
Export Control of AOS Hardware

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In this application note, we discuss our understanding of the export control regulations from the US Department of Commerce that covers our hardware. This document is only our understanding of the regulations and has not been approved by the US Department of Commerce. This document does not discuss ITAR regulations. The regulations change rapidly, so this document may be out of date. Please consult your own experts prior to any export. Information in this document was obtained through <http://www.gpo.gov/bis/>.

What is export?

Export is transmission of information or product to a non-permanent US resident (green-card holders are permanent US residents). Export can happen inside the US.

Wavefront Sensors

Wavefront sensors are export controlled under fall category 6A005.f.1. They are export controlled for reasons of National Security (NS Column 2) and Anti-Terrorism (AT Column 1). The license exceptions are LVS (less than \$3,000), GBS (Group B Countries), and CIV (civilian use). The relevant entry currently reads:

Optical equipment, as follows:

- 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.

As such, no license is required for our lowest-cost Fire-i wavefront sensor since it can only achieve less than 30Hz. Our higher-end wavefront sensors, like the Marlin, can achieve frame rates greater than 1,000 Hz, so they are export controlled. Since the higher-end wavefront sensors are priced higher than \$3,000, the LVS exception cannot be used. We have not investigated the CIV exception. For the Group B country (Supplement No. 1 to Part 740) exception, the nation must have no check-marks in the NS2 and AT1 boxes in the Commerce

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AN013: Export Control

Country Chart (Supplement No. 1 to Part 738). In our current reading of this, the following countries fall under the GBS license exception:

Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Hong Kong, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, Switzerland, Turkey, and the United Kingdom.
(NOTE REVISION BELOW)

According to Part 743, no reporting is required for export.

We have received a communication from the Department of State indicated that exporting our wavefront sensor hardware is not in violation of the ITAR regulations.

Membrane Deformable Mirrors (MDMs)

Deformable mirrors fall under category 6A004.a.1, which previously stated:

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

The section currently states (3/1/16):

a. Optical mirrors (reflectors) as follows:

Technical Note: For the purpose of 6A004.a, Laser Induced Damage Threshold (LIDT) is measured according to ISO 21254-1:2011.

a.1. "Deformable mirrors" having an active optical aperture greater than 10 mm and having any of the following, and specially designed components therefor:

a.1.a. Having all the following:

a.1.a.1. A mechanical resonant frequency of 750 Hz or more; and

a.1.a.2. More than 200 actuators;

or

a.1.b. A Laser Induced Damage Threshold (LIDT) being any of the following:

a.1.b.1. Greater than 1 kW/cm² using a "CW laser"; *or*

a.1.b.2. Greater than 2 J/cm² using 20 ns "laser" pulses at 20 Hz repetition rate;

The reasons for control are NS2 and AT1. The exceptions are LVS (<\$3000), GBS (Group B Countries), and CIV (civilian use). The same set of countries listed above is valid for Group B exceptions (See REVISION below). According to Part 743, no reporting is required for export of MDMs. The lowest-cost MDMs are eligible for the LVS exception.

AN013: Export Control

REVISION (8/25/10):

Clarification from an export counselor (202-482-4811) indicated that even though the NS2 box is checked for some of the group B nations, ***we can ship to ALL of the group B nations*** listed below because at this time all of these nations do not have AT1 checked. We will still need to review the "Lists to Check" at <http://www.bis.doc.gov/complianceand enforcement/liststocheck.htm> and the end use to ensure eligibility to export under the Group B exception (GBS).

Questions for Export Recipient:

1. What is the end-use of this item?
2. Who is the final recipient?
3. Do you intend to re-export this item?

AN013: Export Control

Country Group B

Afghanistan	Greece	Palau
Algeria	Grenada	Panama
Andorra	Guatemala	Papua New Guinea
Angola	Guinea	Paraguay
Antigua and Barbuda	Guinea-Bissau	Peru
Argentina	Guyana	Philippines
Aruba	Haiti	Poland
Australia	Honduras	Portugal
Austria	Hong Kong	Qatar
The Bahamas	Hungary	Romania
Bahrain	Iceland	Rwanda
Bangladesh	India	Saint Kitts & Nevis
Barbados	Indonesia	Saint Lucia
Belgium	Ireland	Saint Vincent and the Grenadines
Belize	Israel	Samoa
Benin	Italy	San Marino
Bhutan	Jamaica	Sao Tome & Principe
Bolivia	Japan	Saudi Arabia
Bosnia & Herzegovina	Jordan	Senegal
Botswana	Kenya	Serbia
Brazil	Kiribati	Seychelles
Brunei	Korea, South	Sierra Leone
Bulgaria	! Kosovo	Singapore
Burkina Faso	Kuwait	Slovakia
Burundi	Latvia	Slovenia
Cameroon	Lebanon	Solomon Islands
Canada	Lesotho	Somalia
Cape Verde	Liberia	South Africa
Central African Republic	Liechtenstein	Spain
Chad	Lithuania	Sri Lanka
Chile	Luxembourg	Surinam
Colombia	Macedonia, The Former	Swaziland
Comoros	Yugoslav Republic of	Sweden
Congo (Democratic Republic of the)	Madagascar	Switzerland
Congo (Republic of the)	Malawi	Taiwan
Costa Rica	Malaysia	Tanzania
Cote d'Ivoire	Maldives	Thailand
Croatia	Mali	Togo
Cyprus	Malta	Tonga
Czech Republic	Marshall Islands	Trinidad & Tobago
Denmark	Mauritania	Tunisia
Djibouti	Mauritius	Turkey
Dominica	Mexico	Tuvalu
Dominican Republic	Micronesia, Federated States of	Uganda
East Timor	Monaco	United Arab Emirates
Ecuador	Montenegro	United Kingdom
Egypt	Morocco	United States
El Salvador	Mozambique	Uruguay
Equatorial Guinea	Namibia	Vanuatu
Eritrea	Nauru	Vatican City
Estonia	Nepal	Venezuela
Ethiopia	Netherlands	Western Sahara
Fiji	Netherlands Antilles	Yemen
Finland	New Zealand	Zambia
France	Nicaragua	Zimbabwe
Gabon	Niger	
Gambia, The	Nigeria	
Germany	Norway	
Ghana	Oman	
	Pakistan	

Appendix A: An ITAR Section Pertaining to DEW from Part 121

The following is a section from Part 121 “The United States Munitions List” of Title 22 Chapter I.

http://pmdtc.state.gov/regulations_laws/documents/official_itar/ITAR_Part_121.pdf

“Enumeration of Articles

§ 121.1 General. The United States Munitions List.

(a) The following articles, services and related technical data are designated as defense articles and defense services pursuant to §§38 and 47(7) of the Arms Export Control Act (22 U.S.C. 2778 and 2794(7)). Changes in designations will be published in the Federal Register. Information and clarifications on whether specific items are defense articles and services under this subchapter may appear periodically through the Internet Web site of the Directorate of Defense Trade Controls.

(b) *Significant military equipment*: An asterisk precedes certain defense articles in the following list. The asterisk means that the article is deemed to be “Significant Military Equipment” to the extent specified in §120.7 of this subchapter. The asterisk is placed as a convenience to help identify such articles. Note that technical data directly related to the manufacture or production of any defense articles enumerated in any category that are designated as Significant Military Equipment (SME) shall itself be designed SME.”

...

“Category XVIII—Directed Energy Weapons (DEW)

*(a) Directed energy weapon systems specifically designed or modified for military applications (e.g., destruction, degradation or rendering mission-abort of a target). These include, but are not limited to:

- (1) Laser systems, including continuous wave or pulsed laser systems, specifically designed or modified to cause blindness;
- (2) Lasers of sufficient continuous wave or pulsed power to effect destruction similar to the manner of conventional ammunition;
- (3) Particle beam systems;
- (4) Particle accelerators that project a charged or neutral particle beam with destructive power;
- (5) High power radio-frequency (RF) systems;

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AN013: Export Control

(6) High pulsed power or high average power radio frequency beam transmitters that produce fields sufficiently intense to disable electronic circuitry at distant targets;

(7) Prime power generation, energy storage, switching, power conditioning, thermal management or fuel-handling equipment;

(8) Target acquisition or tracking systems;

(9) Systems capable of assessing target damage, destruction or mission-abort;

(10) Beam-handling, propagation or pointing equipment;

(11) Equipment with rapid beam slew capability for rapid multiple target operations;

(12) Negative ion beam funneling equipment; and,

(13) Equipment for controlling and slewing a high-energy ion beam.

*(b) Equipment specifically designed or modified for the detection or identification of, or defense against, articles controlled in paragraph (a) of this category.

(c) Tooling and equipment specifically designed or modified for the production of defense articles controlled by this category.

(d) Test and evaluation equipment and test models specifically designed or modified for the defense articles controlled by this category. This includes, but is not limited to, diagnostic instrumentation and physical test models.

(e) Components, parts, accessories, attachments and associated equipment specifically designed or modified for the articles in paragraphs (a) through (d) of this category.

(f) Technical data (as defined in §120.10 of this subchapter) and defense services (as defined in §120.9 of this subchapter) directly related to the defense articles enumerated in paragraphs (a) through (e) of this category. Technical data directly related to the manufacture or production of any defense articles enumerated in this category that are designated as Significant Military Equipment (SME) shall itself be designated SME.

(g) The following interpretations explain and amplify terms used in this category and elsewhere in this subchapter:

(1) The components, parts, accessories, attachments and associated equipment include, but are not limited to adaptive optics and phase conjugators components, space-qualified accelerator components, targets and specifically designed target diagnostics, current injectors for negative hydrogen ion beams, and space-qualified foils for neutralizing negative hydrogen isotope beams.

AN013: Export Control

(2) The particle beam systems in paragraph (a)(3) of this category include devices embodying particle beam and electromagnetic pulse technology and associated components and subassemblies (e.g., ion beam current injectors, particle accelerators for neutral or charged particles, beam handling and projection equipment, beam steering, fire control, and pointing equipment, test and diagnostic instruments, and targets) which are specifically designed or modified for directed energy weapon applications.

(3) The articles controlled in this category include any end item, component, accessory, attachment, part, firmware, software or system that has been designed or manufactured using technical data and defense services controlled by this category.

(4) The articles specifically designed or modified for military application controlled in this category include any articles specifically developed, configured, or adapted for military application.”