

- specific modulus greater than 3.18 X 10 m (1.25 X 10 inches);
- b. Resaturated pyrolyzed (i.e., carbon-carbon) materials designed for rocket systems;
- c. Fine grain recrystallized bulk graphites (with a bulk density of at least 1.72 g/cc measured at 15°C), a pyrolytic, or fibrous reinforced graphites useable for rocket nozzles and reentry vehicle nose tips;
- d. 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 useable for nose tips;
- e. Tungsten, molybdenum and alloys of these metals in the form of uniform spherical or atomized particles of 500 micrometer diameter or less with a purity of 97 percent or higher of fabrication of rocket motor components: i.e., heat shields, nozzle substrates, nozzle throats, and thrust factor control surfaces;
- f. Maraging steels (steels generally characterized by high nickel, very low carbon content and the use of substitutional elements to produce age-hardening) having an Ultimate Tensile Strength of 1.5 X 10 Pa or greater, measured at 20°C.

**Note to Item 6008.:**

Maraging steels are only covered by 6008.f. above for the purpose of this group 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).

**6009. Instrumentation, navigation and direction finding equipment and systems, and associated production and test equipment, as follows, and specially designed components and software therefor:**

- 6009. a. Integrated flight instrument systems, which include gyro-stabilizers or automatic pilots and integration software therefor, designed or modified for use in the systems in Item 6001.;
- b. Gyro-astro compasses and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites;
- c. Accelerometers with a threshold of 0.05 g or less, or a linearity error within 0.25 percent of full scale output or both, which are designed for use in inertial navigation systems or in guidance systems of all types;
- d. All types of gyros usable in the systems in Item 6001., with a rated drift rate stability of less than 0.5 degree (1 sigma or rms) per hour in a 1 g environment;
- e. Continuous output accelerometers or gyros of any type, specified to function at acceleration levels greater than 100 g;
- f. Inertial or other equipment using accelerometers described by subitems 6009.c. and e. above or gyros described by subitems 6009.d. or e. above, and systems incorporating such equipment, and specially designed integration software therefor;
- g. Specially designed test, calibration, and alignment equipment, and "production equipment" for the above, including the following:
  - 1. For laser gyro equipment, the following equipment used to characterize mirrors, having the threshold accuracy shown or better:
    - i. Scatterometer (10 ppm);
    - ii. Reflectometer (50 ppm);
    - iii. Profilometer (5 Angstroms);
  - 2. For other inertial equipment:
    - i. Inertial Measurement Unit (IMU Module);
    - ii. IMU Platform Tester;
    - iii. IMU Stable Element Handling Fixture;
    - iv. IMU Platform Balance Fixture;
    - v. Gyro Tuning Test Station;
    - vi. Gyro Dynamic Balance Station;
    - vii. Gyro Run-In/Motor Test Station;
    - viii. Gyro Evacuation and Filling Station;
    - ix. Centrifuge Fixture for Gyro Bearings;
    - x. Accelerometer Axis Align Station;
    - xi. Accelerometer Test Station.

**Notes to Item 6009.:**

- 1. Sub-items 6009.a. through f. do not embargo equipment exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

2. In subitem 6009.d.:

- a. Drift rate is defined as the time rate of output deviation from the desired output. It consists of random and systematic components and is expressed as an equivalent angular displacement per unit time with respect to inertial space;
- b. Stability is defined as 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.

**6010. Flight control systems and "technology", as follows: "designed or modified" for the systems in Item 6001. as well as the specially designed test, calibration, and alignment equipment therefor:**

- 6010. a. Hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire systems);
- b. Attitude control equipment;
- c. 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;
- d. Design technology for integration of the flight control, guidance, and propulsion data into a flight management system for optimization of rocket system trajectory.

**Note to Item 6010.:**

Sub-items 6010.a. and b. do not embargo equipment exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

**6011. Avionics equipment, "technology" and components, as follows: "designed or modified" for use in the systems in Item 6001. and specially designed software therefor:**

- 6011. a. Radar and laser radar systems, including altimeters;
- b. Passive sensors for determining bearings to specific electromagnetic sources (direction finding equipment) or terrain characteristics;
- c. Global Positioning System (GPS) or similar satellite receivers:
  - 1. Capable of providing navigation information under the following operational conditions:
    - i. At speeds in excess of 515 m/sec (1,000 nautical miles/hour); and
    - ii. At altitudes in excess of 18 km (60,000 feet); or
  - 2. Designed or modified for use with unmanned air vehicles covered by Item 6001.;
- d. Electronic assemblies and components specially designed for military use and operation at temperatures in excess of 125°C;
- e. Design technology for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards from external sources, as follows:
  - 1. Design technology for shielding systems;
  - 2. Design technology for the configuration of hardened electrical circuits and subsystems;
  - 3. Determination of hardening criteria for the above.

**Notes to Item 6011.:**

- 1. Item 6011. does not embargo equipment exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.
- 2. Examples of equipment included in this Item:
  - a. Terrain contour mapping equipment;
  - b. Scene mapping and correlation (both digital and analog) equipment;
  - c. Doppler navigation radar equipment;
  - d. Passive interferometer equipment;
  - e. Imaging sensor equipment (both active and passive);
- 3. In subitem 6011.a., laser radar systems embody specialized transmission, scanning, receiving and signal processing techniques for utilization of lasers for echo ranging, direction finding and discrimination of targets by location, radial speed and body reflection characteristics.