

CATEGORY 7—NAVIGATION AND AVIONICS

7A SYSTEMS, EQUIPMENT AND COMPONENTS

N.B.:

For automatic pilots for underwater vehicles, see Category 8.

For radar, see Category 6. (*L.N. 65 of 2004*)

7A001 Accelerometers as follows and specially designed components for accelerometers:

N.B.:

For angular or rotational accelerometers, see 7A001(b). See also 7A101.

(a) Linear accelerometers having any of the following characteristics:

- (1) Specified to function at linear acceleration levels less than or equal to 15 g and having:
 - (a) A “bias” “stability” of less (better) than 130 micro g with respect to a fixed calibration value over a period of one year; *or*
 - (b) A “scale factor” “stability” of less (better) than 130 ppm with respect to a fixed calibration value over a period of one year;
- (2) Specified to function at linear acceleration levels exceeding 15 g but less than or equal to 100 g and having all of the following: (*L.N. 161 of 2011*)
 - (a) A “bias” “repeatability” of less (better) than 1 250 micro g over a period of one year; *and*
 - (b) A “scale factor” “repeatability” of less (better) than 1 250 ppm over a period of one year; (*L.N. 42 of 2017*)
- (3) Designed for use in inertial navigation or guidance systems and specified to function at linear acceleration levels exceeding 100 g; (*L.N. 85 of 2023*)

Note:

7A001(a)(1) and 7A001(a)(2) do not apply to accelerometers limited to measurement of only vibration or shock. (*L.N. 161 of 2011*)

(b) Angular or rotational accelerometers, specified to function at linear acceleration levels exceeding 100 g;

(*L.N. 254 of 2008*)

7A002 Gyros or angular rate sensors, having any of the following characteristics and specially designed components for gyros or angular rate sensors:

N.B.:

See also 7A102. For angular or rotational accelerometers, see 7A001(b).

- (a) Specified to function at linear acceleration levels less than or equal to 100 g and having any of the following:
- (1) An angular rate range of less than 500 degrees per second and having any of the following: *(L.N. 85 of 2023)*
- (a) A “bias” “stability” of less (better) than 0.5 degree per hour, when measured in a 1 g environment over a period of one month, and with respect to a fixed calibration value;
- (b) An “angle random walk” of less (better) than or equal to 0.0035 degree per square root hour;
- Note:*
7A002(a)(1)(b) does not control “spinning mass gyros”.
- Technical Note:*
(Repealed L.N. 42 of 2017)
- (2) An angular rate range greater than or equal to 500 degrees per second and having any of the following: *(L.N. 85 of 2023)*
- (a) A “bias” “stability” of less (better) than 4 degrees per hour, when measured in a 1 g environment over a period of three minutes, and with respect to a fixed calibration value;
- (b) An “angle random walk” of less (better) than or equal to 0.1 degree per square root hour;
- Note:*
7A002(a)(2)(b) does not control “spinning mass gyros”. *(L.N. 161 of 2011; L.N. 42 of 2017)*
- (b) Specified to function at linear acceleration levels exceeding 100 g; *(L.N. 161 of 2011)*
- (c)-(d) *(Repealed L.N. 161 of 2011)*
- (L.N. 254 of 2008)*

7A003 ‘Inertial measurement equipment or systems’ that meet any of the following descriptions:

N.B.:

See also 7A103.

Notes:

1. ‘Inertial measurement equipment or systems’ incorporate accelerometers or gyroscopes to measure changes in velocity and orientation in order to determine or maintain heading or position without requiring an external reference once aligned. ‘Inertial measurement equipment or systems’ include the following:
 - Attitude and Heading Reference Systems (AHRs);
 - Gyrocompasses;
 - Inertial Measurement Units (IMUs);
 - Inertial Navigation Systems (INSs);
 - Inertial Reference Systems (IRSs);
 - Inertial Reference Units (IRUs).

2. 7A003 does not control ‘inertial measurement equipment or systems’ that are certified for use on “civil aircraft” by the civil aviation authority or authorities of one or more “Participating States”.

Technical Note:

‘Positional aiding references’ independently provide position, and include all of the following:

- (a) “Satellite navigation system”;
- (b) “Data-Based Referenced Navigation” (“DBRN”). (*L.N. 85 of 2023*)
- (a) Designed for “aircraft”, land vehicles or vessels, providing position without the use of ‘positional aiding references’, and having any of the following “accuracies” subsequent to normal alignment: (*L.N. 85 of 2023*)
 - (1) 0.8 nautical miles per hour (nm/hr) “Circular Error Probable” (“CEP”) rate or less (better);
 - (2) 0.5% distanced travelled “CEP” or less (better);
 - (3) Total drift of 1 nautical mile “CEP” or less (better) in a 24-hour period;

Technical Note:

The performance parameters in 7A003(a)(1), 7A003(a)(2) and 7A003(a)(3) typically apply to ‘inertial measurement equipment or systems’ designed for “aircraft”, vehicles and vessels, respectively. These parameters result from the utilization of specialized non-positional aiding references (e.g. altimeter, odometer, velocity log). As a consequence, the specified performance values cannot be readily converted between these parameters. Equipment designed for multiple platforms are evaluated against each applicable entry 7A003(a)(1), 7A003(a)(2) or 7A003(a)(3).

- (b) Designed for “aircraft”, land vehicles or vessels, with an embedded ‘positional aiding reference’ and providing position after loss of all ‘positional aiding references’ for a period of up to 4 minutes, having an “accuracy” of less (better) than 10 metres “CEP”;

Technical Note:

7A003(b) refers to systems in which ‘inertial measurement equipment or systems’ and other independent ‘positional aiding references’ are built into a single unit (i.e. embedded) in order to achieve improved performance.

- (c) Designed for “aircraft”, land vehicles or vessels, providing heading or True North determination and meeting any of the following descriptions:
 - (1) Having a maximum operating angular rate less (lower) than 500 deg/s and a heading “accuracy” without the use of ‘positional aiding references’ equal to or less (better) than 0.07 deg sec(Lat) (equivalent to 6 arc minutes rms at 45 degrees latitude);
 - (2) Having a maximum operating angular rate equal to or greater (higher) than 500 deg/s and a heading “accuracy” without the use of ‘positional aiding references’ equal to or less (better) than 0.2 deg sec(Lat) (equivalent to 17 arc minutes rms at 45 degrees latitude);
- (d) Providing acceleration measurements or angular rate measurements, in more than one dimension, and meeting any of the following descriptions:
 - (1) Having performance specified in 7A001 or 7A002 along any axis, without the use of any aiding references;

- (2) Being “space-qualified” and providing angular rate measurements having an “angle random walk” along any axis of less (better) than or equal to 0.1 degree per square root hour;

Note:

7A003(d)(2) does not control ‘inertial measurement equipment or systems’ that contain “spinning mass gyros” as the only type of gyro.

(L.N. 42 of 2017; L.N. 85 of 2023)

7A004 ‘Star trackers’ and their components, as follows:

N.B.:

See also 7A104. *(L.N. 89 of 2021)*

- (a) ‘Star trackers’ with a specified azimuth “accuracy” of equal to or less (better) than 20 seconds of arc throughout the specified lifetime of the equipment; *(L.N. 85 of 2023)*
- (b) Components specially designed for equipment specified in 7A004(a) as follows:
 - (1) Optical heads or baffles;
 - (2) Data processing units;

Technical Note:

‘Star trackers’ are also referred to as stellar attitude sensors or gyro-astro compasses.

(L.N. 89 of 2013)

7A005 “Satellite navigation system” receiving equipment having any of the following and specially designed components therefor: *(L.N. 85 of 2023)*

N.B.:

See also 7A105. For equipment specially designed for military use, see ML11.

- (a) Employing a decryption algorithm specially designed or modified for government use to access the ranging code for position and time;
- (b) Employing ‘adaptive antenna systems’;

Note:

7A005(b) does not apply to “satellite navigation system” receiving equipment that only uses components designed to filter, switch, or combine signals from multiple omnidirectional antennae that do not implement adaptive antenna techniques. *(L.N. 85 of 2023)*

Technical Note:

For the purposes of 7A005(b) ‘adaptive antenna systems’ dynamically generate one or more spatial nulls in an antenna array pattern by signal processing in the time domain or frequency domain.

(L.N. 161 of 2011)

7A006 Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive, having any of the following characteristics:

N.B.:

See also 7A106.

- (a) “Power management”; *or*
- (b) Using phase shift key modulation;

7A007 *(Repealed L.N. 95 of 2006)*

7A008 Underwater sonar navigation systems using Doppler-velocity or correlation-velocity logs integrated with a heading source and having a positioning “accuracy” of equal to or less (better) than 3% of distance travelled “Circular Error Probable” (“CEP”) and specially designed components for those systems; *(L.N. 85 of 2023)*

Note:

7A008 does not include systems specially designed for installation on surface vessels or systems requiring acoustic beacons or buoys to provide positioning data.

N.B.:

See 6A001(a) for acoustic systems, and 6A001(b) for correlation-velocity and Doppler-velocity sonar log equipment. See 8A002 for other marine systems.

(L.N. 254 of 2008)

7A101 Linear accelerometers, other than those specified in 7A001, designed for use in inertial navigation systems or in guidance systems of all types, usable in ‘missiles’, having all of the following characteristics, and specially designed components for those linear accelerometers; *(L.N. 85 of 2023)*

- (a) A “bias” “repeatability” of less (better) than 1 250 micro g;
- (b) A “scale factor” “repeatability” of less (better) than 1 250 ppm;

Note:

7A101 does not control accelerometers specially designed and developed as MWD (Measurement While Drilling) Sensors for use in downhole well service operations. *(L.N. 161 of 2011; L.N. 42 of 2017; L.N. 89 of 2021)*

Technical Notes:

1. In 7A101, the term ‘missile’ means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.
2. In 7A101, the measurement of “bias” and “scale factor” refers to a one sigma standard deviation with respect to a fixed calibration over a period of one year.

(L.N. 226 of 2009)

7A102 All types of gyros, other than those controlled by 7A002, usable in ‘missiles’, with a rated “drift rate” ‘stability’ of less than 0.5° (1 sigma or rms) per hour in a 1 g environment and specially designed components therefor; (L.N. 95 of 2006; L.N. 254 of 2008)

Technical Notes:

1. In 7A102, ‘missiles’ means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.
2. In 7A102, ‘stability’ means a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition (IEEE STD 528-2001 paragraph 2.247). (L.N. 254 of 2008)

(L.N. 85 of 2023)

7A103 Instrumentation, navigation equipment and systems, other than those controlled by 7A003, as follows; and specially designed components therefor:

(a) ‘Inertial measurement equipment or systems’, using accelerometers or gyros as follows: (L.N. 89 of 2021)

- (1) Accelerometers specified in 7A001(a)(3), 7A001(b) or 7A101 or gyros specified in 7A002 or 7A102; or

Note:

7A103(a)(1) does not control equipment containing accelerometers controlled by 7A001(a)(3) that are designed to measure vibration or shock. (L.N. 89 of 2021)

- (2) Accelerometers specified in 7A001(a)(1) or 7A001(a)(2) designed for use in inertial navigation systems or in guidance systems of all types, and usable in ‘missiles’; (L.N. 42 of 2017; L.N. 89 of 2021)

Note:

7A103(a)(2) does not include equipment containing accelerometers specified in 7A001(a)(1) or 7A001(a)(2) where such accelerometers are specially designed and developed as MWD (Measurement While Drilling) Sensors for use in downhole well service operations. (L.N. 89 of 2021)

Technical Note:

‘Inertial measurement equipment or systems’ controlled by 7A103(a) incorporate accelerometers or gyros to measure changes in velocity and orientation in order to determine or maintain heading or position without requiring an external reference once aligned. (L.N. 89 of 2021)

Note:

‘Inertial measurement equipment or systems’ in 7A103(a) include:

- Attitude and Heading Reference Systems (AHRSS)
- Gyrocompasses
- Inertial Measurement Units (IMUs)
- Inertial Navigation Systems (INSs)
- Inertial Reference Systems (IRSs)
- Inertial Reference Units (IRUs) (L.N. 89 of 2021)

- (b) Integrated flight instrument systems, which include gyrostabilisers or automatic pilots, designed or modified for use in ‘missiles’; (*L.N. 183 of 1999; L.N. 65 of 2004; L.N. 95 of 2006; L.N. 254 of 2008*)
- (c) ‘Integrated navigation systems’, designed or modified for ‘missiles’ and capable of providing a navigational accuracy of 200 m ‘CEP’ or less; (*L.N. 85 of 2023*)

Technical Notes: (L.N. 85 of 2023)

1. An ‘integrated navigation system’ typically incorporates the following components: (*L.N. 85 of 2023*)
 - (a) An inertial measurement device (e.g. an attitude and heading reference system, inertial reference unit, or inertial navigation system);
 - (b) One or more external sensors used to update the position or velocity or both, either periodically or continuously throughout the flight (e.g. satellite navigation receiver, radar altimeter, or Doppler radar); *and*
 - (c) Integration hardware and software. (*L.N. 254 of 2008*)
 2. In 7A103(c), ‘CEP’ (Circular Error Probable or Circle of Equal Probability) is a measure of accuracy, defined as the radius of the circle inside of which there is a 50% probability of being located. (*L.N. 85 of 2023*)
- (d) Three axis magnetic heading sensors, designed or modified to be integrated with flight control and navigation systems, other than those specified in 6A006, having all of the following characteristics, and specially designed components for those sensors: (*L.N. 42 of 2017*)
 - (1) Internal tilt compensation in pitch (± 90 degrees) and roll (± 180 degrees) axes;
 - (2) Capable of providing azimuthal accuracy better (less) than 0.5 degrees rms at latitude of ± 80 degrees, reference to local magnetic field;

Note:

Flight control and navigation systems in 7A103(d) include gyrostabilizers, automatic pilots and inertial navigation systems. (*L.N. 254 of 2008*)

Technical Note:

In 7A103, ‘missiles’ means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km. (*L.N. 254 of 2008*)

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

7A105 Receiving equipment for ‘navigation satellite systems’, other than those specified in 7A005, having any of the following characteristics, and specially designed components therefor: (*L.N. 42 of 2017; L.N. 89 of 2021*)

- (a) Designed or modified for use in space launch vehicles controlled by 9A004, sounding rockets controlled by 9A104 or unmanned aerial vehicles controlled by 9A012 or 9A112(a); (*L.N. 95 of 2006; L.N. 42 of 2017; L.N. 85 of 2023*)

- (b) Designed or modified for airborne applications and having any of the following characteristics:
- (1) Capable of providing navigation information at speeds in excess of 600 m/s; *(L.N. 95 of 2006)*
 - (2) Employing decryption, designed or modified for military or governmental services, to gain access to a ‘navigation satellite system’ secured signal/data; *or (L.N. 89 of 2021)*
 - (3) Being specially designed to employ anti-jam features (e.g. null steering antenna or electronically steerable antenna) to function in an environment of active or passive countermeasures;

Note:

7A105(b)(2) and 7A105(b)(3) do not control equipment designed for commercial, civil or ‘Safety of Life’ (e.g. data integrity, flight safety) ‘navigation satellite system’ services. *(L.N. 89 of 2021)*

Technical Note:

In 7A105, ‘navigation satellite system’ includes Global Navigation Satellite Systems (GNSS; e.g. GPS, GLONASS, Galileo or BeiDou) and Regional Navigation Satellite Systems (RNSS; e.g. NavIC, QZSS). *(L.N. 89 of 2021)*

(L.N. 65 of 2004)

7A106 Altimeters, other than those controlled by 7A006, of radar or laser radar type, designed or modified for use in space launch vehicles controlled by 9A004 or sounding rockets controlled by 9A104;

(L.N. 183 of 1999; L.N. 65 of 2004; L.N. 95 of 2006)

7A115 Passive sensors for determining bearing to specific electromagnetic source (direction finding equipment) or terrain characteristics, designed or modified for use in space launch vehicles controlled by 9A004 or sounding rockets controlled by 9A104; *(L.N. 183 of 1999; L.N. 65 of 2004; L.N. 95 of 2006)*

Note:

Equipment controlled by 7A105, 7A106 and 7A115 includes the following:

- (a) Terrain contour mapping equipment;
- (b) Scene mapping and correlation (both digital and analogue) equipment;
- (c) Doppler navigation radar equipment;
- (d) Passive interferometer equipment;
- (e) Imaging sensor equipment (both active and passive). *(L.N. 89 of 2021)*

- 7A116 Flight control systems and servo valves, as follows; designed or modified for use in space launch vehicles controlled by 9A004 or sounding rockets controlled by 9A104 or “missiles”: (*L.N. 183 of 1999; L.N. 65 of 2004; L.N. 95 of 2006; L.N. 89 of 2021*)
- (a) Pneumatic, hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire and fly-by-light systems); (*L.N. 89 of 2021*)
 - (b) Attitude control equipment;
 - (c) Flight control servo valves designed or modified for the systems controlled by 7A116(a) or 7A116(b) and designed or modified to operate in a vibration environment greater than 10 g rms between 20 Hz and 2 kHz; (*L.N. 65 of 2004; L.N. 95 of 2006; L.N. 85 of 2023*)

Note:

For conversion of manned aircraft to operate as “missiles”, 7A116 includes the systems, equipment and valves designed or modified to enable operation of manned aircraft as unmanned aerial vehicles. (*L.N. 89 of 2021*)

- 7A117 “Guidance sets”, usable in “missiles”, capable of achieving system accuracy of 3.33% or less of the range (e.g. a ‘CEP’ of 10 km or less at a range of 300 km); (*E.R. 6 of 2020; L.N. 85 of 2023*)

Technical Note:

In 7A117, ‘CEP’ (Circular Error Probable or Circle of Equal Probability) is a measure of accuracy, defined as the radius of the circle centred at the target, at a specific range, in which 50% of the payloads impact. (*L.N. 85 of 2023*)

7B TEST, INSPECTION AND PRODUCTION EQUIPMENT

- 7B001 Test, calibration or alignment equipment specially designed for equipment controlled by 7A;

Note:

7B001 does not control test, calibration or alignment equipment for ‘Maintenance Level I’ or ‘Maintenance Level II’.

Technical Notes:

1. ‘Maintenance Level I’ (*L.N. 85 of 2023*)

The failure of an inertial navigation unit is detected on the “aircraft” by indications from the control and display unit (CDU) or by the status message from the corresponding subsystem. By following the manufacturer’s manual, the cause of the failure may be localized at the level of the malfunctioning line replaceable unit (LRU). The operator then removes the LRU and replaces it with a spare. (*E.R. 6 of 2020*)

2. ‘Maintenance Level II’ (*L.N. 85 of 2023*)

The defective LRU is sent to the maintenance workshop (the manufacturer’s or that of the operator responsible for level II maintenance). At the maintenance workshop, the malfunctioning LRU is tested by various appropriate means to verify and localize the defective shop replaceable assembly (SRA) module responsible for the failure. This

SRA is removed and replaced by an operative spare. The defective SRA (or possibly the complete LRU) is then shipped to the manufacturer. ‘Maintenance Level II’ does not include the disassembly or repair of specified accelerometers or gyro sensors. (L.N. 161 of 2011; E.R. 6 of 2020)

(L.N. 85 of 2023)

7B002 Equipment, as follows, specially designed to characterize mirrors for ring “laser” gyros:

N.B.:

See also 7B102.

1. Scatterometers having a measurement “accuracy” of 10 ppm or less (better);
2. Profilometers having a measurement “accuracy” of 0.5 nm (5 angstrom) or less (better);
(L.N. 85 of 2023)

7B003 Equipment specially designed for the “production” of equipment specified in 7A;

Note:

7B003 includes:

- (a) Gyro tuning test stations;
- (b) Gyro dynamic balance stations;
- (c) Gyro run-in/motor test stations;
- (d) Gyro evacuation and fill stations;
- (e) Centrifuge fixtures for gyro bearings;
- (f) Accelerometer axis align stations; *and*
- (g) Fibre optic gyro coil winding machines. (L.N. 254 of 2008)

(L.N. 65 of 2004; L.N. 254 of 2008)

7B101 (Repealed L.N. 65 of 2004)

7B102 Reflectometers specially designed to characterize mirrors, for “laser” gyros, having a measurement accuracy of 50 ppm or less (better);

(L.N. 65 of 2004)

7B103 “Production facilities” and “production equipment” as follows:

- (a) “Production facilities” specially designed for equipment controlled by 7A117;

- (b) “Production equipment”, and other test, calibration and alignment equipment, other than that controlled by 7B001 to 7B003, designed or modified to be used with equipment controlled by 7A;

(L.N. 65 of 2004; L.N. 95 of 2006)

7B104 *(Repealed L.N. 65 of 2004)*

7C MATERIALS None

7D SOFTWARE

7D001 “Software” specially designed or modified for the “development” or “production” of equipment controlled by 7A or 7B;

7D002 “Source code” for the operation or maintenance of any inertial navigation equipment, including inertial equipment not specified in 7A003 or 7A004, or Attitude and Heading Reference Systems (‘AHRS’);

Note:

7D002 does not apply to “source code” for the operation or maintenance of gimballed ‘AHRS’.

Technical Note:

‘AHRS’ generally differs from Inertial Navigation Systems (INS) in that an ‘AHRS’ provides attitude and heading information and normally does not provide the acceleration, velocity and position information associated with an INS.

(L.N. 89 of 2013)

7D003 Other “software”, as follows:

(a) “Software” specially designed or modified to improve the operational performance or reduce the navigational error of systems to the levels specified in 7A003, 7A004 or 7A008; *(L.N. 254 of 2008)*

(b) “Source code” for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the levels specified in 7A003 or 7A008 by continuously combining heading data with any of the following: *(L.N. 65 of 2004; L.N. 254 of 2008)*

(1) Doppler radar or sonar velocity data; *(L.N. 254 of 2008)*

(2) “Satellite navigation system” references data; *or (L.N. 161 of 2011)*

(3) Data from “Data-Based Referenced Navigation” (“DBRN”) Systems; *(L.N. 65 of 2004)*

(c)-(d) *(Repealed L.N. 42 of 2017)*

- (e) Computer-aided-design (CAD) “software” specially designed for the “development” of “active flight control systems”, helicopter multi-axis fly-by-wire or fly-by-light controllers or helicopter “circulation-controlled anti-torque or circulation-controlled direction control systems” whose “technology” is controlled by 7E004(b)(1), 7E004(b)(3), 7E004(b)(4), 7E004(b)(5), 7E004(b)(7), 7E004(b)(8), 7E004(c)(1) or 7E004(c)(2);

(L.N. 85 of 2023)

7D004 “Source code” incorporating “development” “technology” controlled by 7E004(a)(2), 7E004(a)(3), 7E004(a)(5), 7E004(a)(6) or 7E004(b), for any of the following:

- (a) Digital flight management systems for “total control of flight”;
- (b) Integrated propulsion and flight control systems;
- (c) “Fly-by-wire systems” or “fly-by-light systems”;
- (d) Fault-tolerant or self-reconfiguring “active flight control systems”;
- (e) Not used;
- (f) Air data systems based on surface static data;
- (g) 3-dimensional displays;

Note:

7D004 does not control “source code” associated with common computer elements and utilities (e.g. input signal acquisition, output signal transmission, computer program and data loading, built-in test, task scheduling mechanisms) not providing a specific flight control system function.

(L.N. 42 of 2017)

7D005 “Software” specially designed to decrypt “satellite navigation system” ranging code designed for government use;

(L.N. 42 of 2017; L.N. 85 of 2023)

7D101 “Software” specially designed or modified for the “use” of equipment controlled by 7A001 to 7A006, 7A101 to 7A106, 7A115, 7A116(a), 7A116(b), 7B001, 7B002, 7B003, 7B102 or 7B103;

(L.N. 65 of 2004; L.N. 95 of 2006)

7D102 Integration “software” as follows:

- (a) Integration “software” for the equipment controlled by 7A103(b);

(b) Integration “software” specially designed for the equipment controlled by 7A003 or 7A103(a); *(L.N. 132 of 2001)*

(c) Integration “software” designed or modified for the equipment controlled by 7A103(c); *(L.N. 95 of 2006)*

Note:

A common form of integration “software” employs Kalman filtering. *(L.N. 65 of 2004)*

7D103 “Software” specially designed for modelling or simulation of the “guidance sets” controlled by 7A117 or for their design integration with the space launch vehicles controlled by 9A004 or sounding rockets controlled by 9A104; *(L.N. 183 of 1999; L.N. 65 of 2004; L.N. 95 of 2006; L.N. 89 of 2021)*

Note:

“Software” controlled by 7D103 remains controlled when combined with specially designed hardware controlled by 4A102. *(L.N. 226 of 2009)*

7D104 “Software” specially designed or modified for the operation or maintenance of “guidance sets” controlled by 7A117;

Note:

7D104 includes “software”, specially designed or modified to enhance the performance of “guidance sets” to achieve or exceed the accuracy controlled by 7A117.

(L.N. 89 of 2021)

7E TECHNOLOGY

7E001 “Technology” according to the General Technology Note for the “development” of equipment or “software”, specified in 7A, 7B, 7D001, 7D002, 7D003, 7D005, 7D101, 7D102 and 7D103;

Note:

7E001 includes key management “technology” exclusively for equipment specified in 7A005(a). *(L.N. 42 of 2017)*

(L.N. 42 of 2017)

7E002 “Technology” according to the General Technology Note for the “production” of equipment controlled by 7A or 7B;

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

Note:

7E003 does not control maintenance “technology” directly associated with calibration, removal or replacement of damaged or unserviceable LRUs and SRAs of a “civil aircraft” as described in ‘Maintenance Level I’ or ‘Maintenance Level II’. (L.N. 85 of 2023)

N.B.:

See Technical Notes to 7B001.

7E004 Other “technology”, as follows:

(a) “Technology” for the “development” or “production” of any of the following: (L.N. 85 of 2023)

(1) (Repealed L.N. 89 of 2013)

(2) Air data systems based on surface static data only, i.e. which dispense with conventional air data probes; (E.R. 6 of 2020)

(3) Three dimensional displays for “aircraft”; (L.N. 161 of 2011)

(4) (Repealed L.N. 161 of 2011)

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

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

(7) “Data-Based Referenced Navigation” (“DBRN”) Systems designed to navigate underwater, using sonar or gravity databases, that provide a positioning “accuracy” equal to or less (better) than 0.4 nautical miles; (L.N. 254 of 2008)

(b) “Development” “technology”, as follows, for “active flight control systems” (including “fly-by-wire systems” or “fly-by-light systems”): (L.N. 42 of 2017)

(1) Photonic-based “technology” for sensing “aircraft” or flight control component state, transferring flight control data, or commanding actuator movement, “required” for “fly-by-light systems” or “active flight control systems”; (L.N. 42 of 2017)

(2) (Repealed L.N. 42 of 2017)

(3) Real-time algorithms to analyze component sensor information to predict and preemptively mitigate impending degradation and failures of components within an “active flight control system”;

Note:

7E004(b)(3) does not control algorithms for off-line maintenance. (L.N. 42 of 2017)

(4) Real-time algorithms to identify failures of components and reconfigure force and moment controls to mitigate “active flight control system” degradation and failures;

Note:

7E004(b)(4) does not control algorithms for the elimination of fault effects through comparison of redundant data sources, or off-line pre-planned responses to anticipated failures. (L.N. 42 of 2017)

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

Note:

7E004(b)(5) does not control:

1. “Technology” for integration of digital flight control, navigation and propulsion control data into a digital flight management system for “flight path optimisation”.
2. “Technology” for “aircraft” flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

(6) *(Repealed L.N. 42 of 2017)*

(7) “Technology” “required” for deriving the functional requirements for “fly-by-wire systems” having all of the following— *(L.N. 85 of 2023)*

- (a) that have ‘inner-loop’ airframe stability controls requiring a loop closure rate of 40 Hz or greater;

Technical Note:

‘Inner-loop’ refers to functions of “active flight control systems” that automate airframe stability controls.

(b) that meet any of the following descriptions:

- (1) Correct an aerodynamically unstable airframe, measured at any point in a design flight envelope, that would lose recoverable control if not corrected within 0.5 seconds;
- (2) Combine controls in 2 or more axes while compensating for ‘abnormal changes in aircraft state’;

Technical Note:

‘Abnormal changes in aircraft state’ include in-flight structural damage, loss of engine thrust, disabled control surface and destabilizing shifts in cargo load.

- (3) Perform the functions specified in 7E004(b)(5);

Note:

7E004(b)(7)(b)(3) does not control autopilots.

- (4) Enable an “aircraft” to have a stable controlled flight, other than during take-off or landing, at an angle of attack greater than 18 degrees, a side slip at 15 degrees, a pitch rate or yaw rate of 15 degrees per second, or a roll rate of 90 degrees per second; *(L.N. 42 of 2017)*

(8) “Technology” “required” for deriving the functional requirements for “fly-by-wire systems” to achieve—

- (a) No loss of control of the “aircraft” in the event of a consecutive sequence of any 2 individual faults within the “fly-by-wire system”; *and*
- (b) A probability of loss of control of the “aircraft” that is less (better) than 1×10^{-9} failures per flight hour; *(L.N. 42 of 2017)*

Note:

7E004(b) does not control “technology” associated with common computer elements and utilities (e.g. input signal acquisition, output signal transmission, computer program and data loading, built-in test, task scheduling mechanisms) not providing a specific flight control system function. *(L.N. 42 of 2017; E.R. 6 of 2020)*

- (c) “Technology” for the “development” of helicopter systems, as follows:
- (1) Multi-axis fly-by-wire or fly-by-light controllers which combine the functions of at least two of the following into one controlling element:
 - (a) Collective controls;
 - (b) Cyclic controls;
 - (c) Yaw controls;
 - (2) “Circulation-controlled anti-torque or circulation-controlled directional control systems”;
 - (3) Rotor blades incorporating ‘variable geometry aerofoils’ for use in systems using individual blade control;

Technical Note:

‘Variable geometry aerofoils’ use trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight. (L.N. 85 of 2023)

(L.N. 85 of 2023)

7E101 “Technology” according to the General Technology Note for the “use” of equipment controlled by 7A001 to 7A006, 7A101 to 7A106, 7A115 to 7A117, 7B001, 7B002, 7B003, 7B102, 7B103, 7D101 to 7D103;

(L.N. 65 of 2004; L.N. 95 of 2006)

7E102 “Technology” for protection of avionics and electrical sub-systems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards, from external sources, as follows:

- (a) Design “technology” for shielding systems;
- (b) Design “technology” for the configuration of hardened electrical circuits and sub-systems;
- (c) Design “technology” for the determination of hardening criteria of 7E102(a) and (b);

7E104 “Technology” for the integration of the flight control, guidance, and propulsion data into a flight management system for optimization of rocket system trajectory;