CATEGORY 6 - SENSORS AND LASERS

A. SYSTEMS, EQUIPMENT AND COMPONENTS

6A001 Acoustic systems, equipment and components, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

***License Requirement Notes**: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.*

License Exceptions

LVS: $3000; N/A for 6A001.a.1.b.1 object detection and location systems having a transmitting frequency below 5 kHz or a sound pressure level exceeding 210 dB (reference 1 µPa at 1 m) for equipment with an operating frequency in the band from 30 kHz to 2 kHz inclusive; 6A001.a.2.a.1, a.2.a.2, 6A001.a.2.a.3, a.2.a.5, a.2.a.6, 6A001.a.2.b; processing equipment controlled by 6A001.a.2.c, and specially designed for real time application with towed acoustic hydrophone arrays; a.2.e.1, a.2.e.2; and bottom or bay cable systems controlled by 6A001.a.2.f and having processing equipment specially designed for real time application with bottom or bay cable systems.

GBS: Yes for 6A001.a.1.b.4

CIV: Yes for 6A001.a.1.b.4

List of Items Controlled

Unit: $ value
Related Controls: See also 6A991
Related Definitions: N/A
Items:

a. Marine acoustic systems, equipment and specially designed components therefor, as follows:

a.1. Active (transmitting or transmitting-and-receiving) systems, equipment and specially designed components therefor, as follows:

***Note:** 6A001.a.1 does not control:*

a. Depth sounders operating vertically below the apparatus, not including a scanning function exceeding ± 20°, and limited to measuring the depth of water, the distance of submerged or buried objects or fish finding;

b. Acoustic beacons, as follows:

1. Acoustic emergency beacons;

2. Pingers specially designed for relocating or returning to an underwater position.

a.1.a. Wide-swath bathymetric survey systems designed for sea bed topographic mapping and having all of the following:

a.1.a.1. Designed to take measurements at an angle exceeding 20° from the vertical;

a.1.a.2. Designed to measure depths exceeding 600 m below the water surface; *and*

a.1.a.3. Designed to provide any of the following:

a.1.a.3.a. Incorporation of multiple beams any of which is less than 1.9°; *or*

a.1.a.3.b. Data accuracies of better than 0.3% of water depth across the swath averaged

over the individual measurements within the swath;

a.1.b. Object detection or location systems, having any of the following:

a.1.b.1. A transmitting frequency below 10 kHz;

a.1.b.2. Sound pressure level exceeding 224dB (reference 1 μPa at 1 m) for equipment with an operating frequency in the band from 10 kHz to 24 kHz inclusive;

a.1.b.3. Sound pressure level exceeding 235 dB (reference 1 μPa at 1 m) for equipment with an operating frequency in the band between 24 kHz and 30 kHz;

a.1.b.4. Forming beams of less than 1° on any axis and having an operating frequency of less than 100 kHz;

a.1.b.5. Designed to operate with an unambiguous display range exceeding 5,120 m; *or*

a.1.b.6. Designed to withstand pressure during normal operation at depths exceeding 1,000 m and having transducers with any of the following:

a.1.b.6.a. Dynamic compensation for pressure; *or*

a.1.b.6.b. Incorporating other than lead zirconate titanate as the transduction element;

a.1.c. Acoustic projectors, including transducers, incorporating piezoelectric, magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination and having any of the following:

Notes:

1. The control status of acoustic projectors, including transducers, specially designed for other equipment is determined by the control status of the other equipment.

2. 6A001.a.1.c does not control electronic sources that direct the sound vertically only, or mechanical (e.g., air gun or vapor-shock gun) or chemical (e.g., explosive) sources.

a.1.c.1. An instantaneous radiated 'acoustic power density' exceeding 0.01 $mW/mm^2/Hz$ for devices operating at frequencies below 10 kHz;

a.1.c.2. A continuously radiated 'acoustic power density' exceeding 0.001 $mW/mm^2/Hz$ for devices operating at frequencies below 10 kHz; *or*

Technical Note: *'Acoustic power density' is obtained by dividing the output acoustic power by the product of the area of the radiating surface and the frequency of operation.*

a.1.c.3. Side-lobe suppression exceeding 22 dB;

a.1.d. Acoustic systems, equipment and specially designed components for determining the position of surface vessels or underwater vehicles, designed to operate at a range exceeding 1,000 m with a positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1,000 m;

Note: *6A001.a.1.d includes:*

a. Equipment using coherent "signal processing" between two or more beacons and the hydrophone unit carried by the surface vessel or underwater vehicle;

b. Equipment capable of automatically correcting speed-of-sound propagation errors for calculation of a point.

a.2. Passive (receiving, whether or not related

in normal application to separate active equipment) systems, equipment and specially designed components therefor, as follows:

a.2.a. Hydrophones having any of the following:

Note: *The control status of hydrophones specially designed for other equipment is determined by the control status of the other equipment.*

a.2.a.1. Incorporating continuous flexible sensing elements;

a.2.a.2. Incorporating flexible assemblies of discrete sensing elements with either a diameter or length less than 20 mm and with a separation between elements of less than 20 mm;

a.2.a.3. Having any of the following sensing elements:

a.2.a.3.a. Optical fibers;

a.2.a.3.b. 'Piezoelectric polymer films' other than polyvinylidene-fluoride (PVDF) and its co-polymers {P(VDF-TrFE) and P(VDF-TFE)}; *or*

a.2.a.3.c. 'Flexible piezoelectric composites';

a.2.a.4. A 'hydrophone sensitivity' better than -180dB at any depth with no acceleration compensation;

a.2.a.5. Designed to operate at depths exceeding 35 m with acceleration compensation; *or*

a.2.a.6. Designed for operation at depths exceeding 1,000 m;

Technical Notes:

1. 'Piezoelectric polymer film' sensing elements consist of polarized polymer film that is stretched over and attached to a supporting frame or spool (mandrel).

2. 'Flexible piezoelectric composite' sensing elements consist of piezoelectric ceramic particles or fibers combined with an electrically insulating, acoustically transparent rubber, polymer or epoxy compound, where the compound is an integral part of the sensing elements.

3. 'Hydrophone sensitivity' is defined as twenty times the logarithm to the base 10 of the ratio of rms output voltage to a 1 V rms reference, when the hydrophone sensor, without a pre-amplifier, is placed in a plane wave acoustic field with an rms pressure of 1 µPa. For example, a hydrophone of -160 dB (reference 1 V per µPa) would yield an output voltage of 10^{-8} V in such a field, while one of -180 dB sensitivity would yield only 10^{-9} V output. Thus, -160 dB is better than -180 dB.

a.2.b. Towed acoustic hydrophone arrays having any of the following:

a.2.b.1. Hydrophone group spacing of less than 12.5 m or 'able to be modified' to have hydrophone group spacing of less than 12.5 m;

a.2.b.2. Designed or 'able to be modified' to operate at depths exceeding 35m;

Technical Note: *'Able to be modified' in 6A001.a.2.b means having provisions to allow a change of the wiring or interconnections to alter hydrophone group spacing or operating depth limits. These provisions are: spare wiring exceeding 10% of the number of wires, hydrophone group spacing adjustment blocks or internal depth limiting devices that are adjustable or that control more than one hydrophone group.*

a.2.b.3. Heading sensors controlled by 6A001.a.2.d;

a.2.b.4. Longitudinally reinforced

array hoses;

a.2.b.5. An assembled array of less than 40 mm in diameter;

a.2.b.6. [RESERVED]; *or*

a.2.b.7. Hydrophone characteristics controlled by 6A001.a.2.a;

a.2.c. Processing equipment, specially designed for towed acoustic hydrophone arrays, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

a.2.d. Heading sensors having all of the following:

a.2.d.1. An accuracy of better than ± 0.5°; *and*

a.2.d.2. Designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m;

a.2.e. Bottom or bay cable systems, having any of the following:

a.2.e.1. Incorporating hydrophones controlled by 6A001.a.2.a; *or*

a.2.e.2. Incorporating multiplexed hydrophone group signal modules having all of the following characteristics:

a.2.e.2.a. Designed to operate at depths exceeding 35 m or having an adjustable or removal depth sensing device in order to operate at depths exceeding 35 m; *and*

a.2.e.2.b. Capable of being operationally interchanged with towed acoustic hydrophone array modules;

a.2.f. Processing equipment, specially designed for bottom or bay cable systems, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

b. Correlation-velocity and Doppler-velocity sonar log equipment designed to measure the horizontal speed of the equipment carrier relative to the sea bed, as follows:

b.1. Correlation-velocity sonar log equipment having any of the following characteristics:

b.1.a. Designed to operate at distances between the carrier and the sea bed exceeding 500 m; *or*

b.1.b. Having speed accuracy better than 1% of speed;

b.2. Doppler-velocity sonar log equipment having speed accuracy better than 1% of speed.

Note 1: *6A001.b. does not apply to depth sounders limited to any of the following:*

a. Measuring the depth of water;

b. Measuring the distance of submerged or buried objects; or

c. Fish finding.

Note 2: *6A001.b. does not apply to equipment specially designed for installation on surface vessels.*

6A002 Optical sensors.

License Requirements

Reason for Control: NS, MT, CC, RS, AT, UN

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
MT applies to optical detectors in 6A002.a.1, a.3, or .e that are specially designed or modified to protect "missiles" against nuclear effects (e.g., Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for "missiles".	MT Column 1
RS applies to 6A002.a.1, a.2, a.3 (except a.3.d.2.a and a.3.e for lead selenide based focal plane arrays (FPAs)), .c, and .e	RS Column 1
CC applies to police-model infrared viewers in 6A002.c	CC Column 1
AT applies to entire entry	AT Column 1
UN applies to 6A002.a.1, a.2, a.3 and c.	Iraq, North Korea, and Rwanda.

***License Requirement Notes**: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.*

License Exceptions

LVS: $3000; *except* N/A for MT and for 6A002.a.1, a.2, a.3, .c, and .e
GBS: N/A
CIV: N/A

List of Items Controlled

Unit: Number
Related Controls: The following commodities are subject to the export licensing authority of U.S. Department of State, Directorate of Defense Trade Controls (22 CFR part 121): 1.) "Image intensifiers" defined in 6A002.a.2 and "focal plane arrays" defined in 6A002.a.3 specially designed, modified, or configured for military use and not part of civil equipment; 2.) "Space qualified" solid-state detectors defined in 6A002.a.1, "space qualified" imaging sensors (e.g., "monospectral imaging sensors" and "multispectral imaging sensors") defined in 6A002.b.2.b.1, and "space qualified" cryocoolers defined in 6A002.d.1, unless, on or after September 23, 2002, the Department of State issues a commodity jurisdiction determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. See also 6A102, 6A202, and 6A992

***Note**: Exporters may apply for a commodity jurisdiction request with the Department of State, Directorate of Defense Trade Controls for "space qualified" solid-state detectors defined in 6A002.a.1 and imaging sensors (e.g., "monospectral imaging sensors" and "multispectral imaging sensors") defined in 6A002.b.2.b.1 that may have predominant civil application(s).*

Related Definitions: N/A
Items:

a. Optical detectors, as follows:

***Note:** 6A002.a does not control germanium or silicon photodevices.*

***N.B.:** Silicon and other material based 'microbolometer' non "space-qualified" "focal plane arrays" are only specified under 6A002.a.3.f.*

a.1. "Space-qualified" solid-state detectors, as follows:

a.1.a. "Space-qualified" solid-state detectors, having all of the following:

a.1.a.1. A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; *and*

a.1.a.2. A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;

a.1.b. "Space-qualified" solid-state detectors, having all of the following:

a.1.b.1. A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; *and*

a.1.b.2. A response "time constant" of 95 ns or less;

a.1.c. "Space-qualified" solid-state detectors having a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

a.2. Image intensifier tubes and specially designed components therefor, as follows:

a.2.a. Image intensifier tubes having all of the following:

a.2.a.1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;

a.2.a.2. A microchannel plate for electron image amplification with a hole pitch (center-to-center spacing) of 12 µm or less; *and*

a.2.a.3. Any of the following photocathodes:

a.2.a.3.a. S-20, S-25 or multialkali photocathodes with a luminous sensitivity exceeding 350 µA/lm;

a.2.a.3.b. GaAs or GaInAs photocathodes; *or*

a.2.a.3.c. Other III-V compound semiconductor photocathodes;

Note: *6A002.a.2.a.3.c does not apply to compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.*

a.2.b. Specially designed components, as follows:

a.2.b.1. Microchannel plates having a hole pitch (center-to-center spacing) of 12 µm or less;

a.2.b.2. GaAs or GaInAs photocathodes;

a.2.b.3. Other III-V compound semiconductor photocathodes;

Note: *6A002.a.2.b.3 does not control compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.*

a.3. Non-"space-qualified" "focal plane arrays", as follows:

N.B.: *Silicon and other material based 'microbolometer' non"space-qualified" "focal plane arrays" are only specified in 6A002.a.3.f.*

Technical Notes:

1. Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays".

2. For the purposes of 6A002.a.3. 'cross scan direction' is defined as the axis parallel to the linear array of detector elements and the 'scan direction' is defined as the axis perpendicular to the linear array of detector elements.

Note 1: *6A002.a.3 includes photoconductive arrays and photovoltaic arrays.*

Note 2: *6A002.a.3 does not control:*

a. Multi-element (not to exceed 16 elements) encapsulated photoconductive cells using either lead sulphide or lead selenide;

b. Pyroelectric detectors using any of the following:

b.1. Triglycine sulphate and variants;

b.2. Lead-lanthanum-zirconium titanate and variants;

b.3. Lithium tantalate;

b.4. Polyvinylidene fluoride and variants; or

b.5. Strontium barium niobate and variants.

a.3.a. Non-"space-qualified" "focal plane arrays", having all of the following:

a.3.a.1. Individual elements with a peak response within the wavelength range exceeding 900 nm but not exceeding 1,050 nm; *and*

a.3.a.2. A response "time constant" of less than 0.5 ns;

a.3.b. Non-"space-qualified" "focal plane arrays", having all of the following:

a.3.b.1. Individual elements with a peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,200 nm; *and*

a.3.b.2. A response "time constant" of 95 ns or less;

a.3.c. Non-"space-qualified" non-linear (2-dimensional) "focal plane arrays", having individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

N.B.: *Silicon and other material based 'microbolometer' non"space-qualified" "focal plane arrays" are only specified in 6A002.a.3.f.*

a.3.d. Non-"space-qualified" linear (1-dimensional) "focal plane arrays", having all of the following:

a.3.d.1. Individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 3,000 nm; *and*

a.3.d.2. Any of the following :

a.3.d.2.a. A ratio of scan direction dimension of the detector element to the cross-scan direction dimension of the detector element of less than 3.8; *or*

a.3.d.2.b. Signal processing in the element (SPRITE);

a.3.e. Non-"space-qualified" linear (1-dimensional) "focal plane arrays", having individual elements with a peak response in the wavelength range exceeding 3,000 nm but not exceeding 30,000 nm.

a.3.f. Non-"space-qualified" non-linear (2-dimensional) infrared "focal plane arrays" based on 'microbolometer' material having individual elements with an unfiltered response in the wavelength range equal to or exceeding 8,000 nm but not exceeding 14,000 nm.

Technical Notes:

1. For the purposes of 6A002.a.3.f. 'microbolometer' is defined as a thermal imaging detector that, as a result of a temperature change in the detector caused by the absorption of infrared radiation, is used to generate any usable signal.

2. Non- imaging thermal detectors are not controlled by 6A002.a.3. Imaging thermal

detectors are a multi-element array of thermal detectors with the capacity to form a visual, electronic or other representation of an object with sufficient fidelity to enable understanding of its shape or other spatial characteristics, such as height, width, or area. A multi-element array of thermal detectors without the capacity to form spatial representation of an object is non-imaging.

3. 6A002.a.3.f captures all non-"space-qualified" non-linear (2-dimensional) infrared "focal plane arrays" based on microbolometer material having individual elements with any unfiltered response between 8,000 nm and 14,000 nm.

b. "Monospectral imaging sensors" and "multispectral imaging sensors" designed for remote sensing applications, having any of the following:

b.1. An Instantaneous-Field-Of-View (IFOV) of less than 200 µrad (microradians); *or*

b.2. Being specified for operation in the wavelength range exceeding 400 nm but not exceeding 30,000 nm and having all the following:

b.2.a. Providing output imaging data in digital format; *and*

b.2.b. Being any of the following:

b.2.b.1. "Space-qualified"; *or*

b.2.b.2. Designed for airborne operation, using other than silicon detectors, and having an IFOV of less than 2.5 mrad (milliradians).

c. Direct view imaging equipment operating in the visible or infrared spectrum, incorporating any of the following:

c.1. Image intensifier tubes having the characteristics listed in 6A002.a.2.a; *or*

c.2. "Focal plane arrays" having the characteristics listed in 6A002.a.3.

Technical Note: *"Direct view" refers to imaging equipment, operating in the visible or infrared spectrum, that presents a visual image to a human observer without converting the image into an electronic signal for television display, and that cannot record or store the image photographically, electronically or by any other means.*

Note: *6A002.c does not control the following equipment incorporating other than GaAs or GaInAs photocathodes:*

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Medical equipment;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Flame detectors for industrial furnaces;

e. Equipment specially designed for laboratory use.

d. Special support components for optical sensors, as follows:

d.1. "Space-qualified" cryocoolers;

d.2. Non-"space-qualified" cryocoolers, having a cooling source temperature below 218 K (-55° C), as follows:

d.2.a. Closed cycle type with a specified Mean-Time-To-Failure (MTTF), or Mean-Time-Between-Failures (MTBF), exceeding 2,500 hours;

d.2.b. Joule-Thomson (JT) self-regulating minicoolers having bore (outside) diameters of less than 8 mm;

d.3. Optical sensing fibers specially fabricated either compositionally or structurally, or modified by coating, to be acoustically, thermally, inertially, electromagnetically or nuclear radiation sensitive.

e. "Space qualified" "focal plane arrays" having more than 2,048 elements per array and having a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm.

6A003 Cameras.

License Requirements

Reason for Control: NS, NP, RS, AT, UN

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
NP applies to items controlled in paragraphs 6A003.a.2, a.3 and a.4.	NP Column 1
RS applies to items controlled in 6A003.b.3, to items controlled in 6A003.b.4.a, and to items controlled in 6A003.b.4.b that have a frame rate greater than 60 Hz or that incorporate a focal plane array with more than 111,000 elements, or to items in 6A003.b.4.b when being exported or reexported to be embedded in a civil product. (But see § 742.6(a)(2)(iii) and (v) for certain exemptions)	RS Column 1
RS applies to items controlled in 6A003.b.4.b that have a frame rate of 60 Hz or less and that incorporate a focal plane array with not more than 111,000 elements if not being exported or reexported to be embedded in a civil product.	RS Column 2
RS applies to items controlled in 6A003.b.4.b	A license is required to export or reexport these items to Hong Kong. This license requirement does not appear in the Commerce Country Chart.
AT applies to entire entry	AT Column 1
UN applies to items controlled in 6A003.b.3 and b.4.	Iraq and Rwanda.

License Exceptions

LVS: $1500, except N/A for 6A003.a.2 through a.6, b.1, b.3 and b.4
GBS: Yes for 6A003.a.1
CIV: Yes for 6A003.a.1

List of Items Controlled

Unit: Number
Related Controls: Related Controls: (1) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (2) Also see ECCN 6A203. (3) See ECCN 8A002.d and .e for cameras specially designed or modified for underwater use. (4) See ECCN 0A919 for foreign made military commodities that incorporate cameras described in 6A003.b.4.b. (5) Section 744.9

imposes license requirements on cameras described in 6A003.b.4.b if being exported for incorporation into an item controlled by ECCN 0A919 or for a military end-user.
Related Definitions: N/A
Items:

a. Instrumentation cameras and specially designed components therefor, as follows:

Note: *Instrumentation cameras, controlled by 6A003.a.3 to 6A003.a.5, with modular structures should be evaluated by their maximum capability, using plug-ins available according to the camera manufacturer's specifications.*

a.1. High-speed cinema recording cameras using any film format from 8 mm to 16 mm inclusive, in which the film is continuously advanced throughout the recording period, and that are capable of recording at framing rates exceeding 13,150 frames/s;

Note: *6A003.a.1 does not control cinema recording cameras designed for civil purposes.*

a.2. Mechanical high speed cameras, in which the film does not move, capable of recording at rates exceeding 1,000,000 frames/s for the full framing height of 35 mm film, or at proportionately higher rates for lesser frame heights, or at proportionately lower rates for greater frame heights;

a.3. Mechanical or electronic streak cameras having writing speeds exceeding 10 mm/μs;

a.4. Electronic framing cameras having a speed exceeding 1,000,000 frames/s;

a.5. Electronic cameras, having all of the following:

a.5.a. An electronic shutter speed (gating capability) of less than 1μs per full frame; *and*

a.5.b. A read out time allowing a framing rate of more than 125 full frames per second.

a.6. Plug-ins, having all of the following characteristics:

a.6.a. Specially designed for instrumentation cameras which have modular structures and that are controlled by 6A003.a; *and*

a.6.b. Enabling these cameras to meet the characteristics specified in 6A003.a.3, 6A003.a.4 or 6A003.a.5, according to the manufacturer's specifications.

b. Imaging cameras, as follows:

Note: *6A003.b does not control television or video cameras specially designed for television broadcasting.*

b.1. Video cameras incorporating solid state sensors, having a peak response in the wavelength range exceeding 10 nm, but not exceeding 30,000 nm and having all of the following:

b.1.a. Having any of the following:

b.1.a.1. More than 4×10^6 "active pixels" per solid state array for monochrome (black and white) cameras;

b.1.a.2. More than 4×10^6 "active pixels" per solid state array for color cameras incorporating three solid state arrays; *or*

b.1.a.3. More than 12×10^6 "active pixels" for solid state array color cameras incorporating one solid state array; *and*

b.1.b. Having any of the following:

b.1.b.1. Optical mirrors controlled by 6A004.a.;

b.1.b.2. Optical control equipment controlled by 6A004.d.; *or*

b.1.b.3. The capability for annotating internally generated camera tracking data.

Technical Notes:

1. For the purposes of this entry, digital video cameras should be evaluated by the maximum number of "active pixels" used for capturing moving images.

2. For the purpose of this entry, camera tracking data is the information necessary to define camera line of sight orientation with respect to the earth. This includes: 1) the horizontal angle the camera line of sight makes with respect to the earth's magnetic field direction and; 2) the vertical angle between the camera line of sight and the earth's horizon.

b.2. Scanning cameras and scanning camera systems, having all of the following:

b.2.a. A peak response in the wavelength range exceeding 10 nm, but not exceeding 30,000 nm;

b.2.b. Linear detector arrays with more than 8,192 elements per array; *and*

b.2.c. Mechanical scanning in one direction;

b.3. Imaging cameras incorporating image intensifier tubes having the characteristics listed in 6A002.a.2.a;

b.4. Imaging cameras incorporating "focal plane arrays" having any of the following:

b.4.a. Incorporating "focal plane arrays" controlled by 6A002.a.3.a. to 6A002.a.3.e.; *or*

b.4.b. Incorporating "focal plane arrays" controlled by 6A002.a.3.f.

Note 1: *'Imaging cameras' described in 6A003.b.4 include "focal plane arrays" combined with sufficient signal processing electronics, beyond the read out integrated circuit, to enable as a minimum the output of an analog or digital signal once power is supplied.*

Note 2: *6A003.b.4.a does not control imaging cameras incorporating linear "focal plane arrays" with twelve elements or fewer, not employing time-delay-and-integration within the element, designed for any of the following:*

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Industrial equipment used for inspection or monitoring of heat flows in buildings, equipment or industrial processes;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Equipment specially designed for laboratory use; or

e. Medical equipment.

Note 3: *6A003.b.4.b. does not control imaging cameras having any of the following characteristics:*

a. A maximum frame rate equal to or less than 9 Hz;

b. Having all of the following:

1. Having a minimum horizontal or vertical Instantaneous-Field -of-View (IFOV) of at least 10 mrad/pixel (milliradians/pixel);

2. Incorporating a fixed focal-length lens that is not designed to be removed;

3. Not incorporating a direct view display, and

Technical Note: *'Direct view' refers to an imaging camera operating in the infrared spectrum that presents a visual image to a human observer using a near-to-eye micro display incorporating any light-security mechanism.*

4. Having any of the following:

a. No facility to obtain a viewable image of the detected field-of-view, or

b. The camera is designed for a single kind of application and designed not to be user modified, or

Technical Note:

Instantaneous Field of View (IFOV) specified in Note 3.b is the lesser figure of the Horizontal FOV or the Vertical FOV.

Horizontal IFOV = horizontal Field of View (FOV)/number of horizontal detector elements

Vertical IFOV= vertical Field of View (FOV)/number of vertical detector elements.

c. Where the camera is specially designed for installation into a civilian passenger land vehicle of less than three tons (gross vehicle weight) and having all of the following:

1. Is operable only when installed in any of the following:

a. The civilian passenger land vehicle for which it was intended; or

b. A specially designed, authorized maintenance test facility; and

2. Incorporates an active mechanism that forces the camera not to function when it is removed from the vehicle for which it was intended.

Note: *When necessary, details of the items will be provided, upon request, to the Bureau of Industry and Security in order to ascertain compliance with the conditions described in Note 3.b.4. and Note 3.c. in this Note to 6A003.b.4.b.*

6A004 Optics.

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Requirement Notes*: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.*

License Exceptions

LVS: $3000
GBS: Yes for 6A004.a.1, a.2, a.4, b, d.2, and d.4
CIV: Yes for 6A004.a.1, a.2, a.4, b, d.2, and d.4

List of Items Controlled

Unit: Number
Related Controls: 1.) For optical mirrors or 'aspheric optical elements' specially designed for lithography equipment, see ECCN 3B001. 2.) "Space qualified" components for optical systems defined in 6A004.c and optical control equipment defined in 6A004.d.1 are subject to the export licensing authority of the Department of State, Directorate of Defense Trade Controls (22 CFR part 121). 3.) See also 6A994.
Related Definitions: An 'aspheric optical element' is any element used in an optical system whose imaging surface or surfaces are designed to depart from the shape of an ideal

sphere.
Items:

a. Optical mirrors (reflectors), as follows:

a.1. "Deformable mirrors" having either continuous or multi-element surfaces, and specially designed components therefor, capable of dynamically repositioning portions of the surface of the mirror at rates exceeding 100 Hz;

a.2. Lightweight monolithic mirrors having an average "equivalent density" of less than 30 kg/m^2 and a total mass exceeding 10 kg;

a.3. Lightweight "composite" or foam mirror structures having an average "equivalent density" of less than 30 kg/m^2 and a total mass exceeding 2 kg;

a.4. Beam steering mirrors more than 100 mm in diameter or length of major axis, that maintain a flatness of lambda/2 or better (lambda is equal to 633 nm) having a control bandwidth exceeding 100 Hz.

b. Optical components made from zinc selenide (ZnSe) or zinc sulphide (ZnS) with transmission in the wavelength range exceeding 3,000 nm but not exceeding 25,000 nm and having any of the following:

b.1. Exceeding 100 cm^3 in volume; *or*

b.2. Exceeding 80 mm in diameter or length of major axis and 20 mm in thickness (depth).

c. "Space-qualified" components for optical systems, as follows:

c.1. Lightweighted to less than 20% "equivalent density" compared with a solid blank of the same aperture and thickness;

c.2. Substrates, substrates having surface coatings (single-layer or multi-layer, metallic or dielectric, conducting, semiconducting or insulating) or having protective films;

c.3. Segments or assemblies of mirrors designed to be assembled in space into an optical system with a collecting aperture equivalent to or larger than a single optic 1 m in diameter;

c.4. Manufactured from "composite" materials having a coefficient of linear thermal expansion equal to or less than 5×10^{-6} in any coordinate direction.

d. Optical control equipment, as follows:

d.1. Specially designed to maintain the surface figure or orientation of the "space-qualified" components controlled by 6A004.c.1 or 6A004.c.3;

d.2. Having steering, tracking, stabilization or resonator alignment bandwidths equal to or more than 100 Hz and an accuracy of 10 μrad (microradians) or less;

d.3. Gimbals having all of the following:

d.3.a. A maximum slew exceeding 5°;

d.3.b. A bandwidth of 100 Hz or more;

d.3.c. Angular pointing errors of 200 μrad (microradians) or less; *and*

d.3.d. Having any of the following:

d.3.d.1. Exceeding 0.15 m but not exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 2 rad (radians)/s^2; *or*

d.3.d.2. Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 0.5 rad (radians)/s^2;

d.4. Specially designed to maintain the alignment of phased array or phased segment mirror systems consisting of mirrors with a segment diameter or major axis length of 1 m or

more.

e. 'Aspheric optical elements' having all of the following characteristics:

e.1. The largest dimension of the optical-aperture is greater than 400 mm;

e.2. The surface roughness is less than 1 nm (rms) for sampling lengths equal to or greater than 1 mm; *and*

e.3. The coefficient of linear thermal expansion's absolute magnitude is less than 3×10^{-6}/K at 25° C;

***Technical Notes**:*

1. [RESERVED]

2. Manufacturers are not required to measure the surface roughness listed in 6A004.e.2 unless the optical element was designed or manufactured with the intent to meet, or exceed, the control parameter.

***Note:** 6A004.e does not control aspheric optical elements having any of the following:*

a. A largest optical-aperture dimension less than 1 m and a focal length to aperture ratio equal to or greater than 4.5:1;

b. A largest optical-aperture dimension equal to or greater than 1 m and a focal length to aperture ratio equal to or greater than 7:1;

c. Being designed as Fresnel, flyeye, stripe, prism or diffractive optical elements;

d. Being fabricated from borosilicate glass having a coefficient of linear thermal expansion greater than 2.5×10^{-6}/K at 25° C;or

e. Being an x-ray optical element having inner mirror capabilities (e.g., tube-type mirrors).

6A005 "Lasers" (other than those described in 0B001.g.5 or .h.6), components and optical equipment, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, NP, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
NP applies to "lasers" controlled by 6A005.a.2, b.2.b, b.3.a, b.4.b, b.6.b., c.1.b, c.2.b, d.3.c, and d.4.c, as described in the following License Requirements Note.	NP Column 1
AT applies to entire entry	AT Column 1

***License Requirements Note:** NP controls apply to the following "lasers" controlled by 6A005:*

***(a)** Pulsed excimer "lasers" controlled by 6A005.d.4.c having all of the following characteristics:*

(1) Operating at wavelengths between 240 and 360 nm;

(2) A repetition rate > 250 Hz; and

(3) An average output power > 500 W;

***(b)** Copper vapor "lasers" controlled by 6A005.b.4.b having all of the following characteristics:*

(1) Operating at wavelengths between 500 and 600 nm; and

(2) An average output power ≥ 40 W;

(c) *Pulsed carbon dioxide "lasers" controlled by 6A005.d.3.c (except industrial CO_2 lasers used in applications such as cutting and welding), having all of the following characteristics:*

(1) Operating at wavelengths between 9,000 and 11,000 nm;

(2)A repetition rate > 250 Hz;

(3) An average output power > 2.5kW; and

(4) A pulse width < 200ns;

(d) *Argon ion "lasers" controlled by 6A005.a.2 having all of the following characteristics:*

(1) Operating at wavelengths between 400 and 515 nm; and

(2) An average output power ≥ 50 W;

(e) *Alexandrite "lasers" controlled by 6A005.c.2.b having all of the following characteristics:*

(1) Operating at wavelengths between 720 and 800 nm;

(2) A bandwidth ≤ 0.005 nm;

(3) A repetition rate > 125 Hz; and

(4) Average output power > 30 W;

(f) *Pulse-excited, Q-switched neodymium-doped (other than glass) "lasers" controlled by 6A005.b.6.b having all of the following characteristics:*

(1) An output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm;

(2) A pulse duration equal to or more than 1 ns; and

(3) A single-transverse mode output having an average power exceeding 40 W or a multiple-transverse mode output having an average power exceeding 50W;

(g) *Neodymium-doped (other than glass) "lasers" controlled by "6A005.a.4, b.2, b.3, b.4, having all of the following characteristics:*

(1) Incorporating frequency doubling for output wavelength between 500 and 550 nm; and

(2) Average output power > 40 W;

(h) *Tunable pulsed single-mode dye laser oscillators controlled by 6A005.c.1.b or 6A005.c.2.b having all of the following characteristics:*

(1) Operating at wavelengths between 300 nm and 800 nm;

(2) An average output power greater than 1 W;

(3) A repetition rate greater than 1 kHz; and

(4) Pulse width less than 100 ns;

(i) *Tunable pulsed dye laser amplifiers and oscillators controlled by 6A005.c.1.b or 6A005.c.2.b having all of the following characteristics:*

(1) Operating at wavelengths between 300 nm and 800 nm;

(2) An average output power greater than 30 W;

(3) A repetition rate greater than 1 kHz; and

(4) Pulse width less than 100 ns;

Note: *NP controls do not apply to single mode oscillators.*

License Exceptions

LVS: N/A for NP items
$3000 for all other items

GBS: Neodymium-doped (other than glass) "lasers" controlled by 6A005.b.6.c.2 (except 6A005.b.6.c.2.b) that have an output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm, and an average or CW output power not exceeding 2kW, and operate in a pulse-excited, non- "Q-switched" multiple-transverse mode, or in a continuously excited, multiple-transverse mode; Dye and Liquid Lasers controlled by 6A005.c.1, c.2 and c.3, except for a pulsed single longitudinal mode oscillator having an average output power exceeding 1 W and a repetition rate exceeding 1 kHz if the "pulse duration" is less than 100 ns; CO "lasers" controlled by 6A005.d.2 having a CW maximum rated single or multimode output power not exceeding 10 kW; CO_2 or CO/CO_2 "lasers" controlled by 6A005.d.3 having an output wavelength in the range from 9,000 to 11,000 nm and having a pulsed output not exceeding 2 J per pulse and a maximum rated average single or multimode output power not exceeding 5 kW; CO_2 "lasers" controlled by 6A005.d.3 that operate in CW multiple-transverse mode, and having a CW output power not exceeding 15kW; and 6A005.f.1.

CIV: Neodymium-doped (other than glass) "lasers" controlled by 6A005.b.6.c.2 (except 6A005.b.6.c.2.b) that have an output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm, and an average or CW output power not exceeding 2kW, and operate in a pulse-excited, non- "Q-switched" multiple-transverse mode, or in a continuously excited, multiple-transverse mode; Dye and Liquid Lasers controlled by 6A005.c.1, c.2 and c.3, except for a pulsed single longitudinal mode oscillator having an average output power exceeding 1 W and a repetition rate exceeding 1 kHz if the "pulse duration" is less than 100 ns; CO "lasers" controlled by 6A005.d.2 having a CW maximum rated single or multimode output power not exceeding 10 kW; CO_2 or CO/CO_2 "lasers" controlled by 6A005.d.3 having an output wavelength in the range from 9,000 to 11,000 nm and having a pulsed output not exceeding 2 J per pulse and a maximum rated average single or multimode output power not exceeding 5 kW; CO_2 "lasers" controlled by 6A005.d.3 that operate in CW multiple-transverse mode, and having a CW output power not exceeding 15kW; and 6A005.f.1.

List of Items Controlled

Unit: Number

Related Controls: (1) See ECCN 6D001 for "software" for items controlled under this entry. (2) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 6A205 and 6A995. (4) See ECCN 3B001 for excimer "lasers" specially designed for lithography equipment. (5) "Lasers" specially designed or prepared for use in isotope separation are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (6) Shared aperture optical elements, capable of operating in "super-high power

laser" applications, and "lasers" specifically designed, modified, or configured for military application 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: 'Wall-plug efficiency' is defined as the ratio of laser output power (or "average output power") to total electrical input power required to operate the "laser", including the power supply/conditioning and thermal conditioning/heat exchanger.
Items:

Notes:

1. *Pulsed "lasers" include those that run in a continuous wave (CW) mode with pulses superimposed.*

2. *Eximer, semiconductor, chemical, CO, CO_2, and non-repetitive pulsed Nd:glass "lasers" are only specified in 6A005.d.*

3. *6A005 includes fiber "lasers".*

4. *The control status of "lasers" incorporating frequency conversion (i.e., wavelength change) by means other than one "laser" pumping another "laser" is determined by applying the control parameters for both the output of the source "laser" and the frequency-converted optical output.*

5. *6A005 does not control the following "lasers":*

a. *Ruby with output energy below 20 J;*

b. *Nitrogen;*

c. *Krypton.*

a. Non-"tunable" continuous wave "(CW) lasers", having any of the following:

a.1. An output wavelength less than 150 nm with an output power exceeding 1W;

a.2. An output wavelength of 150 nm or more but not exceeding 520 nm and having an output power exceeding 30 W;

Note: *6A005.a.2 does not control Argon "lasers" having an output power equal to or less than 50 W.*

a.3. An output wavelength exceeding 520 nm but not exceeding 540 nm and having any of the following:

a.3.a. A single transverse mode output having an output power exceeding 50 W; *or*

a.3.b. A multiple transverse mode output having an output power exceeding 150 W;

a.4. An output wavelength exceeding 540 nm but not exceeding 800 nm and having an output power exceeding 30 W;

a.5. An output wavelength exceeding 800 nm but not exceeding 975 nm and having any of the following:

a.5.a. A single transverse mode output having an output power exceeding 50 W; *or*

a.5.b. A multiple transverse mode output having an output power exceeding 80 W;

a.6. An output wavelength exceeding 975 nm but not exceeding 1,150 nm and having any of the following;

a.6.a. A single transverse mode output having any of the following:

a.6.a.1. A "wall-plug efficiency" exceeding 12% and an output power exceeding 100 W; *or*

a.6.a.2. An output power exceeding

150 W; *or*

a.6.b. A multiple transverse mode output having any of the following:

a.6.b.1. A "wall-plug efficiency" exceeding 18% and an output power exceeding 500 W; *or*

a.6.b.2. An output power exceeding 2 kW;

Note: *6A005.a.6.b does not control multiple transverse mode, industrial "lasers" with output power exceeding 2kW and not exceeding 6 kW with a total mass greater than 1,200 kg. For the purpose of this note, total mass includes all components required to operate the "laser", e.g., "laser", power supply, heat exchanger, but excludes external optics for beam conditioning and/or delivery.*

a.7. An output wavelength exceeding 1,150 nm but not exceeding 1,555 nm and having any of the following:

a.7.a. A single transverse mode having an output power exceeding 50 W; *or*

a.7.b. A multiple transverse mode having an output power exceeding 80 W; *or*

a.8. An output wavelength exceeding 1,555 nm and having an output power exceeding 1 W.

b. Non-"tunable" "pulsed lasers", having any of the following;

b.1. An output wavelength less than 150 nm and having any of the following:

b.1.a. An output energy exceeding 50 mJ per pulse and a "peak power" exceeding 1 W; *or*

b.1.b. An "average output power" exceeding 1 W;

b.2. An output wavelength of 150 nm or more but not exceeding 520 nm and having any of the following:

b.2.a. An output energy exceeding 1.5 J per pulse and a "peak power" exceeding 30 W; *or*

b.2.b. An "average output power" exceeding 30 W;

Note: *6A005.b.2.b does not control Argon "lasers" having an "average output power" equal to or less than 50 W.*

b.3. An output wavelength exceeding 520 nm, but not exceeding 540 nm and having any of the following:

b.3.a. A single transverse mode output having any of the following:

b.3.a.1. An output energy exceeding 1.5 J per pulse and a "peak power" exceeding 50 W; *or*

b.3.a.2. An "average output power" exceeding 50 W; *or*

b.3.b. A multiple transverse mode output having any of the following:

b.3.b.1. An output energy exceeding 1.5 J per pulse and a "peak power" exceeding 150 W; *or*

b.3.b.2. An "average output power" exceeding 150 W;

b.4. An output wavelength exceeding 540 nm but not exceeding 800 nm and having any of the following:

b.4.a. An output energy exceeding 1.5 J per pulse and a "peak power" exceeding 30 W; *or*

b.4.b. An "average output power" exceeding 30 W;

b.5. An output wavelength exceeding 800 nm but not exceeding 975 nm and having any of the following:

b.5.a. A "pulse duration" not exceeding 1 μs and having any of the following:

b.5.a.1. An output energy exceeding 0.5 J per pulse and a "peak power" exceeding 50 W;

b.5.a.2. A single transverse mode output having an "average output power" exceeding 20 W; *or*

b.5.a.3. A multiple transverse mode output having an "average output power" exceeding 50 W; *or*

b.5.b. A "pulse duration" exceeding 1 μs and having any of the following:

b.5.b.1. An output energy exceeding 2 J per pulse and a "peak power" exceeding 50 W;

b.5.b.2. A single transverse mode output having an "average output power" exceeding 50 W; *or*

b.5.b.3. A multiple transverse mode output having an "average output power" exceeding 80 W.

b.6. An output wavelength exceeding 975 nm but not exceeding 1,150 nm and having any of the following:

b.6.a. A "pulse duration" of less than 1 ns and having any of the following:

b.6.a.1. An output "peak power" exceeding 5 GW per pulse;

b.6.a.2. An "average output power" exceeding 10 W; *or*

b.6.a.3. An output energy exceeding 0.1 J per pulse;

b.6.b. A "pulse duration" exceeding 1 ns but not exceeding 1 μs, and having any of the following:

b.6.b.1. A single transverse mode output having any of the following:

b.6.b.1.a. A "peak power" exceeding 100 MW;

b.6.b.1.b. An "average output power" exceeding 20 W limited by design to a maximum pulse repetition frequency less than or equal to 1 kHz;

b.6.b.1.c. A 'wall-plug efficiency' exceeding 12% and an "average output power" exceeding 100 W and capable of operating at a pulse repetition frequency greater than 1 kHz;

b.6.b.1.d. An "average output power" exceeding 150 W and capable of operating at a pulse repetition frequency greater than 1 kHz; *or*

b.6.b.1.e. An output energy exceeding 2 J per pulse;

b.6.b.2. A multiple transverse mode output having any of the following:

b.6.b.2.a. A "peak power" exceeding 400 MW;

b.6.b.2.b. A 'wall-plug efficiency' exceeding 18% and an "average output power" exceeding 500 W;

b.6.b.2.c. An "average output power" exceeding 2 kW; *or*

b.6.b.2.d. An output energy exceeding 4 J per pulse; *or*

b.6.c. A "pulse duration" exceeding 1 μs and having any of the following:

b.6.c.1. A single transverse mode output having any of the following:

b.6.c.1.a. A "peak power" exceeding 500 kW;

b.6.c.1.b. A 'wall-plug efficiency' exceeding 12% and an "average output power" exceeding 100 W; *or*

b.6.c.1.c. An "average output power" exceeding 150 W; *or*

b.6.c.2. A multiple transverse mode output having any of the following:

b.6.c.2.a. A "peak power" exceeding 1 MW;

b.6.c.2.b. A 'wall-plug efficiency' exceeding 18% and an "average output power" exceeding 500 W; *or*

b.6.c.2.c. An "average output power" exceeding 2 kW;

b.7. An output wavelength exceeding 1,150 nm but not exceeding 1,555 nm and having any of the following:

b.7.a. A "pulse duration" not exceeding 1 μs and having any of the following:

b.7.a.1. An output energy exceeding 0.5 J per pulse and a "peak power" exceeding 50 W;

b.7.a.2. A single transverse mode output having an "average output power" exceeding 20 W; *or*

b.7.a.3. A multiple transverse mode output having an "average output power" exceeding 50 W; *or*

b.7.b. A "pulse duration" exceeding 1 μs and having any of the following:

b.7.b.1. An output energy exceeding 2 J per pulse and a "peak power" exceeding 50 W;

b.7.b.2. A single transverse mode output having an "average output power" exceeding 50 W; *or*

b.7.b.3. A multiple transverse mode output having an "average output power" exceeding 80 W; *or*

b.8. An output wavelength exceeding 1,555 nm and having any of the following:

b.8.a. An output energy exceeding 100 mJ per pulse and a "peak power" exceeding 1 W; *or*

b.8.b. An "average output power" exceeding 1 W;

c. "Tunable" lasers, having any of the following:

Note: *6A005.c includes titanium-sapphire (Ti: $Al_2 0_3$), thulium-YAG (Tm: YAG), thulium-YSGG (Tm:YSGG), alexandrite (Cr:$BeAl_2 0_4$), color center "lasers", dye "lasers", and liquid "lasers".*

c.1. An output wavelength less than 600 nm and having any of the following:

c.1.a. An output energy exceeding 50 mJ per pulse and a "peak power" exceeding 1 W; *or*

c.1.b. An average or CW output power exceeding 1W;

c.2. An output wavelength of 600 nm or more but not exceeding 1,400 nm and having any of the following:

c.2.a. An output energy exceeding 1 J per pulse and a "peak power" exceeding 20 W; *or*

c.2.b. An average or CW output power exceeding 20 W; *or*

c.3. An output wavelength exceeding 1,400 nm and having any of the following:

c.3.a. An output energy exceeding 50 mJ per pulse and a "peak power" exceeding 1 W; *or*

c.3.b. An average or CW output power exceeding 1 W;

d. Other "lasers", not controlled in 6A005.a., 6A005.b, or 6A005.c, as follows:

d.1. Semiconductor "lasers", as follows:

Notes:

1. *6A005.d.1 includes semiconductor "lasers" having optical output connectors (e.g., fiber optic pigtails).*

2. *The control status of semiconductor "lasers" specially designed for other equipment is determined by the control status of the other equipment.*

d.1.a. Individual single-transverse mode semiconductor "lasers", having any of the following:

d.1.a.1. A wavelength equal to or less than 1,510 nm and having an average or CW output power exceeding 1.5 W; *or*

d.1.a.2. A wavelength greater than 1,510 nm, and having an average or CW output power exceeding 500 mW;

d.1.b. Individual, multiple-transverse mode semiconductor "lasers", having any of the following:

d.1.b.1. A wavelength of less than 1,400 nm and having an average or CW output power exceeding 10W;

d.1.b.2. A wavelength equal to or greater than 1,400 nm and less than 1,900 nm, and having an average or CW output power exceeding 2.5 W; *or*

d.1.b.3. A wavelength equal to or greater than 1,900 nm and having an average or CW output power exceeding 1 W.

d.1.c. Individual semiconductor "laser" arrays, having any of the following:

d.1.c.1. A wavelength of less than 1,400 nm and having an average or CW output power exceeding 80 W;

d.1.c.2. A wavelength equal to or greater than 1,400 nm and less than 1,900 nm and having an average or CW output power exceeding 25 W; *or*

d.1.c.3. A wavelength equal to or greater than 1,900 nm and having an average or CW output power exceeding 10 W.

d.1.d. Array stacks of semiconductor "lasers" containing at least one array that is controlled under 6A005.d.1.c.

Technical Notes*:*

1. Semiconductor "lasers" are commonly called "laser" diodes.

2. An "array" consists of multiple semiconductor "laser" emitters fabricated as a single chip so that the centers of the emitted light beams are on parallel paths.

3. An "array stack" is fabricated by stacking, or otherwise assembling, "arrays" so that the centers of the emitted light beams are on parallel paths.

d.2. Carbon monoxide (CO) "lasers" having any of the following:

d.2.a. An output energy exceeding 2 J per pulse and a "peak power" exceeding 5 kW; *or*

d.2.b. An average or CW output power exceeding 5 kW;

d.3. Carbon dioxide (CO_2) "lasers" having any of the following:

d.3.a. A CW output power exceeding 15 kW;

d.3.b. A pulsed output having a "pulse duration" exceeding 10 µs and having any of the following:

d.3.b.1. An "average output power" exceeding 10 kW; *or*

d.3.b.2. A "peak power" exceeding 100 kW; *or*

d.3.c. A pulsed output having a "pulse duration" equal to or less than 10 µs and having any of the following:

d.3.c.1. A pulse energy exceeding 5 J per pulse; *or*

d.3.c.2. An "average output power" exceeding 2.5 kW;

d.4. Excimer "lasers", having any of the following:

d.4.a. An output wavelength not exceeding 150 nm and having any of the following:

d.4.a.1. An output energy exceeding 50 mJ per pulse; *or*

d.4.a.2. An "average output power" exceeding 1 W;

d.4.b. An output wavelength exceeding 150 nm but not exceeding 190 nm and having any of the following:

d.4.b.1. An output energy exceeding 1.5 J per pulse; *or*

d.4.b.2. An "average output power" exceeding 120 W;

d.4.c. An output wavelength exceeding 190 nm but not exceeding 360 nm and having any of the following:

d.4.c.1. An output energy exceeding 10 J per pulse; *or*

d.4.c.2. An "average output power" exceeding 500 W; *or*

d.4.d. An output wavelength exceeding 360 nm and having any of the following:

d.4.d.1. An output energy exceeding 1.5 J per pulse; *or*

d.4.d.2. An "average output power" exceeding 30 W;

Note: *For excimer "lasers" specially designed for lithography equipment, see 3B001.*

d.5. "Chemical lasers", as follows:

d.5.a. Hydrogen Fluoride (HF) "lasers";

d.5.b. Deuterium Fluoride (DF) "lasers";

d.5.c. "Transfer lasers", as follows:

d.5.c.1. Oxygen Iodine (O_2-I) "lasers";

d.5.c.2. Deuterium Fluoride-Carbon dioxide (DF-CO_2) "lasers";

d.6. "Non-repetitive pulsed" Neodymium (Nd) glass "lasers", having any of the following:

d.6.a. A "pulse duration" not exceeding 1 μs and an output energy exceeding 50 J per pulse; *or*

d.6.b. A "pulse duration" exceeding 1 μs and an output energy exceeding 100 J per pulse;

Note: *"Non-repetitive pulsed" refers to "lasers" that produce either a single output pulse or that have a time interval between pulses exceeding one minute.*

e. Components, as follows:

e.1. Mirrors cooled either by active cooling or by heat pipe cooling;

Technical Note*: Active cooling is a cooling technique for optical components using flowing fluids within the subsurface (nominally less than 1 mm below the optical surface) of the optical component to remove heat from the optic.*

e.2. Optical mirrors or transmissive or partially transmissive optical or electro-optical components specially designed for use with controlled "lasers";

f. Optical equipment, as follows:

N.B.: *For shared aperture optical elements, capable of operating in "Super-High Power Laser" ("SHPL") applications, see the U.S. Munitions List (22 CFR part 121).*

f.1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront having any the following:

f.1.a. Frame rates equal to or more than 100 Hz and phase discrimination of at least 5% of the beam's wavelength; *or*

f.1.b. Frame rates equal to or more than 1,000 Hz and phase discrimination of at least 20% of the beam's wavelength;

f.2. "Laser" diagnostic equipment capable of measuring "SHPL" system angular beam steering errors of equal to or less than 10 μrad;

f.3. Optical equipment and components specially designed for a phased-array "SHPL" system for coherent beam combination to an accuracy of lambda/10 at the designed wavelength, or 0.1 μm, whichever is the smaller;

f.4. Projection telescopes specially designed for use with "SHPL" systems.

6A006 "Magnetometers", "magnetic gradiometers", "intrinsic magnetic gradiometers", underwater electric field sensors, and "compensation systems", and specially designed components therefor, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Requirement Notes*: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.*

License Exceptions

LVS: $1500, N/A for 6A006.a.1; "Magnetometers" and subsystems defined in 6A006.a.2 using optically pumped or nuclear precession (proton/Overhauser) having a "noise level" (sensitivity) lower (better) than 2 pT rms per square root Hz; and 6A006.d.

GBS: N/A

CIV: N/A

List of Items Controlled

Unit: $ value
Related Controls: See also 6A996. This entry does not control instruments specially designed for fishery applications or biomagnetic measurements for medical diagnostics.
Related Definitions: N/A
Items:

a. "Magnetometers" and subsystems, as follows:

a.1. Using "superconductive" (SQUID) "technology" and having any of the following characteristics:

a.1.a. SQUID systems designed for stationary operation, without specially designed subsystems designed to reduce in-motion noise, and having a "noise level" (sensitivity) equal to or lower (better) than 50 fT (rms) per square root Hz at a frequency of 1 Hz; *or*

a.1.b. SQUID systems having an in-motion-magnetometer "noise level" (sensitivity) lower (better) than 20 pT (rms) per square root Hz at a frequency of 1 Hz and specially designed to reduce in-motion noise;

a.2. Using optically pumped or nuclear precession (proton/Overhauser) "technology" having a "noise level" (sensitivity) lower (better) than 20 pT (rms) per square root Hz;

a.3. Using fluxgate "technology" having a "noise level" (sensitivity) equal to or lower (better) than 10 pT (rms) per square root Hz at a frequency of 1 Hz;

a.4. Induction coil "magnetometers" having a "noise level" (sensitivity) lower (better) than any of the following:

a.4.a. 0.05 nT rms/square root Hz at frequencies of less than 1 Hz;

a.4.b. 1×10^{-3} nT rms/square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; *or*

a.4.c. 1×10^{-4} nT rms/square root Hz at frequencies exceeding 10 Hz;

a.5. Fiber optic "magnetometers" having a "noise level" (sensitivity) lower (better) than 1 nT rms per square root Hz;

b. Underwater electric field sensors having a "noise level" (sensitivity) lower (better) than 8 nanovolt per meter per square root Hz when measured at 1 Hz.

c. "Magnetic gradiometers" as follows:

c.1. "Magnetic gradiometers" using multiple "magnetometers" controlled by 6A006.a;

c.2. Fiber optic "intrinsic magnetic gradiometers" having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.3 nT/m rms per square root Hz;

c.3. "Intrinsic magnetic gradiometers", using "technology" other than fiber-optic "technology", having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.015 nT/m rms per square root Hz; *and*

d. "Compensation systems" for magnetic and Underwater Electric Field Sensors resulting in a performance equal to or better than the control parameters of 6A006.a, 6A006.b, and 6A006.c.

6A007 Gravity meters (gravimeters) and gravity gradiometers, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, MT, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
MT applies to 6A007.b and .c when the accuracies in 6A007.b.1 and b.2 are met or exceeded	MT Column 1
AT applies to entire entry	AT Column 1

License Exceptions

LVS: $3000; N/A for MT
GBS: N/A
CIV: N/A

List of Items Controlled

Unit: $ value
Related Controls: See also 6A107 and 6A997
Related Definitions: N/A
Items:

a. Gravity meters designed or modified for ground use having a static accuracy of less (better) than 10 μgal;

***Note**: 6A007.a does not control ground gravity meters of the quartz element (Worden) type.*

b. Gravity meters designed for mobile platforms for ground, marine, submersible, space or airborne use, having all of the following:

b.1. A static accuracy of less (better) than 0.7 mgal; *and*

b.2. An in-service (operational) accuracy of less (better) than 0.7 mgal having a time-to-steady-state registration of less than 2 minutes under any combination of attendant corrective compensations and motional influences;

c. Gravity gradiometers.

6A008 Radar systems, equipment and assemblies having any of the following characteristics (see List of Items Controlled), and specially designed components therefor.

License Requirements

Reason for Control: NS, MT, RS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
MT applies to items that are designed for airborne applications and that are usable in systems controlled for MT reasons	MT Column 1
RS applies to 6A008.j.1	RS Column 1
AT applies to entire entry	AT Column 1

***License Requirement Notes**: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.*

License Exceptions

LVS: $5000; N/A for MT and for 6A008.j.1 and 6A008.l.3
GBS: Yes, for 6A008.b, .c, and l.1 only
CIV: Yes, for 6A008.b, .c, and l.1 only

List of Items Controlled

Unit: $ value
Related Controls: This entry does not control: Secondary surveillance radar (SSR); Car radar designed for collision prevention; Displays or monitors used for Air Traffic Control (ATC) having no more than 12 resolvable elements per mm; Meteorological (weather) radar. See also 6A108 and 6A998. ECCN 6A998 controls, *inter alia*, the LIDAR equipment excluded by the note to paragraph j of this

ECCN (6A008).
Related Definitions: N/A
Items:

Note: *6A008 does not control:*

a. Secondary surveillance radar (SSR);

b. Civil Automotive Radar;

c. Displays or monitors used for air traffic control (ATC) having no more than 12 resolvable elements per mm;

d. Meteorological (weather) radar.

a. Operating at frequencies from 40 GHz to 230 GHz and having any of the following:

a.1. An "average output power" exceeding 100 mW; or

a.2. Locating accuracy of 1 m or less (better) in range and 0.2 degree or less (better) in azimuth;

b. Having a tunable bandwidth exceeding ±6.25% of the center operating frequency;

Technical Note*: The center operating frequency equals one half of the sum of the highest plus the lowest specified operating frequencies.*

c. Capable of operating simultaneously on more than two carrier frequencies;

d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or sidelooking airborne (SLAR) radar mode;

e. Incorporating "electronically steerable phased array antennae";

f. Capable of heightfinding non-cooperative targets;

Note*: 6A008.f does not control precision approach radar (PAR) equipment conforming to ICAO standards.*

g. Specially designed for airborne (balloon or airframe mounted) operation and having Doppler "signal processing" for the detection of moving targets;

h. Employing processing of radar signals using any of the following:

h.1. "Radar spread spectrum" techniques; *or*

h.2. "Radar frequency agility" techniques;

i. Providing ground-based operation with a maximum "instrumented range" exceeding 185 km;

Note*: 6A008.i does not control:*

a. Fishing ground surveillance radar;

b. Ground radar equipment specially designed for en route air traffic control, provided that all the following conditions are met:

1. It has a maximum "instrumented range" of 500 km or less;

2. It is configured so that radar target data can be transmitted only one way from the radar site to one or more civil ATC centers;

3. It contains no provisions for remote control of the radar scan rate from the en route ATC center; and

4. It is to be permanently installed;

c. Weather balloon tracking radars.

j. Being "laser" radar or Light Detection and Ranging (LIDAR) equipment, having any of the following:

j.1. "Space-qualified"; *or*

j.2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20 μrad (microradians);

***Note**: 6A008.j does not control LIDAR equipment specially designed for surveying or for meteorological observation.*

k. Having "signal processing" sub-systems using "pulse compression", with any of the following:

k.1. A "pulse compression" ratio exceeding 150; *or*

k.2. A pulse width of less than 200 ns; *or*

l. Having data processing sub-systems with any of the following:

l.1. "Automatic target tracking" providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage;

***Note**: 6A008.l.1 does not control conflict alert capability in ATC systems, or marine or harbor radar.*

l.2. Calculation of target velocity from primary radar having non-periodic (variable) scanning rates;

l.3. Processing for automatic pattern recognition (feature extraction) and comparison with target characteristic data bases (waveforms or imagery) to identify or classify targets; *or*

l.4. Superposition and correlation, or fusion, of target data from two or more "geographically dispersed" and "interconnected radar sensors" to enhance and discriminate targets.

***Note**: 6A008.l.4 does not control systems, equipment and assemblies designed for marine traffic control.*

6A102 Radiation hardened detectors, other than those controlled by 6A002, specially designed or modified for protecting against nuclear effects (*e.g.*, Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects) and usable for "missiles", designed or rated to withstand radiation levels which meet or exceed a total irradiation dose of 5×10^5 rads (silicon).

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: Components in number
Related Controls: N/A
Related Definitions: In this entry, a detector is defined as a mechanical, electrical, optical or chemical device that automatically identifies and records, or registers a stimulus such as an environmental change in pressure or temperature, an electrical or electromagnetic signal or radiation from a radioactive material.
Items:

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

6A103 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, usable in protecting "missiles" against nuclear effects (e.g.

Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable 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.)

6A107 Gravity meters (gravimeters) and specially designed components for gravity meters and gravity gradiometers, as follows (see List of Items Controlled).

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: N/A
Items:

a. Gravity meters (gravimeters), other than those controlled by 6A007.b, designed or modified for airborne or marine use, and having a static or operational accuracy of 7 x 10^{-6} m/s^2 (0.7 milligal) or better, and having a time to steady-state registration of two minutes or less, usable for "missiles";

b. Specially designed components for gravity meters controlled in 6A007.b or 6A107.a and gravity gradiometers controlled in 6A007.c.

6A108 Radar systems and tracking systems, other than those controlled by 6A008, as follows (see List of Items Controlled).

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: 1.) This entry does not control airborne civil weather radar conforming to international standards for civil weather radars provided that they do not incorporate any of the following: (a) Phased array antennas; (b) Frequency agility; (c) Spread spectrum; or (d) Signal processing specially designed for the tracking of vehicles. 2.) Items in 6A108.a that are specially designed or modified for "missiles" or for items on the U.S. Munitions List are subject to the export licensing authority of the U.S. Department of State, Defense Trade Controls (see 22 CFR part 121).
Related Definitions: Laser radar systems are defined as those that 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.
Items:

a. Radar and laser radar systems designed or modified for use in "missiles";

***Note**: 6A108.a includes the following:*

a. Terrain contour mapping equipment;

b. Imaging sensor equipment;

c. Scene mapping and correlation (both digital and analog) equipment;

d. Doppler navigation radar equipment.

b. Precision tracking systems, usable for rockets, missiles, or unmanned aerial vehicles capable of achieving a "range" equal to or greater than 300 km, as follows:

b.1. Tracking systems which use a code translator installed on the rocket or unmanned aerial vehicle in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of in-flight position and velocity;

b.2. Range instrumentation radars including associated optical/infrared trackers with all of the following capabilities:

b.2.a. Angular resolution better than 3 milliradians;

b.2.b. Range of 30 km or greater with a range resolution better than 10 m rms;

b.2.c. Velocity resolution better than 3 m/s.

6A202 Photomultiplier tubes having both of the following characteristics (see List of Items Controlled).

License Requirements

Reason for Control: NP, AT

Control(s)	*Country Chart*
NP applies to entire entry	NP 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: Number
Related Controls: See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry.
Related Definitions: N/A
Items:

a. Photocathode area of greater than 20 cm^2; *and*

b. Anode pulse rise time of less than 1 ns.

6A203 Cameras and components, other than those controlled by 6A003, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NP, AT

Control(s)	*Country Chart*
NP applies to entire entry	NP 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: Equipment and components in number; parts and accessories in $ value
Related Controls: (1) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (2) Also see ECCN 6A003.a.2, a.3, and a.4.
Related Definitions: N/A
Items:

a. Mechanical rotating mirror cameras, as follows, and specially designed components therefor:

a.1. Framing cameras with recording rates greater than 225,000 frames per second;

a.2. Streak cameras with writing speeds greater than 0.5 mm per microsecond;

Note: *Components of cameras controlled by 6A203.a include their synchronizing electronics units and rotor assemblies consisting of turbines, mirrors and bearings.*

b. Electronic streak cameras, electronic framing cameras, tubes and devices, as follows:

b.1. Electronic streak cameras capable of 50 ns or less time resolution;

b.2. Streak tubes for cameras controlled by 6A203.b.1;

b.3. Electronic (or electronically shuttered) framing cameras capable of 50 ns or less frame exposure time;

b.4. Framing tubes and solid-state imaging devices for use with cameras controlled by 6A203.b.3, as follows:

b.4.a. Proximity focused image intensifier tubes having the photocathode deposited on a transparent conductive coating to decrease photocathode sheet resistance;

b.4.b. Gated silicon intensifier target (SIT) videcon tubes, where a fast system allows gating the photoelectrons from the photocathode before they impinge on the SIT plate;

b.4.c. Kerr or Pockels cell electro-optical shuttering;

b.4.d. Other framing tubes and solid-state imaging devices having a fast-image gating time of less than 50 ns specially designed for cameras controlled by 6A203.b.3.

c. Radiation-hardened TV cameras, or lenses therefor, specially designed or rated as radiation hardened to withstand a total radiation dose greater than 50×10^3 Gy (silicon) (5×10^6 rad (silicon)) without operational degradation.

Technical Note: *The term Gy (silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation.*

6A205 "Lasers", "laser" amplifiers and oscillators, other than those controlled by 0B001.g.5, 0B001.h.6, or 6A005, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NP, AT

Control(s)	*Country Chart*
NP applies to entire entry	NP 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: Equipment in number
Related Controls: (1) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (2) Also see ECCNs 6A005 and 6A995. (3) See ECCN 6A005.a.2 for additional controls on argon ion lasers; See ECCN 6A005.b.6.b for additional controls on neodymium-doped lasers. (4) "Lasers" specially designed or prepared for use in isotope separation are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).
Related Definitions: N/A
Items:

a. Argon ion "lasers" having both of the following characteristics:

a.1. Operating at wavelengths between 400 nm and 515 nm; *and*

a.2. An average output power greater than 40 W;

b. Tunable pulsed single-mode dye laser oscillators having all of the following characteristics:

b.1. Operating at wavelengths between 600 nm and 800 nm;

b.2. Having an average output greater than 1W;

b.3 A repetition rate greater than 1 kHz; *and*

b.4. Pulse width less than 100 ns;

c. [RESERVED]

d. Pulsed carbon dioxide "lasers" having all of the following characteristics:

d.1. Operating at wavelengths between 9,000 nm and 11,000 nm;

d.2. A repetition rate greater than 250 Hz;

d.3. An average output power greater than 500 W; *and*

d.4. Pulse width of less than 200 ns;

e. Para-hydrogen Raman shifters designed to operate at 16 micrometer output wavelength and at a repetition rate greater than 250 Hz.;

f. Neodymium-doped (other than glass) lasers with an output wavelength between 1000 and 1100 nm having either of the following:

f.1. Pulse-excited and Q-switched with a pulse duration equal to or greater than 1 ns, and having either of the following:

f.1.a. A single-transverse mode output with an average output power greater than 40 W; or

f.1.b. A multiple-transverse mode output with an average output power greater than 50 W; *or*

f.2. Incorporating frequency doubling to give an output wavelength between 500 and 550 nm with an average output power of greater than 40 W.

6A225 Velocity interferometers for measuring velocities exceeding 1 km/s during time intervals of less than 10 microseconds.

License Requirements

Reason for Control: NP, AT

Control(s)	*Country Chart*
NP applies to entire entry	NP 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: Equipment in number; parts and accessories in $ value
Related Controls: See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry.
Related Definitions: N/A
ECCN Controls: 6A225 includes velocity interferometers, such as VISARs (Velocity interferometer systems for any reflector) and DLIs (Doppler laser interferometers).
Items:

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

6A226 Pressure sensors, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NP, AT

Control(s)	*Country Chart*
NP applies to entire entry	NP 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: Equipment in number; parts and accessories in $ value
Related Controls: See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry.
Related Definitions: N/A
Items:

a. Manganin gauges for pressures greater than 100 kilobars; *or*

b. Quartz pressure transducers for pressures greater than 100 kilobars.

6A991 Marine or terrestrial acoustic equipment, n.e.s., capable of detecting or locating underwater objects or features or positioning surface vessels or underwater vehicles; and specially designed components, n.e.s.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 2

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:

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

6A992 Optical Sensors, not controlled by 6A002.

License Requirements

Reason for Control: AT, RS

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

RS applies to entire entry. A license is required for items controlled by this entry for export or reexport to Iraq or transfer within Iraq for regional stability reasons. The Commerce Country Chart is not designed to determine RS license requirements for this entry. See §§742.6 and 746.3 of the EAR for additional information.

License Exceptions

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

List of Items Controlled

Unit: Equipment in number; parts and accessories in $ value
Related Controls: N/A
Related Definitions: N/A
Items:

a. Image intensifier tubes and specially designed components therefor, as follows:

a.1. Image intensifier tubes having all the following:

a.1.a. A peak response in wavelength range exceeding 400 nm, but not exceeding 1,050 nm;

a.1.b. A microchannel plate for electron image amplification with a hole pitch (center-to-center spacing) of less than 25 micrometers; *and*

a.1.c. Having any of the following:

a.1.c.1. An S-20, S-25 or multialkali photocathode; *or*

a.1.c.2. A GaAs or GaInAs photocathode;

a.2. Specially designed microchannel plates having both of the following characteristics:

a.2.a. 15,000 or more hollow tubes per plate; *and*

a.2.b. Hole pitch (center-to-center spacing) of less than 25 micrometers.

b. Direct view imaging equipment operating in the visible or infrared spectrum, incorporating image intensifier tubes having the characteristics listed in 6A992.a.1.

6A993 Cameras, not controlled by 6A003 or 6A203, as follows (see List of Items Controlled).

License Requirements

Reason for Control: AT

Controls	*Country Chart*
AT applies to entire entry	AT Column 1

License Exceptions

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

List of Items Controlled

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

a. Cameras that meet the criteria of Note 3 to 6A003.b.4.

b. [RESERVED]

6A994 Optics, not controlled by 6A004.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

License Exceptions

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

List of Items Controlled

Unit: Equipment in number; parts and accessories in $ value
Related Controls: N/A
Related Definitions: N/A
Items:

a. Optical filters:

a.1. For wavelengths longer than 250 nm, comprised of multi-layer optical coatings and having either of the following:

a.1.a. Bandwidths equal to or less than 1 nm Full Width Half Intensity (FWHI) and peak transmission of 90% or more; *or*

a.1.b. Bandwidths equal to or less than 0.1 nm FWHI and peak transmission of 50% or more;

Note: *6A994 does not control optical filters with fixed air gaps or Lyot-type filters.*

a.2. For wavelengths longer than 250 nm, and having all of the following:

a.2.a. Tunable over a spectral range of 500 nm or more;

a.2.b. Instantaneous optical bandpass of 1.25 nm or less;

a.2.c. Wavelength resettable within 0.1 ms to an accuracy of 1 nm or better within the tunable spectral range; *and*

a.2.d. A single peak transmission of 91% or more;

a.3. Optical opacity switches (filters) with a field of view of 30° or wider and a response time equal to or less than 1 ns;

b. "Fluoride fiber" cable, or optical fibers therefor, having an attenuation of less than 4 dB/km in the wavelength range exceeding 1,000 nm but not exceeding 3,000 nm.

6A995 "Lasers" (see List of Items Controlled).

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

License Exceptions

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

List of Items Controlled

Unit: Equipment in number; parts and accessories in $ value
Related Controls: N/A
Related Definitions: N/A
Items:

a. Carbon dioxide (CO_2) "lasers" having any of the following:

a.1. A CW output power exceeding 10 kW;

a.2. A pulsed output with a "pulse duration" exceeding 10 microseconds; *and*

a.2.a. An average output power exceeding 10 kW; *or*

a.2.b. A pulsed "peak power" exceeding 100 kW; *or*

a.3. A pulsed output with a "pulse duration" equal to or less than 10 microseconds; *and*

a.3.a. A pulse energy exceeding 5 J per pulse and "peak power" exceeding 2.5 kW; *or*

a.3.b. An average output power exceeding 2.5 kW;

b. Semiconductor lasers, as follows:

b.1. Individual, single-transverse mode semiconductor "lasers" having:

b.1.a. An average output power exceeding 100 mW; *or*

b.1.b. A wavelength exceeding 1,050 nm;

b.2. Individual, multiple-transverse mode semiconductor "lasers", or arrays of individual semiconductor "lasers", having a wavelength exceeding 1,050 nm;

c. Ruby "lasers" having an output energy exceeding 20 J per pulse;

d. Non-"tunable" "pulsed lasers" having an output wavelength exceeding 975 nm but not exceeding 1,150 nm and having any of the following:

d.1. A "pulse duration" equal to or exceeding 1 ns but not exceeding 1 μs, and having any of the following:

d.1.a. A single transverse mode output and having any of the following:

d.1.a.1. A 'wall-plug efficiency' exceeding 12% and an "average output power" exceeding 10 W and capable of operating at a pulse repetition frequency greater than 1kHz; *or*

d.1.a.2. An "average output power" exceeding 20 W; *or*

d.1.b. A multiple transverse mode output and having any of the following:

d.1.b.1. A 'wall-plug efficiency' exceeding 18% and an "average output power" exceeding 30W;

d.1.b.2. A "peak power" exceeding 200 MW; *or*

d.1.b.3. An "average output power" exceeding 50 W; *or*

d.2. A "pulse duration" exceeding 1 μs and having any of the following:

d.2.a. A single transverse mode output and having any of the following:

d.2.a.1. A 'wall-plug efficiency' exceeding 12% and an "average output power" exceeding 10 W and capable of operating at a pulse repetition frequency greater than 1 kHz; *or*

d.2.a.2. An "average output power" exceeding 20 W; *or*

d.2.b. A multiple transverse mode output

and having any of the following:

d.2.b.1. A 'wall-plug efficiency' exceeding 18% and an "average output power" exceeding 30 W; *or*

d.2.b.2. An "average output power" exceeding 500 W;

e. Non-"tunable" continuous wave "(CW) lasers", having an output wavelength exceeding 975 nm but not exceeding 1,150nm and having any of the following:

e.1. A single transverse mode output and having any of the following:

e.1.a. A 'wall-plug efficiency' exceeding 12% and an "average output power" exceeding 10 W and capable of operating at a pulse repetition frequency greater than 1 kHz; *or*

e.1.b. An "average output power" exceeding 50 W; *or*

e.2. A multiple transverse mode output and having any of the following:

e.2.a. A 'wall-plug efficiency' exceeding 18% and an "average output power" exceeding 30 W; *or*

e.2.b. An "average output power" exceeding 500 W;

Note: *6A995.e.2.b does not control multiple transverse mode, industrial "lasers" with output power less than o equal to 2kW with a total mass greater than 1,200kg. For the purpose of this note, total mass includes all components required to operate the "laser", e.g., "laser", power supply, heat exchanger, but excludes external optics for beam conditioning and/or delivery.*

f. Non-"tunable" "lasers", having a wavelength exceeding 1,400 nm, but not exceeding 1555 nm *and* having any of the following:

f.1. An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; *or*

f.2. An average or CW output power exceeding 1 W;

g. Free electron "lasers."

6A996 "Magnetometers" not controlled by ECCN 6A006, "Superconductive" electromagnetic sensors, and specially designed components therefor, as follows (see List of Items Controlled).

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
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: N/A
Items:

a. "Magnetometers", n.e.s., having a "noise level" (sensitivity) lower (better) than 1.0 nT rms per square root Hz.

b. "Superconductive" electromagnetic sensors, components manufactured from "superconductive" materials:

b.1. Designed for operation at temperatures below the "critical temperature" of at least one of their "superconductive" constituents (including Josephson effect devices or "superconductive" quantum interference devices (SQUIDS));

b.2. Designed for sensing electromagnetic field variations at frequencies of 1 KHz or less; *and*

b.3. Having any of the following characteristics:

b.3.a. Incorporating thin-film SQUIDS with a minimum feature size of less than 2 µm and with associated input and output coupling circuits;

b.3.b. Designed to operate with a magnetic field slew rate exceeding 1 x 10^6 magnetic flux quanta per second;

b.3.c. Designed to function without magnetic shielding in the earth's ambient magnetic field; *or*

b.3.d. Having a temperature coefficient less (smaller) than 0.1 magnetic flux quantum/K.

6A997 Gravity meters (gravimeters) for ground use, n.e.s.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
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: N/A
Items:

a. Having a static accuracy of less (better) than 100 microgal; *or*

b. Being of the quartz element (Worden) type.

6A998 Radar systems, equipment and assemblies, n.e.s., (see List of Items Controlled), and specially designed components therefor.

License Requirements

Reason for Control: RS, AT

Control(s)	*Country Chart*
RS applies to paragraph .b	RS 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: N/A
Items:

a. Airborne radar equipment, n.e.s., and specially designed components therefor.

b. "Space-qualified""laser" radar or Light Detection and Ranging (LIDAR) equipment specially designed for surveying or for meteorological observation.

6A999 Specific processing equipment, as follows (see List of Items Controlled).

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.	

License Exceptions

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

List of Items Controlled

Unit: $ value
Related Controls: See also 6A203
Related Definitions: N/A
Items:

a. Seismic detection equipment;

b. Radiation hardened TV cameras, n.e.s.

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

6B004 Optical equipment, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Exceptions

LVS: $5000
GBS: Yes for 6B004.b
CIV: Yes for 6B004.b

List of Items Controlled

Unit: Number
Related Controls: This entry does not control microscopes.
Related Definitions: N/A
Items:

a. Equipment for measuring absolute reflectance to an accuracy of ± 0.1% of the reflectance value;

b. Equipment other than optical surface scattering measurement equipment, having an unobscured aperture of more than 10 cm, specially designed for the non-contact optical measurement of a non-planar optical surface figure (profile) to an "accuracy" of 2 nm or less (better) against the required profile.

6B007 Equipment to produce, align and calibrate land-based gravity meters with a static accuracy of better than 0.1 mgal.

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Exceptions

LVS: $5000
GBS: N/A
CIV: N/A

List of Items Controlled

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

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

6B008 Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor.

License Requirements

Reason for Control: NS, MT, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
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: Number
Related Controls: See also 6B108
Related Definitions: N/A
Items:

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

6B108 Systems, other than those controlled by 6B008, specially designed for radar cross section measurement usable for rockets, missiles, or unmanned aerial vehicles capable of achieving a "range" equal to or greater than 300 km and their subsystems.

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: Number
Related Controls: N/A
Related Definitions: N/A
Items:

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

6B995 Specially designed or modified equipment, including tools, dies, fixtures or gauges, and other specially designed components and accessories therefor.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

License Exceptions

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

List of Items Controlled

Unit: Equipment in number; parts and accessories in $ value
Related Controls: N/A
Related Definitions: N/A
Items:

a. For the manufacture or inspection of:

a.1. Free electron "laser" magnet wigglers;

a.2. Free electron "laser" photo injectors;

b. For the adjustment, to required tolerances, of the longitudinal magnetic field of free electron "lasers".

C. MATERIALS

6C002 Optical sensor materials, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Exceptions

LVS: $3000
GBS: N/A
CIV: N/A

List of Items Controlled

Unit: Number
Related Controls: See also 6C992
Related Definitions: N/A
Items:

a. Elemental tellurium (Te) of purity levels of 99.9995% or more;

b. Single crystals (including epitaxial wafers) of any of the following:

b.1. Cadmium zinc telluride (CdZnTe), with zinc content less than 6% by mole fraction;

b.2. Cadmium telluride (CdTe) of any purity level; *or*

b.3. Mercury cadmium telluride (HgCdTe) of any purity level.

***Technical Note**: Mole fraction is defined as the ratio of moles of ZnTe to the sum of the moles of CdTe and ZnTe present in the crystal.*

6C004 Optical materials, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Exceptions

LVS: $1500
GBS: Yes for 6C004.a and .e
CIV: Yes for 6C004.a and .e

List of Items Controlled

Unit: $ value
Related Controls: See also 6C994
Related Definitions: N/A
Items:

a. Zinc selenide (ZnSe) and zinc sulphide (ZnS) "substrate blanks" produced by the chemical vapor deposition process, having any of the following:

a.1. A volume greater than 100 cm^3; *or*

a.2. A diameter greater than 80 mm having a thickness of 20 mm or more;

b. Boules of the following electro-optic materials:

b.1. Potassium titanyl arsenate (KTA);

b.2. Silver gallium selenide ($AgGaSe_2$);

b.3. Thallium arsenic selenide (Tl_3AsSe_3, also known as TAS);

c. Non-linear optical materials, having all of the following:

c.1. Third order susceptibility (chi 3) of 10^{-6} m^2/V^2 or more; *and*

c.2. A response time of less than 1 ms;

d. "Substrate blanks" of silicon carbide or beryllium beryllium (Be/Be) deposited materials exceeding 300 mm in diameter or major axis length;

e. Glass, including fused silica, phosphate glass, fluorophosphate glass, zirconium fluoride (ZrF_4) and hafnium fluoride (HfF_4), having all of the following:

e.1. A hydroxyl ion (OH-) concentration of less than 5 ppm;

e.2. Integrated metallic purity levels of less than 1 ppm; *and*

e.3. High homogeneity (index of refraction variance) less than 5 x 10^{-6};

f. Synthetically produced diamond material with an absorption of less than 10^{-5} cm^{-1} for wavelengths exceeding 200 nm but not exceeding 14,000 nm.

6C005 Synthetic crystalline "laser" host material in unfinished form, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Exceptions

LVS: $1500
GBS: N/A
CIV: N/A

List of Items Controlled

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

a. Titanium doped sapphire;

b. Alexandrite.

6C992 Optical sensing fibers not controlled by 6A002.d.3 which are modified structurally to have a 'beat length' of less than 500 mm (high birefringence) or optical sensor materials not described in 6C002.b and having a zinc content of equal to or more than 6% by 'mole fraction.'

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

License Exceptions

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

List of Items Controlled

Unit: Equipment in number; parts and accessories in $ value
Related Controls: N/A
Related Definitions: 'Mole fraction' is defined as the ratio of moles of ZnTe to the sum of the moles of CdTe and ZnTe present in the crystal. 2) 'Beat length' is the distance over which two orthogonally polarized signals, initially in phase, must pass in order to achieve a 2 Pi radian(s) phase difference.
Items:

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

6C994 Optical materials.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

License Exceptions

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

List of Items Controlled

Unit: Equipment in number; parts and accessories in $ value
Related Controls: N/A
Related Definitions: 1) 'Fluoride fibers' are fibers manufactured from bulk fluoride compounds. 2) 'Optical fiber preforms' are bars, ingots, or rods of glass, plastic or other materials that have been specially processed for use in fabricating optical fibers. The characteristics of the preform determine the basic parameters of the resultant drawn optical fibers.
Items:

a. Low optical absorption materials, as follows:

a.1. Bulk fluoride compounds containing ingredients with a purity of 99.999% or better; *or*

Note: *6C994.a.1 controls fluorides of zirconium or aluminum and variants.*

a.2. Bulk fluoride glass made from compounds controlled by 6C004.e.1;

b. 'Optical fiber preforms' made from bulk fluoride compounds containing ingredients with a purity of 99.999% or better, specially designed for the manufacture of 'fluoride fibers' controlled by 6A994.b.

D. SOFTWARE

6D001 "Software" specially designed for the "development" or "production" of equipment controlled by 6A004, 6A005, 6A008 or 6B008.

License Requirements

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

Control(s)	*Country Chart*
NS applies to "software" for equipment controlled by 6A004, 6A005, 6A008 or 6B008	NS Column 1
MT applies to "software" for equipment controlled by 6A008 or 6B008 for MT reasons	MT Column 1
NP applies to "software" for equipment controlled by 6A005 for NP reasons	NP Column 1
RS applies to "software" for equipment controlled by 6A008.j.1	RS Column 1
AT applies to entire entry	AT Column 1

License Requirement Notes: See §743.1 of the EAR for reporting requirements for exports under License Exceptions

License Exceptions

CIV: N/A

TSR: Yes, except for the following:
1) Items controlled for MT reasons;
2) "Software" specially designed for the "development" or "production" of "space qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment defined in 6A008.j.1; or
3) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" specially designed for the "development" or "production" of equipment controlled by 6A008.l.3 or 6B008.

List of Items Controlled

Unit: $ value
Related Controls: "Software" specially designed for the "development" or "production" of "space qualified" components for optical systems defined in 6A004.c and "space qualified" optical control equipment defined in 6A004.d.1 is subject to the export licensing authority of the Department of State, Directorate of Defense Trade Controls (22 CFR part 121). See also 6D991, and ECCN 6E001 ("development") for "technology" for items controlled under this entry.
Related Definitions: N/A
Items:

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

6D002 "Software" specially designed for the "use" of equipment controlled by 6A002.b, 6A008 or 6B008.

License Requirements

Reason for Control: NS, MT, RS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 1
MT applies to "software" for equipment controlled by 6A008 or 6B008 for MT reasons	MT Column 1

RS applies to "software" for equipment controlled by 6A008.j.1	RS Column 1
AT applies to entire entry	AT Column 1

License Exceptions

CIV: N/A
TSR: Yes, except N/A for the following
1) Items controlled for MT reasons; or
2) "Software" specially designed for the "use" of "space qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment defined in 6A008.j.1.

List of Items Controlled

Unit: $ value
Related Controls: "Software" specially designed for the "use" of "space qualified" imaging sensors (e.g., "monospectral imaging sensors" and "multispectral imaging sensors") defined in 6A002.b.2.b.1 is subject to the export licensing authority of the Department of State, Directorate of Defense Trade Controls (22 CFR part 121), unless, on or after September 23, 2002, the Department of State issues a commodity jurisdiction determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. "Software" specially designed for the "use" of "space qualified" LIDAR equipment specially designed for surveying or for meteorological observation, released from control under the note in 6A008.j, is controlled in 6D991. See also 6D102, 6D991, and 6D992
Related Definitions: N/A
Items:

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

6D003 Other "software", as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

License Requirement Notes*: See §743.1 of the EAR for reporting requirements* for exports under License Exceptions.

License Exceptions

CIV: Yes for 6D003.h.1
TSR: Yes, except for exports or reexports To destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" for items controlled by 6D003.a.

List of Items Controlled

Unit: $ value
Related Controls: See also 6D103 and 6D993
Related Definitions: N/A
Items:

a. Acoustics "software", as follows:

a.1. "Software" specially designed for acoustic beam forming for the "real time processing" of acoustic data for passive reception using towed hydrophone arrays;

a.2. "Source code" for the "real time processing" of acoustic data for passive reception using towed hydrophone arrays;

a.3. "Software" specially designed for acoustic beam forming for the "real time processing" of acoustic data for passive reception using bottom or bay cable systems;

a.4. "Source code" for the "real time processing" of acoustic data for passive reception using bottom or bay cable systems.

b. Optical sensors. None.

c. Cameras. None.

d. Optics. None.

e. Lasers. None

f. Magnetic and Electric Field Sensors "software", as follows:

f.1. "Software" specially designed for magnetic and electric field "compensation systems" for magnetic sensors designed to operate on mobile platforms;

f.2. "Software" specially designed for magnetic and electric field anomaly detection on mobile platforms;

g. Gravimeters. "Software" specially designed to correct motional influences of gravity meters or gravity gradiometers;

h. Radar "software", as follows:

h.1. Air Traffic Control "software" application "programs" hosted on general purpose computers located at Air Traffic Control centers and capable of any of the following:

h.1.a. Processing and displaying more than 150 simultaneous "system tracks"; *or*

h.1.b. Accepting radar target data from more than four primary radars;

h.2. "Software" for the design or "production" of radomes which:

h.2.a. Are specially designed to protect the "electronically steerable phased array antennae" controlled by 6A008.e.; *and*

h.2.b. Result in an antenna pattern having an "average side lobe level" more than 40 dB below the peak of the main beam level.

***Technical Note**: "Average side lobe level" in 6D003.h.2.b is measured over the entire array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam.*

6D102 "Software" specially designed or modified for the "use" of goods controlled by 6A108.

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

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.

6D103 "Software" that processes post-flight, recorded data, enabling determination of vehicle position throughout its flight path, specially designed or modified for "missiles".

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

CIV: N/A
TSR: N/A

List of Items Controlled

Unit: $ value

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

6D991 "Software" specially designed for the "development", "production", or "use" of equipment controlled by 6A002.e, 6A991, 6A996, 6A997, or 6A998.

License Requirements

Reason for Control: RS, AT

Control(s)	*Country Chart*
RS applies to "software" for equipment controlled by 6A002.e or 6A998.b	RS Column 1
AT applies to entire entry, except "software" for equipment controlled by 6A991	AT Column 1
AT applies to "software" for equipment controlled by 6A991	AT Column 2

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.

6D992 "Software" specially designed for the "development" or "production" of equipment controlled by 6A992, 6A994, or 6A995.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

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.

6D993 Other "software" not controlled by 6D003.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

License Exceptions

CIV: N/A
TSR: N/A

List of Items Controlled

Unit: Equipment in number; parts and accessories in $ value
Related Controls: N/A
Related Definitions: N/A
Items:

a. Air Traffic Control (ATC) "software" application "programs" hosted on general purpose computers located at Air Traffic Control centers, and capable of automatically handing over primary radar target data (if not correlated with secondary surveillance radar (SSR) data) from the host ATC center to another ATC center;

6D994 "Software" designed or modified for cameras incorporating "focal plane arrays" specified by 6A002.a.3.f and designed or modified to remove a frame rate restriction and allow the camera to exceed the frame rate specified in 6A003.b.4. Note 3.a.

License Requirements

Reason for Control: RS

Control(s)	*Country Chart*
RS applies to entire entry	RS Column 1

License Exceptions

CIV: N/A
TSR: N/A

List of Items Controlled

Unit: $ value
Items:

The list of Items Controlled is in the ECCN heading.

E. TECHNOLOGY

6E001 "Technology" according to the General Technology Note for the "development" of equipment, materials or "software" controlled by 6A (except 6A991, 6A992, 6A994, 6A995, 6A996, 6A997, or 6A998), 6B (except 6B995), 6C (except 6C992 or 6C994), or 6D (except 6D991, 6D992, or 6D993).

License Requirements

Reason for Control: NS, MT, NP, RS, CC, AT, UN

Control(s)	*Country Chart*
NS applies to "technology" for items controlled by 6A001 to 6A008, 6B004 to 6B008, 6C002 to 6C005, or 6D001 to 6D003	NS Column 1
MT applies to "technology" for items controlled by 6A002, 6A007, 6A008, 6A102, 6A107, 6A108, 6B008, 6B108, 6D001, 6D002, 6D102 or 6D103 for MT reasons	MT Column 1

NP applies to "technology" for equipment controlled by 6A003, 6A005, 6A202, 6A203, 6A205, 6A225, 6A226 or 6D001 for NP reasons	NP Column 1
RS applies to "technology" for equipment controlled by 6A002.a.1, .a.2, .a.3, .c, or .e, 6A003.b.3 or .b.4, or 6A008.j.1	RS Column 1
CC applies to "technology" for equipment controlled by 6A002 for CC reasons	CC Column 1
AT applies to entire entry	AT Column 1
UN applies to "technology" for equipment controlled by 6A002 or 6A003 for UN reasons	Iraq, North Korea, and Rwanda

***License Requirement Notes**: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.*

License Exceptions

CIV: N/A

TSR: Yes, except for the following:

1) Items controlled for MT reasons;

2) "Technology" for commodities controlled by 6A002.e, 6A004.e, or 6A008.j.1;

3) "Technology" for "software" specially designed for "space qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment defined in 6A008.j.1 and controlled by 6D001 or 6D002;

4) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" for the "development" of the following: (a) Items controlled by 6A001.a.1.b.1, 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.3, 6A001.a.2.a.5, 6A001.a.2.a.6, 6A001.a.2.b, 6A001.a.2.e., 6A002.a.1.c, 6A008.l.3, 6B008, 6D003.a; (b) Equipment controlled by 6A001.a.2.c or 6A001.a.2.f when specially designed for real time applications; or (c) "Software" controlled by 6D001 and specially designed for the "development" or "production" of equipment controlled by 6A008.l.3 or 6B008; or

5) Exports or reexports to Rwanda.

List of Items Controlled

Unit: N/A

Related Controls: "Technology" according to the General Technology Note for the "development" of the following commodities is subject to the export licensing authority of the Department of State, Directorate of Defense Trade Controls (22 CFR part 121): "Space qualified" 1.) Components for optical systems defined in 6A004.c and optical control equipment defined in 6A004.d.1.; 2.) Solid-state detectors defined in 6A002.a.1, "imaging sensors" (e.g., "monospectral imaging sensors" and "multispectral imaging sensors") defined in 6A002.b.2.b.1, and cryocoolers defined in 6A002.d.1 unless on or after September 23, 2002, the Department of State issues a commodity jurisdiction determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. See also 6E101, 6E201, and 6E991

Related Definitions: N/A

Items:

The list of items controlled is contained in the

ECCN heading.

6E002 "Technology" according to the General Technology Note for the "production" of equipment or materials controlled by 6A (except 6A991, 6A992, 6A994, 6A995, 6A996, 6A997 or 6A998), 6B (except 6B995) or 6C (except 6C992 or 6C994).

License Requirements

Reason for Control: NS, MT, NP, RS, CC, AT, UN

Control(s)	*Country Chart*
NS applies to "technology" for equipment controlled by 6A001 to 6A008, 6B004 to 6B008, or 6C002 to 6C005	NS Column 1
MT applies to "technology" for equipment controlled by 6A002, 6A007, 6A008, 6A102, 6A107, 6A108, 6B008, or 6B108 for MT reasons	MT Column 1
NP applies to "technology" for equipment controlled by 6A003, 6A005, 6A202, 6A203, 6A205, 6A225 or 6A226 for NP reasons	NP Column 1
RS applies to "technology" for equipment controlled by 6A002.a.1, .a.2, .a.3, .c or .e, 6A003.b.3 or .b.4, or 6A008.j.1	RS Column 1
CC applies to "technology" for equipment controlled by 6A002 for CC reasons	CC Column 1
AT applies to entire entry	AT Column 1
UN applies to "technology" for equipment controlled by Korea, and 6A002 or 6A003 for UN reasons	Iraq, North Rwanda

License Requirement Notes*: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.*

License Exceptions

CIV: N/A

TSR: Yes, except for the following:
1) Items controlled for MT reasons;
2) "Technology" for commodities controlled by 6A002.e, 6A004.e, 6A008.j.1;
3) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" for the "development" of the following: (a) Items controlled by 6A001.a.1.b.1, 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.3, 6A001.a.2.a.5, 6A001.a.2.a.6, 6A001.a.2.b, and 6A001.a.2.c; and (b) Equipment controlled by 6A001.a.2.e and 6A001.a.2.f when specially designed for real time applications; or (c) "Software" controlled by 6D001 and specially designed for the "development" or "production" of equipment controlled by 6A002.a.1.c, 6A008.l.3 or 6B008; or
4) Exports or reexports to Rwanda.

List of Items Controlled

Unit: N/A
Related Controls: "Technology" according to the General Technology Note for the "production" of the following commodities is subject to the export licensing authority of the Department of State, Directorate of Defense

Trade Controls (22 CFR part 121) when intended for use on a satellite: "Space qualified" 1.) Components for optical systems defined in 6A004.c and optical control equipment defined in 6A004.d.1.; 2.) Solid-state detectors defined in 6A002.a.1, "imaging sensors" (e.g., "monospectral imaging sensors" and "multispectral imaging sensors") defined in 6A002.b.2.b.1, and cryocoolers defined in 6A002.d.1 unless on or after September 23, 2002, the Department of State issues a commodity jurisdiction determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. See also 6E992.
Related Definitions: N/A
Items:

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

6E003 Other "technology", as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	*Country Chart*
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

License Exceptions

CIV: N/A
TSR: Yes

List of Items Controlled

Unit: N/A
Related Controls: See also 6E993
Related Definitions: N/A
Items:

a. Acoustics. None.

b. Optical sensors. None.

c. Cameras. None.

d. Optics, "technology", as follows:

d.1. Optical surface coating and treatment "technology" "required" to achieve uniformity of 99.5% or better for optical coatings 500 mm or more in diameter or major axis length and with a total loss (absorption and scatter) of less than 5 x 10^{-3};

N.B.: *See also 2E003.f.*

d.2. Optical fabrication "technology" using single point diamond turning techniques to produce surface finish accuracies of better than 10 nm rms on non-planar surfaces exceeding 0.5 m^2;

e. Lasers. "Technology" "required" for the "development", "production" or "use" of specially designed diagnostic instruments or targets in test facilities for "SHPL" testing or testing or evaluation of materials irradiated by "SHPL" beams;

f. Magnetic and Electric Field Sensors. None

g. Gravimeters. None

h. Radar. None

6E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" controlled by 6A002, 6A007.b and .c, 6A008, 6A102, 6A107, 6A108, 6B108, 6D102 or 6D103.

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

CIV: N/A
TSR: N/A

List of Items Controlled

Unit: N/A
Related Controls: N/A
Related Definitions: 1.) This entry only controls "technology" for equipment controlled by 6A008 when it is designed for airborne applications and is usable in "missiles". 2.) This entry only controls "technology" for items in 6A002.a.1, a.3, and .e that are specially designed or modified to protect "missiles" against nuclear effects (*e.g.*, Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for "missiles." 3.) This entry only controls "technology" for items in 6A007.b and .c when the accuracies in 6A007.b.1 and b.2 are met or exceeded.
Items:

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

6E201 "Technology" according to the General Technology Note for the "use" of equipment controlled by 6A003.a.2. 6A003.a.3, 6A003.a.4; 6A005.a.2, 6A005.b.2.b, 6A005.b.3.a, 6A005.b.4.b, 6A005.b.6.b, 6A005.c.1.b, 6A005.c.2.b, 6A005.d.3.c, or 6A005.d.4.c (as described in the license requirement note to 6A005); 6A202, 6A203, 6A205, 6A225 or 6A226.

License Requirements

Reason for Control: NP, AT

Control(s)	*Country Chart*
NP applies to entire entry	NP 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
ECCN Controls: This entry only controls "technology" for "lasers" in 6A005 that are controlled for NP reasons.
Items:

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

6E991 "Technology" for the "development", "production" or "use" of equipment controlled by 6A991, 6A996, 6A997, or 6A998.

License Requirements

Reason for Control: RS, AT

Control(s)	*Country Chart*
RS applies to "technology"	RS Column 1

for equipment controlled by 6A998.b.

AT applies to entire entry except "technology" for equipment controlled by 6A991	AT Column 1
AT applies to "technology" for equipment controlled by 6A991	AT Column 2

License Exceptions

CIV: N/A
TSR: N/A

List of Items Controlled

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

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

6E992 "Technology" for the "development" or "production" of equipment, materials or "software" controlled by 6A992, 6A994, or 6A995, 6B995, 6C992, 6C994, or 6D993.

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
AT applies to entire entry	AT Column 1

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.

6E993 Other "technology", not controlled by 6E003, as follows (see List of Items Controlled).

License Requirements

Reason for Control: AT

Control(s)	*Country Chart*
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. Optical fabrication technologies for serially producing optical components at a rate exceeding 10 m^2 of surface area per year on any single spindle and with:

a.1. An area exceeding 1 m^2; *and*

a.2. A surface figure exceeding lambda/10 rms at the designed wavelength;

b. "Technology" for optical filters with a bandwidth equal to or less than 10 nm, a field of view (FOV) exceeding 40° and a resolution exceeding 0.75 line pairs per milliradian;

c. "Technology" for the "development" or "production" of cameras controlled by 6A993;

d. "Technology" "required" for the "development" or "production" of non-triaxial fluxgate "magnetometers" or non-triaxial fluxgate "magnetometer" systems, having any of the following:

d.1. A "noise level" of less than 0.05 nT rms per square root Hz at frequencies of less than 1 Hz; *or*

d.2. A "noise level" of less than 1 x 10^{-3} nT rms per square root Hz at frequencies of 1 Hz or more.

EAR99 Items subject to the EAR that are *not* elsewhere specified in this CCL Category *or* in any other category in the CCL are designated by the number *EAR99*.