

**CATEGORY 7 - NAVIGATION AND AVIONICS**

(MWD) sensors for use in downhole well service applications.

*Related Definitions:* N/A

*Items:*

**A. SYSTEMS, EQUIPMENT AND COMPONENTS**

a. Linear accelerometers having any of the following:

*N.B.1:* For automatic pilots for underwater vehicles, see Category 8. For radar, see Category 6.

a.1. Specified to function at linear acceleration levels less than or equal to 15 g, and having any of the following:

**7A001 Accelerometers as follows (see List of Items Controlled), and specially designed components therefor.**

a.1.a. A “bias” “stability” of less (better) than 130 micro g with respect to a fixed calibration value over a period of one year; or

**License Requirements**

a.1.b. A “scale factor” “stability” of less (better) than 130 ppm with respect to a fixed calibration value over a period of one year;

*Reason for Control:* NS, MT, AT

a.2. Specified to function at linear acceleration levels exceeding 15 g, and having all of the following:

<i>Control(s)</i>	<i>Country Chart</i>
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NS applies to entire entry	NS Column 1
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MT applies to commodities that meet or exceed the parameters of 7A101.	MT Column 1
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AT applies to entire entry	AT Column 1
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a.2.a. A “bias” “repeatability” of less (better) than 5,000 micro g over a period of one year; *and*

a.2.b. A “scale factor” “repeatability” of less (better) than 2,500 ppm over a period of one year; *or*

**License Exceptions**

LVS: N/A

GBS: N/A

CIV: N/A

a.3. Designed for use in inertial navigation or guidance systems and specified to function at linear acceleration levels exceeding 100 g.

**List of Items Controlled**

b. Angular or rotational accelerometers specified to function at linear acceleration levels exceeding 100 g.

*Unit:* \$ value

*Related Controls:* See also [7A101](#) and [7A994](#).

For angular or rotational accelerometers, see [7A001.b](#). MT controls do not apply to accelerometers that are specially designed and developed as Measurement While Drilling

**7A002 Gyros or angular rate sensors, having any of the following characteristics (see List of Items Controlled), and specially designed components therefor.**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
MT applies to commodities that meet or exceed the parameters of 7A102.	MT Column 1
AT applies to entire entry	AT Column 1

**License Requirement Note:** *For the purpose of MT controls only, the term ‘stability’ is defined as a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition. (This definition does not refer to dynamic or servo stability.) (IEEE STD 528-2001 paragraph 2.247)*

**License Exceptions**

LVS: N/A  
 GBS: N/A  
 CIV: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* See also [7A102](#) and [7A994](#). For angular or rotational accelerometers, see [7A001.b](#).  
*Related Definitions:* N/A  
*Items:*

- a. A “bias” “stability”, when measured in a 1 g environment over a period of one month, and with

respect to a fixed calibration value, of less (better) than 0.5 degree per hour when specified to function at linear acceleration levels up to and including 100 g;

- b. An “angle random walk” of less (better) than or equal to 0.0035 degree per square root hour; *or*

**Note:** *7A002.b does not control spinning mass gyros (spinning mass gyros are gyros which use a continually rotating mass to sense angular motion).*

- c. A rate range greater than or equal to 500 degrees per second and having any of the following:

- c.1. A “bias” “stability”, when measured in a 1 g environment over a period of three minutes, and with respect to a fixed calibration value of less (better) than 40 degrees per hour; *or*

- c.2. An “angle random walk” of less (better) than or equal to 0.2 degree per square root hour; *or*

- d. Specified to function at linear acceleration levels exceeding 100 g.

**7A003 Inertial Systems and specially designed components therefor.**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
MT applies to commodities in 7A003.d that meet or exceed the parameters of 7A103	MT Column 1

AT applies to entire entry AT Column 1

### License Exceptions

LVS: N/A

GBS: N/A

CIV: N/A

### List of Items Controlled

*Unit:* \$ value

*Related Controls:* See also [7A103](#) and [7A994](#). Inertial Navigation Systems(INS) and inertial equipment, and specially designed components therefor specifically designed, modified or configured for military use are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* “Data-Based Referenced Navigation” (“DBRN”) systems are systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.

*Items:*

a. Inertial Navigation Systems (INS) (gimballed or strapdown) and inertial equipment designed for “aircraft”, land vehicles, vessels (surface or underwater) or “spacecraft” for navigation, attitude, guidance or control, having any of the following characteristics, and specially designed components therefor:

a.1. Navigation error (free inertial) subsequent to normal alignment of 0.8 nautical mile per hour (nm/hr) “Circular Error Probable” (“CEP”) or less (better); *or*

a.2. Specified to function at linear acceleration levels exceeding 10 g;

b. Hybrid Inertial Navigation Systems embedded with Global Navigation Satellite System(s) (GNSS) or with “Data-Based Referenced Navigation” (“DBRN”) System(s) for navigation, attitude, guidance or control, subsequent to normal alignment, having an INS navigation position accuracy, after loss of GNSS or “DBRN” for a period of up to 4 minutes, of less (better) than 10 meters “Circular Error Probable” (“CEP”);

c. Inertial Measurement equipment for heading or True North determination having any of the following characteristics, and specially designed components therefor:

c.1. Designed to have heading or True North determination accuracy equal to, or less (better) than 0.07 deg sec (Lat) equivalent to 6 arc minutes RMS at 45 degrees latitude; *or*

c.2. Designed to have a non-operating shock level of 900 g or greater at a duration of 1-msec, or greater;

d. Inertial measurement equipment including Inertial Measurement Units (IMU) and Inertial Reference Systems (IRS), incorporating accelerometers or gyros controlled by 7A001 or 7A002, and specially designed components therefor.

**Note 1:** *The parameters of 7A003.a and 7A003.b are applicable with any of the following environmental conditions:*

*a. Input random vibration with an overall magnitude of 7.7 g rms in the first 0.5 hour and a total test duration of 1.5 hour per axis in each of the 3 perpendicular axes, when the random vibration meets all of the following:*

*1. A constant Power Spectral Density (PSD) value of 0.04 g<sup>2</sup>/Hz over a frequency interval of 15 to 1,000 Hz; and*

2. The PSD attenuates with frequency from 0.04 g<sup>2</sup>/Hz to 0.01 g<sup>2</sup>/Hz over a frequency interval from 1,000 to 2,000 Hz;

b. An angular rate capability about one or more axes of equal to or more than +2.62 rad/s (150 deg/s); or

c. According to national standards equivalent to a. or b. of this note.

**Note 2:** 7A003 does not control inertial navigation systems that are certified for use on “civil aircraft” by civil authorities of a Wassenaar Arrangement Participating State, see Supplement No. 1 to Part 743 for a list of these countries.

**Note 3:** 7A003.c.1 does not control theodolite systems incorporating inertial equipment specially designed for civil surveying purposes.

**Technical Note:** 7A003.b refers to systems in which an INS and other independent navigation aids are built into a single unit (embedded) in order to achieve improved performance.

**7A004 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.**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
MT applies to entire entry	MT Column 1

AT applies to entire entry

AT Column 1

**License Exceptions**

LVS: N/A  
 GBS: N/A  
 CIV: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* See also [7A104](#) and [7A994](#)  
*Related Definitions:* N/A  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7A005 Global navigation satellite systems (i.e. GPS or GLONASS) receiving equipment, and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

*Note to 7A005:* See also [7A105](#) and [7A994](#).

**7A006 Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive, having any of the following characteristics (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

LVS: N/A  
GBS: N/A  
CIV: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* See also [7A106](#), [7A994](#)  
and Category 6 for controls on radar.  
*Related Definitions:* N/A  
*Items:*

- a. “Power management”; or
- b. Using phase shift key modulation.

**7A008 Underwater sonar navigation systems, using Doppler velocity or correlation velocity logs integrated with a heading source, having a positioning accuracy of equal to or less (better) than 3% of distance traveled “Circular Error Probable” (“CEP”), and specially designed components therefore.**

**License Requirements**

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

**License Exceptions**

CIV: N/A  
TSR: N/A

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:* [7A008](#) does not control systems specially designed for installation on surface vessels or systems requiring acoustic beacons or buoys to provide positioning data. See 6A001.a for acoustic systems, and 6A001.b for correlation-velocity and Doppler-velocity sonar log equipment. See 8A002 for other marine systems.

*Related Definitions:* N/A  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7A101 Accelerometers, other than those controlled by 7A001 (see List of Items Controlled), and specially designed components therefor.**

**License Requirements**

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

LVS: N/A  
GBS: N/A  
CIV: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* This entry does not control accelerometers which are specially designed and developed as MWD (Measurement While Drilling) sensors for use in downhole well service operations.  
*Related Definitions:* N/A  
*Items:*

a. Linear accelerometers designed for use in inertial navigation systems or in guidance systems of all types, usable in “missiles” having *all* of the following characteristics, and specially designed components therefore:

1. ‘Scale factor’ “repeatability” less (better) than 1250 ppm; and

2. ‘Bias’ “repeatability” less (better) than 1250 micro g.

*Note: The measurement of ‘bias’ and ‘scale factor’ refers to one sigma standard deviation with respect to a fixed calibration over a period of one year.*

b. Accelerometers of any type, designed for use in inertial navigation systems or in guidance systems of all types, specified to function at acceleration levels greater than 100 g.

*Note to paragraph (b): This paragraph (b) does not include accelerometers that are designed to measure vibration or shock.*

**7A102 Gyros, other than those controlled by 7A002 (see List of Items Controlled), and specially designed components therefor.**

**License Requirements**

*Reason for Control:* MT, AT

*Control(s)* Country Chart

MT applies to entire entry MT Column 1

AT applies to entire entry AT Column 1

**License Exceptions**

LVS: N/A

GBS: N/A

CIV: N/A

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* 1.) 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. 2.) 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.

*Items:*

a. All types of gyros, usable in rockets, missiles, or unmanned aerial vehicles capable of achieving a “range” equal to or greater than 300 km, with a rated “drift rate” ‘stability’ of less than 0.5 degrees (1 sigma or rms) per hour in a 1 g environment.

b. Gyros of any type, designed for use in inertial navigation systems or in guidance systems of all types, specified to function at acceleration levels greater than 100 g.

*Technical Note: In this entry, the term ‘stability’ is defined as a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition. (This definition does not refer to dynamic or servo stability.) (IEEE STD 528-2001 paragraph 2.247)*

**7A103 Instrumentation, navigation equipment and systems, other than those controlled by 7A003, and specially designed components therefor.**

**License Requirements**

*Reason for Control:* MT, AT

*Control(s)*                                      *Country Chart*                                      *controlled.*

MT applies to entire entry      MT Column 1

AT applies to entire entry      AT Column 1

**License Exceptions**

LVS: N/A

GBS: N/A

CIV: N/A

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:* 1.) For rockets, missiles, or unmanned aerial vehicles controlled under the U.S. Munitions List (22 CFR part 121), items described in [7A103.b](#) are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (See 22 CFR part 121). 2.) Inertial navigation systems and inertial equipment, and specially designed components therefor specifically designed, modified or configured for military use are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:*

a. Inertial or other equipment using accelerometers or gyros controlled by 7A001, 7A002, 7A101 or 7A102 and systems incorporating such equipment;

*Note 1:* 7A103.a does not control equipment containing accelerometers specially designed and developed as MWD (Measurement While Drilling) sensors for use in down-hole well services operations.

*Note 2:* 7A103.a does not control inertial or other equipment using accelerometers or gyros controlled by 7A001 or 7A002 that are only NS

b. Integrated flight instrument systems, which include gyrostabilizers or automatic pilots, designed or modified for use in rockets, missiles, or unmanned aerial vehicles capable of achieving a “range” equal to or greater than 300 km.

c. Integrated Navigation Systems, designed or modified for use in rockets, missiles, or unmanned aerial vehicles capable of achieving a “range” equal to or greater than 300 km and capable of providing a navigational accuracy of 200m Circular Error Probable (CEP) or less.

**Technical Note:** An ‘integrated navigation system’ typically incorporates the following components:

1. An inertial measurement device (e.g., an attitude and heading reference system, inertial reference unit, or inertial navigation system);
2. One or more external sensors used to update the position and/or velocity, either periodically or continuously throughout the flight (e.g., satellite navigation receiver, radar altimeter, and/or Doppler radar); and
3. Integration hardware and software.

**7A104 Gyro-astro compasses and other devices, other than those controlled by 7A004, which derive position or orientation by means of automatically tracking celestial bodies or satellites and specially designed components therefor.**

**License Requirements**

*Reason for Control:* MT, AT

*Control(s)*                                      *Country Chart*

MT applies to entire entry      MT Column 1

AT applies to entire entry

AT Column 1

electronically steerable antenna) to function in an environment of active or passive countermeasures.

**License Exceptions**

LVS: N/A  
 GBS: N/A  
 CIV: N/A

*Note to 7A105: See also 7A005 and 7A994*

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* This entry controls specially designed components for gyro-astro compasses and other devices controlled by [7A004](#).  
*Related Definitions:* N/A  
*Items:*

**7A106 Altimeters, other than those controlled by 7A006, of radar or laser radar type, designed or modified for use in “missiles”. (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**7A107 Three axis magnetic heading sensors having all of the following characteristics, and specially designed components therefor.**

The list of items controlled is contained in the ECCN heading.

**License Requirements**

*Reason for Control:* MT, AT

**7A105 Receiving equipment for Global Navigation Satellite Systems (GNSS) (e.g. GPS, GLONASS, or Galileo) having any of the following characteristics, and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

*Control(s)*                      *Country Chart*

MT applies to entire entry              MT Column 1

AT applies to entire entry              AT Column 1

1. Designed or modified for use in “missiles”; or
2. Designed or modified for airborne applications and having any of the following:
  - a. Capable of providing navigation information at speeds in excess of 600 m/s (1,165 nautical mph);
  - b. Employing decryption, designed or modified for military or governmental services, to gain access to GNSS secured signal/data; or
  - c. Being specially designed to employ anti-jam features (e.g. null steering antenna or

**License Exceptions**

LVS: N/A  
 GBS: N/A  
 CIV: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:*

a. Internal tilt compensation in pitch (+/-90 degrees) and roll (+/-180 degrees) axes;

b. Capable of providing azimuthal accuracy better

(less) than 0.5 degrees rms at latitudes of +/- 80 degrees, referenced to local magnetic field; *and*

c. Designed or modified to be integrated with flight control and navigation systems.

*Note: Flight control and navigation systems in 7A107 include gyrostabilizers, automatic pilots and inertial navigation systems.*

**7A115** Passive sensors for determining bearing to specific electromagnetic source (direction finding equipment) or terrain characteristics, designed or modified for use in “missiles”. (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)

**7A116** Flight control systems (hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire systems) and attitude control equipment) designed or modified for “missiles”. (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)

**7A117** “Guidance sets” capable of achieving system accuracy of 3.33% or less of the range (e.g., a “CEP” of 10 km or less at a range of 300 km). (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)

**7A994** Other navigation direction finding equipment, airborne communication equipment, all aircraft inertial navigation systems not controlled under 7A003 or 7A103, and other avionics equipment, including parts and components, n.e.s.

**License Requirements**

*Reason for Control:* RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
RS applies to QRS11-00100-100/101 and QRS11-00050-443/569 Micromachined Angular Rate Sensors. See Related Controls.	RS Column 1

AT applies to entire entry	AT Column 1
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*License Requirement Notes: There is no de minimis level for foreign-made commercial primary or standby instrument systems that integrate QRS11-00100-100/101 or commercial automatic flight control systems that integrate QRS11-00050-443/569 Micromachined Angular Rate Sensors (see §734.4(a) of the EAR).*

**License Exceptions**

LVS: N/A  
 GBS: N/A  
 CIV: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* QRS11 Micromachined Angular Rate Sensors are subject to the export licensing jurisdiction of the U.S. Department of State, Directorate of Defense Trade Controls, unless the QRS11-00100-100/101 is integrated into and included as an integral part of a commercial

primary or standby instrument system of the type described in ECCN [7A994](#), or aircraft of the type described in ECCN 9A991 that incorporates such systems, or is exported solely for integration into such a system; or the QRS11-00050-443/569 is integrated into an automatic flight control system of the type described in ECCN [7A994](#), or aircraft of the type described in ECCN 9A991 that incorporates such systems, or are exported solely for integration into such a system. (See Commodity Jurisdiction requirements in 22 CFR Parts 121; Category VIII(e), Note(1)) In the latter case, such items are subject to the licensing jurisdiction of the Department of Commerce. Technology specific to the development and production of QRS11 sensors remains subject to the licensing jurisdiction of the Department of State.

*Related Definitions:* N/A

*Items:*

The list of items controlled is contained in the ECCN heading.

**B. TEST, INSPECTION AND PRODUCTION EQUIPMENT**

**7B001 Test, calibration or alignment equipment specially designed for equipment controlled by 7A (except 7A994).**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

LVS: N/A  
 GBS: N/A  
 CIV: N/A

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:*1.) See also [7B101](#), [7B102](#) and [7B994](#). 2.) This entry does not control test, calibration or alignment equipment for Maintenance level I.

*Related Definition:* 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 localized 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 localize 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.

*Items:*

The list of items controlled is contained in the ECCN heading.

**7B002 Equipment, as follows (see List of Items Controlled), specially designed to characterize mirrors for ring “laser” gyros.**

NS applies to entire entry

NS Column 1

MT applies to entire entry

MT Column 1

AT applies to entire entry

AT Column 1

**License Requirements**

*Reason for Control:* NS, MT, AT

**License Exceptions**

*Control(s)* Country Chart

LVS: N/A

NS applies to entire entry NS Column 1

GBS: N/A

MT applies to entire entry MT Column 1

CIV: N/A

AT applies to entire entry AT Column 1

**List of Items Controlled**

**License Exceptions**

LVS: N/A

GBS: N/A

CIV: N/A

*Unit:* \$ value

*Related Controls:* 1.) See also [7B103](#), (this entry is subject to the licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (see 22 CFR part 121)) and [7B994](#). 2.) This entry includes: Inertial Measurement Unit (IMU module) tester; IMU platform tester; IMU stable element handling fixture; IMU platform balance fixture; gyro tuning test station; gyro dynamic balance station; gyro run-in/motor test station; gyro evacuation and fill station; centrifuge fixtures for gyro bearings; accelerometer axis align stations; accelerometer test station; and fiber optic gyro coil winding machines.

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:* See also [7B102](#) and [7B994](#)

*Related Definitions:* N/A

*Items:*

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).

*Related Definitions:* N/A

*Items:*

The list of items controlled is contained in the ECCN heading.

**7B003 Equipment specially designed for the “production” of equipment controlled by 7A (except 7A994).**

**7B101 “Production equipment”, and other test, calibration, and alignment equipment, other than that described in 2B119 to 2B122, 7B003, and 7B102, designed or modified to be used with equipment controlled by 7A001 to 7A004 or 7A101 to 7A104.**

**License Requirements**

*Reason for Control:* NS, MT, AT

**License Requirements**

*Control(s)* Country Chart

*Reason for Control:* MT, AT

MT applies to entire entry

MT Column 1

*Control(s)*

*Country Chart*

AT applies to entire entry

AT Column 1

MT applies to entire entry

MT Column 1

**License Exceptions**

AT applies to entire entry

AT Column 1

LVS: N/A

GBS: N/A

CIV: N/A

**License Exceptions**

LVS: N/A

GBS: N/A

CIV: N/A

**List of Items Controlled**

**List of Items Controlled**

Unit: \$ value

*Related Controls:*1.) See also 2B119 to 2B122, [7B003](#), [7B102](#), and [7B994](#). 2.) This entry includes: inertial measurement unit (IMU module) tester; IMU platform tester; IMU stable element handling fixture; IMU platform balance fixture; gyro tuning test station; gyro dynamic balance stations; gyro run-in/motor test stations; gyro evacuation and filling stations; centrifuge fixtures for gyro bearings; accelerometer axis align stations; and accelerometer test stations.

*Related Definitions:* N/A

*Items:*

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

- a. Scatterometers having a threshold accuracy of 10 ppm or less (better).
- b. Reflectometers having a threshold accuracy of 50 ppm or less (better).
- c. Prolifometers having a threshold accuracy of 0.5nm (5 angstrom) or less (better).

The list of items controlled is contained in the ECCN heading.

**7B103 Specially designed “production facilities” for equipment controlled by 7A117. (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**7B102 Equipment, other than those controlled by 7B002, designed or modified to characterize mirrors, for laser gyro equipment, as follows (see List of Items Controlled).**

**7B994 Other equipment for the test, inspection, or “production” of navigation and avionics equipment.**

**License Requirements**

**License Requirements**

*Reason for Control:* MT, AT

*Reason for Control:* AT

*Control(s)*

*Country Chart*

*Control(s)*

*Country Chart*

AT applies to entire entry

AT Column 1

equipment controlled for MT reasons. MT does not apply to "software" for equipment controlled by 7A008.

**License Exceptions**

LVS: N/A  
 GBS: N/A  
 CIV: N/A

RS applies to "software" for inertial navigation systems inertial equipment, and specially designed components therefor, for "civil aircraft".

RS Column 1

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:*

AT applies to entire entry

AT Column 1

**License Exceptions**

CIV: N/A  
 TSR: N/A

The list of items controlled is contained in the ECCN heading.

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* 1.) See also [7D101](#) and [7D994](#). 2.) The "software" related to [7A003.b](#), [7A005](#), [7A103.b](#), [7A105](#), [7A106](#), [7A115](#), [7A116](#), [7A117](#), or [7B103](#) are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.) 3.) "Software" for inertial navigation systems and inertial equipment, and specially designed components therefor, not for use on civil aircraft are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)  
*Related Definitions:* N/A  
*Items:*

**C. MATERIALS  
 [RESERVED]**

**D. SOFTWARE**

**7D001 "Software" specially designed or modified for the "development" or "production" of equipment controlled by 7A (except 7A994) or 7B (except 7B994).**

**License Requirements**

*Reason for Control:* NS, MT, RS, AT

*Control(s)* Country Chart

NS applies to "software" for equipment controlled by 7A001 to 7A004, 7A006, 7A008, 7B001, 7B002 or 7B003

NS Column 1

MT applies to "software" for MT Column 1

The list of items controlled is contained in the ECCN heading.

**7D002 “Source code” for the “use” of any inertial navigation equipment including inertial equipment not controlled by 7A003 or 7A004, or Attitude and Heading Reference Systems (AHRS) (except gimballed AHRS).**

*Reason for Control:* NS, MT, AT

*Control(s)* Country Chart

NS applies to entire entry NS Column 1

MT applies to "software" for equipment controlled for MT reasons. MT does not apply to "software" for equipment controlled by 7A008. MT Column 1

AT applies to entire entry AT Column 1

**License Requirements**

*Reason for Control:* NS, MT, AT

*Control(s)* Country Chart

NS applies to entire entry NS Column 1

MT applies to entire entry MT Column 1

AT applies to entire entry AT Column 1

**License Exceptions**

CIV: N/A  
TSR: N/A

**License Exceptions**

CIV: N/A  
TSR: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* 1.) See also [7D102](#) and [7D994](#). 2.) This entry does not control “source code” for the “use” of gimballed AHRS.  
*Related Definition:* 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.  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7D003 Other “software”, as follows (see List of Items Controlled).**

**License Requirements**

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* See also [7D103](#) and [7D994](#)  
*Related Definitions:* ‘Data-Based Referenced Navigation’ (‘DBRN’) systems are systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.  
*Items:*

- a. “Software” specially designed or modified to improve the operational performance or reduce the navigational error of systems to the levels controlled by 7A003, 7A004 or 7A008;
- b. “Source code” for hybrid integrated systems that improves the operational performance or reduces the navigational error of systems to the level controlled by 7A003 or 7A008 by continuously combining heading data with any of the following:

- b.1. Doppler radar or sonar velocity data;
- b.2. Global navigation satellite systems (i.e., GPS or GLONASS) reference data; *or*
- b.3. Data from ‘Data-Based Referenced Navigation’ (‘DBRN’) systems;
- c. “Source code” for integrated avionics or mission systems that combine sensor data and employ “expert systems”;
- d. “Source code” for the “development” of any of the following:
  - d.1. Digital flight management systems for “total control of flight”;
  - d.2. Integrated propulsion and flight control systems;
  - d.3. Fly-by-wire or fly-by-light control systems;
  - d.4. Fault-tolerant or self-reconfiguring “active flight control systems”;
  - d.5. Airborne automatic direction finding equipment;
  - d.6. Air data systems based on surface static data; *or*
  - d.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 by 7E004.b, 7E004.c.1 or 7E004.c.2.

**7D101 “Software” specially designed or modified for the “use” of equipment controlled by 7A001 to 7A006, 7A101 to 7A107, 7A115, 7A116, 7B001, 7B002, 7B003, 7B101, 7B102, or 7B103.**

**License Requirements**

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

CIV: N/A  
 TSR: N/A

**List of Items Controlled**

*Unit:* \$ value  
*Related Controls:* 1.) The “software” related to [7A003.b](#), [7A005](#), [7A103.b](#), [7A105](#), [7A106](#), [7A115](#), [7A116](#), [7A117](#), or [7B103](#) are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.) 2.) “Software” for inertial navigation systems and inertial equipment, and specially designed components therefor, not designed for use on civil aircraft by civil aviation authorities of a country listed in Country Group A:1 is subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)  
*Related Definitions:* N/A  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7D102 Integration “software”, as follows (See List of Items Controlled).**

**License Requirements**

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
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MT applies to entire entry	MT Column 1
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AT applies to entire entry	AT Column 1
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**License Exceptions**

CIV: N/A  
TSR: N/A

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:* The “software” related to [7A003.b](#) or [7A103.b](#) are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:*

a. Integration “software” for the equipment controlled by 7A103.b.

b. Integration “software” specially designed for the equipment controlled by 7A003 or 7A103.a.

**7D103 “Software” specially designed for modelling or simulation of the “guidance sets” controlled by 7A117 or for their design integration with “missiles”. (This entry is subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**7D994 “Software”, n.e.s., for the “development”, “production”, or “use” of navigation, airborne communication and other avionics.**

**License Requirements**

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry	AT Column 1
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**License Exceptions**

CIV: N/A  
TSR: N/A

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

The list of items controlled is contained in the ECCN heading.

**E. TECHNOLOGY**

**7E001 “Technology” according to the General Technology Note for the “development” of equipment or “software” controlled by 7A (except 7A994), 7B (except 7B994) or 7D (except 7D994).**

**License Requirements**

*Reason for Control:* NS, MT, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NS applies to “technology”	NS Column 1
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for items controlled by 7A001 to 7A004, 7A006, 7A008, 7B001 to 7B003, 7D001 to 7D003

MT applies to "technology" for equipment controlled for MT reasons. MT does not apply to "technology" for equipment controlled by 7A008. MT Column 1

RS applies to "technology" for inertial navigation systems, inertial equipment and specially designed components therefor, for civil aircraft RS Column 1

AT applies to entire entry AT Column 1

**License Exceptions**

CIV: N/A  
TSR: N/A

**List of Items Controlled**

*Unit:* N/A  
*Related Controls:* 1.) See also [7E101](#) and [7E994](#). 2.) The "technology" related to [7A003.b](#), [7A005](#), [7A103.b](#), [7A105](#), [7A106](#), [7A115](#), [7A116](#), [7A117](#), [7B103](#), software in [7D101](#) specified in the Related Controls paragraph of ECCN [7D101](#), [7D102.a](#), or [7D103](#) are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* N/A  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7E002 "Technology" according to the General Technology Note for the "production" of equipment controlled by 7A (except 7A994) or 7B (except 7B994).**

**License Requirements**

*Reason for Control:* NS, MT, RS, AT

*Control(s)* Country Chart

NS applies to "technology" for equipment controlled by 7A001 to 7A004, 7A006, 7A008 or 7B001 to 7B003 NS Column 1

MT applies to "technology" for equipment controlled for MT reasons. MT does not apply to "technology" for equipment controlled by 7A008. MT Column 1

RS applies to "technology" for inertial navigation systems, inertial equipment and specially designed components therefor, for civil aircraft RS Column 1

AT applies to entire entry AT Column 1

**License Exceptions**

CIV: N/A  
TSR: N/A

**List of Items Controlled**

*Unit:* N/A  
*Related Controls:* 1.) See also [7E102](#) and [7E994](#). 2.) The "technology" related to [7A003.b](#), [7A005](#), [7A103.b](#), [7A105](#), [7A106](#), [7A115](#), [7A116](#), [7A117](#), or [7B103](#) are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* N/A  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7E003 “Technology” according to the General Technology Note for the repair, refurbishing or overhaul of equipment controlled by 7A001 to 7A004.**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

CIV: N/A  
 TSR: N/A

**List of Items Controlled**

*Unit:* N/A  
*Related Controls:* See also [7E994](#). This entry 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.  
*Related Definition:* Refer to the Related Definitions for 7B001.  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7E004 Other “technology”, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
MT applies to entire entry, except 7E004.a.7.	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

CIV: N/A  
 TSR: N/A

**List of Items Controlled**

*Unit:* N/A  
*Related Controls:* See also [7E104](#) and [7E994](#)  
*Related Definitions:* “Primary flight control” means an “aircraft” stability or maneuvering control using force/moment generators, i.e., aerodynamic control surfaces or propulsive thrust vectoring.  
*Items:*

- a. “Technology” for the “development” or “production” of:
  - a.1. Airborne automatic direction finding equipment operating at frequencies exceeding 5 MHz;
  - a.2. Air data systems based on surface static data only, i.e., that dispense with conventional air data probes;
  - a.3. Raster-type head-up displays or three dimensional displays for “aircraft”;

a.4. Inertial navigation systems or gyro-astro compasses containing accelerometers or gyros controlled by 7A001 or 7A002;

a.5. Electric actuators (i.e., electromechanical, electrohydrostatic and integrated actuator package) specially designed for “primary flight control”;

a.6. “Flight control optical sensor array” specially designed for implementing “active flight control systems”;

a.7. “DBRN” systems designed to navigate underwater using sonar or gravity databases that provide a positioning accuracy equal to or less (better) than 0.4 nautical miles.

b. “Development” “technology”, as follows, for “active flight control systems” (including fly-by-wire or fly-by-light):

b.1. Configuration design for interconnecting multiple microelectronic processing elements (on-board computers) to achieve “real time processing” for control law implementation;

b.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 center of gravity;

b.3. Electronic management of data redundancy or systems redundancy for fault detection, fault tolerance, fault isolation or reconfiguration;

*Note: 7E004.b.3. does not control “technology” for the design of physical redundancy.*

b.4. Flight controls that permit inflight reconfiguration of force and moment controls for real time autonomous air vehicle control;

b.5. Integration of digital flight control, navigation and propulsion control data into a digital flight management system for “total control of flight”;

*Note: 7E004.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 optimization”;

2. “Development” “technology” for “aircraft” flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

b.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 9E003.a.9.*

c. “Technology” for the “development” of helicopter systems, as follows:

c.1. Multi-axis fly-by-wire or fly-by-light controllers that combine the functions of at least two of the following into one controlling element:

c.1.a. Collective controls;

c.1.b. Cyclic controls;

c.1.c. Yaw controls;

c.2. “Circulation-controlled anti-torque or circulation-controlled directional control systems”;

c.3. Rotor blades incorporating “variable geometry airfoils” for use in systems using individual blade control.

**7E101 “Technology”, according to the General Technology Note for the “use” of equipment controlled by 7A001 to 7A006, 7A101 to 7A107, 7A115 to 7A117, 7B001, 7B002, 7B003, 7B101, 7B102, 7B103, or 7D101 to 7D103.**

**License Requirements**

*Reason for Control:* MT, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry	MT Column 1
RS applies to “use” of inertial navigation systems, inertial equipment and specially designed components therefor, for civil aircraft.	RS Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

CIV: N/A  
 TSR: N/A

**List of Items Controlled**

*Unit:* N/A  
*Related Controls:* The “technology” related to [7A003.b](#), [7A005](#), [7A103.b](#), [7A105](#), [7A106](#), [7A115](#), [7A116](#), [7A117](#), [7B103](#), software specified in the Related Controls paragraph of ECCN [7D101](#), [7D102.a](#), or [7D103](#) are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)  
*Related Definitions:* N/A  
*Items:*

The list of items controlled is contained in the ECCN heading.

**7E102 “Technology” for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards, from external sources, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

CIV: N/A  
 TSR: N/A

**List of Items Controlled**

*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:*

- a. Design “technology” for shielding systems;
- b. Design “technology” for the configuration of hardened electrical circuits and subsystems;
- c. Design “technology” for the determination of hardening criteria of .a and .b of this entry.

