equal to or less than 25°; or
2. All of the following:
   a. Depths more than five times their diameter;
   b. Diameters less than 0.4 mm; and
   c. Incidence angles of more than 25°;

Technical Note

For the purposes of 9.E.3.c., incidence angle is measured from a plane tangential to the airfoil surface at the point where the hole axis enters the airfoil surface.

9. E. 3. d. "Technology" "required" for any of the following:

1. The "development" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems; or
2. The "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems;

9. E. 3. e. 1. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:

a. A box volume of 1.2 m3 or less;

b. An overall power output of more than 750 kW based on 80/1269/EEC, ISO 2534 or national equivalents; <u>and</u>

c. A power density of more than 700 kW/m3 of box volume;

<u>Technical Note</u>

Box volume: the product of three perpendicular dimensions is measured in the following way:

<u>Length</u>: The length of the crankshaft from front flange to flywheel face;

<u>Width</u>: The widest of the following:

a. The outside dimension from valve cover to valve cover;

b. The dimensions of the outside edges of the cylinder heads; <u>or</u>

c. The diameter of the flywheel housing;

<u>Height</u>: The largest of the following:

a. The dimension of the crankshaft centre-line to the top plane of the valve cover (or cylinder head) plus twice the stroke; <u>or</u>

b. The diameter of the flywheel housing.

9. E. 3. e. 2. "Technology" "required" for the "production" of specially designed components, as follows, for high output diesel engines:

a. "Technology" "required" for the "production" of engine systems having all of the following components employing ceramics materials controlled by 1.C.7:

1. Cylinder liners;
2. Pistons;
3. Cylinder heads; <u>and</u>
4. One or more other components (including exhaust ports, turbochargers, valve guides, valve assemblies or insulated fuel injectors);

9. E. 3. e. 2. b. "Technology" "required" for the "production" of turbocharger systems, with single-stage compressors having all of the following:

1. Operating at pressure ratios of 4:1 or higher;
2. A mass flow in the range from 30 to 130 kg per minute; <u>and</u>
3. Variable flow area capability within the compressor or turbine sections;

9. E. 3. e. 2. c. "Technology" "required" for the "production" of fuel injection systems with a specially designed multifuel (e.g., diesel or jet fuel) capability covering a viscosity range from diesel fuel (2.5 cSt at 310.8 K (37.8°C)) down to gasoline fuel (0.5 cSt at 310.8 K (37.8°C)), having both of the following:

1. Injection amount in excess of 230 mm3 per injection per cylinder; and
2. Specially designed electronic control features for switching governor characteristics automatically depending on fuel property to provide the same torque characteristics by using the appropriate sensors;

9. E. 3. e. 3. "Technology" "required" for the "development" or "production" of high output diesel engines for solid, gas phase or liquid film (or combinations thereof) cylinder wall lubrication, permitting operation to temperatures exceeding 723 K (450°C), measured on the cylinder wall at the top limit of travel of the top ring of the piston.

Technical Note

High output diesel engines: diesel engines with a specified brake mean effective pressure of 1.8 MPa or more at a speed of 2,300 r.p.m., provided the rated speed is 2,300 r.p.m. or more.

Annex 1

ANNEX 1 OF THE LIST OF DUAL-USE GOODS AND TECHNOLOGIES

Note *This Annex contains a sub-set of the Items controlled by the List of Dual-Use Goods and Technologies.*

N.B. *Where abbreviated entries are used, see List of Dual-Use Goods and Technologies for full details. Text that differs from that in the List of DualUse Goods and Technologies is shaded.*

Category 1

1.A.2.
"Composite" structures or laminates...
1.C.1.
Materials specially designed for use as absorbers of electromagnetic waves...
1.C.7.c. & 1.C.7.d.
Ceramic-ceramic "composite" materials...
1.C.10.c. & 1.C.10.d.
Fibrous or filamentary materials...
1.C.12.
Materials as follows...
1.D. 2
"Software" for the "development" of organic "matrix", metal "matrix" or carbon "matrix" laminates or "composites" listed on this Annex.
1.E.1.
"Technology" according to the General Technology Note for the "development" or "production" of equipment and materials in 1.A.2. or 1.C. of this Annex.
1.E. 2.e. & 1.E.2.f.
Other "technology"...

Category 2*1)

1)* Italy and Switzerland reserve the right to notify only denials on machine-tools in 2.B.1.a. and 2.B.1.b. of this Annex.

2.B.1.a.

Machine tools for turning, having all of the following characteristics:

1. Positioning accuracy with "all compensations available" equal to or less (better) than 3.6 m according to ISO 230/2 (1997) or national equivalents along any linear axis**;** and
2. Two or more axes which can be coordinated simultaneously for "contouring control".

2.B.1.b.
Machine tools for milling, having any of the following characteristics:

1.a. Positioning accuracy with "all compensations available" equal to or less (better) than 3.6m according to ISO230/2 (1997) or national equivalents along any linear axis**;** and

b. Three linear axes plus one rotary axis which can be coordinated simultaneously for "contouring control"; or

Category 2 (contd.)

2.B.1.b.
2. Five or more axes which can be coordinated simultaneously for "contouring control" and have a positioning accuracy with "all compensations available" equal to or less (better) than 3.6m according to ISO230/2 (1997) or national equivalents along any linear axis; or

3. A positioning accuracy for jig boring machines, with "all compensations available", equal to or less (better) than 3m according to ISO230/2 (1997) or national equivalents along any linear axis;

2.B.1.d.
Electrical discharge machines (EDM)....
2.B.1.f.
Deep-hole-drilling machines....
2.B.3.
"Numerically controlled" or manual machine tools....

2.D.1.
"Software", other than that controlled by 2.D.2., specially designed for the "development" or "production" of equipment in 2.B. of this Annex.
2.E.1.
"Technology" according to the General Technology Note for the "development" of equipment or "software" in 2.B. or 2.D. of this Annex.

2.E.2.
"Technology" according to the General Technology Note for the "production" of equipment in 2.B. of this Annex.

Category 3

3.A.2.g.2.
Atomic frequency standards....
3.B.1.a.2.
Metal organic chemical vapour deposition reactors....
3.D.1.
"Software" specially designed for the "development" or "production" of equipment in 3.A.2.g. or 3.B. of this Annex.
3.E.1.
"Technology" according to the General Technology Note for the "development" or "production" of equipment in 3.A. or 3.B. of this Annex.

Category 4

4.A.1.a.2.
Electronic computers......radiation hardened;
4.A.3.b.
"Digital computers" having a "composite theoretical performance" ("CTP") exceeding 6,500 Mtops.
4.A.3.c.
"Electronic assemblies" specially designed or modified for enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 4.A.3.b in this Annex.

Category 4 (contd.)

Note 1 4.A.3.c. applies only to "electronic assemblies" and programmable interconnections not exceeding the limit in 4.A.3.b. in this Annex when shipped as unintegrated "electronic assemblies".

Note 2 4.A.3.c. does not control "electronic assemblies" specially designed for a product or family of products whose maximum configuration does not exceed the limit of 4.A.3.b. in this Annex.

4.D.1.
"Software" specially designed for the "development" or "production" of equipment or "software" in 4.A. or 4.D. of this Annex.

4.E.1.
"Technology" according to the General Technology Note for the "development" or "production" of equipment or "software" in 4.A. or 4.D. of this Annex.

Category 5 - Part 1

5.A.1.b.3.
Being radio equipment ....
5.A.1.b.4.
Being digitally controlled radio receivers...
5.B.1.a.
Equipment and specially designed components or accessories therefor, specially designed for the "development", "production" or "use" of equipment, functions or features in Category 5 - Part 1 of this Annex.

5.D.1.a.
"Software" specially designed for the "development" or "production" of equipment, functions or features in Category5 - Part 1 of this Annex.

5.D.1.b.
"Software" specially designed or modified to support "technology" listed under 5.E.1. of this Annex.

5.E.1.a.
"Technology" according to the General Technology Note for the "development" or "production" of equipment, functions, features or "software" in Category 5 - Part 1 of this Annex.

Category 5 - Part 2
- None

Category 6

6.A.1.a.1.b.
Object detection or location systems having any of the following:

1. A transmitting frequency below 5kHz;
2. Sound pressure level exceeding 224dB (reference 1mPa at 1m) for equipment with an operating frequency in the band from 5kHz to 24kHz inclusive;
3. Sound pressure level;
4. Forming beams of ;
5. Designed to operate
6. Designed to withstand;

6.A.1.a.2.a.1.
6.A.1.a.2.a.2.
6.A.1.a.2.a.7.
Hydrophones...Incorporating
Hydrophones...Having any
Hydrophones...Designed for
6.A.1.a.2.b.
Towed acoustic hydrophone arrays...

6.A.1.a.2.c.
Processing equipment, specially designed for real time application with towed acoustic hydrophone arrays, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beam-forming using Fast Fourier or other transforms or processes;

6.A.1.a.2.d.
Heading sensors....

6.A.1.a.2.e.

Bottom or bay cable systems having any of the following:

1. Incorporating hydrophones... or
2. Incorporating multiplexed hydrophone group signal modules;

6.A.1.a.2.f.
Processing equipment, specially designed for real time application with bottom or bay cable systems, having "user accessible programmability" and time or frequency domain

processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

6.A.2.a.1.a.
6.A.2.a.1.b.
"Space-qualified" solid-state detectors.....
"Space-qualified" solid-state detectors.....
6.A.2.a.1.c.
"Space-qualified" solid-state detectors...

6.A.2.a.2.a.
Image intensifier tubes ...

1. A peak response
2. A microchannel plate
3. Photocathodes, as follows:
    a. S-20, S-25 or multialkali photocathodes with a luminous sensitivity exceeding 550mA/lm;
    b. GaAs or GaInAs photocathodes;
    c. Other III-V compound semiconductor photocathodes.

Category 6 (contd.)

6.A.2.a.3.
Non-space qualified "focal plane arrays";

Note 3
In 6.A.2.a.3. the following "focal plane arrays" are not included in this Annex:

a. Platinum Silicide (PtSi) "focal plane arrays" having less than 10,000 elements;

b. Iridium Silicide (IrSi) "focal plane arrays".

6.A.2.a.3.

Note 4
In 6.A.2.a.3. the following "focal plane arrays" are not included in this Annex:

a. Indium Antimonide (InSb) or Lead Selenide (PbSe) "focal plane arrays" having less than 256 elements;

b. Indium Arsenide (InAs) "focal plane arrays";

c. Lead Sulphide (PbS) "focal plane arrays";

d. Indium Gallium Arsenide (InGaAs) "focal plane arrays".

Note 5
In 6.A.2.a.3. Mercury Cadmium Telluride (HgCdTe) "focal plane arrays" as follows are not included in this Annex:

1. Scanning Arrays having any of the following:

a. 30 elements or less; or

b. incorporating time delay-and-integration within the element and having 2 elements or less;

2. Staring Arrays having less than 256 elements.

6.A.2.a.3.
Technical Notes
'Scanning Arrays' are defined as "focal plane arrays" designed for use with a scanning optical system that images a scene in a sequential manner to produce an image;

'Staring Arrays' are defined as "focal plane arrays" designed for use with a non-scanning optical system that images a scene.

Note 6

In 6.A.2.a.3. the following "focal plane arrays" are not included in this Annex:

a. Gallium Arsenide (GaAs) or Gallium Aluminum Arsenide (GaAlAs) quantum well "focal plane arrays" having less than 256 elements;

b. Pyroelectric or Ferroelectric (including barium-strontium titanate, lead zirconate titanate or lead scandium titanate) "focal plane arrays" having less than 8,000 elements;

c. Vanadium Oxide-Silicon nitride microbolometer "focal plane arrays" having less than 8,000 elements.

<u>Category 6</u> (contd.)

6.A.2.b.
"Monospectral imaging sensors" and "multispectral imaging sensors"....
6.A.2.c.
Direct view imaging equipment operating in the visible or infrared spectrum, incorporating any of the following:

1. Image intensifier tubes having the characteristics listed in 6.A.2.a.2.a. of this Annex; <u>or</u>
2. "Focal plane arrays" having the characteristics listed in 6.A.2.a.3. of this Annex;

6.A.2.e.
"Space-qualified" "focal plane arrays"....
6.A.3.b. 3
Imaging cameras incorporating image intensifier tubes having the characteristics listed in 6.A.2.a.2.a. of this Annex;
6.A.3.b.4
Imaging cameras incorporating "focal plane arrays" having the characteristics listed in 6.A.2.a.3. of this Annex;
6.A.4.c.
"Space-qualified" components for optical systems....
6.A.4.d.
Optical control equipment.....

6.A.6.g.

Magnetic compensation systems...

Note In 6.A.6.g. those compensators which provide only absolute values of the earth's magnetic field as output, (i.e., the frequency bandwidth of the output extends from DC to at least 0.8Hz) are not included in this Annex.

6.A.6.h.
"Superconductive" electromagnetic sensors......
6.A.8.d.
Radar systems.....Capable of
6.A.8.h.
Radar systemsEmploying processing
6.A.8.k.
Radar systemsHaving "signal processing"
6.A.8.l.3.
Radar systemsHaving data processing Processing for
6.B.8.
Pulse radar cross-section

6.D.1.
"Software" specially designed for the "development" or "production"of equipment in 6.A.4., 6.A.8. or 6.B.8. of this Annex.
6.D.3.a.
"Software", as follows:
6.E.1.
"Technology" according to

6.E.2.
"Technology" according to the General Technology Note for the "production" of equipment in 6.A. or 6.B. of this Annex.

Category 7

7.D.2.
"Source code" for the "use"
7.D.3.a.
"Software" specially designed or modified to
7.D.3.b.
"Source code" for
7.D.3.c.
7.D.3.d.1. to 4. & 7.
"Source code" for
"Source code" for the "development" of
7.E.1. & 7.E.2.
"Technology" according to the General Technology Note...

Category 8

8.A.1.b.
Manned, untethered submersible vehicles
8.A.1.c.
Unmanned, tethered submersible vehicles.....
8.A.1.d.
Unmanned, untethered submersible vehicles...

8.A.2.b.
Systems specially designed or modified for the automated control of the motion of submersible vehicles in 8.A.1. of this Annex using navigation data and having closed loop servo-controls:

1. Enabling;
2. Maintaining; or
3. Maintaining;

8.A.2.h.
"Robots" specially designed for underwater use......

8.A.2.j.
Air independent power systems.......
8.A.2.o.3.
Noise reduction systems for use on vessels...
8.A.2.p.
Pumpjet propulsion systems....

8.D.1.
"Software" specially designed for the "development" or "production" of equipment in 8.A. of this Annex.
8.D.2
Specific "software"

8.E.1.
"Technology" according to the General Technology Note for the "development" or "production" of equipment in 8.A. of this Annex.
8.E.2.a.
Other "technology"........

Category 9

9.A.11.
Ramjet, scramjet or combined cycle engines...
9.B.1.b.
Ceramic cores or shells

9.D.1.
"Software" specially designed or modified for the "development" of equipment or "technology" in 9.A., 9.B. or 9.E.3. of this Annex.

9.D.2.
"Software" specially designed or modified for the "production" of equipment in 9.A. or 9.B. of this Annex.

9.D.4.a.
Other "software"2D or 3D
9.D.4.c.
Other "software""Software" specially

9.E.1.
"Technology" according to the General Technology Note.....
9.E.2.
"Technology" according to the General Technology Note

9.E.3.a.1.
Other "technology"Gas turbine blades
9.E.3.a.2. to 5. & 9.E.3.a.8., 9.E.3.a.9.
Other "technology"

Annex 2

ANNEX 2 OF THE LIST OF DUAL-USE GOODS AND TECHNOLOGIES

Note *This Annex is a sub-set of the Items contained in Annex 1.*

N.B. *Where abbreviated entries are used, see List of Dual-Use Goods and Technologies for full details. Text that differs from that in the List of DualUse Goods and Technologies is shaded.*

Category 1

1.A.2.a.
"Composite" structures or laminates having an organic "matrix" and made from materials listed under 1.C.10.c. or 1.C.10.d.

1.C.1.
Materials specially designed for use as absorbers of electromagnetic waves...

1.C.12.
Materials as follows...

1.E.1.
"Technology" according to the General Technology Note for the "development" or "production" of equipment and materials in 1.A.2 or 1.C. of this Annex.

Category 2

None

Category 3

None

Category 4

4.A.3.b.
"Digital computers" having a "composite theoretical performance" ("CTP") exceeding 10,000 Mtops.

4.A.3.c.
"Electronic assemblies" specially designed or modified for enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 4.A.3.b in this Annex.

Note 1 4.A.3.c. applies only to "electronic assemblies" and programmable interconnections not exceeding the limit in 4.A.3.b. in this Annex when shipped as unintegrated "electronic assemblies".

Note 2 4.A.3.c. does not control "electronic assemblies" specially designed for a product or family of products whose maximum configuration does not exceed the limit of 4.A.3.b. in this Annex.

4.D.1.
"Software" specially designed for the "development" or "production" of equipment in 4.A. of this Annex.

4.E.1.
"Technology" according to the General Technology Note for the "development" or "production" of equipment or "software" in 4.A. or 4.D. of this Annex.

Category 5 - Part 1

5.A.1.b.4.
Digitally controlled radio receivers...

5.D.1.a.
"Software" specially designed for the "development" or "production" of equipment, functions or features in Category5, Part 1 of this Annex.

5.E.1.a.
"Technology" according to the General Technology Note for the "development" or "production" of equipment, functions, features or "software" in Category 5, Part 1 of this Annex.

Category 5 - Part 2

None

Category 6

6.A.1.a.2.a.1., 2. & 7.
Hydrophones...Incorporating

6.A.1.a.2.b.
Towed acoustic hydrophone arrays...

6.A.1.a.2.c.
Processing equipment, specially designed for real time application with towed acoustic hydrophone arrays, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

6.A.1.a.2.e.
Bottom or bay cable systems having any of the following:

1. Incorporating hydrophones... or
2. Incorporating multiplexed hydrophone group signal modules ;

6.A.1.a.2.f.
Processing equipment, specially designed for real time application with bottom or bay cable systems, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

6.A.2.a.1.c.
"Space-qualified" solid-state detectors...
6.A.8.l.3.
Radar systemsHaving data processing Processing for
6.B.8.
Pulse radar cross-section

6.D.1.
"Software" specially designed for the "development" or "production" of equipment in 6.A.8., or 6.B.8. of this Annex.
6.D.3.a.
"Software", as follows:

6.E.1.
"Technology" according to the General Technology Note for the "development" of equipment or "software" in 6.A., 6.B., or 6.D. of this Annex.
6.E.2.
"Technology" according to the General Technology Note for the "production" of equipment in 6.A. or 6.B. of this Annex.

Category 7

7.D.3.a.
"Software" specially designed or modified to
7.D.3.b.
"Source code" for

Category 8

8.A.1.b.
Manned, untethered submersible vehicles...
8.A.1.d.
Unmanned, untethered submersible vehicles...
8.A.2.o.3.b.
Active noise reduction or cancellation systems...

8.D.1.
"Software" specially designed for the "development" or "production" of equipment in 8.A. of this Annex.

8.E.1.
"Technology" according to the General Technology Note for the "development" or "production" of equipment in 8.A. of this Annex.

Category 9

9.A.11.
Ramjet, scramjet or combined cycle engines...

9.D.1.
"Software" specially designed or modified for the "development" of equipment or "technology" in 9.A. or 9.E.3. of this Annex.

9.D.2.
"Software" specially designed or modified for the "production" of equipment in 9.A. of this Annex.

9.E.1.
"Technology" according to the General Technology Note for the "development" of equipment or "software" in 9.A.11. or 9.D. of this Annex.

9.E.2.
"Technology" according to the General Technology Note for the "production" of equipment in 9.A.11. of this Annex.

9.E.3.a.1.
Other "technology"Gas turbine blades

9.E.3.a.3.a.
"Technology" "required" for
Components manufactured from...
Organic "composite" materials designed to operate above 588K (315C).

MUNITIONS LIST*

Note 1 *Terms in "quotations" are defined terms. Refer to 'Definitions of Terms used in these Lists' annexed to this List.*

Note 2 *CAS numbers are shown as examples. They do not cover all the chemicals and mixtures controlled by the Munitions List.*

GENERAL TECHNOLOGY NOTE

The export of "technology" which is "required" for the "development", "production" or "use" of items controlled in the Munitions List is controlled according to the provisions in the Munitions List entries. This "technology" remains under control even when applicable to any uncontrolled item.

Controls do not apply to that "technology" which is the minimum necessary for the installation, operation, maintenance (checking) and repair of those items which are not controlled or whose export has been authorised.

Controls do not apply to "technology" "in the public domain", to "basic scientific research" or to the minimum necessary information for patent applications.

ML1.* Arms and automatic weapons with a calibre of 12.7 mm (calibre 0.50 inches) or less and accessories, as follows, and specially designed components therefor:

a. Rifles, carbines, revolvers, pistols, machine pistols and machine guns:

Note *ML1.a. does not control the following:*

1. *Muskets, rifles and carbines manufactured earlier than 1938;*
2. *Reproductions of muskets, rifles and carbines the originals of which were manufactured earlier than 1890;*
3. *Revolvers, pistols and machine guns manufactured earlier than 1890, and their reproductions;*

b. Smooth-bore weapons specially designed for military use;

c. Weapons using caseless ammunition;

d. Silencers, special gun-mountings, clips, weapons sights and flash suppressers for arms controlled by sub-items ML1.a., ML1.b. or ML1.c.

Technical Note

Smooth-bore weapons specially designed for military use as specified in ML1.b. are those which:

a. Are proof tested at pressures above 1,300 bars;

b. Operate normally and safely at pressures above 1,000 bars; and

c. Are capable of accepting ammunition above 76.2 mm in length (e.g., commercial 12-gauge magnum shot gun shells).

The parameters in this Technical Note are to be measured according to the standards of the Commission Internationale Permanente.

Note 1 *ML1. does not control smooth-bore weapons used for hunting or sporting purposes. These weapons must not be specially designed for military use or of the fully automatic firing type.*

Note 2 *ML1. does not control firearms specially designed for dummy ammunition and which are incapable of firing any controlled ammunition.*

Note 3 *ML1. does not control weapons using non-centre fire cased ammunition and which are not of the fully automatic firing type.*

ML2. Armament or weapons with a calibre greater than 12.7 mm (calibre 0.50 inches), projectors and accessories, as follows, and specially designed components therefor:

a. Guns, howitzers, cannon, mortars, anti-tank weapons, projectile launchers, military flame throwers, recoilless rifles and signature reduction devices therefor;

Note ML2.a. includes injectors, metering devices, storage tanks and other specially designed components for use with liquid propelling charges for any of the equipment controlled by ML2.a.

b. Military smoke, gas and pyrotechnic projectors or generators.

Note ML2.b. does not control signal pistols.

c. Weapons sights.

ML3. Ammunition, and specially designed components therefor, for the weapons controlled by ML1., ML2. or ML12.

Note 1 Specially designed components include:

a. Metal or plastic fabrications such as primer anvils, bullet cups, cartridge links, rotating bands and munitions metal parts;

b. Safing and arming devices, fuses, sensors and initiation devices ;

c. Power supplies with high one-time operational output;

d. Combustible cases for charges;

e. Submunitions including bomblets, minelets and terminally guided projectiles.

Note 2 ML3. does not control ammunition crimped without a projectile (blank star) and dummy ammunition with a pierced powder chamber.

Note 3 ML3. does not control cartridges specially designed for any of the following purposes:

a. Signalling;

b. Bird scaring; or

c. Lighting of gas flares at oil wells.

ML4. Bombs, torpedoes, rockets, missiles, and related equipment and accessories, as follows, specially designed for military use, and specially designed components therefor:

a. Bombs, torpedoes, grenades, smoke canisters, rockets, mines, missiles, depth charges, demolition-charges, demolition-devices and demolition-kits, "military pyrotechnic" devices, cartridges and simulators (i.e. equipment simulating the characteristics of any of these items);

Note ML4.a. includes:*

1. *Smoke grenades, fire bombs, incendiary bombs and explosive devices;*
2. *Missile rocket nozzles and re-entry vehicle nosetips.*

b. Equipment specially designed for the handling, control, activation, powering with one-time operational output, launching, laying, sweeping, discharging, decoying, jamming, detonation or detection of items controlled by ML4.a.

Note ML4.b. includes:

1. *Mobile gas liquefying equipment capable of producing 1,000 kg or more per day of gas in liquid form;*
2. *Buoyant electric conducting cable suitable for sweeping magnetic mines.*

ML5. Fire control, and related alerting and warning equipment, and related systems, test and alignment and countermeasure equipment, as follows, specially designed for military use, and specially designed components and accessories therefor:

a. Weapon sights, bombing computers, gun laying equipment and weapon control systems;

b. Target acquisition, designation, range-finding, surveillance or tracking systems; detection, data fusion, recognition or identification equipment; and sensor integration equipment;

c. Countermeasure equipment for items controlled by ML5.a. or ML5.b.

d. Field test or alignment equipment, specially designed for items controlled by ML5.a.

or ML5.b.

ML6. Ground vehicles and components therefor specially designed or modified for military use.

Technical Note

For the purposes of ML6. the term ground vehicles includes trailers.

Note 1 *ML6. includes:*

a. Tanks and other military armed vehicles and military vehicles fitted with mountings for arms or equipment for mine laying or the launching of munitions controlled under ML4;

b. Armoured vehicles;

c. Amphibious and deep water fording vehicles;

d. Recovery vehicles and vehicles for towing or transporting ammunition or weapon systems and associated load handling equipment.

Note 2 *Modification of a ground vehicle for military use entails a structural, electrical or mechanical change involving one or more specially designed military components. Such components include:*

a. Pneumatic tyre casings of a kind specially designed to be bullet-proof or to run when deflated;

b. Tyre inflation pressure control systems, operated from inside a moving vehicle;

c. Armoured protection of vital parts, (e.g., fuel tanks or vehicle cabs);

d. Special reinforcements for mountings for weapons.

Note 3 *ML6. does not control civil automobiles or trucks designed for transporting money or valuables, having armoured protection.*

ML7. Chemical or biological toxic agents, "tear gases", radioactive materials, related equipment, components, materials and "technology" as follows:

a. Biological agents and radioactive materials "adapted for use in war" to produce casualties in humans or animals, degrade equipment or damage crops or the environment, and chemical warfare (CW) agents;

b. CW binary precursors and key precursors, as follows:

1. Alkyl (Methyl, Ethyl, n-Propyl or Isopropyl Phosphonyl Difluorides, such as: DF: Methyl Phosphonyldifluoride (CAS 676-99-3);
2. O-Alkyl (H or equal to or less than C10, including cycloalkyl) O-2-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) aminoethyl alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphonite and corresponding alkylated and protonated salts, such as:
   QL: O-Ethyl-2-di-isopropylaminoethyl methylphosphonite
   (CAS 57856-11-8);
3. Chlorosarin: O-Isopropyl methylphosphonochloridate (CAS 1445-76-7);
4. Chlorosoman: O-Pinakolyl methylphosphonochloridate (CAS 7040-57-5);

c. "Tear gases" and "riot control agents" including:

1. Bromobenzyl cyanide (CA) (CAS 5798-79-8);
2. o-Chlorobenzylidenemalononitrile (o-Chlorobenzalmalononitrile) (CS) (CAS 2698-41-1);
3. Phenylacyl chloride (-chloroacetophenone) (CN) (CAS 532-27-4);
4. Dibenz-(b,f)-1,4-oxazephine (CR) (CAS 257-07-8);

d. Equipment specially designed or modified for the dissemination of any of the following and specially designed components therefor:

1. Materials or agents controlled by ML7.a. or c.; <u>or</u>
2. CW made up of precursors controlled by ML7.b.

e. Equipment specially designed for defence against materials controlled by ML7.a. or c. and specially designed components therefor;

<u>Note</u> ML7.e. includes protective clothing.

f. Equipment specially designed for the detection or identification of materials controlled by ML7.a. or c. and specially designed components therefor;

<u>Note</u> ML7.f. does not control personal radiation monitoring dosimeters.

<u>N.B.</u> For civil gas masks and protective equipment see also entry 1.A.4. on the Dual-Use List.

ML7. g. "Biopolymers" specially designed or processed for the detection or identification of CW agents controlled by ML7.a., and the cultures of specific cells used to produce them;

h. "Biocatalysts" for the decontamination or degradation of CW agents, and biological systems therefor, as follows:

1. "Biocatalysts" specially designed for the decontamination or degradation of CW agents controlled by ML7.a. resulting from directed laboratory selection or genetic manipulation of biological systems;
2. Biological systems, as follows: "expression vectors", viruses or cultures of cells containing the genetic information specific to the production of "biocatalysts" controlled by ML7.h.1.;

i. "Technology" as follows:

1. "Technology" for the "development", "production" or " use" of toxicological agents, related equipment or components controlled by ML7.a. to ML7.f.;
2. "Technology" for the "development", "production" or "use" of "biopolymers" or cultures of specific cells controlled by ML7.g.;
3. "Technology" exclusively for the incorporation of "biocatalysts", controlled by ML7.h.1., into military carrier substances or military material.

Note 1 ML7.a. includes the following

a. CW nerve agents:

1. O-Alkyl (equal to or less than C10, including cycloalkyl) alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) - phosphonofluoridates, such as:

Sarin (GB):O-Isopropyl methylphosphonofluoridate (CAS 107-44-8); and

Soman (GD):O-Pinacolyl methylphosphonofluoridate (CAS 96-64-0);

2. O-Alkyl (equal to or less than C10, including cycloalkyl) N,N-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphoramidocyanidates, such as:

Tabun (GA):O-Ethyl N,N-dimethylphosphoramidocyanidate (CAS 77-81-6);

3. O-Alkyl (H or equal to or less than C10, including cycloalkyl) S-2-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-aminoethyl alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphonothiolates and corresponding alkylated and protonated salts, such as:

VX: O-Ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate

(CAS 50782-69-9);

<u>Note 1</u> b. CW vesicant agents

1. Sulphur mustards, such as:

2-Chloroethylchloromethylsulphide (CAS 2625-76-5);
Bis(2-chloroethyl) sulphide (CAS 505-60-2);
Bis(2-chloroethylthio) methane (CAS 63869-13-6);
1,2-bis (2-chloroethylthio) ethane (CAS 3563-36-8);
1,3-bis (2-chloroethylthio) -n-propane (CAS 63905-10-2);
1,4-bis (2-chloroethylthio) -n-butane;
1,5-bis (2-chloroethylthio) -n-pentane;
Bis (2-chloroethylthiomethyl) ether;
Bis (2-chloroethylthioethyl) ether (CAS 63918-89-8);

2. Lewisites, such as:

2-chlorovinyldichloroarsine (CAS 541-25-3);
Tris (2-chlorovinyl) arsine (CAS 40334-70-1);
Bis (2-chlorovinyl) chloroarsine (CAS 40334-69-8);

3. Nitrogen mustards, such as:

HN1: bis (2-chloroethyl) ethylamine (CAS 538-07-8);
HN2: bis (2-chloroethyl) methylamine (CAS 51-75-2);
HN3: tris (2-chloroethyl) amine (CAS 555-77-1);

c. CW incapacitating agents such as:

3-Quinuclindinyl benzilate (BZ) (CAS 6581-06-2);

d. CW defoliants such as:

1. Butyl 2-chloro-4-fluorophenoxyacetate (LNF);
2. 2,4,5-trichlorophenoxyacetic acid mixed with 2,4-dichlorophenoxyacetic acid (Agent Orange).

<u>Note 2</u> ML7.e. includes air conditioning units specially designed or modified for nuclear, biological or chemical filtration.

<u>Note 3</u> ML7.a. and ML7.c. do not control:

a. Cyanogen chloride;

b. Hydrocyanic acid;
c. Chlorine;
d. Carbonyl chloride (phosgene);
e. Diphosgene (trichloromethyl-chloroformate);
f. Ethyl bromoacetate;
g. Xylyl bromide;
h. Benzyl bromide;
i. Benzyl iodide;
j. Bromo acetone;
k. Cyanogen bromide;
l. Bromo methylethylketone;
m. Chloro acetone;
n. Ethyl iodoacetate;
o. Iodo acetone;
p. Chloropicrin.

Note 4 *The "technology", cultures of cells and biological systems listed in ML7.g., ML7.h.2. and ML7.i.3. are exclusive and these sub-items do not control "technology", cells or biological systems for civil purposes, such as agricultural, pharmaceutical, medical, veterinary, environmental, waste management, or in the food industry.*

Note 5
ML7.c. does not control tear gases or riot control agents individually packaged for personal self defence purposes.

Note 6
ML7.d., ML7.e. and ML7.f. control equipment specially designed or modified for military purposes.

N.B. See also entry 1.A.4. on the Dual-Use List.

ML 8. "Military explosives" and fuels**,** including propellants, and related substances, as follows:

a. Substances, as follows, and mixtures thereof:
1. Spherical aluminium powder (CAS 7429-90-5) with a particle size of 60 μm or

less, manufactured from material with an aluminium content of 99% or more;

2. Metal fuels in particle form whether spherical, atomized, spheroidal, flaked or ground, manufactured from material consisting of 99 % or more of any of the following:

a. Metals and mixtures thereof:

1. Beryllium (CAS 7440-41-7) in particle sizes of less than 60 μm;
2. Iron powder (CAS 7439-89-6) with particle size of 3 μm or less produced by reduction of iron oxide with hydrogen;

2. b. Mixtures, which contain any of the following:

1. Zirconium (CAS 7440-67-7), magnesium (CAS 7439-95-4) and alloys of these in particle sizes of less than 60 μm;
2. Boron (CAS 7440-42-8) or boron carbide (CAS 12069-32-8) fuels of 85% purity or higher and particle sizes of less than 60 μm;

3. Perchlorates, chlorates and chromates composited with powdered metal or other high energy fuel components;
4. Deleted (transferred to 1.C.11.d.)
5. Compounds composed of fluorine and any of the following: other halogens, oxygen, nitrogen;
6. Carboranes; decaborane(CAS 17702-41-9); pentaborane and derivatives thereof;
7. Cyclotetramethylenetetranitramine (CAS 2691-41-0) (HMX); octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazine; 1,3,5,7-tetranitro-1,3,5,7-tetraza-cyclooctane; (octogen, octogene);
8. Hexanitrostilbene (HNS) (CAS 20062-22-0);
9. Diaminotrinitrobenzene (DATB) (CAS 1630-08-6);
10. Triaminotrinitrobenzene (TATB) (CAS 3058-38-6);
11. Triaminoguanidinenitrate (TAGN) (CAS 4000-16-2);
12. Titanium subhydride of stoichiometry TiH 0.65-1.68;
13. Dinitroglycoluril (DNGU, DINGU) (CAS 55510-04-8); tetranitroglycoluril (TNGU, SORGUYL) (CAS 55510-03-7);
14. Tetranitrobenzotriazolobenzotriazole (TACOT) (CAS 25243-36-1);
15. Diaminohexanitrobiphenyl (DIPAM) (CAS 17215-44-0);
16. Picrylaminodinitropyridine (PYX) (CAS 38082-89-2);
17. 3-nitro-1,2,4-triazol-5-one (NTO or ONTA) (CAS 932-64-9);
18. Hydrazine (CAS 302-01-2) in concentrations of 70% or more; hydrazine nitrate (CAS 37836-27-4); hydrazine perchlorate (CAS 27978-54-7); unsymmetrical dimethyl hydrazine (CAS 57-14-7); monomethyl (CAS 60-34-4) hydrazine; symmetrical dimethyl hydrazine (CAS 540-73-8);
19. Ammonium perchlorate (CAS 7790-98-9);

20. Cyclotrimethylenetrinitramine (RDX) (CAS 121-82-4) ; cyclonite; T4; hexahydro-1,3,5-trinitro-1,3,5-triazine; 1,3,5-trinitro-1,3,5-triaza-cyclohexane (hexogen, hexogene);

ML8. a. 21. Hydroxylammonium nitrate (HAN) (CAS 13465-08-2); hydroxylammonium perchlorate (HAP) (CAS 15588-62-2);

22. 2-(5-cyanotetrazolato) penta amine-cobalt (III) perchlorate (or CP) (CAS 70247-32-4);
23. cis-bis (5-nitrotetrazolato) tetra amine-cobalt (III) perchlorate (or BNCP);
24. 7-Amino-4,6-dinitrobenzofurazane-1-oxide (ADNBF) (CAS 97096-78-1); amino dinitrobenzofuroxan;
25. 5,7-diamino-4,6-dinitrobenzofurazane-1-oxide (CAS 117907-74-1), (CL-14 or diamino dinitrobenzofuroxan);
26. 2,4,6-trinitro-2,4,6-triazacyclohexanone (K-6 or Keto-RDX) (CAS 115029-35-1);
27. 2,4,6,8-tetranitro-2,4,6,8-tetraazabicyclo [3,3,0]-octanone-3 (CAS 130256-72-3) (tetranitrosemiglycouril, K-55 or keto-bicyclic HMX);
28. 1,1,3-trinitroazetidine (TNAZ) (CAS 97645-24-4);
29. 1,4,5,8-tetranitro-1,4,5,8-tetraazadecalin (TNAD) (CAS 135877-16-6);
30. Hexanitrohexaazaisowurtzitane (CAS 135285-90-4) (CL-20 or HNIW); and chlathrates of CL-20;
31. Polynitrocubanes with more than four nitro groups;
32. Ammonium dinitramide (ADN or SR 12) (CAS 140456-78-6);
33. Trinitrophenylmethylnitramine (tetryl) (CAS 479-45-8);

ML8. b. Explosives and propellants that meet the following performance parameters:

1. Any explosive with a detonation velocity exceeding 8,700 m/s or a detonation pressure exceeding 34 GPa (340 kbar);
2. Other organic explosives not listed in ML8. yielding detonation pressures of 25 GPa (250 kbar) or more that will remain stable at temperatures of 523 K (250°C) or higher for periods of 5 minutes or longer;
3. Any other United Nations (UN) Class 1.1 solid propellant not listed in ML8. with a theoretical specific impulse (under standard conditions) of more than 250 s for non-metallised, or more than 270 s for aluminised compositions;
4. Any UN Class 1.3 solid propellant with a theoretical specific impulse of more than 230 s for non-halogenised, 250 s for non-metallised and 266 s for metallised compositions;

5. Any other gun propellants not listed in ML8. having a force constant of more than 1,200 kJ/kg;
6. Any other explosive, propellant or pyrotechnic not listed in ML8. that can sustain a steady-state burning rate of more than 38 mm/s under standard conditions of 6.89 MPa (68.9 bar) pressure and 294 K (21°C); or
7. Elastomer modified cast double based propellants (EMCDB) with extensibility at maximum stress of more than 5% at 233 K (-40°C);

ML8. c. "Military pyrotechnics";

ML8. d. Other substances, as follows:
1. Aircraft fuels specially formulated for military purposes;
2. Military materials containing thickeners for hydrocarbon fuels specially formulated for use in flamethrowers or incendiary munitions, such as metal stearates or palmates (also known as octal) (CAS 637-12-7) and M1, M2, M3 thickeners;
3. Liquid oxidisers comprised of or containing inhibited red fuming nitric acid (IRFNA) (CAS 8007-58-7) or oxygen difluoride;

ML8. e. "Additives" and "precursors", as follows:
1. Azidomethylmethyloxetane (AMMO) and its polymers;
2. Basic copper salicylate (CAS 62320-94-9); lead salicylate (CAS 15748-73-9);
3. Bis(2,2-dinitropropyl) formal (CAS 5917-61-3) or Bis(2,2-dinitropropyl) acetal (CAS 5108-69-0);
4. Bis-(2-fluoro-2,2-dinitroethyl) formal (FEFO) (CAS 17003-79-1);
5. Bis-(2-hydroxyethyl) glycolamide (BHEGA) (CAS 17409-41-5);
6. Bis(2-methyl aziridinyl) methylamino phosphine oxide (Methyl BAPO) (CAS 85068-72-0);
7. Bisazidomethyloxetane and its polymers (CAS 17607-20-4);
8. Bischloromethyloxetane (BCMO) (CAS 142173-26-0);
9. Butadienenitrileoxide (BNO);
10. Butanetrioltrinitrate (BTTN) (CAS 6659-60-5);
11. Catocene (CAS 37206-42-1) (2,2-Bis-ethylferrocenyl propane); ferrocene carboxylic acids; N-butyl-ferrocene (CAS 319904-29-7); Butacene (CAS 125856-62-4) and other adducted polymer ferrocene derivatives;
12. Dinitroazetidine-t-butyl salt;
13. Energetic monomers, plasticisers and polymers containing nitro, azido, nitrate, nitraza or difluoroamino groups;

14. Poly-2,2,3,3,4,4-hexafluoropentane-1,5-diol formal (FPF-1);
15. Poly-2,4,4,5,5,6,6-heptafluoro-2-tri-fluoromethyl-3-oxaheptane-1,7-diol formal (FPF-3);
16. Glycidylazide Polymer (GAP) (CAS 143178-24-9) and its derivatives;
17. Hexabenzylhexaazaisowurtzitane (HBIW) (CAS 124782-15-6);
18. Hydroxyl terminated polybutadiene (HTPB) with a hydroxyl functionality equal to or greater than 2.2 and less than or equal to 2.4, a hydroxyl value of less than 0.77 meq/g, and a viscosity at 30°C of less than 47 poise (CAS 69102-90-5);
19. Superfine iron oxide (Fe203 hematite) with a specific surface area more than 250 m2/g and an average particle size of 0.003 µm or less (CAS 1309-37-1);
20. Lead beta-resorcylate (CAS 20936-32-7);
21. Lead stannate (CAS 12036-31-6), lead maleate (CAS 19136-34-6), lead citrate (CAS 14450-60-3);
22. Lead-copper chelates of beta-resorcylate or salicylates (CAS 68411-07-4);
23. Nitratomethylmethyloxetane or poly (3-Nitratomethyl, 3-methyl oxetane); (Poly-NIMMO) (NMMO) (CAS 84051-81-0);
24. 3-Nitraza-1,5-pentane diisocyanate (CAS 7406-61-9);

ML8. e. 25. N-Methyl-p-Nitroaniline (CAS 100-15-2);

26. Organo-metallic coupling agents, specifically:
   a. Neopentyl [diallyl] oxy, tri [dioctyl] phosphato titanate (CAS 103850-22-2); also known as titanium IV, 2,2[bis 2-propenolato-methyl, butanolato, tris (dioctyl) phosphato] (CAS 110438-25-0); or LICA 12 (CAS 103850-22-2);
   b. Titanium IV, [(2-propenolato-1) methyl, n-propanolatomethyl] butanolato-1, tris [dioctyl]pyrophosphate; or KR3538;
   c. Titanium IV, [(2-propenolato-1)methyl, n-propanolatomethyl] butanolato-1, tris (dioctyl)phosphate;
27. Polycyanodifluoroaminoethyleneoxide (PCDE);
28. Polyfunctional aziridine amides with isophthalic, trimesic (BITA or butylene imine trimesamide), isocyanuric or trimethyladipic backbone structures and 2-methyl or 2-ethyl substitutions on the aziridine ring;
29. Polyglycidylnitrate or poly (nitratomethyl oxirane); (Poly-GLYN) (PGN) (CAS 27814-48-8);
30. Polynitroorthocarbonates;
31. Propyleneimine, 2-methylaziridine (CAS 75-55-8);
32. Tetraacetyldibenzylhexaazaisowurtzitane (TAIW);
33. Tetraethylenepentaamineacrylonitrile (TEPAN) (CAS 68412-45-3); cyanoethylated

polyamines and their salts;

34. Tetraethylenepentaamineacrylonitrileglycidol (TEPANOL) (CAS 68412-46-4); cyanoethylated polyamines adducted with glycidol and their salts;
35. Triphenyl bismuth (TPB) (CAS 603-33-8);
36. Tris-1-(2-methyl)aziridinyl phosphine oxide (MAPO) (CAS 57-39-6); bis(2-methyl aziridinyl) 2-(2-hydroxypropanoxy) propylamino phosphine oxide (BOBBA 8); and other MAPO derivatives;
37. 1,2,3-Tris[1,2-bis(difluoroamino)ethoxy] propane (CAS 53159-39-0); tris vinoxy propane adduct (TVOPA);
38. 1,3,5-trichlorobenzene (CAS 108-70-3);
39. 1,2,4 trihydroxybutane (1,2,4-butanetriol);
40. 1,3,5,7 tetraacetyl-1,3,5,7,-tetraaza cyclo-octane (TAT) (CAS 41378-98-7);
41. 1,4,5,8 Tetraazadecalin (CAS 5409-42-7);
42. Low (less than 10,000) molecular weight, alcohol-functionalised, poly(epichlorohydrin); poly(epichlorohydrindiol) and triol.

Note 1 The military explosives and fuels containing the metals or alloys listed in ML8.a.1. and ML8.a.2. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.

See also entry 1.C.11. on the Dual-Use List.

Note 2 ML8. does not control boron and boron carbide enriched with boron-10 (20% or more of total boron-10 content).

Note 3 Aircraft fuels controlled by ML8.d.1. are finished products not their constituents.

Note 4 ML8. does not control perforators specially designed for oil well logging.

Note 5 ML8. does not control the following substances when not compounded or mixed with military explosives or powdered metals:

a. Ammonium picrate;
b. Black powder;
c. Hexanitrodiphenylamine;
d. Difluoroamine (HNF2);
e. Nitrostarch;
f. Potassium nitrate;
g. Tetranitronaphthalene;

h. Trinitroanisol;

i. Trinitronaphthalene;

j. Trinitroxylene;

k. Fuming nitric acid non-inhibited and not enriched;

l. Acetylene;

m Propane;

n. Liquid oxygen;

o. Hydrogen peroxide in concentrations of less than 85%;

p. Misch metal;

q N-pyrrolidinone; 1-methyl-2-pyrrolidinone;

r. Dioctylmaleate;

s. Ethylhexylacrylate;

t. Triethylaluminium (TEA), trimethylaluminium (TMA), and other pyrophoric metal alkyls and aryls of lithium, sodium, magnesium, zinc and boron;

u. Nitrocellulose;

v. Nitroglycerin (or glyceroltrinitrate, trinitroglycerine) (NG);

w. 2,4,6-trinitrotoluene (TNT);

x. Ethylenediaminedinitrate (EDDN);

y. Pentaerythritoltetranitrate (PETN);

aa. Lead azide, normal and basic lead styphnate, and primary explosives or priming compositions containing azides or azide complexes;

bb. Triethyleneglycoldinitrate (TEGDN);

cc. 2,4,6-trinitroresorcinol (styphnic acid);

dd. Diethyldiphenyl urea; dimethylidiphenyl urea; methylethyldiphenyl urea [Centralites];

ee. N,N-diphenylurea (unsymmetrical diphenylurea);

ff. Methyl-N,N-diphenylurea (methyl unsymmetrical diphenylurea);

gg. Ethyl-N,N-diphenylurea (ethyl unsymmetrical diphenylurea);

hh. 2-Nitrodiphenylamine (2-NDPA);

ii. 4-Nitrodiphenylamine (4-NDPA);

jj. 2,2-dinitropropanol;

*kk. Chlorine trifluoride***.**

ML9. Vessels of war, special naval equipment and accessories, as follows, and components therefor, specially designed for military use:

a. Combatant vessels and vessels (surface or underwater) specially designed or modified for offensive or defensive action, whether or not converted to non-military use, regardless of current state of repair or operating condition, and whether or not they contain weapon delivery systems or armour, and hulls or parts of hulls for such vessels;

b. Engines, as follows:

1. Diesel engines specially designed for submarines with both of the following characteristics:
   a. A power output of 1.12 MW (1,500 hp.) or more; <u>and</u>
   b. A rotary speed of 700 rpm or more;
2. Electric motors specially designed for submarines having all of the following characteristics:
   a. A power output of more than 0.75 MW (1,000 hp.);
   b. Quick reversing;
   c. Liquid cooled; <u>and</u>
   d. Totally enclosed;
3. Non-magnetic diesel engines specially designed for military use with a power output of 37.3 kW (50 hp.) or more and with a non-magnetic content in excess of 75% of total mass;

c. Underwater detection devices specially designed for military use and controls thereof;

d. Submarine and torpedo nets;

e. Equipment for guidance and navigation specially designed for military use;

f. Hull penetrators and connectors specially designed for military use that enable interaction with equipment external to a vessel;

<u>Note</u> *ML9.f. includes connectors for vessels which are of the single-conductor, multi-conductor, coaxial or waveguide type, and hull penetrators for vessels, both of which are capable of remaining impervious to leakage from without and of retaining required characteristics at marine depths exceeding 100 m; and fibre-optic connectors and optical hull penetrators specially designed for "laser" beam transmission regardless of depth. It does not include ordinary propulsive shaft and hydrodynamic control-rod hull penetrators.*

g. Silent bearings, with gas or magnetic suspension, active signature or vibration suppression controls, and equipment containing those bearings, specially designed for military use.

ML10. "Aircraft", unmanned airborne vehicles, aero-engines and "aircraft" equipment, related equipment and components, specially designed or modified for military use, as follows:

a. Combat "aircraft" and specially designed components therefor;

b. Other "aircraft" specially designed or modified for military use, including military reconnaissance, assault, military training, transporting and airdropping troops or military equipment, logistics support, and specially designed components therefor;

c. Aero-engines specially designed or modified for military use, and specially designed components therefor;

d. Unmanned airborne vehicles and related equipment, specially designed or modified for military use, as follows, and specially designed components therefor:

1. Unmanned airborne vehicles including remotely piloted air vehicles (RPVs) and autonomous programmable vehicles;
2. Associated launchers and ground support equipment;
3. Related equipment for command and control.

e. Airborne equipment, including airborne refuelling equipment, specially designed for use with the "aircraft" controlled by ML10.a. or ML10.b. or the aero-engines controlled by ML10.c., and specially designed components therefor;

f. Pressure refuellers, pressure refuelling equipment, equipment specially designed to facilitate operations in confined areas and ground equipment, developed specially for "aircraft" controlled by ML10.a. or ML10.b., or for aero-engines controlled by ML10.c.;

g. Pressurised breathing equipment and partial pressure suits for use in "aircraft", anti-g suits, military crash helmets and protective masks, liquid oxygen converters used for "aircraft" or missiles, and catapults and cartridge actuated devices for emergency escape of personnel from "aircraft";

h. Parachutes used for combat personnel, cargo dropping or "aircraft" deceleration, as follows:

1. Parachutes for:
   a. Pin point dropping of rangers;
   b. Dropping of paratroopers;
2. Cargo parachutes;
3. Paragliders**,** drag parachutes, drogue parachutes for stabilisation and attitude control of dropping bodies, (e.g. recovery capsules, ejection seats, bombs);
4. Drogue parachutes for use with ejection seat systems for deployment and inflation sequence regulation of emergency parachutes;
5. Recovery parachutes for guided missiles, drones or space vehicles;
6. Approach parachutes and landing deceleration parachutes;
7. Other military parachutes;

ML10. i. Automatic piloting systems for parachuted loads; equipment specially designed or modified for military use for controlled opening jumps at any height, including oxygen equipment.

Note 1 ML10.b. does not control "aircraft" or variants of those "aircraft" specially designed for military use which:

a. Are not configured for military use and are not fitted with equipment or attachments specially designed or modified for military use; and

b. Have been certified for civil use by the civil aviation authority in a participating state.

Note 2 ML10.c. does not control:

a. Aero-engines designed or modified for military use which have been certified by civil aviation authorities in a participating state for use in "civil aircraft", or specially designed components therefor;

b. Reciprocating engines or specially designed components therefor.

Note 3 The control in ML10.b. and ML10.c. on specially designed components and related equipment for non-military "aircraft" or aero-engines modified for military use applies only to those military components and to military related equipment required for the modification to military use.

ML11. Electronic equipment, not controlled elsewhere on the Munitions List, specially designed for military use and specially designed components therefor.

Note ML11. includes:

a. Electronic countermeasure and electronic counter-countermeasure equipment (i.e., equipment designed to introduce extraneous or erroneous signals into radar or radio communication receivers or otherwise hinder the reception, operation or effectiveness of adversary electronic receivers including their countermeasure equipment), including jamming and counter-jamming equipment;
b. Frequency agile tubes;
c. Electronic systems or equipment designed either for surveillance and monitoring of the electro-magnetic spectrum for military intelligence or security purposes or for counteracting such surveillance and monitoring;
d. Underwater countermeasures, including acoustic and magnetic jamming and decoy, equipment designed to introduce extraneous or erroneous signals into sonar receivers;
e. Data processing security equipment, data security equipment and transmission and signalling line security equipment, using ciphering processes;
f. Identification, authentification and keyloader equipment and key management, manufacturing and distribution equipment.

ML12. High velocity kinetic energy weapon systems and related equipment, as follows, and specially designed components therefor:

a. Kinetic energy weapon systems specially designed for destruction or effecting mission-abort of a target;

b. Specially designed test and evaluation facilities and test models, including diagnostic instrumentation and targets, for dynamic testing of kinetic energy projectiles and systems.

N.B. For weapon systems using sub-calibre ammunition or employing solely chemical propulsion, and ammunition therefor, see ML1. to ML4.

Note 1 *ML12. includes the following when specially designed for kinetic energy weapon systems:*

a. Launch propulsion systems capable of accelerating masses larger than 0.1 g to velocities in excess of 1.6 km/s, in single or rapid fire modes;

b. Prime power generation, electric armour, energy storage, thermal management, conditioning, switching or fuel-handling equipment; and electrical interfaces between power supply, gun and other turret electric drive functions;

c. Target acquisition, tracking, fire control or damage assessment systems;

d. Homing seeker, guidance or divert propulsion (lateral acceleration) systems for projectiles.

Note 2 *ML12. controls weapon systems using any of the following methods of propulsion:*

a. Electromagnetic;

b. Electrothermal;

c. Plasma;

d. Light gas; or

e. Chemical (when used in combination with any of the above).

Note 3 *ML12. does not control "technology" for magnetic induction for continuous propulsion of civil transport devices.*

ML13. Armoured or protective equipment and constructions and components, as follows:

a. Armoured plate as follows:

1. Manufactured to comply with a military standard or specification; or
2. Suitable for military use;

b. Constructions of metallic or non-metallic materials or combinations thereof specially designed to provide ballistic protection for military systems, and specially designed components therefor;

c. Military helmets;

d. Body armour and flak suits manufactured according to military standards or specifications, or equivalent, and specially designed components therefor.

<u>Note 1</u> ML13.b. includes materials specially designed to form explosive reactive armour or to construct military shelters.

<u>Note 2</u> ML13.c. does not control conventional steel helmets, neither modified or designed to accept, nor equipped with any type of accessory device.

<u>Note 3</u> ML13.d. does not control individual suits of body armour for personal protection and accessories therefor when accompanying their users .

<u>N.B.</u> See also entry 1.A.5. on the Dual-Use List.

ML14. Specialised equipment for military training or for simulating military scenarios and specially designed components and accessories therefor.

<u>Technical Note</u>

The term 'specialised equipment for military training' includes military types of attack trainers, operational flight trainers, radar target trainers, radar target generators, gunnery training devices, anti-submarine warfare trainers, flight simulators (including human-rated centrifuges for pilot/astronaut training), radar trainers, instrument flight trainers, navigation trainers, missile launch trainers, target equipment, drone "aircraft", armament trainers, pilotless "aircraft" trainers and mobile training units.

<u>Note</u> ML14. includes image generating and interactive environment systems for simulators when specially designed or modified for military use.

ML15. Imaging or countermeasure equipment, as follows, specially designed for military use, and specially designed components and accessories therefor:

a. Recorders and image processing equipment;
b. Cameras, photographic equipment and film processing equipment;
c. Image intensifier equipment;
d. Infrared or thermal imaging equipment;
e. Imaging radar sensor equipment;

f. Countermeasure or counter-countermeasure equipment for the equipment controlled by sub-items ML15.a. to ML15.e.

Note ML15.f. includes equipment designed to degrade the operation or effectiveness of military imaging systems or to minimize such degrading effects.

Note 1 The term 'specially designed components' includes the following when specially designed for military use:

a. Infrared image converter tubes;

b. Image intensifier tubes (other than first generation);

c. Microchannel plates;

d. Low-light-level television camera tubes;

e. Detector arrays (including electronic interconnection or read out systems);

f. Pyroelectric television camera tubes;

g. Cooling systems for imaging systems;

h. Electrically triggered shutters of the photochromic or electro-optical type having a shutter speed of less than 100 μs, except in the case of shutters which are an essential part of a high speed camera;

i. Fibre optic image inverters;

j. Compound semiconductor photocathodes.

Note 2 ML15 does not control "first generation image intensifier tubes" or equipment specially designed to incorporate "first generation image intensifier tubes".

N.B. For the status of weapons sights incorporating "first generation image intensifer tubes" see entries ML1., ML2. and ML5.a.

N.B. See also entries 6.A.2.a.2. and 6.A.2.b. on the Dual-Use List.

ML16. Forgings, castings and other unfinished products the use of which in a controlled product is identifiable by material composition, geometry or function, and which are specially designed for any products controlled by ML1.to ML4., ML6., ML9., ML10., ML12. or ML19.

ML17. Miscellaneous equipment, materials and libraries, as follows, and specially designed components therefor:

a. Self-contained diving and underwater swimming apparatus, as follows:

1. Closed or semi-closed circuit (rebreathing) apparatus specially designed for military use (i.e. specially designed to be non magnetic);
2. Specially designed components for use in the conversion of open-circuit apparatus to military use;
3. Articles designed exclusively for military use with self-contained diving and underwater swimming apparatus;

b. Construction equipment specially designed for military use;

c. Fittings, coatings and treatments for signature suppression, specially designed for military use;

d. Field engineer equipment specially designed for use in a combat zone;

e. "Robots", "robot" controllers and "robot" "end-effectors", having any of the following characteristics:

1. Specially designed for military use;
2. Incorporating means of protecting hydraulic lines against externally induced punctures caused by ballistic fragments (e.g., incorporating self-sealing lines) and designed to use hydraulic fluids with flash points higher than 839 K (566°C); <u>or</u>
3. Specially designed or rated for operating in an electro-magnetic pulse (EMP) environment;

f. Libraries (parametric technical databases) specially designed for military use with equipment controlled by the Munitions List;

g. Nuclear power generating equipment or propulsion equipment, including "nuclear reactors", specially designed for military use and components therefor specially designed or modified for military use;

h. Equipment and material, coated or treated for signature suppression, specially designed for military use, other than those controlled elsewhere in the Munitions List;

i. Simulators specially designed for military "nuclear reactors";

j. Mobile repair shops specially designed to service military equipment;

k. Field generators specially designed for military use;

l. Containers specially designed for military use;

m. Bridges specially designed for military use.

Technical Note

For the purpose of ML17., the term 'library' (parametric technical database) means a collection of technical information of a military nature, reference to which may enhance the performance of military equipment or systems.

ML18. Equipment and "technology" for the production of products referred to in the Munitions List, as follows:

a. Specially designed or modified production equipment for the production of products controlled by the Munitions List, and specially designed components therefor;

b. Specially designed environmental test facilities and specially designed equipment therefor, for the certification, qualification or testing of products controlled by the Munitions List;

c. Specific production "technology", even if the equipment with which such "technology" is to be used is not controlled;

d. "Technology" specific to the design of, the assembly of components into, and the operation, maintenance and repair of complete production installations even if the components themselves are not controlled.

Note 1 ML18.a. and ML18.b. include the following equipment:

a. Continuous nitrators;

b. Centrifugal testing apparatus or equipment having any of the following characteristics:

1. Driven by a motor or motors having a total rated horsepower of more than 298 kW (400 hp);

2. Capable of carrying a payload of 113 kg or more; or

3. Capable of exerting a centrifugal acceleration of 8 g or more on *a payload of 91 kg or more;*

c. Dehydration presses;

d. Screw extruders specially designed or modified for military explosive extrusion;

e. Cutting machines for the sizing of extruded propellants;

f. Sweetie barrels (tumblers) 1.85 m or more in diameter and having over 227 kg product capacity;

g. Continuous mixers for solid propellants;

h. Fluid energy mills for grinding or milling the ingredients of military explosives;

i. Equipment to achieve both sphericity and uniform particle size in metal powder listed in ML8.a.1.;

j. Convection current converters for the conversion of materials listed in ML8.a.6.

Technical Note

For the purposes of ML18., the term 'production' includes design, examination, manufacture, testing and checking.

ML18. *Note 2*

a. The term 'products referred to in the Munitions List' includes:

1. Products not controlled if inferior to specified concentrations as follows:

a. hydrazine (see ML8.a.18.);

b. "Military explosives" (see ML8.);

2. Products not controlled if inferior to technical limits, (i.e., "superconductive" materials not controlled by 1.C.5. on the Dual-Use List; "superconductive" electromagnets not controlled by 3.A.1.e.3. on the Dual-Use List; "superconductive" electrical equipment excluded from control under ML20.b.);

3. Metal fuels and oxidants deposited in laminar form from the vapour phase (see ML8.a.2.);

b. The term 'products referred to in the Munitions List' does not include:

1. Signal pistols (see ML2.b.);

2. The substances excluded from control under Note 3 to ML7.;

3. Personal radiation monitoring dosimeters (see ML7.f.) and masks *for protection against specific industrial hazards, see also Dual-Use List;*

4. *Acetylene, propane, liquid oxygen, difluoramine (HNF2), fuming nitric acid and potassium nitrate powder (see Note 5 to ML8.);*
5. *Aero-engines excluded from control under ML10.;*
6. *Conventional steel helmets not equipped with, or modified or designed to accept, any type of accessory device (see Note 2 to ML13.);*
7. *Equipment fitted with industrial machinery, which is not controlled such as coating machinery not elsewhere specified and equipment for the casting of plastics;*
8. *Muskets, rifles and carbines dated earlier than 1938, reproductions of muskets, rifles and carbines dated earlier than 1890, revolvers, pistols and machine guns dated earlier than 1890, and their reproductions;*

Note 3 Note 2.b.8. of ML18. does not release from controls "technology" or production equipment for non-antique small arms, even if used to produce reproductions of antique small arms.

Note 4 ML18.d. does not control "technology" for civil purposes, such as agricultural, pharmaceutical, medical, veterinary, environmental, waste management, or in the food industry.

N.B. See Note 4 to ML7.

ML19. Directed energy weapon systems (DEW), related or countermeasure equipment and test models, as follows, and specially designed components therefor:

a. "Laser" systems specially designed for destruction or effecting mission-abort of a target;

b. Particle beam systems capable of destruction or effecting mission-abort of a target;

c. High power radio-frequency (RF) systems capable of destruction or effecting mission-abort of a target;

d. Equipment specially designed for the detection or identification of, or defence against, systems controlled by ML19.a. to ML19.c.;

e. Physical test models and related test results for the systems, equipment and components controlled by this Item.

f. Continuous wave or pulsed "laser" systems specially designed to cause permanent blindness to unenhanced vision, i.e., to the naked eye or to the eye with corrective eyesight devices.

Note 1 *Directed energy weapon systems controlled by ML19. include systems whose capability is derived from the controlled application of:*

a. "Lasers" of sufficient continuous wave or pulsed power to effect destruction similar to the manner of conventional ammunition;

b. Particle accelerators which project a charged or neutral particle beam with destructive power;

c. High pulsed power or high average power radio frequency beam transmitters which produce fields sufficiently intense to disable electronic circuitry at a distant target.

Note 2 *ML19. includes the following when specially designed for directed energy weapon systems:*

a. Prime power generation, energy storage, switching, power conditioning or fuel-handling equipment;

b. Target acquisition or tracking systems;

c. Systems capable of assessing target damage, destruction or mission-abort;

d. Beam-handling, propagation or pointing equipment;

e. Equipment with rapid beam slew capability for rapid multiple target operations;

f. Adaptive optics and phase conjugators;

g. Current injectors for negative hydrogen ion beams;

h. "Space qualified" accelerator components;

i. Negative ion beam funnelling equipment;

j. Equipment for controlling and slewing a high energy ion beam;

k. "Space qualified" foils for neutralising negative hydrogen isotope beams.

ML20. Cryogenic and "superconductive" equipment, as follows, and specially designed components and accessories therefor:

a. Equipment specially designed or configured to be installed in a vehicle for military ground, marine, airborne or space applications, capable of operating while in motion and of producing or maintaining temperatures below 103 K (170°C);

<u>Note</u> ML20.a. includes mobile systems incorporating or employing accessories or components manufactured from non-metallic or non-electrical conductive materials, such as plastics or epoxy-impregnated materials.

b. "Superconductive" electrical equipment (rotating machinery and transformers) specially designed or configured to be installed in a vehicle for military ground, marine, airborne or space applications, capable of operating while in motion.

<u>Note</u> ML20.b. does not control direct-current hybrid homopolar generators that have single-pole normal metal armatures which rotate in a magnetic field produced by superconducting windings, provided those windings are the only superconducting component in the generator.

ML21. "Software", as follows:

a. "Software" specially designed or modified for the "development", "production" or "use" of equipment or materials controlled by the Munitions List;

b. Specific "software", as follows:
1. "Software" specially designed for:
   a. Modelling, simulation or evaluation of military weapon systems;
   b. "Development", monitoring, maintenance or up-dating of "software" embedded in military weapon systems;
   c. Modelling or simulating military operation scenarios, not controlled by ML14.;
   d. Command, Communications, Control and Intelligence (C3I) applications;
2. "Software" for determining the effects of conventional, nuclear, chemical or biological warfare weapons.
3. "Software", not controlled by ML21.a., b.1. or b.2., specially designed or modified to enable equipment not controlled by the Munitions List to perform the military functions of equipment controlled by ML5., ML7.f., ML9.c., ML9.e., ML10.e., ML11., ML14., ML15., ML17.i., or ML18.

ML22. "Technology" according to the General Technology Note of the Munitions List for the "development", "production" or "use" of items controlled in the Munitions List, other than that "technology" controlled in ML7. and ML18.

DEFINITIONS OF TERMS USED IN THESE LISTS

This document contains the definitions of the terms used in these Lists, in alphabetical order.

Note 1 Definitions apply throughout the Lists and their Annexes. The references are purely advisory and have no effect on the universal application of defined terms throughout these Lists and their Annexes.

Note 2 Words and terms contained in the List of Definitions only take the defined meaning where this is indicated by their being enclosed in quotations marks (" "). Elsewhere, words and terms take their commonly accepted (dictionary) meanings, unless a local definition for a particular control is given. (See also 'Statements of Understanding and Validity Notes Definition of Terms used in these Lists').

Cat 2 "Accuracy"
Cat 6 (Usually measured in terms of inaccuracy) is the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value.

Cat 7 "Active flight control systems"
Function to prevent undesirable "aircraft" and missile motions or structural loads by autonomously processing outputs from multiple sensors and then providing necessary preventive commands to effect automatic control.

Cat 6 "Active pixel"
Cat 8 A minimum (single) element of the solid state array which has a photoelectric transfer function when exposed to light (electromagnetic) radiation.

Cat 1 "Adapted for use in war"
ML 7 Any modification or selection (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) designed to increase the effectiveness in producing casualties in humans or animals, degrading equipment or damaging crops or the environment.

Cat 2 "Adaptive control"
A control system that adjusts the response from conditions detected during the operation (Reference: ISO 2806-1980).

ML8. "Additives"
Substances used in explosive formulations to improve their properties.

Cat 1 "Aircraft"
Cat 7 & 9 A fixed wing, swivel wing, rotary wing (helicopter), tilt rotor or tilt-
ML 8, 9 & 10 wing airborne vehicle.

Cat 2 "All compensations available"
"All compensations available" means after all feasible measures available to the manufacturer to minimise all systematic positioning errors for the particular machine-tool model are considered.

Cat 2 "Angular position deviation"

The maximum difference between angular position and the actual, very accurately measured angular position after the workpiece mount of the table has been turned out of its initial position. (Reference: VDI/VDE 2617, Draft: 'Rotary tables on coordinate measuring machines').

Cat 5 "Asymmetric algorithm "

A cryptographic algorithm using different, mathematically-related keys for encryption and decryption.

Technical Note

A common use of "asymmetric algorithms" is key management.

Cat 5 "Asynchronous transfer mode" ("ATM")

A transfer mode in which the information is organised into cells; it is asynchronous in the sense that the recurrence of cells depends on the required or instantaneous bit rate.

Cat 5 "ATM"

"ATM" is equivalent to "Asynchronous transfer mode".

Cat 6 "Automatic target tracking"

A processing technique that automatically determines and provides as output an extrapolated value of the most probable position of the target in real time.

Cat 3 "Basic gate propagation delay time"

The propagation delay time value corresponding to the basic gate used in a "monolithic integrated circuit". For a 'family' of "monolithic integrated circuits", this may be specified either as the propagation delay time per typical gate within the given 'family' or as the typical propagation delay time per gate within the given 'family'.

Technical Notes

1. *"Basic gate propagation delay time" is not to be confused with the input/output delay time of a complex "monolithic integrated circuit".*
2. *'Family' consists of all integrated circuits to which all of the following are applied as their manufacturing methodology and specifications except their respective functions:*

a. The common hardware and software architecture;

b. The common design and process technology; <u>and</u>
c. The common basic characteristics.

GTN "Basic scientific research"

Experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena or observable facts, not primarily directed towards a specific practical aim or objective.

Cat 7 "Bias" (accelerometer)

An accelerometer output when no acceleration is applied.

ML 7 "Biocatalysts"

Enzymes for specific chemical or biochemical reactions or other biological compounds which bind to and accelerate the degradation of CW agents.

<u>Technical Note</u>

'Enzymes' means "biocatalysts" for specific chemical or biochemical reactions.

ML 7 "Biopolymers"

Biological macromolecules as follows:

a. Enzymes for specific chemical or biochemical reactions;
b. Antibodies, monoclonal, polyclonal or anti-idiotypic;
c. Specially designed or specially processed receptors;

<u>Technical Notes</u>

1. *'Anti-idiotypic antibodies' means antibodies which bind to the specific antigen binding sites of other antibodies;*
2. *'Monoclonal antibodies' means proteins which bind to one antigenic site and are produced by a single clone of cells;*
3. *'Polyclonal antibodies' means a mixture of proteins which bind to the specific antigen and are produced by more than one clone of cells;*
4. *'Receptors' means biological macromolecular structures capable of binding ligands, the binding of which affects physiological functions.*

Cat 2 "Camming" (axial displacement)

Axial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle faceplate, at a point next to the circumference of the spindle faceplate (Reference: ISO 230/1 1986, paragraph 5.63).

Cat 1 "Carbon fibre preforms"
An ordered arrangement of uncoated or coated fibres intended to constitute a framework of a part before the "matrix" is introduced to form a "composite".

Cat 4 "CE"
"CE" is equivalent to "computing element".

Cat 6 "Chemical Laser"
A "laser" in which the excited species is produced by the output energy from a chemical reaction.

"Circuit element"
A single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.

Cat 7 "Circulation-controlled anti-torque or circulation-controlled direction control systems"
Control systems using air blown over aerodynamic surfaces to increase or control the forces generated by the surfaces.

Cat 1 "Civil aircraft"
Cat 7 Those "aircraft" listed by designation in published airworthiness
Cat 9 certification lists by the civil aviation authorities to fly commercial civil
ML 10 internal and external routes or for legitimate civil, private or business use.

Cat 1 "Commingled"
Filament to filament blending of thermoplastic fibres and reinforcement fibres in order to produce a fibre reinforcement "matrix" mix in total fibre form.

Cat 1 "Comminution"
A process to reduce a material to particles by crushing or grinding.

Cat 5 "Common channel signalling"
A signalling method in which a single channel between exchanges conveys, by means of labelled messages, signalling information relating to a multiplicity of circuits or calls and other information such as that used for network management.

Cat 4 "Communications channel controller"

The physical interface which controls the flow of synchronous or asynchronous digital information. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

Cat 1 "Composite"
Cat 2 A "matrix" and an additional phase or additional phases consisting of
Cat 6 particles, whiskers, fibres or any combination thereof, present for a
Cat 8 & 9 specific purpose or purposes.

Cat 3 "Composite theoretical performance" ("CTP")
Cat 4 A measure of computational performance given in millions of theoretical operations per second (Mtops), calculated using the aggregation of "computing elements"

N.B. See Category 4, Technical Note.

Cat 2 "Compound rotary table"

A table allowing the workpiece to rotate and tilt about two non-parallel axes, which can be coordinated simultaneously for "contouring control".

Cat 4 "Computing element" ("CE")

The smallest computational unit that produces an arithmetic or logic result.

Cat 2 "Contouring control"

Two or more "numerically controlled" motions operating in accordance with instructions that specify the next required position and the required feed rates to that position. These feed rates are varied in relation to each other so that a desired contour is generated (Ref. ISO/DIS 2806 - 1980).

Cat 1 "Critical temperature"
Cat 3 (sometimes referred to as the transition temperature) of a specific
Cat 6 "superconductive" material is the temperature at which the material loses all resistance to the flow of direct electrical current.

Cat 5 "Cryptography"

The discipline which embodies principles, means and methods for the transformation of data in order to hide its information content, prevent its undetected modification or prevent its unauthorized use. "Cryptography" is limited to the transformation of information using one or more secret parameters (e.g., crypto variables) or associated key management.

Technical Note

'Secret parameter': a constant or key kept from the knowledge of others or shared only within a group.

Cat 3 "CTP"

Cat 4 "CTP" is equivalent to "Composite theoretical performance".

Cat 5 "Data signalling rate"

The rate, as defined in ITU Recommendation 53-36, taking into account that, for non-binary modulation, baud and bit per second are not equal. Bits for coding, checking and synchronisation functions are to be included.

Note When determining the "data signalling rate", servicing and administrative channels shall be excluded.

Technical Note

It is the maximum one-way rate, i.e., the maximum rate in either transmission or reception.

Cat 6 "Deformable Mirrors"

Mirrors:

a. Having a single continuous optical reflecting surface which is dynamically deformed by the application of individual torques or forces to compensate for distortions in the optical waveform incident upon the mirror; or
b. Having multiple optical reflecting elements that can be individually and dynamically repositioned by the application of torques or forces to compensate for distortions in the optical waveform incident upon the mirror.

"Deformable mirrors" are also known as adaptive optic mirrors.

GTN "Development"

Both Is related to all stages prior to serial production, such as: design, design

Lists research, design analyses, design concepts, assembly and testing of prototypes, pilot production schemes, design data, process of transforming design data into a product, configuration design, integration design, layouts.

Cat 1 "Diffusion bonding"

Cat 2 A solid state molecular joining of at least two separate metals into a
Cat 9 single piece with a joint strength equivalent to that of the weakest material.

Cat 4 "Digital computer"
Cat 5 Equipment which can, in the form of one or more discrete variables, perform all of the following:

a. Accept data;
b. Store data or instructions in fixed or alterable (writable) storage devices;
c. Process data by means of a stored sequence of instructions which is modifiable; and
d. Provide output of data.

Technical Note

Modifications of a stored sequence of instructions include replacement of fixed storage devices, but not a physical change in wiring or interconnections.

Cat 5 "Digital transfer rate"

The total bit rate of the information that is directly transferred on any type of medium. (See also "total digital transfer rate").

Cat 2 "Direct-acting hydraulic pressing"

A deformation process which uses a fluid-filled flexible bladder in direct contact with the workpiece.

"Discrete component"

A separately packaged "circuit element" with its own external connections.

Cat 7 "Drift rate" (gyro)

The time rate of output deviation from the desired output. It consists of random and systematic components and is expressed as an equivalent input angular displacement per unit time with respect to inertial space.

Cat 5 "Dynamic adaptive routing"

Automatic rerouting of traffic based on sensing and analysis of current actual network conditions.

Note This does not include cases of routing decisions taken on predefined information.

Cat 3 "Dynamic signal analysers"

"Signal analysers" which use digital sampling and tranformation techniques to form a Fourier spectrum display of the given waveform including amplitude and phase information.

Cat 1 "Effective gram"

"Effective gram" for plutonium isotope is defined as the isotope weight in grams.

Cat 5 "Electronically steerable phased array antenna"

Cat 6 An antenna which forms a beam by means of phase coupling, (i.e., the beam direction is controlled by the complex excitation coefficients of the radiating elements) and the direction of that beam can be varied (both in transmission and reception) in azimuth or in elevation, or both, by application of an electrical signal.

Cat 3 "Electronic assembly"

Cat 4 A number of electronic components (i.e., "circuit elements", "discrete

Cat 5 components", integrated circuits, etc.) connected together to perform (a) specific function(s), replaceable as an entity and normally capable of being disassembled.

Cat 2 "End-effectors"

ML 17 Grippers, active tooling units and any other tooling that is attached to the base-plate on the end of a "robot" manipulator arm.

Technical Note

'Active tooling units' are devices for applying motive power, process energy or sensing to a workpiece.

Cat 6 "Equivalent Density"

The mass of an optic per unit optical area projected onto the optical surface.

Cat 4 "Expert systems"

Cat 7 Systems providing results by application of rules to data which are stored independently of the "programme" and capable of any of the following:

a. Modifying automatically the "source code" introduced by the user;

b. Providing knowledge linked to a class of problems in quasi-natural language; or

c. Acquiring the knowledge required for their development (symbolic training).

ML 7 "Expression Vectors"

Carriers (e.g., plasmid or virus) used to introduce genetic material into host cells.

Cat 7 "FADEC"
Cat 9 Full Authority Digital Engine Control (FADEC) - an electronic control system for gas turbine or combined cycle engines utilising a digital computer to control the variables required to regulate engine thrust or shaft power output throughout the engine operating range from the beginning of fuel metering to fuel shutoff.

Cat 4 "Fault tolerance"

The capability of a computer system, after any malfunction of any of its hardware or "software" components, to continue to operate without human intervention, at a given level of service that provides continuity of operation, data integrity and recovery of service within a given time.

Cat 1 "Fibrous or filamentary materials"
Cat 8 Include:

a. Continuous monofilaments;
b. Continuous yarns and rovings;
c. Tapes, fabrics, random mats and braids;
d. Chopped fibres, staple fibres and coherent fibre blankets;
e. Whiskers, either monocrystalline or polycrystalline, of any length;
f. Aromatic polyamide pulp.

Cat 3 "Film type integrated circuit"

An array of "circuit elements" and metallic interconnections formed by deposition of a thick or thin film on an insulating "substrate".

ML 15 "First generation image intensifier tubes"

Electrostatically focused tubes, employing input and output fibre optic or glass face plates, multi-alkali photocathodes (S-20 or S-25), but not microchannel plate amplifiers.

Cat 5 "Fixed"

The coding or compression algorithm cannot accept externally supplied parameters (eg., cryptographic or key variables) and cannot be modified by the user.

Cat 7 "Flight control optical sensor array"

A network of distributed optical sensors, using "laser" beams, to provide real-time flight control data for on-board processing.

Cat 7 "Flight path optimization"

A procedure that minimizes deviations from a four-dimensional (space and time) desired trajectory based on maximizing performance or effectiveness for mission tasks.

Cat 6 "Focal plane array"

A linear or two-dimensional planar layer, or combination of planar layers, of individual detector elements, with or without readout electronics, which work in the focal plane.

Note This definition does not include a stack of single detector elements or any two, three or four element detectors provided time delay and integration is not performed within the element.

Cat 5 "Frequency hopping "

A form of "spread spectrum" in which the transmission frequency of a single communication channel is made to change by a random or pseudo-random sequence of discrete steps.

Cat 3 "Frequency switching time"

Cat 5 The maximum time (i.e., delay) taken by a signal, when switched from one selected output frequency to another selected output frequency, to reach any of the following:

a. A frequency within 100 Hz of the final frequency; or

b. An output level within 1 dB of the final output level.

Cat 3 "Frequency synthesiser"

Any kind of frequency source or signal generator, regardless of the actual technique used, providing a multiplicity of simultaneous or alternative output frequencies, from one or more outputs, controlled by, derived from or disciplined by a lesser number of standard (or master) frequencies.

Cat 1 "Gas atomisation"

A process to reduce a molten stream of metal alloy to droplets of 500 μm diameter or less by a high pressure gas stream.

Cat 6 "Geographically dispersed"

Sensors are considered "geographically dispersed" when each location is distant from any other more than 1,500 m in any direction. Mobile sensors are always considered "geographically dispersed".

Cat 4 "Global interrupt latency time"

The time taken by the computer system to recognize an interrupt due to the event, service the interrupt and perform a context switch to an alternate memory-resident task waiting on the interrupt.

Cat 2 "Hot isostatic densification"

A process of pressurising a casting at temperatures exceeding 375 K (102°C) in a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal force in all directions to reduce or eliminate internal voids in the casting.

Cat 4 "Hybrid computer"

Equipment which can perform all of the following:

a. Accept data;

b. Process data, in both analogue and digital representations; and

c. Provide output of data.

Cat 3 "Hybrid integrated circuit"

Any combination of integrated circuit(s), or integrated circuit with "circuit elements" or "discrete components" connected together to perform (a) specific function(s), and having all of the following characteristics:

a. Containing at least one unencapsulated device;

b. Connected together using typical IC production methods;

c. Replaceable as an entity; and

d. Not normally capable of being disassembled.

Cat 4 "Image enhancement"

The processing of externally derived information-bearing images by algorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform). This does not include algorithms using only linear or rotational transformation of a single image, such as translation, feature extraction, registration or false coloration.

Cat 5 "Information security"

All the means and functions ensuring the accessibility, confidentiality or integrity of information or communications, excluding the means and functions intended to safeguard against malfunctions. This includes "cryptography", cryptanalysis, protection against compromising emanations and computer security.

Technical Note

'Cryptanalysis': the analysis of a cryptographic system or its inputs and outputs to derive confidential variables or sensitive data, including clear text. (ISO 7498-2-1988 (E), paragraph 3.3.18).

Cat 3 "Instantaneous bandwidth"

Cat 5 The bandwidth over which output power remains constant within 3 dB without adjustment of other operating parameters.

Cat 6 "Instrumented range"

The specified unambiguous display range of a radar.

Cat 6 "Interconnected radar sensors"

Two or more radar sensors are interconnected when they mutually exchange data in real time.

GTN "In the public domain"

GSN This means "technology" or "software" which has been made available without restrictions upon its further dissemination.

Note Copyright restrictions do not remove "technology" or "software" from being "in the public domain".

Cat 6 "Intrinsic magnetic gradiometer"

A single magnetic field gradient sensing element and associated electronics the output of which is a measure of magnetic field gradient.

Cat 2 "Isostatic presses"

Equipment capable of pressurising a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal pressure in all directions within the cavity upon a workpiece or material.

Cat 2, 3,5 "Laser"
6 & 9 An assembly of components which produce both spatially and
ML5, 9 & 23 temporally coherent light that is amplified by stimulated emission of radiation.

Cat 2 "Linearity"

(Usually measured in terms of non-linearity) is the maximum deviation of the actual characteristic (average of upscale and downscale readings), positive or negative, from a straight line so positioned as to equalise and minimise the maximum deviations.

Cat 4 "Local area network"

A data communication system having all of the following characteristics:

a. Allows an arbitrary number of independent data devices to communicate directly with each other; and
b. Is confined to a geographical area of moderate size (e.g., office building, plant, campus, warehouse).

Technical Note

'Data device' means equipment capable of transmitting or receiving sequences of digital information.

Cat 6 "Magnetic gradiometers"

Are designed to detect the spatial variation of magnetic fields from sources external to the instrument. They consist of multiple "magnetometers" and associated electronics the output of which is a measure of magnetic field gradient. (See also "Intrinsic Magnetic Gradiometer")

Cat 6 "Magnetometers"

Are designed to detect magnetic fields from sources external to the instrument. They consist of a single magnetic field sensing element and associated electronics the output of which is a measure of the magnetic field.

Cat 4 "Main storage"

The primary storage for data or instructions for rapid access by a central processing unit. It consists of the internal storage of a "digital computer" and any hierarchical extension thereto, such as cache storage or non-sequentially accessed extended storage.

Cat 1 "Matrix"
Cat 2 A substantially continuous phase that fills the space between particles,
Cat 8 & 9 whiskers or fibres.

Cat 2 "Measurement uncertainty"

The characteristic parameter which specifies in what range around the output value the correct value of the measurable variable lies with a confidence level of 95%. It includes the uncorrected systematic deviations, the uncorrected backlash and the random deviations

(Reference: ISO 10360-2, or VDI/VDE 2617).

Cat 1 "Mechanical alloying"

An alloying process resulting from the bonding, fracturing and rebonding of elemental and master alloy powders by mechanical impact. Non-metallic particles may be incorporated in the alloy by addition of the appropriate powders.

Cat 1 "Melt extraction"

A process to "solidify rapidly" and extract a ribbon-like alloy product by the insertion of a short segment of a rotating chilled block into a bath of a molten metal alloy.

Cat 1 "Melt spinning"

A process to "solidify rapidly" a molten metal stream impinging upon a rotating chilled block, forming a flake, ribbon or rod-like product.

Cat 3 "Microcomputer microcircuit"

A "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing general purpose instructions from an internal storage, on data contained in the internal storage.

Technical Note

The internal storage may be augmented by an external storage.

Cat 3 "Microprocessor microcircuit"

A "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing a series of general purpose instructions from an external storage.

Technical Note

The "microprocessor microcircuit" normally does not contain integral user-accessible storage, although storage present on-the-chip may be used in performing its logic *function.*

<u>*Note*</u> *This definition includes chip sets which are designed to operate together to provide the function of a "microprocessor microcircuit".*

"Microprogramme"

A sequence of elementary instructions maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction register.

ML 8 "Military explosives"

Solid, liquid or gaseous substances or mixtures of substances which, in their application as primary, booster, or main charges in warheads, demolition and other military applications, are required to detonate.

ML 4 "Military pyrotechnic(s)"

ML 8 Mixtures of solid or liquid fuels and oxidizers which, when ignited, undergo an energetic chemical reaction at a controlled rate intended to produce specific time delays, or quantities of heat, noise, smoke, visible light or infrared radiation. Pyrophorics are a subclass of pyrotechnics, which contain no oxidizers but ignite spontaneously on contact with air.

Cat 3 "Monolithic integrated circuit"

A combination of passive or active "circuit elements" or both which:

a. Are formed by means of diffusion processes, implantation processes or deposition processes in or on a single semiconducting piece of material, a so-called 'chip';
b. Can be considered as indivisibly associated; <u>and</u>
c. Perform the function(s) of a circuit.

Cat 6 "Monospectral imaging sensors"

Are capable of acquisition of imaging data from one discrete spectral band.

Cat 3 "Multichip integrated circuit"

Two or more "monolithic integrated circuits" bonded to a common "substrate".

Cat 4 "Multi-data-stream processing"

The "microprogramme" or equipment architecture technique which permits simultaneous processing of two or more data sequences under the control of one or more instruction sequences by means such as:

a. Single Instruction Multiple Data (SIMD) architectures such as vector or array processors;
b. Multiple Single Instruction Multiple Data (MSIMD) architectures;
c. Multiple Instruction Multiple Data (MIMD) architectures, including those which are tightly coupled, closely coupled or loosely coupled; or
d. Structured arrays of processing elements, including systolic arrays.

Cat 5 "Multilevel security"

A class of system containing information with different sensitivities that simultaneously permits access by users with different security clearances and needs-to-know, but prevents users from obtaining access to information for which they lack authorization.

Technical Note

"Multilevel security" is computer security and not computer reliability which deals with equipment fault prevention or human error prevention in general.

Cat 6 "Multispectral imaging sensors"

Are capable of simultaneous or serial acquisition of imaging data from two or more discrete spectral bands. Sensors having more than twenty discrete spectral bands are sometimes referred to as hyperspectral imaging sensors.

Cat 4 "Network access controller"

A physical interface to a distributed switching network. It uses a common medium which operates throughout at the same "digital transfer rate" using arbitration (e.g., token or carrier sense) for transmission. Independently from any other, it selects data packets or data groups (e.g., IEEE 802) addressed to it. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

Cat 4 "Neural computer"

A computational device designed or modified to mimic the behaviour of a neuron or a collection of neurons, i.e., a computational device which is distinguished by its hardware capability to modulate the weights and numbers of the interconnections of a multiplicity of computational components based on previous data.

Cat 6 "Noise level"

An electrical signal given in terms of power spectral density. The relation between "noise level" expressed in peak-to-peak is given by S2 pp = 8No(f2-f1), where Spp is the peak-to-peak value of the signal (e.g., nanoteslas), No is the power spectral density (e.g., (nanotesla)2/Hz) and (f2-f1) defines the bandwidth of interest.

ML 17 "Nuclear reactor"

Includes the items within or attached directly to the reactor vessel, the equipment which controls the level of power in the core, and the components which normally contain or come into direct contact with or control the primary coolant of the reactor core.

Cat 2 "Numerical control"

The automatic control of a process performed by a device that makes use of numeric data usually introduced as the operation is in progress (Ref. ISO 2382).

Cat 4 "Object code"

Cat 9 "Object code": An equipment executable form of a convenient expression of one or more processes ("source code" (or source language)) which has been converted by a programming system.

Cat 5 "Optical amplification"

In optical communications, an amplification technique that introduces a gain of optical signals that have been generated by a separate optical source, without conversion to electrical signals, i.e., using semiconductor optical amplifiers, optical fibre luminescent amplifiers.

Cat 4 "Optical computer"

A computer designed or modified to use light to represent data and whose computational logic elements are based on directly coupled optical devices.

Cat 3 "Optical integrated circuit"

A "monolithic integrated circuit" or a "hybrid integrated circuit", containing one or more parts designed to function as a photosensor or photoemitter or to perform (an) optical or (an) electro-optical function(s).

Cat 5 "Optical switching"

The routing of or switching of signals in optical form without conversion to electrical signals.

Cat 3 "Overall current density"

The total number of ampere-turns in the coil (i.e., the sum of the number of turns multiplied by the maximum current carried by each turn) divided by the total cross-section of the coil (comprising the superconducting filaments, the metallic matrix in which the superconducting filaments are embedded, the encapsulating material, any cooling channels, etc.).

Cat 6 "Peak power"

Energy per pulse in joules divided by the pulse duration in seconds.

Cat 5 "Personalised smart card"

A smart card containing a microcircuit which has been programmed for a specific application and cannot be reprogrammed for any other application by the user.

Cat 7 "Power management"

Changing the transmitted power of the altimeter signal so that received power at the "aircraft" altitude is always at the minimum necessary to determine the altitude.

ML 8 "Precursors"

Speciality chemicals used in the manufacture of military explosives.

Cat 1 "Previously separated"

The application of any process intended to increase the concentration of the controlled isotope.

Cat 7 "Primary flight control"

"Aircraft" stability or manoeuvering control using force/moment generators, i.e. aerodynamic control surfaces or propulsive thrust vectoring.

Cat 4 "Principal element"

An element is a "principal element" when its replacement value is more than 35% of the total value of the system of which it is an element. Element value is the price paid for the element by the manufacturer of the system, or by the system integrator. Total value is the normal international selling price to unrelated parties at the point of manufacture or consolidation of shipment.

GTN "Production"

Means all production stages, such as: product engineering, manufacture, integration, assembly (mounting), inspection, testing, quality assurance.

Cat 2 "Programme"
Cat 4 A sequence of instructions to carry out a process in, or convertible
Cat 5 & 6 into, a form executable by an electronic computer.

Cat 6 "Pulse compression"

The coding and processing of a radar signal pulse of long time duration to one of short time duration, while maintaining the benefits of high pulse energy.

Cat 6 "Pulse duration"

Duration of a "laser" pulse measured at Full Width Half Intensity (FWHI) levels.

Cat 6 "Q-switched laser"

A "laser" in which the energy is stored in the population inversion or in the optical resonator and subsequently emitted in a pulse.

Cat 6 "Radar frequency agility"

Any technique which changes, in a pseudo-random sequence, the carrier frequency of a pulsed radar transmitter between pulses or between groups of pulses by an amount equal to or larger than the pulse bandwidth.

Cat 6 "Radar spread spectrum"

Any modulation technique for spreading energy originating from a signal with a relatively narrow frequency band, over a much wider band of frequencies, by using random or pseudo-random coding.

Cat 3 "Real-time bandwidth"

For "dynamic signal analysers", the widest frequency range which the analyser can output to display or mass storage without causing any discontinuity in the analysis of the input data. For analysers with more than one channel, the channel configuration yielding the widest "real-time bandwidth" shall be used to make the calculation.

Cat 2, 4 "Real time processing"
Cat 6 & 7 The processing of data by a computer system providing a required level of

service, as a function of available resources, within a guaranteed response time, regardless of the load of the system, when stimulated by an external event.

Cat 5 "Required"
Cat 6 As applied to "technology", refers to only that portion of "technology"
Cat 9 which is peculiarly responsible for achieving or exceeding the controlled
GTN performance levels, characteristics or functions. Such "required" "technology" may be shared by different products.

Cat 2 "Resolution"

The least increment of a measuring device; on digital instruments, the least significant bit. (Reference: ANSI B-89.1.12)

ML 7 "Riot control agents"

Substances which produce temporary irritating or disabling physical effects which disappear within minutes of removal from exposure. There is no significant risk of permanent injury and medical treatment is rarely required.

Cat 2 "Robot"
Cat 8 A manipulation mechanism, which may be of the continuous path or of
ML 17 the point-to-point variety, may use sensors, and has all the following characteristics:

a. Is multifunctional;
b. Is capable of positioning or orienting material, parts, tools or special devices through variable movements in three dimensional space;
c. Incorporates three or more closed or open loop servo-devices which may include stepping motors; <u>and</u>
d. Has "user-accessible programmability" by means of the teach/playback method or by means of an electronic computer which may be a programmable logic controller, i.e., without mechanical intervention.

<u>*Note*</u> *The above definition does not include the following devices:*

1. *Manipulation mechanisms which are only manually/teleoperator controllable;*
2. *Fixed sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is mechanically limited by fixed stops, such as pins or cams. The sequence of motions and the selection of paths or angles are not variable or changeable by*

mechanical, electronic or electrical means;

3. *Mechanically controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is mechanically limited by fixed, but adjustable stops, such as pins or cams. The sequence of motions and the selection of paths or angles are variable within the fixed programme pattern. Variations or modifications of the programme pattern (e.g., changes of pins or exchanges of cams) in one or more motion axes are accomplished only through mechanical operations;*
4. *Non-servo-controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is variable but the sequence proceeds only by the binary signal from mechanically fixed electrical binary devices or adjustable stops;*
5. *Stacker cranes defined as Cartesian coordinate manipulator systems manufactured as an integral part of a vertical array of storage bins and designed to access the contents of those bins for storage or retrieval.*

Cat 1 "Rotary atomisation"

A process to reduce a stream or pool of molten metal to droplets to a diameter of 500 μm or less by centrifugal force.

Cat 2 "Run out" (out-of-true running)

Radial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle axis at a point on the external or internal revolving surface to be tested (Reference: ISO 230/1-1986, paragraph 5.61).

Cat 7 "Scale factor" (gyro or accelerometer)

The ratio of change in output to a change in the input intended to be measured. Scale factor is generally evaluated as the slope of the straight line that can be fitted by the method of least squares to input-output data obtained by varying the input cyclically over the input range.

Cat 3 "Settling time"

The time required for the output to come within one-half bit of the final value when switching between any two levels of the converter.

Cat 6 "SHPL"
"SHPL" is equivalent to "Super High Power Laser".

Cat 3 "Signal analysers"
Apparatus capable of measuring and displaying basic properties of the single-frequency components of multi-frequency signals.

Cat 3 "Signal processing"
Cat 4 The processing of externally derived information-
Cat 5 bearing signals by algorithms such as time
Cat 6 compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform).

Both "Software"
Lists A collection of one or more "programmes" or "microprogrammes" fixed in any tangible medium of expression.

"Solidify rapidly"
A process involving the solidification of molten material at cooling rates exceeding 1,000 K/sec.

Cat 4 "Source code"
Cat 5 A convenient expression of one or more processes which may be
Cat 6 turned by a programming system into equipment executable
Cat 7 form ("object code" (or object language)).
Cat 9

Cat 7 "Spacecraft"
Cat 9 Active and passive satellites and space probes.

Cat 3 "Space qualified"
Cat 6 Products designed, manufactured and tested to meet the special electrical,
ML 23 mechanical or environmental requirements for use in the launch and deployment of satellites or high altitude flight systems operating at altitudes of 100 km or higher.

Cat 1 "Splat quenching"
A process to "solidify rapidly" a molten metal stream impinging upon a chilled block,

forming a flake-like product.

Cat 5 "Spread spectrum"

The technique whereby energy in a relatively narrow-band communication channel is spread over a much wider energy spectrum.

Cat 6 "Spread spectrum" radar - see "Radar spread spectrum"

Cat 7 "Stability"

Standard deviation (1 sigma) of the variation of a particular parameter from its calibrated value measured under stable temperature conditions. This can be expressed as a function of time.

Cat 2 "Stored programme controlled"
Cat 3 A control using instructions stored in an electronic storage which a
Cat 5 processor can execute in order to direct the performance of predetermined functions.

Technical Note

Equipment may be "stored programme controlled" whether the electronic storage is internal or external to the equipment.

Cat 3 "Substrate"

A sheet of base material with or without an interconnection pattern and on which or within which "discrete components" or integrated circuits or both can be located.

Cat 6 "Substrate blanks"

Monolithic compounds with dimensions suitable for the production of optical elements such as mirrors or optical windows.

Cat 2 "Superalloy"
Cat 9 Nickel-, cobalt- or iron-base alloys having strengths superior to any alloys in the AISI 300 series at temperatures over 922 K (649°C) under severe environmental and operating conditions.

Cat 1 "Superconductive"
Cat 3 Refers to materials,(i.e., metals, alloys or compounds) which can lose all
Cat 6 electrical resistance (i.e., which can attain infinite electrical conductivity
Cat 8 and carry very large electrical currents without Joule heating).

ML 18 & 20 *Technical Note*

The "superconductive" state of a material is individually characterised by a "critical temperature", a critical magnetic field, which is a function of temperature, and a critical current density which is, however, a function of both magnetic field and temperature.

Cat 6 "Super High Power Laser" ("SHPL")

A "laser" capable of delivering (the total or any portion of) the output energy exceeding 1 kJ within 50 ms or having an average or CW power exceeding 20 kW.

Cat 1 "Superplastic forming"

Cat 2 A deformation process using heat for metals that are normally characterised by low values of elongation (less than 20%) at the breaking point as determined at room temperature by conventional tensile strength testing, in order to achieve elongations during processing which are at least 2 times those values.

Cat 5 " Symmetric algorithm "

A cryptographic algorithm using an identical key for both encryption and decryption.

Technical Note

A common use of "symmetric algorithms" is confidentiality of data.

Cat 6 "System tracks"

Processed, correlated (fusion of radar target data to flight plan position) and updated aircraft flight position report available to the Air Traffic Control centre controllers.

Cat 4 "Systolic array computer"

A computer where the flow and modification of the data is dynamically controllable at the logic gate level by the user.

ML 7 "Tear gases"

Gases which produce temporary irritating or disabling effects which disappear within minutes of removal from exposure.

GTN & "Technology"

Both Lists Specific information necessary for the "development", "production" or "use" of a product. The information takes the form of technical data or technical assistance. Controlled "technology" is defined in the General Technology Note and in the Dual-Use List.

Technical Notes

1. *'Technical data' may take forms such as blueprints, plans, diagrams, models, formulae, tables, engineering designs and specifications, manuals and instructions written or recorded on other media or devices such as disk, tape, read-only memories.*
2. *'Technical assistance' may take forms such as instruction, skills, training, working knowledge, consulting services. 'Technical assistance' may involve transfer of 'technical data'.*

Cat 4 "Terminal interface equipment"

Equipment at which information enters or leaves the telecommunication system, e.g., telephone, data device, computer, facsimile device.

Cat 4 "Three dimensional Vector Rate"

The number of vectors generated per second which have 10 pixel poly line vectors, clip tested, randomly oriented, with either integer or floating point X-Y-Z coordinate values (whichever produces the maximum rate).

Cat 2 "Tilting spindle"

A tool-holding spindle which alters, during the machining process, the angular position of its centre line with respect to any other axis.

Cat 6 "Time constant"

The time taken from the application of a light stimulus for the current increment to reach a value of 1-1/e times the final value (i.e., 63% of the final value).

Cat 7 "Total control of flight"

Automated control of "aircraft" state variables and flight path to meet mission objectives responding to real time changes in data regarding objectives, hazards or other "aircraft".

Cat 5 "Total digital transfer rate"

The number of bits, including line coding, overhead and so forth per unit time passing between corresponding equipment in a digital transmission system. (See also "digital transfer rate")

Cat 6 "Transfer laser"

A "laser" in which the lasing species is excited through the transfer of energy by collision of a non-lasing atom or molecule with a lasing atom or molecule species.

Cat 6 "Tunable"

The ability of a "laser" to produce a continuous output at all wavelengths over a range of several "laser" transitions. A line selectable "laser" produces discrete wavelengths within one "laser" transition and is not considered "tunable".

GTN "Use"
Cat 1, 2, 4 Operation, installation (including on-site
Cat 5, 6, 7 installation), maintenance (checking), repair,
Cat 8 & 9 overhaul and refurbishing.

Cat 4 "User-accessible programmability"
Cat 5 The facility allowing a user to insert, modify or replace "programmes" by means other than:
Cat 6 a. A physical change in wiring or interconnections; <u>or</u>
b. The setting of function controls including entry of parameters.

Cat 1 "Vacuum atomisation"

A process to reduce a molten stream of metal to droplets of a diameter of 500 μm or less by the rapid evolution of a dissolved gas upon exposure to a vacuum.

Cat 7 "Variable geometry airfoils"

Use trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

ACRONYMS AND ABBREVIATIONS USED IN THESE LISTS

An acronym or abbreviation, when used as a defined term, will be found in 'Definitions of Terms used in these Lists'.

ACRONYM OR ABBREVIATION	MEANING
ABEC	Annular Bearing Engineers Committee
AGMA	American Gear Manufacturers Association
AHRS	attitude and heading reference systems
ALU	arithmetic logic unit
ATC	air traffic control
C^3I	command, communications, control & intelligence
CAD	computer-aided-design
CAS	Chemical Abstracts Service
CDU	control and display unit
CEP	circular error probable
CNTD	controlled nucleation thermal deposition
CVD	chemical vapour deposition
CW	chemical warfare
CW (for lasers)	continuous wave
DEW	directed energy weapon systems
DME	distance measuring equipment
DS	directionally solidified
EB-PVD	electron beam physical vapour deposition
EBU	European Broadcasting Union
ECM	electro-chemical machining
ECR	electron cyclotron resonance
EDM	electrical discharge machines
EEPROMS	electrically erasable programmable read only memory
EIA	Electronic Industries Association
EMC	electromagnetic compatibility
EMCDB	elastomer modified cast double based propellants
FFT	Fast Fourier Transform
GLONASS	global navigation satellite system
GPS	global positioning system
HBT	hetero-bipolar transistors

HDDR	high density digital recording
HEMT	high electron mobility transistors
ICAO	International Civil Aviation Organisation
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IFOV	instantaneous-field-of-view
ILS	instrument landing system
IRIG	inter-range instrumentation group

ACRONYM OR ABBREVIATION	**MEANING**
ISAR	inverse synthetic aperture radar
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JIS	Japanese Industrial Standard
JT	Joule-Thomson
LIDAR	light detection and ranging
LRU	line replaceable unit
MAC	message authentication code
Mach	ratio of speed of an object to speed of sound (after Ernst Mach)
MLS	microwave landing systems
MOCVD	metal organic chemical vapour deposition
MRI	magnetic resonance imaging
MTBF	mean-time-between-failures
Mtops	million theoretical operations per second
MTTF	mean-time-to-failure
NBC	Nuclear, Biological and Chemical
NDT	non-destructive test
PAR	precision approach radar
PIN	personal identification number
ppm	parts per million
PSD	power spectral density
QAM	quadrature-amplitude-modulation
RF	radio frequency
RPV	remotely piloted air vehicles
SACMA	Suppliers of Advanced Composite Materials Association
SAR	synthetic aperture radar

SC	single crystal
SLAR	sidelooking airborne radar
SMPTE	Society of Motion Picture and Television Engineers
SRA	shop replaceable assembly
SRAM	static random access memory
SRM	SACMA Recommended Methods
SSB	single sideband
SSR	secondary surveillance radar
TCSEC	trusted computer system evaluation criteria
TIR	total indicated reading
UTS	ultimate tensile strength
VOR	very high frequency omni-directional range
YAG	yttrium/aluminum garnet

주 의

1. 본 보고서는 과학기술부에서 시행한 정책연구사업의 연구보고서 입니다.
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