



Applying Performance Based Approach to Airworthiness



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Overview



- Performance Based Equivalence
- PBN certification of the Finnish Air Force F/A-18
- Enablers for PBN certification
- Conclusions





Performance Equivalence for Military Aircraft “Joint Framework Roadmap”



“For Military Aircraft, Performance Equivalence is the ability to meet the required functional attributes of ATM/CNS systems against the **performance, safety, security** and **interoperability** requirements of regulated airspace. This includes the measurable (e.g. metrics from regulations and standards) and non-measurable functional requirements (e.g. procedures or technical architecture), demonstrated through the evaluation of accuracy, integrity, continuity of function and availability.”

ANNEX 1

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Why performance equivalence?

- Compliance with civil aviation requirements
- Use of civil aviation navigation procedures.
- Provide the ***same level of safety*** by alternative means.
 - comparing the ***performance of operation*** to relevant civil aviation requirements
 - technical capability of a/c
 - man-machine interface
 - supporting capabilities





Rationale behind the need for PBN also in military aviation



- Navigation without land based systems/aids
- Design requirements for military assets
 - differences compared to civil aviation
- Performance (accuracy) equivalent to civil aviation requirements
 - utilization of military capabilities

=> alternative means to gain compliance are used to provide **the *equal level of safety*** when operating in common airspace





PBN certification for Finnish Air Force F/A-18



RNAV5, RNAV1, RNP APCH (LNAV only) for F/A-18 SCS 25(X)F





Evaluation & Approval process

- Coordination between the Finnish Military Aviation Authority (FiMAA), Air Force Command (AFCOMFIN) and Defense Force Logistics Command (DEFLOGCOM)
 - certification of a/c configuration (FiMAA)
 - flight test campaign
 - coordination with National Transportation Safety Agency, Trafi (FiMAA)
 - operations instructions and training syllabus (AFCOMFIN)
 - navigation data management (DEFLOGCOM)





F/A-18 capability compared to civil requirements



AMC 20-4A	Vaatus	Lausunto	Dokumenttiviittaus
4.1.2	Availability and Integrity		
	Acceptable means of compliance for assessment of the effects associated with the loss of navigation function or erroneous display of related information is given in AMC 25-11 paragraph 4 a (3)(viii).	HN-koneella ja sen navigointijärjestelmällä on FINAF:n tyyppihyväksyntä, näin ollen koko järjestelmää ei tositeta. RNAV järjestelmän käyttö tullaan Ilmavoimien toimesta evaluoimaan ja kouluttamaan vaaditulla tavalla. Evaluatiossa otetaan huomioon virheellisen tulkinna/valinnan mahdollisuus.	
	The minimum level of availability and integrity required for Basic RNAV systems for use in designated European airspace can be met by a single installed system comprising one or more sensors, RNAV computer, control display unit and navigation display(s) (e.g. ND, HSI or CDI) provided that the system is monitored by the flight crew and that in the event of a system failure the aircraft retains the capability to navigate relative to ground based navigation aids (e.g. VOR, DME and NDB).	Navigointitiedot näkyvät koneen HSI-näytöllä RAIM-toiminto ei ole käytössä	
4.2	Functional Criteria		
4.2.1	Required Functions		
	The following system functions are the minimum required to conduct Basic RNAV operations.		
	(a) Continuous indication of aircraft position relative to track to be displayed to the pilot flying on a navigation display situated in his primary field of view In addition where the minimum flight crew is two pilots, indication of aircraft position relative to track to be displayed to the pilot not flying on a navigation display situated in his primary field of view	F-18 suunnistusjärjestelmä määrittelee automaattisesti sijaintinsa GPS ja INS -pohjalta. Tarvittavat navigointitiedot näkyvät HSI-näytöllä ja HUDilla. RMDI, LMDI, MPCD, HUD -näyttöjen sijannit täyttävät Primary field of view -vaatimuksen.	A1-F18AH-710-100 A1-F18AC-NFM-000
	(b) Display of distance and bearing to the active (To) waypoint	Valitun waypointin etäisyys ja suunta näkyvät HSI-näytöllä.	A1-F18AH-710-100
	(c) Display of ground speed or time to the active (To) waypoint	HSI-näytöllä näkyy aika, joka kuluu valitun waypointin saavuttamiseksi.	A1-F18AH-710-100
	(d) Storage of waypoints; minimum of 4	Täyttää 4 Way pointin vaatimuksen.	A1-F18AC-NFM-000





Data management as an example of an alternative means of compliance



- EASA AMC 20-27A (RNP APCH): *"The database shall be protected against flight crew modification of the stored data."*
- For FINAF F/A-18 Hornet
 - size of the data base for stored waypoints is limited
 - only the points which will be needed in each task will be loaded using Mission Planning System
 - the database is not protected
 - pilots are instructed to make changes/load points during flight only in an emergency
 - data management process differences





Major enablers for PBN certification

- Aircraft modification
- Operation/navigation procedures
- Cooperation
 - aircraft manufacturer , FINAF, DEFLOGCOM and national aviation industry
 - civil and military authority
- Flight training
- Flight safety culture





Conclusions

- Need for compatibility and interoperability with evolving civil Air Traffic Management (ATM) requirements
- Demonstration through the evaluation of accuracy, integrity, continuity of function and availability
- Changes to navigation and navigation data management procedures as well as to flight training syllabus





Thank You for your attention

