

CATEGORY XV— SPACECRAFT AND RELATED ARTICLES

(a) Spacecraft, including satellites and space vehicles, whether designated developmental, experimental, research, or scientific, or having a commercial, civil, or military end-use, that:

* (1) Are specially designed to mitigate effects (e.g., scintillation) of or for detection of a nuclear detonation;

* (2) Autonomously track ground, airborne, missile, or space objects in real-time using imaging, infrared, radar, or laser systems;

* (3) Conduct signals intelligence (SIGINT) or measurement and signatures intelligence (MASINT);

* (4) Are specially designed to be used in a constellation or formation that when operated together, in essence or effect, form a virtual satellite (e.g., functioning as if one satellite) with the characteristics or functions of other items in paragraph (a);

* (5) Are anti-satellite or anti-spacecraft (e.g., kinetic, RF, laser, charged particle);

* (6) Have space-to-ground weapons systems (e.g., kinetic or directed energy);

* (7) Have any of the following electro-optical remote sensing capabilities or characteristics:

(i) Electro-optical visible and near infrared (VNIR) (*i.e.*, 400nm to 1,000nm) or infrared (*i.e.*, greater than 1,000nm to 30,000nm) with less than 40 spectral bands and having a clear aperture greater than 0.35 meters;

(ii) Electro-optical hyperspectral with 40 spectral bands or more in the VNIR, short-wavelength infrared (SWIR) (*i.e.*, greater than 1,000nm to 2,500nm) or any combination of the aforementioned and having a Ground Sample Distance (GSD) less than 30 meters;

(iii) Electro-optical hyperspectral with 40 spectral bands or more in the mid-wavelength infrared (MWIR) (*i.e.*, greater than 2,500nm to 5,500nm) having a narrow spectral bandwidth of $\Delta\lambda$ less than or equal to 20nm full width at half maximum (FWHM) or having a wide spectral bandwidth with $\Delta\lambda$ greater than 20nm FWHM and a GSD less than 200 meters; or

(iv) Electro-optical hyperspectral with 40 spectral bands or more in the long-wavelength infrared (LWIR) (*i.e.*, greater than 5,500nm to 30,000nm) having a narrow spectral bandwidth of $\Delta\lambda$ less than or equal to 50nm FWHM or having a wide spectral bandwidth with $\Delta\lambda$ greater than 50nm FWHM and a GSD less than 500 meters;

NOTE 1 TO PARAGRAPH (A)(7): Ground Sample Distance (GSD) is measured from a spacecraft's nadir (*i.e.*, local vertical) position.

NOTE 2 TO PARAGRAPH (A)(7): Optical remote sensing spacecraft or satellite spectral bandwidth is the smallest difference in wavelength (*i.e.*, $\Delta\lambda$) that can be distinguished at full width at half maximum (FWHM) of wavelength λ .

NOTE 3 TO PARAGRAPH (A)(7): An optical satellite or spacecraft is not Significant Military Equipment (*see* §120.7 of this subchapter) if non-earth pointing.

* (8) Have radar remote sensing capabilities or characteristics (e.g., active electronically scanned array (AESA), synthetic aperture radar (SAR), inverse synthetic aperture radar (ISAR), ultra-wideband SAR), except those having a center frequency equal to or greater than 1 GHz but less than or equal to 10 GHz and having a bandwidth less than 300 MHz;

(9) Provide Positioning, Navigation, and Timing (PNT) signals;

NOTE TO PARAGRAPH (A)(9): This paragraph does not control a satellite or spacecraft that provides only a differential correction broadcast for the purposes of positioning, navigation, or timing.

(10) Provide space-based logistics, surveillance, assembly, repair, or servicing of any spacecraft (e.g., refueling) and have integrated propulsion other than that required for attitude control;

(11) Provide for sub-orbital or in-space human habitation and have integrated propulsion other than that required for attitude control;

(12) That are not commercial communications satellites and that have integrated propulsion other than for attitude control or achieving initial orbit;

*(13) Are classified, contain classified software or hardware, are manufactured using classified production data, or are being developed using classified information (e.g., having classified requirements, specifications, functions, or operational characteristics or include classified cryptographic items controlled under USML Category XIII of this subchapter). "Classified" means classified pursuant to Executive Order 13526, or predecessor order, and a security classification guide developed pursuant thereto or equivalent, or to the corresponding classification rules of another government or international organization.

NOTE 1 TO PARAGRAPH (A): Spacecraft not identified in this paragraph are subject to the EAR (see ECCNs 9A004 and 9A515). Spacecraft described in ECCNs 9A004 and 9A515 remain subject to the EAR even if defense articles described on the USML are incorporated therein, except when such incorporation results in a spacecraft described in this paragraph.

NOTE 2 TO PARAGRAPH (A): This paragraph does not control (a) the International Space Station (ISS) and its specially designed (as defined in the EAR) parts and components, which are subject to the EAR, or (b) those articles for the ISS that are determined to be subject to the EAR via a commodity jurisdiction determination (see §120.4 of this subchapter). Use of a defense article on the ISS that was not specially designed (as defined in the EAR) for the ISS does not cause the item to become subject to the EAR.

NOTE 3 TO PARAGRAPH (A): Attitude control is the exercise of control over spacecraft orientation (e.g., pointing) within an orbital plane, which may include orbit maintenance using the attitude control thrusters.

(b) Ground control systems or training simulators, specially designed for telemetry, tracking, and control (TT&C) of spacecraft in paragraph (a) of this category.

NOTE TO PARAGRAPH (B): Parts, components, accessories, attachments, equipment, or systems that are common to ground control systems or training simulators controlled in this paragraph and those that are used for spacecraft not controlled in paragraph (a) of this category are subject to the EAR.

(c) Global Positioning System (GPS) receiving equipment specially designed for military application, or GPS receiving equipment with any of the following characteristics, and specially designed parts and components therefor:

(1) Specially designed for encryption or decryption (e.g., Y-Code) of GPS precise positioning service (PPS) signals (MT if designed or modified for airborne applications);

(2) [Reserved]

(3) Specially designed for use with a null steering antenna, an electronically steerable antenna, or including a null steering antenna designed to reduce or avoid jamming signals (MT if designed or modified for airborne applications);

NOTE TO PARAGRAPH (C)(3): The articles described in this paragraph are subject to the EAR when, prior to export, reexport, retransfer, or temporary import, they are integrated into and included as an integral part of an item subject to the EAR. Articles do not become subject to the EAR until integrated into the item subject to the EAR. Export, reexport, retransfer, or temporary import of, and technical data and defense services directly related to, defense articles intended to be integrated remain subject to the ITAR.

(4) Specially designed for use with rockets, missiles, SLVs, drones, or unmanned air vehicle systems capable of delivering at least a 500 kg payload to a range of at least 300 km (MT if designed or modified for rockets, missiles, SLVs, drones, or unmanned air vehicle systems controlled in this subchapter).

NOTE TO PARAGRAPH (C)(4): "Payload" is the total mass that can be carried or delivered by the specified rocket, missile, SLV, drone or unmanned aerial vehicle that is not used to maintain flight. For definition of "range" as it pertains to rocket systems, see note 1 to paragraph (a) of USML Category IV For definition of "range" as it pertains to aircraft systems, see note to paragraph (a) of USML Category VIII.

(d) [Reserved]

(e) Spacecraft parts, components, accessories, attachments, equipment, or systems, as follows:

(1) Antenna systems specially designed for spacecraft that:

(i) Have a dimension greater than 25 meters in diameter or length of the major axis;

(ii) Employ active electronic scanning;

(iii) Are adaptive beam forming; or

(iv) Are for interferometric radar;

(2) Space-qualified optics (*i.e.*, lens or mirror), including optical coating, having active properties (e.g., adaptive, deformable) with a largest lateral clear aperture dimension greater than 0.35 meters;

(3) Space-qualified focal plane arrays (FPA) having a peak response in the wavelength range exceeding 900nm and readout integrated circuit (ROIC), whether separate or integrated, specially designed therefor;

(4) Space-qualified mechanical (*i.e.*, active) cryocooler or active cold finger, and associated control electronics specially designed therefor;

(5) Space-qualified active vibration suppression, including active isolation and active dampening, and associated control electronics therefor;

(6) Optical bench assemblies specially designed to enable spacecraft to meet or exceed the parameters described in paragraph (a) of this category;

(7) Space-qualified kinetic or directed-energy systems (e.g., RF, laser, charged particle) specially designed for spacecraft in paragraph (a)(5) or (a)(6) of this category, and specially designed parts and components therefor (e.g., power conditioning and beam-handling/switching, propagation, tracking, and pointing equipment);

(8) [Reserved]

(9) Space-qualified cesium, rubidium, hydrogen maser, or quantum (e.g., based upon Al, Hg, Yb, Sr, Be ions) atomic clocks, and specially designed parts and components therefor;

(10) Attitude determination and control systems, and specially designed parts and components therefor, that provide a spacecraft's geolocation accuracy, without using Ground Location Points, better than or equal to:

(i) 5 meters (CE90) from low earth orbit (LEO);

(ii) 30 meters (CE90) from medium earth orbit (MEO);

(iii) 150 meters (CE90) from geosynchronous orbit (GEO); or

(iv) 225 meters (CE90) from high earth orbit (HEO);

(11) Space-based systems, and specially designed parts and components therefor, as follows:

(i) Nuclear reactors and associated power conversion systems (e.g., liquid metal or gas-cooled fast reactors);

(ii) Radioisotope-based power systems (e.g., radioisotope thermoelectric generators);

(iii) Nuclear thermal propulsion systems (e.g., solid core, liquid core, gas core fission); or

(iv) Plasma based propulsion systems;

(12) Thrusters (e.g., rocket engines) that provide greater than 150 lbf (*i.e.*, 667.23 N) vacuum thrust (MT for rocket motors or engines having a total impulse capacity equal to or greater than 8.41×10^5 newton seconds);

(13) Control moment gyroscope (CMG) specially designed for spacecraft;

(14) Space-qualified monolithic microwave integrated circuits (MMIC) that combine transmit and receive (T/R) functions on a single die as follows:

(i) Having a power amplifier with maximum saturated peak output power (in watts), P_{sat} , greater than 200 divided by the maximum operating frequency (in GHz) squared [$P_{sat} > 200 \text{ W} \cdot \text{GHz}^2 / f_{\text{GHz}}^2$]; or

(ii) Having a common path (e.g., phase shifter-digital attenuator) circuit with greater than 3 bits phase shifting at operating frequencies 10 GHz or below, or greater than 4 bits phase shifting at operating frequencies above 10 GHz;

(15) Space-qualified oscillator for radar in paragraph (a) of this category with phase noise less than $-120 \text{ dBc/Hz} + (20 \log_{10}(\text{RF}))$ (in GHz) measured at $2 \text{ KHz} \cdot \text{RF}$ (in GHz) from carrier;

(16) Space-qualified star tracker or star sensor with angular accuracy less than or equal to 1 arcsec (1-Sigma) per star coordinate, and a tracking rate equal to or greater than 3.0 deg/sec, and specially designed parts and components therefor (MT);

*(17) Primary, secondary, or hosted payload that performs any of the functions described in paragraph (a) of this category;

NOTE 1 TO PARAGRAPH (E)(17): *Primary payload* is that complement of equipment designed from the outset to accomplish the prime mission function of the spacecraft payload mission set. The primary payload may operate independently from the secondary payload(s). *Secondary payload* is that complement of equipment designed from the outset to be fully integrated into the spacecraft payload mission set. The secondary payload may operate separately from the primary payload. *Hosted payload* is a complement of equipment or sensors that uses the available or excess capacity (mass, volume, power, etc.) of a spacecraft to accommodate an additional, independent mission. The hosted payload may share the spacecraft bus support infrastructure. The hosted payload performs an additional, independent mission which does not dictate control or operation of the spacecraft. A hosted payload is not capable of operating as an independent spacecraft. *Spacecraft bus* (distinct from the spacecraft payload), provides the support infrastructure of the spacecraft (e.g., command and data handling, communications and antenna(s), electrical power, propulsion, thermal control, attitude and orbit control, guidance, navigation and control, structure and truss, life support (for crewed mission)) and location (e.g., attachment, interface) for the spacecraft payload. *Spacecraft payload* is that complement of equipment attached to the spacecraft bus that performs a particular mission in space (e.g., communications, observation, science).

NOTE 2 TO PARAGRAPH (E)(17): An ECCN 9A004 or ECCN 9A515.a spacecraft remains a spacecraft subject to the EAR even when incorporating a hosted payload performing a function described in paragraph (a) of this category. All spacecraft that incorporate primary or secondary payloads that perform a function described in paragraph (a) of this category are controlled by that paragraph.

*(18) Secondary or hosted payload, and specially designed parts and components therefor, developed with Department of Defense-funding;

NOTE 1 TO PARAGRAPH (E)(18): This paragraph does not control payloads that are (a) determined to be subject to the EAR via a commodity jurisdiction determination (see §120.4 of this subchapter), or (b) identified in the relevant Department of Defense contract or other funding authorization or agreement as being developed for both military and either civil or commercial applications.

NOTE 2 TO PARAGRAPH (E)(18): This paragraph is applicable only to those contracts or funding authorizations or agreements that are dated May 13, 2015, or later.

(19) Spacecraft heat shields or heat sinks specially designed for atmospheric entry or re-entry, and specially designed parts and components therefor (MT if usable in rockets, SLVs, missiles, drones, or UAVs capable of delivering a payload of at least 500 kg to a range of at least 300 km);

NOTE TO PARAGRAPH (E)(19): "Payload" is the total mass that can be carried or delivered by the specified rocket, SLV, missile, drone, or UAV that is not used to maintain flight. For definition of "range" as it pertains to aircraft systems, see note to paragraph (a) of USML Category VIII. For definition of "range" as it pertains to rocket systems, see note 1 to paragraph (a) of USML Category IV.

(20) Equipment modules, stages, or compartments that contain propulsion other than that required for attitude control and can be separated or jettisoned from another spacecraft (see note 3 to paragraph (a) of this category); or

*(21) Any part, component, accessory, attachment, equipment, or system that:

(i) Is classified;

(ii) Contains classified software; or

(iii) Is being developed using classified information.

NOTE TO PARAGRAPH (E)(21): "Classified" means classified pursuant to Executive Order 13526, or predecessor order, and a security classification guide developed pursuant thereto or equivalent, or to the corresponding classification rules of another government or international organization.

NOTE 1 TO PARAGRAPH (E): Parts, components, accessories, attachments, equipment, or systems specially designed for spacecraft or other articles enumerated in this category but not listed in paragraph (e) are subject to the EAR.

NOTE 2 TO PARAGRAPH (E): The articles described in this paragraph are subject to the EAR when, prior to export, reexport, retransfer, or temporary import, they are integrated into and included as an integral part of an item subject to the EAR (see note 2 to paragraph (e)(17) of this category). Articles do not become subject to the EAR until integrated into the item subject to the EAR. Export, reexport, retransfer, or temporary import of, and technical data and defense services directly related to defense articles intended to be integrated remain subject to the ITAR.

NOTE 3 TO PARAGRAPH (E): For the purposes of this paragraph, an article is space-qualified if it is designed, manufactured, or qualified through successful testing, for operation at altitudes greater than 100 km above the surface of the Earth. The use of an altitude of 100 km above the surface of the Earth in this paragraph does not represent a legal demarcation between national air space and outer space under United States or international law.

NOTE 4 TO PARAGRAPH (E): (1) A determination that a specific article (or commodity) (e.g., by product serial number) is space-qualified by virtue of testing alone does not mean that other articles in the same production run or model series are space-qualified if not individually tested. (2) "Article" is synonymous with "commodity," as defined in EAR §772.1. (3) A specific article not designed or manufactured for use at altitudes greater than 100 km above the surface of the Earth is not space-qualified before it is successfully tested. (4) The terms "designed" and "manufactured" in this definition are synonymous with "specially designed."

(f) Technical data (see §120.10 of this subchapter) and defense services (see §120.9 of this subchapter) directly related to the defense articles described in paragraphs (a) through (e) of this category and classified technical data directly related to items controlled in ECCNs 9A515, 9B515, or 9D515 and defense services using the classified technical data. Defense services include the furnishing of assistance (including training) in the integration of a satellite or spacecraft to a launch vehicle, including both planning and onsite support, regardless of the jurisdiction, ownership, or origin of the satellite or spacecraft, or whether technical data is used. It also includes the furnishing of assistance (including training) in the launch failure analysis of a satellite or spacecraft, regardless of the jurisdiction, ownership, or origin of the satellite or spacecraft, or whether technical data is used. (See §125.4 of this subchapter for exemptions, and §124.15 of this subchapter for special export controls for satellites and satellite launches.) (MT for technical data and defense services related to articles designated as such.)

NOTE 1 TO PARAGRAPH (F): The technical data control of this paragraph does not apply to certain technical data directly related to articles described in paragraphs (c) or (e) of this category when such articles are integrated into and included as an integral part of a satellite subject to the EAR. For controls in these circumstances, see ECCN 9E515. This only applies to that level of technical data (including marketing data) necessary and reasonable for a purchaser to have assurance that a U.S. built item intended to operate in space has been designed, manufactured, and tested in conformance with specified contract requirements (e.g., operational performance, reliability, lifetime, product quality, or delivery expectations) as well as data necessary for normal orbit satellite operations, to evaluate in-orbit anomalies, and to operate and maintain associated ground station equipment (except encryption hardware).

NOTE 2 TO PARAGRAPH (F): Activities and technology/technical data directly related to or required for the spaceflight (e.g., sub-orbital, orbital, lunar, interplanetary, or otherwise beyond Earth orbit) passenger or participant experience, regardless of whether the passenger or participant experience is for space tourism, scientific or commercial research, commercial manufacturing/production activities, educational, media, or commercial transportation purposes, are not subject to the ITAR or the EAR. Such activities and technology/technical data include those directly related to or required for: (a) Spacecraft access, ingress, and egress, including the operation of all spacecraft doors, hatches, and airlocks; (b) physiological training (e.g., human-rated centrifuge training or parabolic flights, pressure suit or spacesuit training/operation); (c) medical evaluation or assessment of the spaceflight passenger or participant; (d) training for and operation by the passenger or participant of health and safety related hardware (e.g., seating, environmental control and life support, hygiene facilities, food preparation, exercise equipment, fire suppression, communications equipment, safety-related clothing or headgear) or emergency procedures; (e) viewing of the interior and exterior of the spacecraft or terrestrial mock-ups; (f) observing spacecraft operations (e.g., pre-flight checks, landing, in-flight status); (g) training in spacecraft or terrestrial mock-ups for connecting to or operating passenger or participant equipment used for purposes other than operating the spacecraft; or (h) donning, wearing, or utilizing the passenger's or participant's flight suit, pressure suit, or spacesuit, and personal equipment.

NOTE 3 TO PARAGRAPH (F): Neither paragraph (f) nor ECCN 9E515 controls the data transmitted to or from a satellite or spacecraft, whether real or simulated, when limited to information about the health, operational status, or function of, or measurements or raw sensor output from, the spacecraft, spacecraft payload(s), or their associated subsystems or components. Such data or technology is subject to the EAR and is designated EAR99. Examples of such data and technology, which are commonly referred to as "housekeeping data," include (a) system, hardware, component configuration, and operation status information pertaining to temperatures, pressures, power, currents, voltages, and battery charges; (b) spacecraft or payload orientation or position information, such as state vector or ephemeris information; (c) payload raw mission or science output, such as images, spectra, particle measurements, or field measurements; (d) command responses; (e) accurate timing information; and (f) link budget data. The act of processing such telemetry data—*i.e.*, converting raw data into engineering units or readable products—or encrypting it does not, in and of itself, cause the telemetry data to become subject to the ITAR or to ECCN 9E515. All classified technical data directly related to items controlled in USML Category XV or ECCNs 9A515, and defense services using the classified technical data, remain subject to the ITAR. This note does not affect controls in paragraph (f), ECCN 9D515, or ECCN 9E515 on software source code or commands that control a spacecraft, payload, or associated subsystem.

(g)-(w) [Reserved]

(x) Commodities, software, and technology subject to the EAR (see §120.42 of this subchapter) used in or with defense articles controlled in this category.

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NOTE TO PARAGRAPH (X): Use of this paragraph is limited to license applications for defense articles controlled in this category where the purchase documentation also includes commodities, software, or technology subject to the EAR (see §123.21(b) of this subchapter).