EUROCONTROL

Avionics requirements for civil aircraft

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Avionics requirements Civil Aircraft
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EUROCONTROL has prepared a short summary offering an overview of avionics requirements for civil aircraft. The intention is to list key avionics requirements including those recently or soon to be brought into force.

It is important to note that the information in these tables relates, unless otherwise stated, to the airspace or airworthiness requirements of the States of the European Civil Aviation Conference (ECAC).

Furthermore, it should also be noted that only National Aeronautical Information Publications (AIPs) and Aeronautical Information Circulars (AICs) contain formal and liable information concerning avionics requirements applicable to civil aircraft.

Where a system requirement is not mandated in ECAC airspace, its application is determined by the worldwide ICAO Annex 6 standards.

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Civil aircraft – Communications requirements				
Domain Programme Area	**Equipment Requirement**	**ECAC Airspace Requirement**	**Airworthiness or Operational Requirement**	**Remarks**
VHF Com 8.33 KHZ	The probability of the loss of voice communication is better than or equal to remote. Depending of the size of the aircraft and the kind of operation, this could mean that only one set of 8.33kHz COM is required. Manufacturers of radios intended to operate in the VHF band, or their authorised representatives established in the Union, shall ensure that from 17 November 2013 all radios placed on the market, are 8, 33 kHz channel spacing capable.	Mandatory carriage above FL195 from 15 March 2007. Below FL195: the European Commission published the new voice channels spacing implementing rule in the Official Journal of the EU on the 16 November 2012 as Regulation (EU) No 1079/2012		Below FL195: Europe has agreed to extend the use of 8.33 kHz radios in several phases. Latest Phase 3 (by 31st Dec. 2018), aimed for full deployment in all European airspace, however European States can propose to delay deployment in areas that have a limited network impact. Attention: Possible amendments to regulation 29/2009 may follow
VHF Com Immunity from FM radio broadcasts	All VHF Comm. equipment		For guidance see JAA TGL16	Some states may have exempted from the requirement.
Controller-Pilot Data Link Communications (CPDLC) ATN/VDL Mode 2	3rd VHF Digital Radio, also either: Communications Management Unit (CMU) and Multi-function Control Display Unit (MCDU), or Air Traffic Service Unit (ATSU) and Dedicated Control and Display Unit (DCDU) or Integrated solution (e.g. Boeing FANS2) or Electronic Flight Bag solution (TBD)	SES Data Link Services Implementing Rule - EC Reg. No. 29/2009 for above FL 285 (all of EU): Feb 2018	See also EASA CS ACNS	Airframe Dates All aircraft: Feb 2020

Civil aircraft – Navigation requirements (1)				
Domain Programme Area	**Equipment Requirement**	**ECAC Airspace Requirement**	**Airworthiness or Operational Requirement**	**Remarks**
ILS	ILS receiver			Terminal aid available at most airports. ILS is expected to continue to provide service well into the future.
MLS	MLS receiver		EU OPS 1.865	Terminal aid to be made available at London Heathrow. Under consideration at other airports
RVSM	ICAO Min. Aircraft System Performance Standard (MASPS)	Mandated from FL 290 to FL410	EC 965/2012, EASA Part SPA and EASA CS-ACNS	See additional details at: www.eurocontrol.int/eurrma and http://www.eurocontrol.int/articles/rvsm-state-aircraft
RNAV5 (previously named B-RNAV)	Navigation specifications detailed in ICAO PBN manual (Doc 9613) RNAV equipment capable of ± 5 NM accuracy must: Automatically determine aircraft position using one or more of the following sensors: VOR/DME, DME/DME, GNSS or INS/IRU	Originally mandated above FL95 for en- route IFR operations. By Jan 2024 mandated for all en-route FLs iaw (EU) 2018/1048. In the lower airspace, National Authorities may designate conventional ATS routes, which can be used by non-PBN capable aircraft until June 2030.	Commission Implementing Regulation (EU) 2018/1048 See also EASA CS-ACNS FAA Order AC90-96A	For ECAC airspace, the primary sources of navigation information are VOR/DME, DME/DME, GNSS and may be augmented by INS/IRU. The availability and continuity of VOR and DME coverage has been calculated for most of Europe and it is considered to be capable of meeting the performance requirements of the en-route phase of operations. More info on PBN can be found: https://pbnportal.eu/epbn/home/home.html
RNAV1	Navigation specifications detailed in ICAO PBN manual (Doc 9613) RNAV systems (GNSS, DME/DME or DME/DME/IRU) capable of ± 1 NM accuracy	RNAV1 specification covers TMAs. PBN Implementing Regulation requires one RNAV 1 SID/STAR to each Instrument Runway End (IRE) by 25 Jan 2024. All SIDs/STARs are to RNAV1 as a minimum by 6 Jun 2030. Post that date conventional operations are contingency only. More info on PBN can be found: https://pbnportal.eu/epbn/home/home.html	Commission Implementing Regulation (EU) 2018/1048 See also EASA CS-ACNS FAA Order AC90-100A	Developed for continental radar environment. Does not require on-board performance monitoring and alerting. GNSS, DME/DME and DME/DME/IRU allowed Accommodates the vast majority of the European fleet. P-RNAV is similar to RNAV 1 and is the accepted certification in ECAC (Doc 7030). P-RNAV certification was JAA TGL10 Rev 1.
RNP1	Navigation specifications detailed in ICAO PBN manual (Doc 9613) RNP System based on GNSS with requirement for on-board performance monitoring and alerting	Not mandated in Europe. However, RNP 1 would be required as the application for SIDs/STARs if a consistent and highly repeatable turn performance using the Radius-to-Fix (RF) functionality was required.	Commission Implementing Regulation (EU) 2018/1048 See also EASA CS-ACNS FAA 90-105A	Requires on-board performance monitoring and alerting. Requires GNSS (possible exceptions) Old generation GPS receivers may have integrity switching issues beyond 30NM of the departure and arrival ARPs. More info on PBN can be found: https://pbnportal.eu/epbn/home/home.html

Civil aircraft – Navigation requirements (2)				
Domain Programme Area	**Equipment Requirement**	**ECAC Airspace Requirement**	**Airworthiness or Operational Requirement**	**Remarks**
RNP APCH (to LNAV/VNAV minima) **also called APV Baro/VNAV**	Navigation specifications detailed in ICAO PBN manual (Doc 9613) Vertically guided approach with VNAV functionality using barometric inputs. Most Commercial Air Transport and Business Aviation aircraft have this capability.	Mandated for all SES Instrument Runway Ends. Full deployment should be complete by Jan 2024. Current deployment status and plans available on the Performance based navigation map tool: https://www.eurocontrol.int/platform/performance-based-navigation-map-tool In Europe, some national authorities accept the use of SBAS to fly LNAV/VNAV procedures.	Commission Implementing Regulation (EU) 2018/1048 EASA CS-ACNS which superseded AMC 20-27	In July 2018, the European Commission adopted the PBN Implementing Regulation EU 2018/1048 (PBN IR). This IR requires the States to publish RNP APCH with three lines of minima (LNAV, LNAV/VNAV & LPV) at all instrument runway ends by 25 January 2024, either as the primary approach capability or as a back up to Precision Approach.
RNP APCH (to LPV minima) **also referred to as APV SBAS**	Navigation specifications detailed in ICAO PBN manual (Doc 9613) Requirements for SBAS receivers are contained in ICAO Annex 10 Volume 1. Also see specification RTCA DO 229D and FAA TSO C145A/146A	As above. Current deployment status and plans available on the Performance based navigation map tool: https://www.eurocontrol.int/platform/performance-based-navigation-map-tool	RNP APCH to LPV minima is enabled by SBAS (such as EGNOS in Europe and WAAS in the USA) to provide lateral and vertical guidance. The lateral guidance is equivalent to an ILS localizer and the vertical guidance is provided against a geometrical path in space rather than a barometric altitude. EASA CS-ACNS which superseded AMC 20-28	European States publishing LPVs will require an EGNOS Working Agreement (EWA) with the EGNOS service provider. RNP APCH operations approval may be required by national authorities in the State of the intended operations. Article 5 of the PBN IR calls for a total PBN environment in 2030; this has implications for ILS PA CAT I. The IR foresees SBAS CAT I as the primary PA CAT I capability; however, this requires aircraft to be fitted with a TSO 145 or TSO146 certified receiver and this level of equipage is very low on CAT aircraft today.
RNP AR APCH (Authorisation Required)	Navigation specifications detailed in ICAO PBN manual (Doc 9613) Enabling System: GNSS	Not mandated but may be required at terrain challenged aerodromes. Permitted by the PBN IR. RNP AR APCH under consideration at selected airports requiring tight navigational accuracy in the approach or missed approach or RF in the Final Approach Segment. (approach specification specifically designed for challenging environments) Current deployment status and plans available on the PBN map tool: https://www.eurocontrol.int/platform/performance-based-navigation-map-tool	See EASA CS ACNS Aircraft eligibility must be determined through demonstration of compliance against the relevant aircraft qualification criteria. Typically documented by Aircraft Manufacturer and accepted by CAA May not require new Aircraft Flight Manual (AFM) entries if previous systems and equipment are adequate.	Relies on GNSS and flight crew performance. Sophisticated approach specification for challenging environments Aircraft equipment eligibility includes: • Aircraft qualification • Maintenance procedures Minimum Equipment List revisions. Airframe and/or avionic revisions will probably require requalification. Crew will need special authorisation beyond the PBN privileges attained with the Instrument Rating.

Civil aircraft – Navigation requirements (3)				
Domain Programme Area	**Equipment Requirement**	**ECAC Airspace Requirement**	**Airworthiness or Operational Requirement**	**Remarks**
GLS CAT I and GLS CAT II/III	Approaches based on GBAS equipment. GBAS performance specification is contained in RTCA DO 253D LAAS receiver MOPS	In operation at selected airports (CAT I operations). CAT II/III systems in trial phase Deployment status and plans available at www.flygls.net	Operational approval not required for CAT I (ILS look-alike) and under development for CAT II/III.	GBAS SARPS for CAT I became applicable in Nov 2001 (refer to ICAO SARPS annex 10 volume 1) GBAS SARPS for CAT II/III published as baseline development standards. CAT II certification in progress CAT III standards being developed
A-RNP (Advanced RNP)	RNP operations where the RNP is performance ranges from 2 NM in Oceanic/Remote Continental down to 0.3 NM for terminal operations. RF required Options for higher continuity, FRT, Baro-VNAV.	No current requirement or mandate. More info on PBN can be found: https://pbnportal.eu/epbn/home/home.html	EASA CS ACNS provides airworthiness requirements. Navigation specification is described in ICAO Doc 9613 4th Edition 2013 (Performance-based Navigation manual)	Provide a means for a single aircraft qualification being applicable to a broader range of applications. Could provide a solution for independent parallel approach operations (Mode 1) using PBN

Civil aircraft – Surveillance requirements (1)				
Domain Programme Area	**Equipment Requirement**	**ECAC Airspace Requirement**	**Airworthiness or Operational Requirement**	**Remarks**
Emergency Locator/ELT	Mandated since 01/01/2002 ICAO SARPS Annex 6 Part 1, para 6.17 See also EU OPS 1 subpart K (1.820)	Consult National A.I.P	See EU OPS 1 Subpart L (1.820) Upcoming requirement EASA NPA 2013-26: 1) Cockpit Voice Recorder: additional requirement ULD (Underwater Location Device) after 1 January 2020: minimum underwater transmission time of 90 days. 2) Provision (flight over water with an aeroplane operated for commercial air transport) to require that aeroplanes with an MCTOM of over 27 000 kg and first issued with an individual CofA on or after 1 January 2005 are, no later than 2019, equipped with an 8.8 kHz ULD (ULD with a very long detection range).	ICAO Worldwide aircraft requirement. All aircraft with a C of A after 1/1/2002 shall be equipped with an automatic ELT capable of transmitting on 121.5MHz and 406MHz. Aeroplanes with a C of A before 1/1/2002 must have any type of ELT capable of transmitting on 121.5MHz and 406MHz. An Operator shall ensure that all ELTs that are capable of transmitting on 406Mhz shall be coded in accordance of ICAO Annex 10 and registered with the national agency responsible for initiating a search & rescue service.
SSR Mode A/C (Surveillance with Altitude reporting)	ICAO Annex 10, Volume IV, Chapter 2	Mandated	The EASA Certification Specification for Airborne Communications, Navigation and Surveillance (CS-ACNS) Issue 2, published July 2020, provides the avionics certification documentation in line with Commission Implementing Rule EU1207/2011. See https://www.easa.europa.eu/document-library/easy-access-rules/easy-access-rules-airborne-communications-navigation-and	The requirements for Mode S ELS, Mode EHS and ADS_B, as detailed in the following rows of the table, apply for flights conducted as IFR/GAT. The requirements for SSR Mode A/V for flights conducted as VFR within each National Airspace can vary therefore refer to National AIC's and AIP's

Civil aircraft – Surveillance requirements (2)				
Domain Programme Area	**Equipment Requirement**	**ECAC Airspace Requirement**	**Airworthiness or Operational Requirement**	**Remarks**
SSR Mode S Elementary Surveillance (ELS)	"Basic Functionality" required: • Automatic reporting of Aircraft Identity • Transponder capability report • Altitude reporting in 25 ft intervals • Flight status • SI Code capability See EASA CS-ACNS	Commission Implementing Rule (IR) EU1207/2011 (laying down requirements for the performance and the interoperability of surveillance for the single European sky), as amended by EU1028/2014 and EU2017/386 which specify the airborne equipage requirements for Mode S ELS. It should also be noted that some States, e.g. DE and NL have published mandates requiring aircraft flying VFR to be compliant with Mode S ELS.	The EASA Certification Specification for Airborne Communications, Navigation and Surveillance (CS-ACNS) Issue 2, published July 2020, provides the avionics certification documentation in line with Commission Implementing Rule EU1207/2011. See https://www.easa.europa.eu/sites/default/files/dfu/Annex%20I%20to%20ED%20Decision%202019-011-R%20-%20CS%20ACNS%20Issue%202.pdf	For more details: consult (IR) (EU) No 1207/2011, EU1028/2014 and EU2017/386 See also: http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1504257764982&uri=CELEX:02011R1207-20170327 For further information regarding the Regulations, and possible exemption mechanisms, please contact DG Move at the European Commission via 'move-infos@ec.europa.eu'
SSR Mode S Enhanced Surveillance (EHS)	See EASA CS-ACNS	Commission Implementing Rule (IR) EU1207/2011 (laying down requirements for the performance and the interoperability of surveillance for the single European sky), as amended by EU1028/2014 and EU2017/386 which specify the airborne equipage requirements for Mode S EHS.		
ADS -B Automatic Dependant Surveillance Broadcast	ADS-B Out Transmit System: EASA ETSO / C166b EUROCAE ED-102A/RTCA DO-260B ICAO Annex 10 Doc. 9871 Ed.2 ADS-B Out Horizontal Position Source: EASA ETSO-129a (plus specific CS-ACNS qualifications).ETSO-C196, or ETSO-C145 / ETSO-C146.	Commission Implementing Rule (IR) (EU) No 1207/2011 (laying down requirements for the performance and the interoperability of surveillance for the single European sky) amended by EU1028/2014 and EU2017/386, which specify the airborne equipage requirements for "ADS-B Out".		

Civil aircraft – Safety Assurance requirements				
Domain Programme Area	**Equipment Requirement**	**ECAC Airspace Requirement**	**Airworthiness or Operational Requirement**	**Remarks**
ACAS II	TCAS ll Software Version 7.1 (adjacent column) ICAO Annex 10 vol.4, PANS OPS Doc 8168, PANS ATM Doc 4444, ICAO Doc 7030, ICAO Doc 9863 (ACAS Manual) ICAO Annex 6, Operation of Aircraft, Part 1 – International Commercial Air Transport – Aeroplane European Commission Regulation No 1332/2011, subsequently amended by Regulation No 2016/583	European Union Airspace: TCAS II version 7.1: - all (civil) aircraft with a maximum certified take-off mass exceeding 5,700 kg or authorised to carry more 19 passengers; - Aircraft not referred above but which are equipped on a voluntary basis with ACAS II, must be equipped with version 7.1. The above does not apply to unmanned aircraft systems. ECAC (outside EU airspace): All civil fixed-wing turbine-engine aircraft with a maximum take-off mass over 5,700 kg, or capable of carrying more than 19 passengers: aircraft with new ACAS installations after 1 January 2014 shall be compliant with version 7.1 and after 1 January 2017 all ACAS units shall be compliant with version 7.1 (per ICAO Annex 10 vol. IV, amendment 85, unless a State filed a difference).	European Commission Regulation No 1332/2011, subsequently amended by Regulation No 2016/583 For certification JAA TGL 8 Revision 2 For pilot training and operational procedures, see ICAO PANS-OPS, Doc 8168, ICAO Doc 9863 and JAA TGL11.	MEL for TCAS II throughout Europe is Class A - 10 days (excluding the day of discovery). MEL requirements EASA - Easy Access Rules for Generic Master Minimum Equipment List (CS-GEN-MMEL). February 2018. Link: https://www.easa.europa.eu/sites/default/files/dfu/Easy%20Access%20Rules%20for%20CS-GEN-MMEL.pdf Some States may have different requirements. E.g. in German airspace, the time period during which TCAS II may be inoperative is reduced to 3 days (refer to German AIP GEN 1.5 para 5). This applies to all aircraft. Any requests for clarifications and quires regarding possible exemptions should be addressed directly to EASA. Email: technicalquestions@easa.europa.eu http://easa.europa.eu/the-agency/faqs/airspace-usage-requirement-acas-ii-v71
EGPWS/TAWS	ICAO ANNEX 6 part 1: Operation of Aircraft, 6.15; Part II: Operation of Aircraft, 6.9.	See also EASA CS-ACNS	An operator shall not operate a turbine powered aeroplane having a maximum certificated take-off mass in excess of 5 700 kg or a maximum approved passenger seating configuration of more than nine unless it is equipped with a ground proximity warning system that includes a predictive terrain hazard warning function.	Note: ICAO worldwide mandate For further guidance on EGWPS airworthiness requirements refer to your State regulator.
Flight Data Monitoring			Awaiting EASA adoption	Proposal is for aircraft > 27,000kg to be equipped with a suitable electronic flight data recorder or quick access recorder where flight data can be regularly replayed for purposes of crew monitoring

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