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From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	10 October 2018
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
No. Cion doc.:	C(2018) 6511 final Annex 1 Part 9/11
Subject:	ANNEX 1 Part 9/11 to the Commission Delegated Regulation amending Council Regulation (EC) No 428/2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items

Delegations will find attached document C(2018) 6511 final Annex 1 Part 9/11.

Encl.: C(2018) 6511 final Annex 1 Part 9/11

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Brussels, 10.10.2018
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ANNEX 1 – PART 9/11

ANNEX

to the

Commission Delegated Regulation

amending Council Regulation (EC) No 428/2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items

ANNEX I (PART IX – Category 7)

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.

7A001 Accelerometers as follows and specially designed components therefor:

N.B. SEE ALSO 7A101.

N.B. For angular or rotational accelerometers, see 7A001.b.

a. Linear accelerometers having any of the following:

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

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:

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; or

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

Note: 7A001.a.1. and 7A001.a.2. do not control accelerometers limited to measurement of only vibration or shock.

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

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

N.B. *SEE ALSO 7A102.*

N.B. *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. A rate range of less than 500 degrees per second and having any of the following:

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; or

b. An "angle random walk" of less (better) than or equal to 0,0035 degree per square root hour; or

Note: *7A002.a.1.b. does not control "spinning mass gyros".*

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

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; or

b. An "angle random walk" of less (better) than or equal to 0,1 degree per square root hour; or

Note: *7A002.a.2.b. does not control "spinning mass gyros".*

b. Specified to function at linear acceleration levels exceeding 100 g.

7A003 'Inertial measurement equipment or systems', having any of the following:

N.B. *SEE ALSO 7A103.*

Note 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:*

- *Attitude and Heading Reference Systems (AHRSs);*
- *Gyrocompasses;*
- *Inertial Measurement Units (IMUs);*
- *Inertial Navigation Systems (INSs);*
- *Inertial Reference Systems (IRSs);*
- *Inertial Reference Units (IRUs).*

Note 2: *7A003 does not control 'inertial measurement equipment or systems' which are certified for use on "civil aircraft" by civil aviation authorities of one or more "EU Member States or Wassenaar Arrangement Participating States.*

Technical Note:

'Positional aiding references' independently provide position, and include:

a. *Global Navigation Satellite Systems (GNSS);*

b. *"Data-Based Referenced Navigation" ("DBRN").*

7A003 continued

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:

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); or

3. Total drift of 1 nautical mile "CEP" or less (better) in a 24 hr 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 utilisation of specialised 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.

7A003 continued

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 meters "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 having any of the following:

1. 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); or

2. 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); or

d. Providing acceleration measurements or angular rate measurements, in more than one dimension, and having any of the following:

1. Performance specified in 7A001 or 7A002 along any axis, without the use of any aiding references; or

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.

7A004 'Star trackers' and components therefor, as follows:

N.B. SEE ALSO 7A104.

a. 'Star trackers' with a specified azimuth "accuracy" equal to or less (better) than 20 seconds of arc throughout the specified lifetime of the equipment;

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.

7A005 Global Navigation Satellite Systems (GNSS) receiving equipment having any of the following and specially designed components therefor:

N.B. SEE ALSO 7A105.

N.B. For equipment specially designed for military use, see Military Goods Controls.

a. Employing a decryption algorithm specially designed or modified for government use to access the ranging code for position and time; or

b. Employing 'adaptive antenna systems'.

Note: 7A005.b. does not control GNSS receiving equipment that only uses components designed to filter, switch, or combine signals from multiple omni-directional antennae that do not implement adaptive antenna techniques.

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.

7A006 Airborne altimeters operating at frequencies other than 4,2 to 4,4 GHz inclusive and having any of the following:

N.B. *SEE ALSO 7A106.*

a. 'Power management'; or

b. Using phase shift key modulation.

Technical Note:
'Power management' is changing the transmitted power of the altimeter signal so that received power at the "aircraft" altitude is always at the minimum necessary to determine the altitude.

7A008 Underwater sonar navigation systems using doppler velocity or correlation velocity logs integrated with a heading source and having a positioning "accuracy" equal to or less (better) than 3% of distance travelled "Circular Error Probable" ("CEP") and specially designed components therefor.

Note: *7A008 does not control 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.

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 the following characteristics, and specially designed components therefor:

a. A "bias" "repeatability" of less (better) than 1 250 micro g; and

b. A "scale factor" "repeatability" of less (better) than 1 250 ppm;

Note: *7A101 does not control accelerometers specially designed and developed as Measurement While Drilling (MWD) Sensors for use in downhole well service operations.*

Technical Notes:
1. In 7A101 '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 one sigma standard deviation with respect to a fixed calibration over a period of one year;

7A102 All types of gyros, other than those specified in 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.

Technical Notes:

1. *In 7A102 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.*
2. *In 7A102'stability' is defined as a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition (IEEE STD 528-2001 paragraph 2,247).*

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

a. 'Inertial measurement equipment or systems', using accelerometers or gyros as follows:

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 specified in 7A001.a.3. that are designed to measure vibration or shock.

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';

Note: 7A103.a.2. does not control 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 down-hole well services operations

7A103.a continued

Technical Note:
'Inertial measurement equipment or systems' specified in 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.

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).*

b. Integrated flight instrument systems which include gyrostabilisers or automatic pilots, designed or modified for use in 'missiles';

c. 'Integrated navigation systems', designed or modified for 'missiles' and capable of providing a navigational accuracy of 200 m Circle of Equal Probability or less;

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

7A103 continued

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 the following characteristics, and specially designed components therefor;

1. Internal tilt compensation in pitch (± 90 degrees) and roll (± 180 degrees) axes;

2. 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.

Technical Note:
In 7A103 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

7A104 Gyro-astro compasses and other devices, other than those specified in 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:

a. Designed or modified for use in space launch vehicles specified in 9A004, sounding rockets specified in 9A104 or unmanned aerial vehicles specified in 9A012 or 9A112.a; or

b. Designed or modified for airborne applications and having any of the following:

1. Capable of providing navigation information at speeds in excess of 600 m/s;

2. Employing decryption, designed or modified for military or governmental services, to gain access to a 'navigation satellite system' secured signal/data; or

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.

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).

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

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 specified in 9A004 or sounding rockets specified in 9A104.

Note: Equipment specified in 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).

7A116 Flight control systems and servo valves, as follows; designed or modified for use in space launch vehicles specified in 9A004 sounding rockets specified in 9A104 or "missiles".

a. Pneumatic, hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire and fly-by-light systems);

b. Attitude control equipment;

c. Flight control servo valves designed or modified for the systems specified in 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.

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.

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).

7B Test, Inspection and Production Equipment

7B001 Test, calibration or alignment equipment, specially designed for equipment specified in 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'

The failure of an inertial navigation unit is detected on the "aircraft" by indications from the Control and Display Unit (CDU) or by the status message from the corresponding sub-system. By following the manufacturer's manual, the cause of the failure may be localised at the level of the malfunctioning Line Replaceable Unit (LRU). The operator then removes the LRU and replaces it with a spare.

2. 'Maintenance Level II'

The defective LRU is sent to the maintenance workshop (the manufacturer's or that of the operator responsible for level II maintenance). At the maintenance workshop, the malfunctioning LRU is tested by various appropriate means to verify and localise 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 controlled accelerometers or gyro sensors.

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

N.B. *SEE ALSO 7B102.*

a. Scatterometers having a measurement "accuracy" of 10 ppm or less (better);

b. Profilometers having a measurement "accuracy" of 0,5 nm (5 angstrom) or less (better).

7B003 Equipment specially designed for the "production" of equipment specified in 7A.

Note: 7B003 includes:

- *Gyro tuning test stations;*
- *Gyro dynamic balance stations;*
- *Gyro run-in/motor test stations;*
- *Gyro evacuation and fill stations;*
- *Centrifuge fixtures for gyro bearings;*
- *Accelerometer axis align stations;*
- *Fibre optic gyro coil winding machines.*

7B102 Reflectometers specially designed to characterise mirrors, for "laser" gyros, having a measurement accuracy of 50 ppm or less (better).

7B103 "Production facilities" and "production equipment" as follows:

a. "Production facilities" specially designed for equipment specified in 7A117;

b. "Production equipment", and other test, calibration and alignment equipment, other than that specified in 7B001 to 7B003, designed or modified to be used with equipment specified in 7A.

7C Materials

None.

7D Software

7D001 "Software" specially designed or modified for the "development" or "production" of equipment specified in 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 control "source code" for the "use" of gimballed 'AHRS'.

Technical Note:
'AHRS' generally differ from Inertial Navigation Systems (INS) in that an 'AHRS' provides attitude and heading information and normally does not provide the acceleration, velocity and position information associated with an INS.

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;

b. "Source code" for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the level specified in 7A003 or 7A008 by continuously combining heading data with any of the following:

1. Doppler radar or sonar velocity data;

2. Global Navigation Satellite Systems (GNSS) reference data; or

3. Data from "Data-Based Referenced Navigation" ("DBRN") systems;

7D003 continued

c. Not used;

d. Not used;

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 specified in 7E004.b.1., 7E004.b.3. to 7E004.b.5., 7E004.b.7., 7E004.b.8., 7E004.c.1. or 7E004.c.2.

7D004 "Source code" incorporating "development" "technology" specified in 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; or

g. Three 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.

7D005 "Software" specially designed to decrypt Global Navigation Satellite Systems (GNSS) ranging code designed for government use.

7D101 "Software" specially designed or modified for the "use" of equipment specified in 7A001 to 7A006, 7A101 to 7A106, 7A115, 7A116.a., 7A116.b., 7B001, 7B002, 7B003, 7B102 or 7B103.

7D102 Integration "software" as follows:

a. Integration "software" for the equipment specified in 7A103.b.;

b. Integration "software" specially designed for the equipment specified in 7A003 or 7A103.a.

c. Integration "software" designed or modified for the equipment specified in 7A103.c.

Note: A common form of integration "software" employs Kalman filtering.

7D103 "Software" specially designed for modelling or simulation of the "guidance sets" specified in 7A117 or for their design integration with the space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

Note: "Software" specified in 7D103 remains controlled when combined with specially designed hardware specified in 4A102.

7D104 "Software" specially designed or modified for the operation or maintenance of "guidance sets" specified in 7A117.

Note: 7D104 includes "software", specially designed or modified to enhance the performance of "guidance sets" to achieve or exceed the accuracy specified in 7A117.

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 and 7D101 to 7D103.

Note: 7E001 includes key management "technology" exclusively for equipment specified in 7A005.a.

7E002 "Technology" according to the General Technology Note for the "production" of equipment specified in 7A or 7B.

7E003 "Technology" according to the General Technology Note for the repair, refurbishing or overhaul of equipment specified in 7A001 to 7A004.

Note: 7E003 does not control "technology" for maintenance, 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'.

N.B. See Technical Notes to 7B001.

7E004 Other "technology" as follows:

a. "Technology" for the "development" or "production" of any of the following:

1. Not used;

2. Air data systems based on surface static data only, i.e., which dispense with conventional air data probes;

3. Three dimensional displays for "aircraft";

4. Not used;

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

Technical Note:
'Primary flight control' is "aircraft" stability or manoeuvring control using force/moment generators, i.e. aerodynamic control surfaces or propulsive thrust vectoring.

6. 'Flight control optical sensor array' specially designed for implementing "active flight control systems"; or

Technical Note:
A 'flight control optical sensor array' is a network of distributed optical sensors, using "laser" beams, to provide real-time flight control data for on-board processing.

7. "DBRN" systems designed to navigate underwater, using sonar or gravity databases, that provide a positioning "accuracy" equal to or less (better) than 0,4 nautical miles;

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

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" "active flight control systems";

2. Not used;

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 purpose of off-line maintenance.

7E004.b. continued

4. Real-time algorithms to identify component failures and reconfigure force and moment controls to mitigate "active flight control system" degradations 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.*

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:*

a. "Technology" for integration of digital flight control, navigation and propulsion control data, into a digital flight management system for 'flight path optimisation';

b. "Technology" for "aircraft" flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

Technical Note:
'Flight path optimisation' is a procedure that minimises deviations from a four-dimensional (space and time) desired trajectory based on maximising performance or effectiveness for mission tasks.

6. Not used;

7. "Technology" "required" for deriving the functional requirements for "fly-by-wire systems" having all of the following:

a. 'Inner-loop' airframe stability controls requiring loop closure rates of 40 Hz or greater; and

Technical Note:
'Inner-loop' refers to functions of "active flight control systems" that automate airframe stability controls.

b. Having any of the following:

1. Corrects an aerodynamically unstable airframe, measured at any point in the design flight envelope, that would lose recoverable control if not corrected within 0,5 seconds;

2. Couples controls in two 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, or destabilizing shifts in cargo load.

3. Performs the functions specified in 7E004.b.5.; or

Note: 7E004.b.7.b.3. does not control autopilots.

4. Enables "aircraft" to have stable controlled flight, other than during take-off or landing, at greater than 18 degrees angle of attack, 15 degrees side slip, 15 degrees/second pitch or yaw rate, or 90 degrees/second roll rate;

8. "Technology" "required" for deriving the functional requirements for "fly-by-wire systems" to achieve all of the following:

a. No loss of control of the "aircraft" in the event of a consecutive sequence of any two individual faults within the "fly-by-wire system"; and
b. Probability of loss of control of the "aircraft" being less (better) than 1×10^{-9} failures per flight hour;

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.

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 direction control systems";

3. Rotor blades incorporating 'variable geometry airfoils', for use in systems using individual blade control.

Technical Note:
'Variable geometry airfoils' use trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

7E101 "Technology" according to the General Technology Note for the "use" of equipment specified in 7A001 to 7A006, 7A101 to 7A106, 7A115 to 7A117, 7B001, 7B002, 7B003, 7B102, 7B103, 7D101 to 7D103.

7E102 "Technology" for protection of avionics and electrical subsystems 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 subsystems;

c. Design "technology" for the determination of hardening criteria of 7E102.a. and 7E102.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.