

Revised Annex IV of the Plan for Ongoing Monitoring and Verification

Items to be Notified Under the Export/Import Mechanism approved by SCR 1051

Provisions related to Missile items

A. Prohibited Items.

The prohibitions under the Plan (S/22871 Rev. 1 of 20 Oct 1991) apply to any ballistic missiles or missile delivery systems (referred as "missile systems") capable of a range greater than 150 kilometres regardless of payload, and to any related major parts, including surface-to-surface missiles, space launch vehicles, sounding rockets, cruise missiles, target drones, reconnaissance drones, and other unmanned air vehicle systems and such other items as are identified below as being prohibited.

B. Dual Use Items.

The following list contains equipment, other items and technologies capable of being used in the development, production, construction, modification or acquisition of missile systems capable of a range greater than 150 kilometers and shall therefore, in accordance with paragraph 40 of the Plan (S/22871 Rev. 1 20 Oct 1991), be subject to ongoing monitoring and verification.

1 (Commodity Designator code: MA010000)

Complete subsystems designed or modified for missile systems, and technologies, production facilities, and production equipment therefore, as follows:

Note: Re-entry vehicles and equipment designed or modified therefor, are prohibited.

6.1 (Commodity Designator code: MA011000)

Individual rocket stages

1.1.1 (Commodity Designator code: MA011100)

Solid- or liquid-propellant rocket engines

6.1.1(Commodity Designator code: MA011200)

Ramjet/scramjet/pulse jet/combined cycle engines, including devices to regulate combustion, and components therefor

6.1.2 (Commodity Designator code: MA011300)

Hybrid rocket motors and components therefor

6.1 (Commodity Designator code: MA012000)

Guidance sets

6.2 (Commodity Designator code: None)

Thrust vector controls, as follows;

6.1.1 (Commodity Designator code: MA013100)

Flexible nozzles

6.1.2 (Commodity Designator code: MA013200)

Fluid or secondary gas injection systems

6.1.3 (Commodity Designator code: MA013300)

Movable engines or nozzles

6.1.4 (Commodity Designator code: None)

Deflection systems of the exhaust gas stream as follows:

6.1.4.1 (Commodity Designator code: MA013410)

Jet vanes

6.1.4.2 (Commodity Designator code: MA013420)

Probes

6.1.4.3 (Commodity Designator code: MA013430)

Jet avator

6.1.4.4 (Commodity Designator code: MA013430)

Thrust tabs

6.1 (Commodity Designator code: MA014000)

Warhead or weapon safing, arming, fuzing and firing mechanisms

2 (Commodity Designator code: None)

Propulsion components and equipment, including components, equipment, propellant and constituent chemicals for propellants usable in missile systems and technology, production facilities and production equipment, as follows:

6.1 (Commodity Designator code: MA021000)

Rocket-motor cases and production equipment therefor including interior lining, insulation and nozzles, and the technology, the production facilities and production equipment therefor; engines, including devices to regulate combustion, and components therefor.

2.2 (Commodity Designator code: MA022000)

Lightweight turbojet, turbofan and turbocompound engines that are small and fuel efficient, as follows:

- a. Engines with both of the following characteristics:
 - i. Maximum thrust greater than 400N (achieved un-installed) excluding civil certified engines with a maximum thrust greater than 8,890N (achieved un-installed), and
 - ii. Specific fuel consumption of 0.15kg/N/hr or less (at sea level static and standard conditions); or
- b. Engines designed or modified for missile systems, regardless of thrust or specific fuel consumption.

6.1 (Commodity Designator code: MA023000)

Production equipment also covers shear forming, and flow-forming machines, including machines combining the function of spin-forming and flow-forming, including components and software therefore, as follows:

- a. Which, according to the manufacturer's technical specification, are capable of being equipped with numerical control units or a computer control, even when not equipped with such units at delivery, and
- b. With more than two axes which are capable of being coordinated simultaneously for contouring control.

2.4 (Commodity Designator code: MA024000)

Staging, clustering, and separation mechanisms, and the technology, production facilities and production equipment therefore.

2.5 (Commodity Designator code: MA025000)

Liquid-propellant control systems and components therefore, including liquid and slurry propellant control systems, and components therefor, designed or modified to operate in vibration environments of more than 5 g RMS between 20 Hz and 2,000 Hz, and the technology, the production facilities and production equipment therefor and also including:

2.5.1 (Commodity Designator code: MA025100)

Servo valves designed for flow rates of 5 litres per minute or greater, at an absolute pressure of 4,000 kPa (600 psi) or greater, with an actuator response time of less than 100 msec;

Note: Servo valves designed for flow rates of 24 litres per minute or greater, at an absolute pressure of 7,000 kPa (1,000 psi) or greater, with an actuator response time of less than 100 msec are prohibited.

2.5.2 (Commodity Designator code: MA025200)

Pumps, for liquid propellants, with shaft speeds equal to or greater than 6,000 RPM or with discharge pressures equal to or greater than 4,000 kPa (600 psi) or with a flow rate of 200 litres per minute or greater at atmospheric pressure.

Note: Pumps, for liquid propellants, with shaft speeds equal to or greater than 8,000 RPM or with discharge pressures equal to or greater than 7,000 kPa (1,000 psi) or 450 litres per minute or greater at standard atmospheric pressure are prohibited.

6 (Commodity Designator code: None)

Propellants and constituent chemicals for propellants, as follows:

6.1 (Commodity Designator code: None)

Propulsive substances:

3.1.1 (Commodity Designator code: MA031100)

Hydrazine with a concentration of more than 70 percent and its derivatives, as follows:

Monomethylhydrazine (MMH); hydrazine hydrate (also known as hydrazine monohydrate), diamine hydrate, and hydrazine aqueous.

3.1.2 (Commodity Designator code: MA031200)

Unsymmetric dimethylhydrazine; (UDMH)

3.1.3 (Commodity Designator code: MA031300)

Organic azides: diazidodecane, diazidohexane

3.2 (Commodity Designator code: MA032000)

Ammonium perchlorate and other solid oxidizers as follows:

Ammonium dinitramide (ADN), compounds of nitroform, dinitramides, nitramines, nitrocubanes

6.1 (Commodity Designator code: MA033000)

Spherical aluminium powder with particles of uniform diameter of less than 500×10^{-6} m (500 microns) and an aluminium content of 97 percent by weight or greater;

6.1.1 (Commodity Designator code: MA033100)

Metal fuels in particle sizes less than 500×10^{-6} m (500 microns), whether spherical, atomized, spheroidal, flaked or ground, consisting of 97 percent by weight or more of any of the following: zirconium*, beryllium, boron**, magnesium, and alloys of these.

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

** The threshold for boron is at 85 percent by weight or higher.

6.1.2 (Commodity Designator code: MA033200)

Nitramines, Cyclotetramethylenetetranitramine (HMX), Cyclotrimethylenetrinitramine (RDX)

3.3.3 (Commodity Designator code: MA033300)

Perchlorates, chlorates or chromates mixed with high energy fuel components such as powdered metals

3.3.4 (Commodity Designator code: MA033400)

Carboranes, decaboranes, pentaboranes and derivatives thereof.

3.3.5 (Commodity Designator code: None)

Liquid oxidizers, as follows:

6.1.1.1 (Commodity Designator code: MA033510)

Dinitrogen Trioxide

6.1.1.2 (Commodity Designator code: MA033520)

Nitrogen dioxide/ dinitrogen tetroxide

6.1.1.3 (Commodity Designator code: MA033530)

Dinitrogen pentoxide

3.3.5.4 (Commodity Designator code: MA033540)

Inhibited Red Fuming Nitric Acid (IRFNA)

3.3.5.5 (Commodity Designator code: MA033550)

Hydrogen peroxide with a concentration greater than 70 percent.

6.1.1.1 (Commodity Designator code: MA033560)

Compounds composed of fluorine and one or more of other halogens, oxygen or nitrogen.

6.1.1 (Commodity Designator code: None)

Polymeric substances as follows:

6.1.1.1 (Commodity Designator code: MA033610)

Carboxyl-terminated polybutadiene (CTPB)

6.1.1.2 (Commodity Designator code: MA033620)

Hydroxyl-terminated polybutadiene (HTPB)

6.1.1.3 (Commodity Designator code: MA033630)

Glycidyl azide polymer (GAP)

3.3.6.4 (Commodity Designator code: MA033640)

Polybutadiene-Acrylic Acid (PBAA)

3.3.6.5 (Commodity Designator code: MA033650)

Polybutadiene-acrylic acid-acryloNitrile (PBAN)

6.1.1.4 (Commodity Designator code: MA033660)

Oxetanes as follows:

Polymers of Nitratomethyl Methyl Oxetane (NIMMO), 3, 3 Bis-(Azido Methyl Oxetane) (BAMO), Azido Methyl Methyl Oxetane (AMMO)

6.1.1.5 (Commodity Designator code: MA033670)

Composite propellants including case-bonded propellants and propellants with nitrated binders

3.3.6.7.1 (Commodity Designator code: MA033671)

Noncomposite propellants including double-base propellants

3.3.6.7.2 (Commodity Designator code: MA033672)

Other high-energy-density propellants, with an energy density of 40×10^6 joules/kg or greater, e.g. boron slurry

6.1 (Commodity Designator code: None)

Other propellant additives and agents:

6.1.1 (Commodity Designator code: None)

Bonding and linking agents as follows:

6.1.1.1 (Commodity Designator code: MA034110)

Tris(1-(2-methyl) aziridiny) phosphine oxide (MAPO)

6.1.1.2 (Commodity Designator code: MA034120)

Trimesol-1(2-ethyl) aziridine (HX-868, BITA)

6.1.1.3 (Commodity Designator code: MA034130)

Tepanol (HX-878), (reaction product of tetraethylenepentamine, acrylonitrile and glycidol)

3.4.1.4 (Commodity Designator code: MA034140)

Tepan (HX-879), (reaction product of tetraethylenepentamine with acrylonitrile)

6.1.1.1 (Commodity Designator code: MA034150)

Polyfunctional aziridene amides with isophthalic, trimesic, isocyanuric, or trimethyladipic backbone with a 2-methyl or 2-ethyl aziridine group (HX-752, H-874 and (HX-877).

6.1.1 (Commodity Designator code: MA034200)

Catalysts and cross linking agents as follows:

isophorone diisocyanate, hexamethyl diisocyanide, dimeryl diisocyanate, trimethylol propane; and

3.4.2.1 (Commodity Designator code: MA034210)

Triphenyl Bismuth (TPB);

6.1.2 (Commodity Designator code: None)

Burning rate modifiers as follows:

6.1.1.1 (Commodity Designator code: MA034310)

Catocene

6.1.1.2 (Commodity Designator code: MA034320)

N-butyl-ferrocene

6.1.1.3 (Commodity Designator code: MA034330)

Butacene

6.1.1.4 (Commodity Designator code: MA034340)

Any other ferrocene derivatives

6.1.1 (Commodity Designator code: None)

Nitrate esters and nitratoplasticizers as follows:

6.1.1.1 (Commodity Designator code: MA034410)

Triethylene glycol dinitrate (TEGDN)

6.1.1.2 (Commodity Designator code: MA034420)

Trimethylolethane trinitrate (TMETN)

6.1.1.3 (Commodity Designator code: MA034430)

1, 2, 4-butanetriol trinitrate (BTTN)

6.1.1.4 (Commodity Designator code: MA034440)

Diethylene glycol dinitrate (DEGDN)

6.1.2 (Commodity Designator code: None)

Stabilizers as follows:

6.1.2.1 (Commodity Designator code: MA034510)

2-nitrodiphenylamine (also known as 2-NDPA), phenylnaphthylamine

6.1.2.2 (Commodity Designator code: MA034520)

N-methyl-p-nitroaniline (MNA)

4 (Commodity Designator code: None)

Production technology or production equipment for missile propellants and propellant constituents and specially designed components therefor, as follows:

4.1 (Commodity Designator code: MA041000)

Production technology and production equipment for the handling or acceptance testing of liquid propellants or propellant constituents described in item 3.

6.1 (Commodity Designator code: MA042000)

Production, handling, mixing, curing, casting, pressing, machining, extruding or acceptance testing of solid propellants or propellant constituents described in item 3, including:

6.1.1 (Commodity Designator code: MA042100)

Batch mixers, with all of the following characteristics:

- a. Capable of mixing under vacuum in the range of zero to 13.326 kPa (1.933 psi); and
- b. Capable of controlling the temperature of the mixing chamber;
- c. With a total volumetric capacity of 110 litres or more;
- d. With at least one mixing/kneading shaft mounted off-centre

Specially designed components for the above batch mixers as follows:

Planetary drive systems,
spare blades, and
spare bowls.

Note: Such batch mixers with a total volumetric capacity of more than 210 litres are prohibited.

Note: Continuous mixers with the same pressure and temperature characteristics as item 4.2.1 and with two or more mixing/kneading shafts and capacity to open the mixing chamber are also prohibited.

4.2.2 (Commodity Designator code: MA042200)

Equipment for the production of atomized or spherical metallic powder less than 500×10^{-6} m (500 microns) in a controlled environment as follows;

- a. Plasma generators (high frequency arc-jet) usable for obtaining sputtered or spherical metallic powders with organization of the process in an argon-water environment;
- b. Electroburst equipment usable for obtaining sputtered or spherical metallic powders with organization of the process in an argon-water environment;
- c. Equipment usable for the "production" of spherical aluminium powders by powdering a melt in an inert medium (e.g. nitrogen).

6.1.1 (Commodity Designator code: MA042300)

Fluid energy mills usable for grinding or milling ammonium perchlorate, RDX or HMX and ammonium perchlorate hammer and pin mills.

6.1.2 (Commodity Designator code: MA042400)

Dryers designed for the drying of ammonium perchlorate or other energetic materials. This includes both batch and continuous drying systems.

6 (Commodity Designator code: None)

Guidance and control equipment, flight control systems, and avionics equipment, as follows:

6.1 (Commodity Designator code: MA051000)

Gyroscopes, accelerometers and other inertial equipment, including instrumentation, navigation and direction finding equipment and systems, and production and test equipment therefor, as follows, and components and software therefor:

Note: Continuous output accelerometers or gyros of any type, designed to function at acceleration levels greater than 100 g, are prohibited.

6.1.1 (Commodity Designator code: MA051100)

Integrated flight instrument systems, including gyrostabilizers or automatic pilots and integration software therefor, usable in missile systems.

6.1.2 (Commodity Designator code: MA051200)

Gyro-astro compasses and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites.

6.2 (Commodity Designator code: MA052000)

Accelerometers with a threshold of 0.5 g or less, or a linearity error of less than 0.25 percent of full scale output, or both, designed for use in inertial navigation systems or in guidance systems of all types except those specially designed and developed as MWD (Measurement While Drilling) Sensors for use in downhole well service operations;

6.3 (Commodity Designator code: MA053000)

All types of gyros usable in missile systems, with a rated drift rate stability of less than 5 degrees (1 sigma or rms) per hour in a 1 g environment.

5.3.1 (Commodity Designator code: MA053100)

Inertial or other equipment using;

a. accelerometers with a threshold of 0.5 g or less, or a linearity error of less than 0.25 percent of full scale output, or both, designed for use in inertial navigation systems or in guidance systems of all types, except those specially designed and developed as MWD (Measurement While Drilling) Sensors for use in downhole well service operations; or

b. gyros with a rated drift rate stability of less than 5 degrees (1 sigma or rms) per hour in a 1 g environment; and systems incorporating such equipment, and integration software therefor.

5.4 (Commodity Designator code: MA054000)

Test, calibration, alignment, and production equipment as follows; for items specified in Integrated flight instrument systems, including gyrostabilizers or automatic pilots and integration software therefor, usable in missile systems; and inertial or other equipment using;

a. accelerometers with a threshold of 0.5 g or less, or a linearity error of less than 0.25 percent of full scale output, or both, designed for use in inertial navigation systems or in guidance systems of all types except those specially designed and developed as MWD (Measurement While Drilling) sensors for use in downhole well service operations; or

b. gyros described by a rated drift rate stability of less than 5 degrees (1 sigma or rms) per hour in a 1 g environment; and systems incorporating such equipment, and integration software.

5.4.1 (Commodity Designator code: MA054100)

For laser gyro equipment, the following equipment used to characterize mirrors, with the threshold accuracy shown or better.

5.4.2 (Commodity Designator code: MA054200)

Scatterometer (10 ppm)

6.1.1 (Commodity Designator code: MA054300)

Reflectometer (50 ppm)

6.1.2 (Commodity Designator code: MA054400)

Profilometer (5 Angstroms)

5.5 (Commodity Designator code: None)

Other inertial equipment;

6.1.1 (Commodity Designator code: MA055100)

Inertial Measurement Unit (IMU) Module Tester

6.1.1.1 (Commodity Designator code: MA055110)

IMU Platform Tester

5.5.1.2 (Commodity Designator code: MA055120)

IMU Stable Element Handling Fixture

6.1.1.1 (Commodity Designator code: MA055130)

IMU Platform Balance fixture

6.1.1 (Commodity Designator code: MA055200)

Gyro Tuning Test Station

5.5.3 (Commodity Designator code: MA055300)

Gyro Dynamic Balance Station

6.1.1 (Commodity Designator code: MA055400)

Gyro Run-In/Motor Test station

5.5.5 (Commodity Designator code: MA055500)

Gyro Evacuation and Filling Station

6.1.1 (Commodity Designator code: MA055600)

Centrifuge Fixture for Gyro Bearings

5.5.7 (Commodity Designator code: MA055700)

Accelerometer Axis Align Station

6.1.1 (Commodity Designator code: MA055800)

Accelerometer Test Station

6 (Commodity Designator code: None)

Flight control systems and technology, as follows, designed or modified for use in missile systems and the test, calibration, and alignment equipment therefor:

6.1 (Commodity Designator code: MA061000)

Hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire systems);

6.2 (Commodity Designator code: MA062000)

Attitude control equipment;

6.2.1 (Commodity Designator code: MA062100)

Design technology for integration of air vehicle fuselage, propulsion system and lifting control surfaces to optimize aerodynamic performance throughout the flight regime of an unmanned air vehicle;

6.2.1.1 (Commodity Designator code: MA062200)

Design technology for integration of flight control, guidance, and propulsion data into a flight management system for optimization of rocket system trajectory.

6.2.2 (Commodity Designator code: MA062200)

Avionics equipment, as follows:

1. Terrain contour mapping equipment;
2. Scene mapping and correlation (both digital and analog) equipment;
3. Doppler navigation radar equipment;
4. Passive interferometer equipment;
5. Imaging sensor equipment (both active and passive) technology and components, as follows, designed or modified for use in missile systems, and software therefore.

6.2.2.1 (Commodity Designator code: MA062210)

Radar and laser radar systems, including altimeters;

6.2.2.2 (Commodity Designator code: MA062220)

Passive sensors for determining bearings to specific electromagnetic sources (direction finding equipment) or terrain characteristics;

6.2.2.3 (Commodity Designator code: MA062230)

Satellite navigation systems such as GPS, Magellan, GLONASS, or Galileo, capable of providing navigation information at speeds in excess of 515 m/sec (1,000 nautical miles/hour) and at altitudes in excess of 18 km (60,000 feet); or

6.2.2.4 (Commodity Designator code: MA062240)

Satellite navigation systems designed or modified for use with missile systems.

6.2.2.5 (Commodity Designator code: MA062250)

Electronic assemblies and components designed, modified, tested, certified, or screened for military use and operation at temperatures in excess of 125° C.

6.2.3 (Commodity Designator code: MA062300)

Design technology for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards from external sources, as follows:

6.2.3.1 (Commodity Designator code: MA062400)

Design technology for shielding systems;

6.2.3.2 (Commodity Designator code: MA062411)

Design technology for the configuration of hardened electrical circuits and subsystems;

6.2.4 (Commodity Designator code: MA062412)

Determination of hardening criteria for; the shielding of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards from external sources, the design criteria for shielding systems, and the configuration of hardened electrical circuits and subsystems.

6 (Commodity Designator code: None)

Equipment and technology for the production of structural composites designed or modified for use in missile systems, as follows, and components, accessories and software therefor, and structural materials usable in missile systems as follows:

6.1 (Commodity Designator code: MA071000)

Filament winding machines for which the motions for positioning, wrapping and winding fibres are capable of being coordinated and programmed in three or more axes, designed to fabricate composite structures or laminates from fibrous or filamentary materials, and coordinating and programming controls;

6.1.1 (Commodity Designator code: MA071100)

Tape-laying machines for which the motions for positioning and laying tape and sheets are capable of being coordinated and programmed in two or more axes;

6.1.2 (Commodity Designator code: MA071200)

Multi-directional, multi-dimensional weaving machines or interlacing machines, including adapters and modification kits for weaving, interlacing or braiding fibres to manufacture composite structures, except textile machinery not modified for the above end uses;

6.1.3 (Commodity Designator code: None)

Equipment designed or modified for the production of fibrous or filamentary materials as follows:

6.1.3.1 (Commodity Designator code: MA071310)

Equipment for converting polymeric fibres (e.g. polyacrylonitrile, rayon or polycarbosilane) including special provision to strain the fibre during heating;

6.1.3.2 (Commodity Designator code: MA071320)

Equipment for the vapour deposition of elements or compounds on heated filament substrates; and

6.1.3.3 (Commodity Designator code: MA071330)

Equipment for the wet-spinning of refractory ceramics (such as aluminium oxide)

6.1.3.4 (Commodity Designator code: MA071340)

Equipment designed or modified for special fibre surface treatment and equipment designed or modified for producing prepregs and preforms, including:

7.1.3.4.1 Rollers;

7.1.3.4.2 Tension stretchers;

7.1.3.4.3 Coating equipment;

7.1.3.4.4 Cutting equipment; and

7.1.3.4.5 Clicker dies.

7.1.3.5 (Commodity Designator code: MA071350)

Technical data (including processing conditions) and procedures for the regulation of temperature, pressures or atmosphere in autoclaves or hydroclaves in the production of composites or partially processed composites.

6.1.3.5 (Commodity Designator code: MA071350)

Components and accessories for the equipment to produce structural composites, fibres, prepregs or preforms, as follows: moulds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof.

7 (Commodity Designator code: None)

Structural materials designed for use in missile systems as follows:

7.1 (Commodity Designator code: MA081000)

Composite structures, laminates, and manufactures thereof, designed or modified for missile systems or the subsystems in item 2.1, and resin impregnated fibre prepregs using resins with a glass transition temperature (T_g), after cure, exceeding 145°C as determined by ASTM D4065 or national equivalents, and metal-coated fibre preforms therefor, made either with organic matrix or metal matrix utilizing fibrous or filamentary reinforcements with a specific tensile strength greater than $7.62 \times 10^4\text{ m}$ (3×10^6 inches) and a specific modulus greater than $3.18 \times 10^6\text{ m}$ (1.25×10^8 inches);

7.1.1 (Commodity Designator code: MA081100)

Resaturated pyrolyzed (i.e., carbon-carbon) materials designed for missile systems;

7.1.2 (Commodity Designator code: MA081200)

Fine grain recrystallized bulk graphites (with a bulk density of at least 1.72 g/cc measured at 15°C and having a particle size of $100 \times 10^{-6}\text{ m}$ (100 microns) or less), pyrolytic, or fibrous reinforced graphites usable for rocket nozzles and reentry vehicle nose tips;

7.1.3 (Commodity Designator code: MA081300)

Ceramic composite materials (dielectric constant less than 6 at frequencies from 100 Hz to 10,000 MHz) for use in missile radomes, and bulk machinable silicon carbide reinforced unfired ceramic usable for nose tips;

7.1.4 (Commodity Designator code: MA081400)

Tungsten, molybdenum and alloys of these metals in the form of uniform spherical or atomized particles of $500 \times 10^{-6}\text{ m}$ (500 microns), or less with a purity of 97 percent by weight;

7.1.5 (Commodity Designator code: MA081500)

Maraging steels (steels generally with high nickel, very low carbon content and using substitutional elements or precipitates to produce age-hardening) with an ultimate tensile strength of $1.5 \times 10^9\text{ Pa}$ or greater, measured at 20°C in the form of sheet, plate or tubing with a wall or plate thickness equal to or less than 5.0 mm (0.2 inch).

7.1.6 (Commodity Designator code: MA081600)

Nitrogen stabilized duplex stainless steel (N-DSS) having all of the following characteristics:

1. containing at least 18 percent by weight chromium and 4.5 - 8.0 percent by weight nickel;
 2. a ferritic-austenitic microstructure (also referred to as a two-phase microstructure) of which at least 10 percent is austenite by volume (according to ASTM E-1181-87 or national equivalents); and
 3. Having any of the following forms:
 - a. ingots or bars having a size of 100 mm or more in each dimension;
 - b. sheets having a width of 600 mm or more and a thickness of 3 mm or less;

or

 - c. tubes having an outer diameter of 600 mm or more and a wall thickness of 3 mm or less.
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7.1.7 (Commodity Designator code: MA081700)

Titanium-stabilized duplex stainless steel (Ti-DSS) having all of the following characteristics:

1. containing 17.0 - 23.0 percent by weight chromium and 4.5 - 7.0 percent by weight nickel;
2. having a titanium content of greater than 0.10 percent by weight; and
3. a ferritic-austenitic microstructure (also referred to as a two-phase microstructure) of which at least 10 percent is austenite by volume (according to ASTM E-1181-87 or national equivalents); and
4. Having any of the following forms:
 - a. ingots or bars having a size of 100 mm or more in each dimension;
 - b. sheets having a width of 600 mm or more and a thickness of 3 mm or less; or
 - c. tubes having an outer diameter of 600 mm or more and a wall thickness of 3 mm or less

7.2 (Commodity Designator code: None)

Pyrolytic deposition and densification equipment and technology as follows:

7.2.1 (Commodity Designator code: MA082100)

Technology for producing pyrolytically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1,300° C to 2,900° C temperature range at pressures of 130 Pa (1 mm Hg) to 20 kPa (150 mm Hg) including technology for the composition of precursor gases, flow-rates and process control schedules and parameters;

7.2.2 (Commodity Designator code: MA082200)

Nozzles for the above processes;

7.2.3 (Commodity Designator code: MA082300)

Equipment and process controls, and software therefor, designed or modified for densification and pyrolysis of structural composites, including:

7.2.3.1 (Commodity Designator code: MA082310)

Isostatic presses with a maximum working pressure of 69 MPa (10,000 psi) or greater and designed to achieve and maintain a controlled thermal environment of 600° C or greater, and possessing a chamber cavity with an inside diameter of 254 mm (10 inches) or greater.

7.2.3.2 (Commodity Designator code: MA082320)

Chemical vapour deposition furnaces designed or modified for the densification of carbon-carbon composites.

7.3 (Commodity Designator code: None)

Launch and ground support equipment, facilities and software designed or modified for missile systems, as follows:

7.3.1 (Commodity Designator code: MA083100)

Apparatus and devices designed or modified for the handling, control, activation and launching of missile systems;

7.3.1.1 (Commodity Designator code: MA083200)

Vehicles designed or modified for the transport, handling, control, activation and launching of missile systems;

7.3.2 (Commodity Designator code: MA083300)

Gravity meters (gravimeters), gravity gradiometers, and specially designed components therefor, designed or modified for airborne or marine use, and with a static or operational accuracy of 7×10^{-6} m/sec² (0.7 milligal) or better, and a time to steady-state registration of two minutes or less;

7.3.3 (Commodity Designator code: MA083400)

Telemetry and telecontrol equipment usable for missile systems;

7.3.4 (Commodity Designator code: MA083500)

Precision tracking systems, as follows:

7.3.4.1 (Commodity Designator code: MA083510)

Tracking systems using a code translator or transponder installed on the missile systems and either surface or airborne references or aviation satellite navigation systems to provide real time measurements of in-flight position and velocity;

Note: Tracking systems specified in item 8.3.4.1 with a range greater than 150km are prohibited.

7.3.4.2 (Commodity Designator code: MA083520)

Range instrumentation radars including associated optical/infrared trackers and the software therefor with an angular resolution better than 3 milli-radians (0.5 mils), and a range of 30 km or greater with a range resolution better than 10 metres RMS, and a velocity resolution better than 3 metres per second; and

Note: Range instrumentation radars specified above with a range greater than 150km are prohibited.

7.3.4.3 (Commodity Designator code: MA083530)

Software with post-flight, recorded data, for the determination of vehicle position throughout its flight path.

7.4 (Commodity Designator code: None)

Analog computers, digital computers or digital differential analyzers and analog-to-digital converters, as follows:

7.4.1 (Commodity Designator code: MA084100)

Analog computers, digital computers, or digital differential analysers designed for use in missile systems, having either of the following characteristics:

7.4.1.1 (Commodity Designator code: MA084110)

Analog computers, digital computers, or digital differential analysers rated for continuous operation at temperatures from below minus 45° C to above plus 55° C; or

7.4.1.2 (Commodity Designator code: MA084120)

Analog computers, digital computers, or digital differential analysers designed as ruggedized or radiation hardened;

7.4.2 (Commodity Designator code: MA084200)

Analog-to-digital converters, designed for missile systems, with either of the following characteristics:

7.4.2.1 (Commodity Designator code: MA084210)

Designed to meet military specifications for ruggedized equipment; or,

7.4.2.2 (Commodity Designator code: MA084220)

Designed, modified, tested, certified or screened for military use, and being one of the following types:

8.4.2.3 (Commodity Designator code: MA084230)

Analog-to-digital converter microcircuits, with a resolution of 8 bits or more or which are radiation-hardened; and are rated for operation in the temperature range from below minus 45° C to above plus 125° C; and are hermetically sealed;

8.4.2.4 (Commodity Designator code: MA084240)

Electrical input type analog-to-digital converter printed circuit boards or modules, having

- a. a resolution of 8 bits or more, and
- b. rated for operation from below minus 45° C to above plus 55° C, and
- c. which incorporate analog-to-digital converter microcircuits, with
 1. a resolution of 8 bits or more or
 2. which are radiation-hardened; and
 3. are rated for operation in the temperature range from below minus 45° C to above plus 125° C; and
 4. are hermetically sealed.

8 (Commodity Designator code: None)

Test facilities and equipment as follows, and software therefor:

8.1 (Commodity Designator code: None)

Vibration test systems and components therefor, as follows:

9.1.1 (Commodity Designator code: MA091100)

Vibration test systems using feedback or closed loop techniques and a digital controller, capable of vibrating a system at 10g RMS or more over the entire range 20 Hz to 2000 Hz and imparting forces of 25kN (5,625 lbs), measured "bare table", or greater;

8.1.1.1 (Commodity Designator code: MA085120)

Digital controllers, which use specially designed vibration test software, with a real-time bandwidth greater than 5 kHz and designed for use with vibration test systems using feedback or closed loop techniques and a digital controller, capable of vibrating a system at 10g RMS or more over the entire range 20 Hz to 2000 Hz and imparting forces of 25kN (5,625 lbs), measured "bare table", or greater;

8.1.1.2 (Commodity Designator code: MA091120)

Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force of 25kN (5,625 lbs), measured "bare table", or greater, and usable in vibration test systems using feedback or closed loop techniques and a digital controller, capable of vibrating a system at 10g RMS or more over the entire range 20 Hz to 2000 Hz and imparting forces of 25kN (5,625 lbs), measured "bare table", or greater;

8.1.1.3 (Commodity Designator code: MA091130)

Bump or shock test tables with or without their associated amplifiers, capable of imparting a force of at least 100g, or greater;

8.1.1.4 (Commodity Designator code: MA091140)

Test piece support structures and electronic units designed to combine multiple shaker units into a complete shaker system capable of providing an effective total force of 25kN (5,625 lbs), measured "bare table", or greater, and usable in vibration test systems using feedback or closed loop techniques and a digital controller, capable of vibrating a system at 10g RMS or more over the entire range 20 Hz to 2000 Hz and imparting forces of 25kN (5,625 lbs), measured "bare table", or greater.

8.1.1 (Commodity Designator code: MA091200)

Wind-tunnels;

8.1.2 (Commodity Designator code: MA091300)

Test benches/stands capable of handling solid or liquid propellant rockets or rocket motors of more than 10kN (2248 lbs) of thrust, or capable of simultaneously measuring the three axial thrust components;

8.1.3 (Commodity Designator code: MA091400)

Environmental chambers and anechoic chambers capable of;

- a. simulating the flight conditions at altitudes of 15,000meters or greater, or
- b. simulating acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to 2×10^5 N per square metre) or with a rated power output of 4 kiloWatts or greater, or,
- c. capable of achieving temperatures of at least minus 50° C to plus 125° C, and
- d. are capable of being equipped with vibration thrusters (shaker units) or acoustic generators capable of generating vibration environments of 10 g RMS or greater between 20 Hz and 2,000 Hz imparting forces of 5kN (1124 lbs) or greater.

8.1.3.1 (Commodity Designator code: MA091410)

Accelerators except those specially designed for medical purposes, capable of delivering electromagnetic radiation produced by "Bremsstrahlung" from accelerated electrons of 2 MeV or greater, and systems containing those accelerators.

8.2 (Commodity Designator code: MA092000)

Software, or software with related specially designed hybrid (combined analogue/digital) computers, for modelling (including in particular the aerodynamic and thermodynamic analysis of the systems), simulation, or design integration of missile systems or subsystems.

8.3 (Commodity Designator code: MA093000)

Materials, devices, and software for reduced observables (e.g. radar reflectivity, ultraviolet/infrared signatures and acoustic signatures, i.e. stealth technology), for applications designed for missile systems or subsystems including:

8.3.1 (Commodity Designator code: MA093100)

Structural materials and coatings specially designed for reducing radar reflectivity by 10 dB or more;

8.3.2 (Commodity Designator code: MA093200)

Coatings, including paints, specially designed for reducing or tailoring reflectivity or emissivity in infrared or ultraviolet spectra by 10 dB or more;

8.3.3 (Commodity Designator code: MA093300)

Software or databases for analysis of signature reduction;

8.3.4 (Commodity Designator code: MA093400)

Radar cross section measurement systems.

8.4 (Commodity Designator code: None)

Material and devices for protecting missile systems against nuclear effects (e.g. Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), as follows:

8.4.1 (Commodity Designator code: MA094100)

Radiation Hardened microcircuits and detectors capable of with standing

- a. a total irradiation dose of 1×10^5 rad Si; or
- b. prompt dose rate of 5×10^8 rad Si/s.

8.4.2 (Commodity Designator code: MA094200)

Radomes designed to withstand a combined thermal shock greater than 100 cal/sq cm accompanied by a peak over pressure of greater than 50 kPa.
