



Challenges to Helicopter Operations

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Welcome

- You are the Expert
- We integrate
- Your responsibility to let us know for any questions, differences, errors, etc

Rule of the game

No Mobile / Hand phone Silent

Interruption questions welcome


Daftar Hadir & survey: aerotekavia.com/pbns




Workshop Facilitator

- ✓ IPTN/PTDI: Flight Test, Military & Airlines
- ✓ MSc Aerospace & Test Pilot UK
- ✓ ICAO Ops Panel: FDA / FLTREC, EFOD AN6(All)
- ✓ Sr Flight Ops Inspector GCAA UAE
- ✓ GCAA Specials Ops (FDM, EFB, AWO/LVO, PBN, MNPS, ETOPS & Polar)
- ✓ Aerotekavia - Flitejob.com





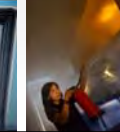

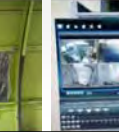




Aerotekavia

OUR PRODUCTS:
Design, produce Training Devices out of 

✓ [Video](#)







AGENDA

- ✓ BRIEF PBN: WHAT, WHY, HOW & WHEN
- ✓ NAVIGATION SPECIFICATIONS
- ✓ AIRCRAFT EQUIPMENT
- ✓ OPERATIONAL APPROVAL
- ✓ CHALLENGES
- ✓ RECENT CHANGES IN AVIATION
 - AIRCRAFT TRACKING
 - EFB

References



- ICAO Annex 6, 14, 19

- Doc 9613 – PBN Manual



- *Doc 9992, 9997 PBN Airspace Design Approval (*Subscribers)



- UAE PBN Ops Approval



- EASA TGL AMC

- FAA AC 20-138D AW Approval of Nav System

PBN ?

Area navigation based on

- performance requirements for aircraft operating along an ATS route, on
 - Instrument approach procedure OR
 - a designated airspace.
-
- Performance requirements = term of accuracy, integrity, continuity and availability

PBN CONCEPT

Component PBN concept

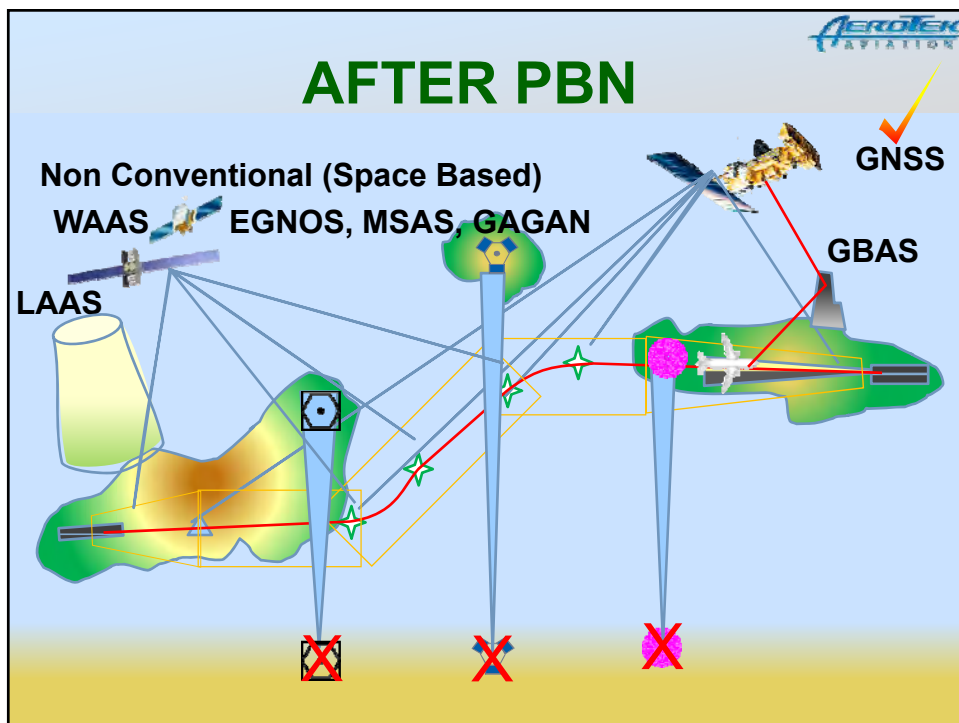
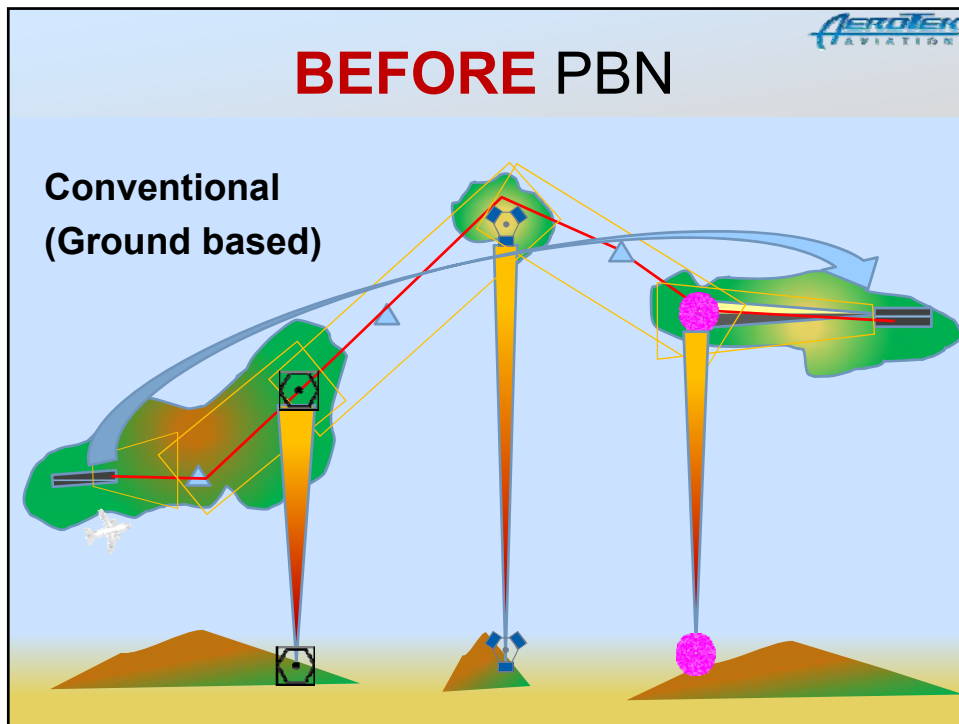
- **Navigation Application** enabled by two components:
 - **NAVAID Infrastructure** and
 - **Navigation Specification.**

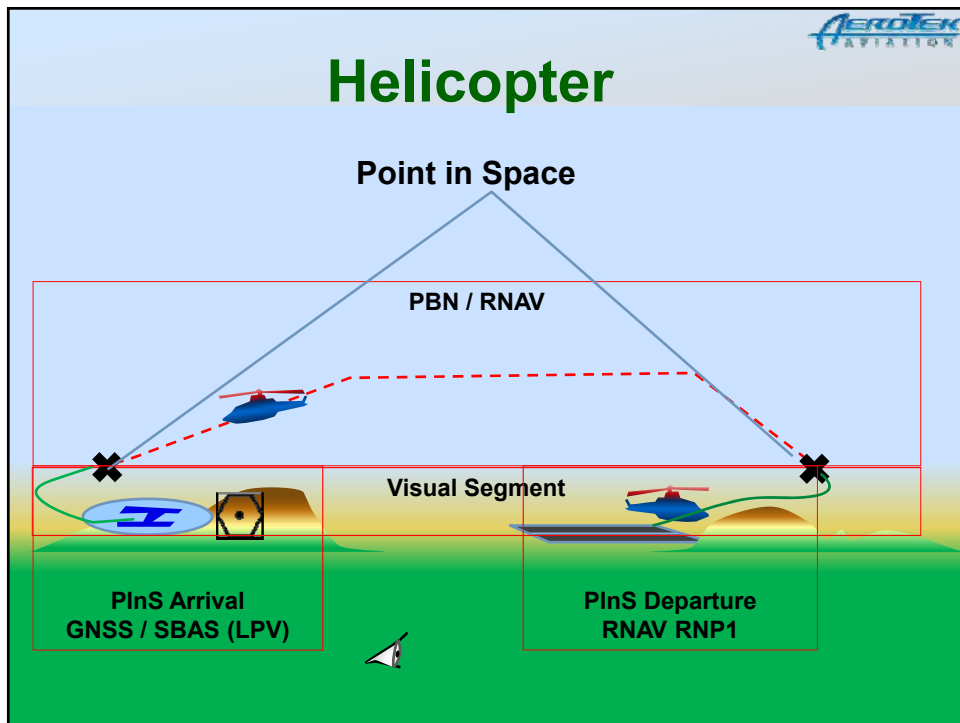
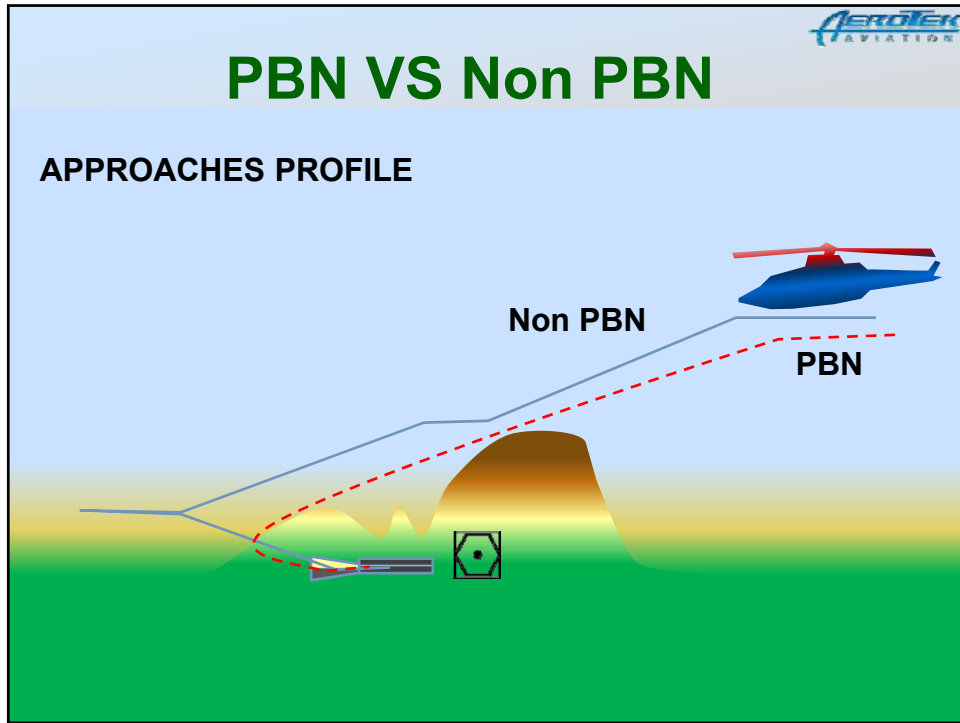
PBN NAVIGATION COMPONENT

NAVIGATION APPLICATION

INFRASTRUCTURE

SPECIFICATIONS







AEROTEK AVIATION

NAVAID INFRASTRUCTURE

Space-based Nav-aids:

- GNSS (Global Navigation Satellite System) : GPS (US), Glonass(RU), Galileo(EU)
- or (GBAS: Groud Based Augmented System)

Ground-based (DME and VOR).

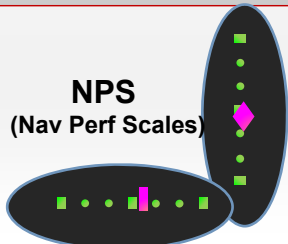



AEROTEK AVIATION

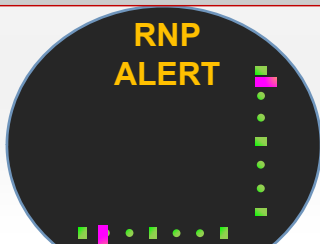
DIFFERENCES

EQUIPMENT	PBN	ALERTING
AIRCRAFT	RNAV	RNP
PERFORMANCE MONITORING		

NPS
(Nav Perf Scales)



RNP ALERT





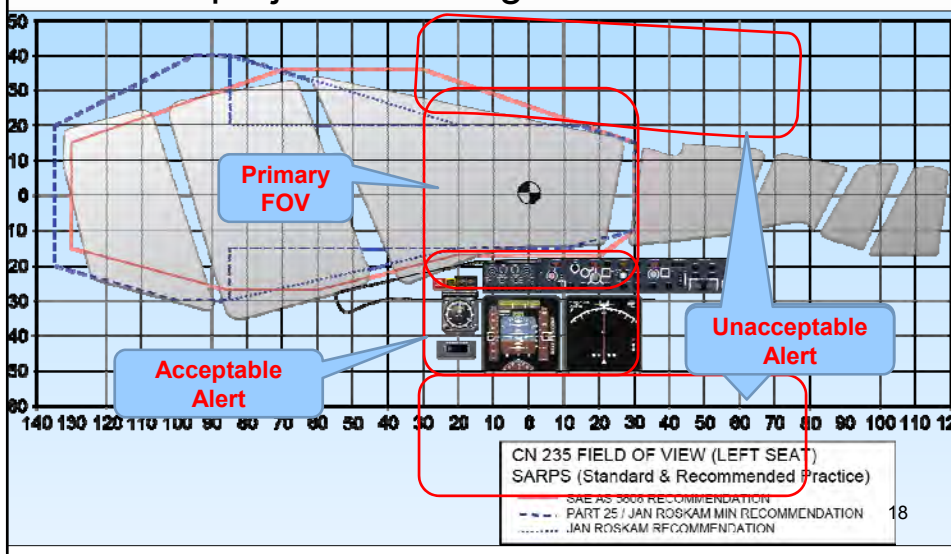
ALERTING > WORKLOAD

- UNABLE RNP
- GPS PRIMARY LOST
- NAV ACCURACY DOWNGRADE
- GPS (EPE, DOP, RAIM, etc)



FOV (Field Of View)

- 2D projection of Flight Deck





RNAV EQUIPMENT



OR



100 nrad, 1-1000 Hz

Developed for
NASA/JPL



<100 nrad, 1-1000 Hz



<500 nrad, 2-1000 Hz

Developed for
HEL-JTO




<300 nrad, 1-1000 Hz



RNP APCH equipment

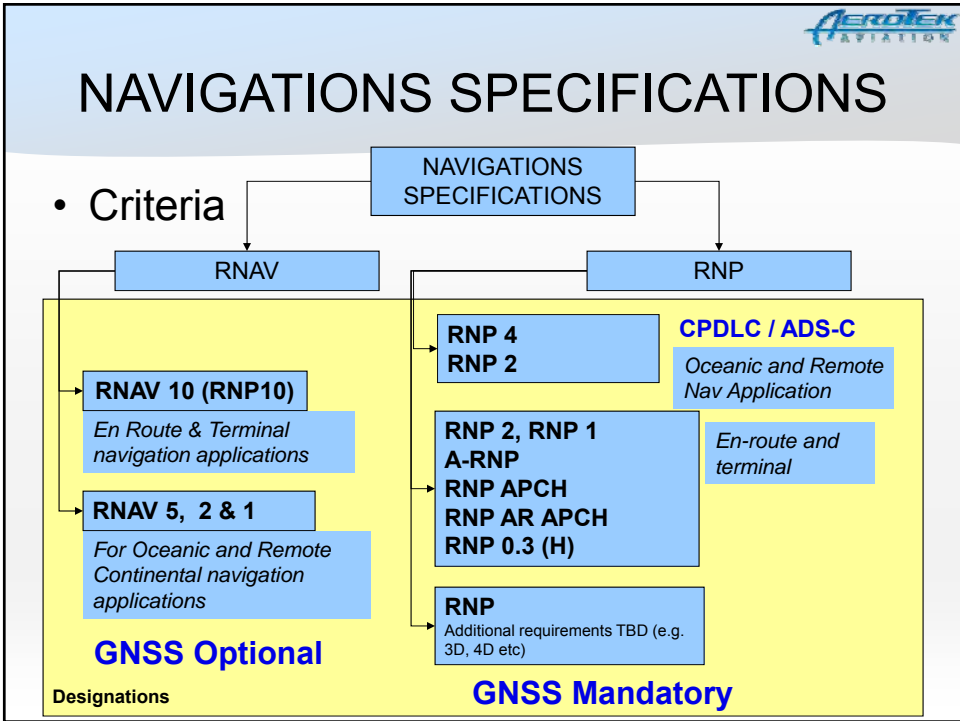
- TAWS (Exc: Mode 5 GS)
 - 2 FMCs, 2 GPS, CDUs *
 - 2 Radio Altimeters **MEL ?**
 - 2 ADIRUs, IRSs in NAV mode *
 - 2 EFIS/MAP or PFD/ND displays *
 - 1 A/P & 2 F/Ds LNAV and VNAV * (RNP > 0.15)
 - 2 A/P & 2 F/Ds LNAV and VNAV *(RNP < 0.15)
 - Current Navigation Database
- In Future These will qualify all AC **A-RNP** (but AR)




Helicopter Specific

AN6/III Amendment :


- a) Procedure design criteria and charting **PBN & Helicopter PinS App & Dept;**
- b) Harmonization **EFBs, HUDs & vision** systems, and fuel use;
- c) Flight recorder requirements to align underwater location device (ULD)





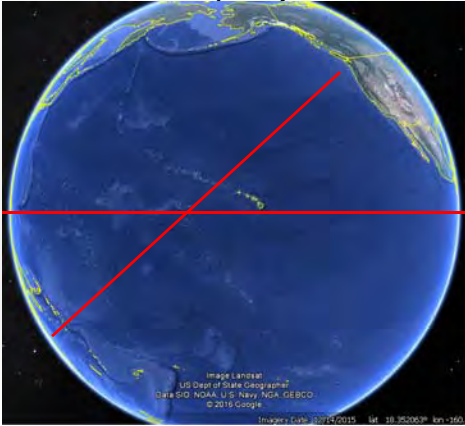

Nav Accuracy

NAVIGATION SPECIFICATION	FLIGHT PHASE			Approach				
	ENR Oceanic/Remote	ENR Continental	ARR	INIT	Interm.	FINAL	Miss	DEP
RNAV 10	10							
RNAV 5 (30Nm)		5	5	GPS Optional				
RNAV 2 &		2						2
RNAV 1		1		1	1		1	1
RNP 4	4							
RNP 2	2	2						
RNP 1				1a	1a		1	1
Adv RNP	2	2 or 1	1	1	1	0.3	1	1
RNP APCH				1	1	0.3	1	
RNP AR APCH				1 - 0.1	1 - 0.1	0.3 - 0.1	1-0.1	
RNP 0.3		0.3	0.3	0.3	0.3		0.3	0.3



CHALLENGES

- EARTH ½ Circumference 10500 Nm
- Pacific (Syd-Seattle) 7000 Nm
- Indian (Capetown-Jog) 5000 Nm



CHALLENGES Helicopter

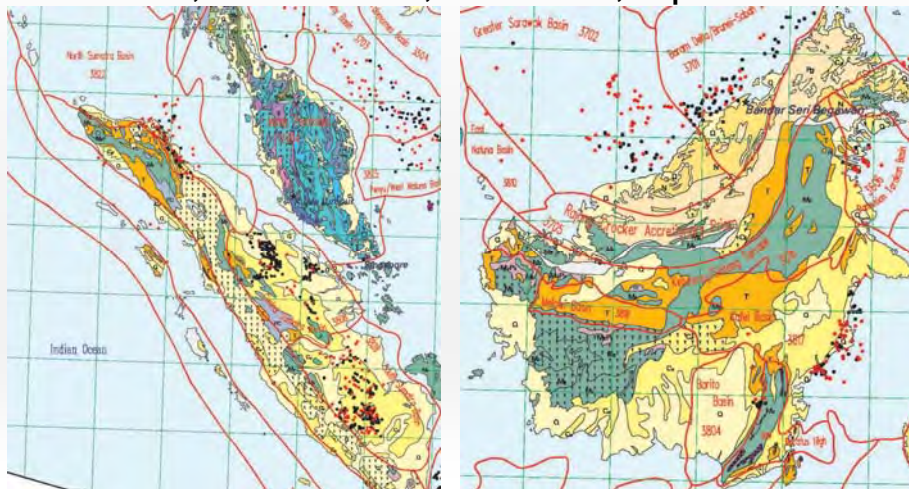
- How many approaches required ?

YR	HELIDECK	ELEVATED	HELIPORT	TOT
2009	36	2	14	52
2010	85	13	38	136
2011	117	20	45	182
2012	155	22	61	238
2013	185	29	60	284
2014	199	36	77	312



CHALLENGES

- Landing Sites Data
- Route, Aerodrome, Obstacle, Operations





OTHER CHALLENGES

Multi state involvements

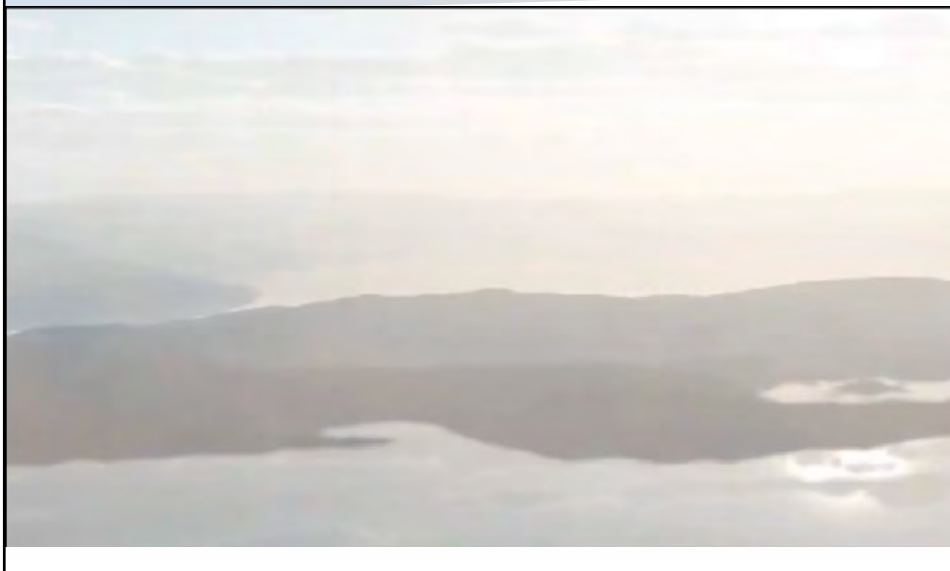
- Oceanic / remote (RNAV 10 / 4)
- PBN RNAV with Ground Nav update

Multi operator / organization involvements

- Operating in to single site by various Opr
- Utilising Route / approach / coordination's
- Charting, Speed control
- Pins (Point IN Space) **H**



RNP WAAS

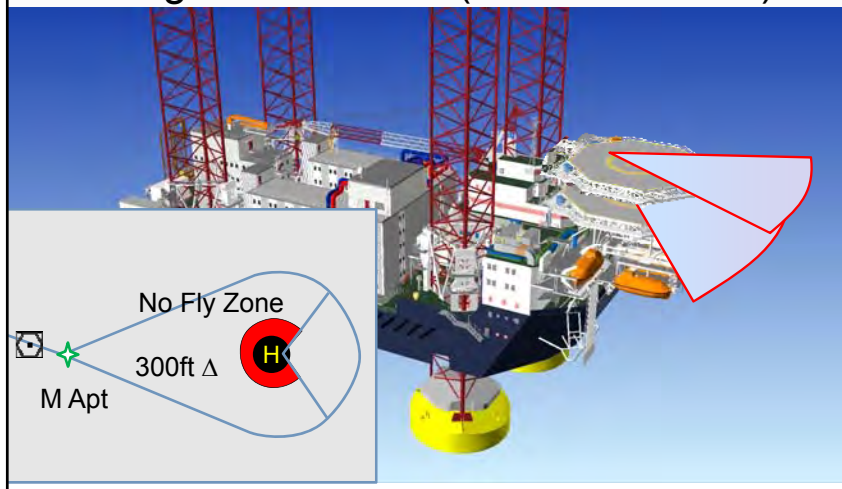



Notes about RNP AR APCH

- Approach **charts** titled **RNAV (RNP)**
- **Lowest DA** currently authorized is **250ft**
- RNP 0.3 (AR) commonly achieves 250ft DA
- **RNP < 0.3** used where required for **lower DA**
- Most RNP AR approaches are RNP 0.3
- **TAWS** is **not part** of the **design** criteria
- No (formal) train-the-trainer courses on the subject

Helideck Data


- Route (entry / exit)
- Height ? Elevation (Fixed / variable)





CHALLENGES

- PBN Manual not accounted OEI, OPR
Data validation required (eg simulator)
- [ANSP or FOO/Dispatcher](#)
- [FOO Dispatcher \(Preparations, RAIM forecast, New ATC Flt Plan \(item10\)](#)
- ERROR ? RAIM
- www.aimindonesia.info
- <http://sapt.faa.gov/outages.php?outageType=129011450&outageResolution=0.7>



Sample RAIM Prediction

augur2.ecacnav.com/augur/app/npa

AUGUR GPS RAIM Prediction Tool - Terminal/Approach Tool [Mirror Site](#)

[GPS Status](#) | [Terminal/Approach Tool](#) | [Visibility Tool](#) | [Route Tool](#) | [Nav Domain Home](#) | [Mirror Site](#) | [Help](#)

Warning: From 1 July 2012, AUGUR coverage will be limited to ECAC airspace only. Please email the helpdesk (augur_helpdesk@ecacnav.com) for further information.

Airports

Airport 01

Airport 02

Airport 03

Airport 04

Airport 05

Airport 06

Airport 07

Airport 08

Airport 09

Airport 10

Configuration

Mask Angle: 5.0 degrees

Algorithm: FD

Mode: APPROACH

Result

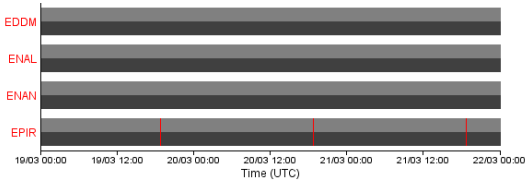
Format: Graphic

Output

Terminal/Approach Check

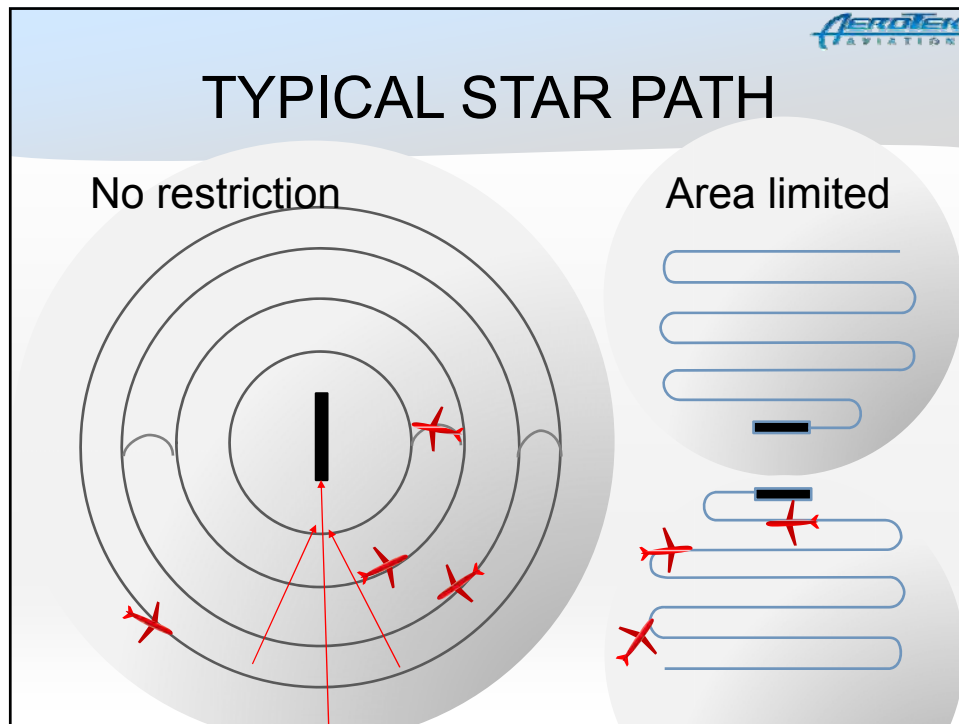
Generated: 19/03/2016 06:07:11 UTC


Scenario Start: 19/03/2016 00:00:00 UTC Scenario Step: 22/03/2016 00:00:00 UTC
Mask Angle: 5.00, Algorithm: Fault Detection Only (FD), Mode: APPROACH
Active NANUs: 2016018



■ RAIM Unavailable ■ Baro Aided ■ Non Baro Aided

Almanac - Week: 805 TOA: 61440





ICAO PBN Evolution 2015

- Through State Letter 15 April 2015
- ICAO ANC - FLTOSP
- An6/I/II & III, PANS-ATM, Doc 4444 and PANS-OPS I — *Flight Procedures* (Doc 8168) regarding:
- Harmonization and alignment of terms, **PBN**, vision systems, icing and ACAS.



Recent ICAO Changes

An6/III 5.2.3 State of the OPR shall, established and documented: (PBN)

- a) Proc (Normal, Abn & Contingency)^{1,2};
- b) Flt crew qual & proficiency req't;
- c) Trg Prog ; and
- d) Maint proc.

- Note: 1 Safety & Risk assessment An 19 = Doc 9997.
- Note 2. Include Nav data management



Recent ICAO Changes

- An6/III par 5.2.4 State of the OPR shall issue a **specific approval** for **complex navigation** specifications. (**RNP APCH, RNP AR APCH, ETC**)
- Ref PBN Operational Approval Manual (Doc 9997).
Through :
 - LETTER OF AUTHORISATION
 - OPERATIONS SPECIFICATIONS
 - Or OPERATIONS MANUAL (Part A and C Route and Aerodrome information's)
 - *Helicopter*: Current helicopter instrument procedure design criteria do not incorporate the use of vertical guidance that is available today through space-based systems nor does it allow for the design of instrument departures.



RNP APCH Chart Designation

Until 30 Nov 2022, charts for :

- RNP APCH shall include term **RNAV(GNSS) RWY 23**
- RNP AR APCH shall include term **RNAV RNP RW13**

From 1 Dec 2022, charts for :

- RNP APCH nav spec shall be designated **RNP RWY 23**.
- RNP AR APCH shall include term RNP with a parenthetical suffix (AR). e.g. **RNP RWY 23 (AR)**



- **Excepts:**



Exceptions

Condition	Suffix	Example
Procedure has only an LPV line of minima	LPV only	RNP RWY 23 (LPV only)
Procedure has only an LNAV/VNAV line of minima	LNAV/VNAV only	RNP RWY 23 (LNAV/VNAV only)
Procedure has both LPV and LNAV/VNAV lines of minima but no LNAV minima	LPV, LNAV/VNAV only	RNP RWY 23 (LPV, LNAV/VNAV only)
Procedure has only an LP line of minima	LP only	RNP RWY 23 (LP only)

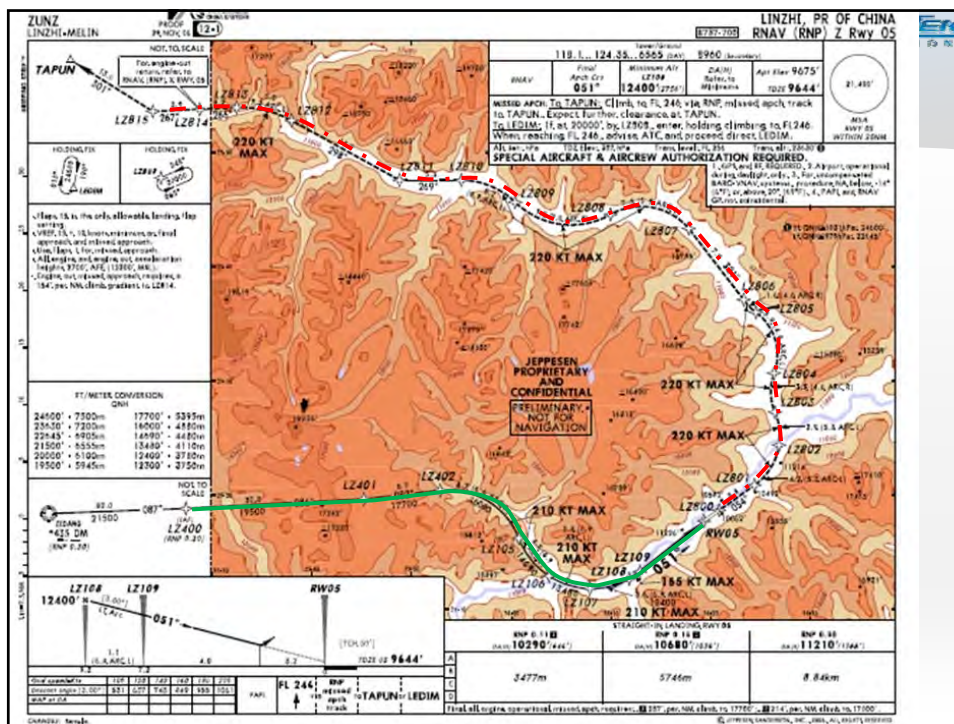
Minima

Future Minima for RNAV approach procedures shall be labelled on the chart as follows:

Minima label	Associated navigation specification
LNAV	RNP APCH
LNAV/VNAV	RNP APCH
LP	RNP APCH
LPV	RNP APCH
RNP 0.x	RNP AR APCH

Validations tools

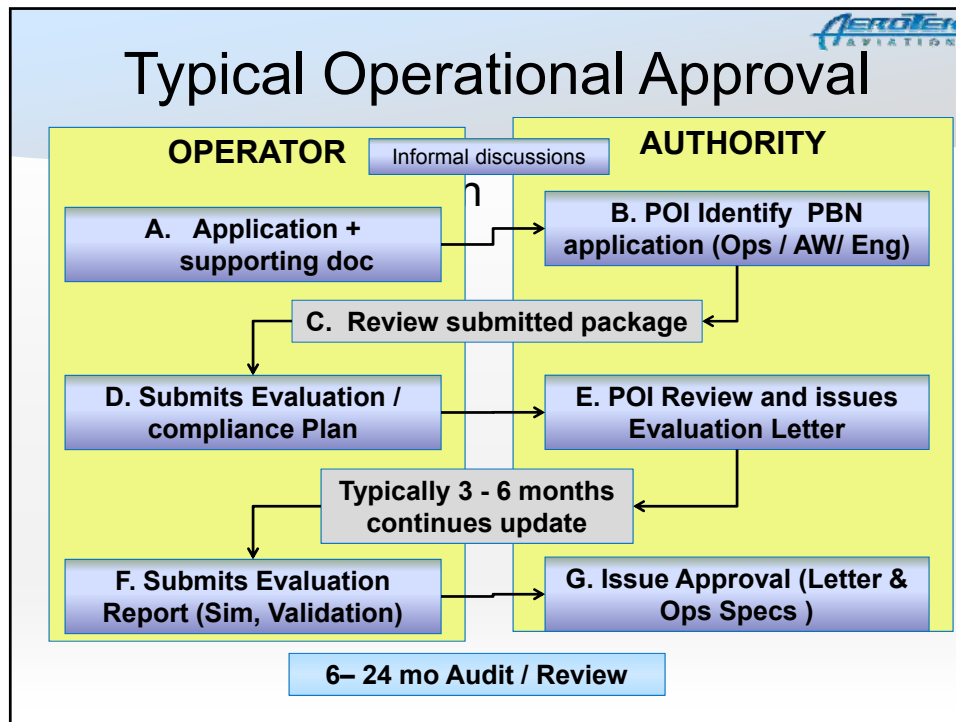




AEROTEK AVIATION

Fuel saving (PBN vs Non PBN)

- CGK MDC
- ILS vs RNP(18 or 36) = +/- **25 Nm / App**
- @190KIAS = Saving 8Min
- If FF 1000GPH = 17GPM = +/-136 USG @US2=USD272/app
- For 30 App / mo = USD 8160/mo
- US\$ 97000 / yr Saving (GA, Safety, etc)
- **#These are assumption / estimate only**



Application phases

OPERATOR

A. Application + supporting doc

Application form

APPLICATIONS FOR SPECIAL OPERATIONS

INITIAL ISSUE / AMENDMENT

AWO (all Weather operations) EFB (Electronic Flight Bag and Software Data)

RVSM (Reduced Vertical Separation Minimal Specifications)

IMPPS (Minimum Navigation Performance Specifications)

EOPS (Extended Range Operations)

ULR (Ultra Long Range Operations) HGS/RUD (Head Up Guidance System)

PBN (Performance Based Navigation)

PRM (Precision Runway Monitoring)

*Use one sheet for initial or subsequent applications

A. APPLICANT DETAILS (OPERATOR / ORGANISATION)

Operator's Name:	ADG NO/ ATO NO:	ICAO:
PH (Post Holder) Operator's:	Phone and Email:	and
PH Maintenance:	Phone and Email:	and
PH Training:	Phone and Email:	and
PH Quality:	Phone and Email:	and

B. OPERATIONS (Operating Procedures / Training)

1. Initial/Recurrent training syllabus (***)	
2. Crew Qualification*	
3. Flight Planning*	
4. ECOP/Checklist / SOP (**)	
5. Post flight procedures*	
6. Maintenance/reporting procedures*	
7. MEL reference related to operations	

C. AIRWORTHINESS ASPECTS

1. Equipment related Type Design approval reflected in:	<input type="checkbox"/> AFM	<input type="checkbox"/> STC	Others: <input type="checkbox"/> FWC.1
2. AFM applicable version of dPM? (**)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	
3. Equipment systems installation approval based on:	<input type="checkbox"/> TPC	<input type="checkbox"/> ETC	<input type="checkbox"/> SB
4. Equipment Maintenance program (**)			
5. MEL - sections of MEL, Staff ref doc, (**)			
6. Maintenance procedures, containing airworthiness*			
7. Downgrading/deferred technologies, relevant to service, repetitive defects, CGAU reporting period*			
8. Maintenance training (critical and recurrent staff and sub-contractor's training syllabus and qualification, etc.) *ref doc			
9. Maintenance practices and procedures (MOP/AME, maintenance program, it and -alone document) (**)			

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A. Application phase

Airworthiness

1. AFM/applicable section of AFM
2. Equipment related Type Design Approval (STC)
3. Equipment systems installation approval
4. Equipment Maintenance program
5. MEL*: section of MEL State ref doc
6. Maintenance Procedures /continuing airworthiness
7. Downgrading/deferred, tech log entries, release to service, repetitive defects
8. Maintenance training
9. Maintenance practices and procedures including reporting and manuals CAME / MOE / MME, maintenance program, stand-alone document, etc)

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A. Application phase

Flight Operations

Application Letter (PBN Details + Documentations)

1. **Initial/Recurrent training:** reference for training and its syllabus) [OM D]
2. **Crew Qualification:** Crew qualification [training]
3. **Flight Planning:** Procedures + Performance & MAB
4. **Documentations/ FCOM/Checklist/SOP;** Procedures
5. **Pre and Post flight procedures:** Administrative control / reporting deviation, filling forms
6. **Monitoring/reporting procedures :** HIRA Hazard & Risk Assessment, continues monitoring
7. **MEL** reference related to operations / procedures

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APPROVAL

OPERATIONS SPECIFICATIONS

(Subject to the approved conditions in the operations manual)

UAE GCAA contact details

Phone No: +97142-1111111 Fax No: +97142-1111111 Email: fops@gcaa.gov.ae

AOC No: AT-001111 Operator Name: Middle East Date: 20 February 2013

Dba Trading Name: Middle East Name & Sign: Middle East

Aircraft Models: Ref to page 2 Section A

Type of Operations: Ref to page 2 Section B Passenger Cargo Others

Area(s) of Operations: World Wide

Special Limitations:

SPECIAL AUTHORIZATION	Yes	No	SPECIAL APPROVAL	REMARKS
Dangerous Goods	<input type="checkbox"/>	<input checked="" type="checkbox"/> N		
Low Visibility Operations				
Approach and Landing		<input checked="" type="checkbox"/> N		
Take Off		<input checked="" type="checkbox"/> N		
RVSM <input type="checkbox"/> N/A		<input checked="" type="checkbox"/> Y		Ref to Page 2 Section F2
ETOPS <input type="checkbox"/> N/A		<input checked="" type="checkbox"/> Y	Maximum Diversion Time: 90 minutes	Ref to Page 2 Section F1
Navigation Specifications for PBN Operations		<input checked="" type="checkbox"/> Y		Ref to Page 2 Section E

- Opspec
- As Per ICAO
- + Extra

A. Authorised Aircraft		OPERATIONS SPECIFICATIONS						
Middle East		AOC No: AT-001111						
A Authorized Aircraft: Manufacture make model series	1	2	3	4	5	6	7	
BOMBARDIER BD700 1A11		BOMBARDIER CL605	DASSAULT FALCON 900	EMBRAER ERJ190	GULFSTREAM GIV	HAWKER 850XP	LEARJET 60	
			DX	100EC-J	X G450		XR	
B Type of Operations								
1 Passenger				✓	✓	✓	✓	
2 Cargo				x	x	x	x	
3 Aerial				x	x	x	x	
4 Ext Load				x	x	x	x	
5 EMS				x	x	x	x	
C AWO [RVR(m)]:								
1 LUTO (Low Visibility)					x	x	x	
2 LVO (Low Visibility Ops)					x	x	x	
2.1 CAT II [RVR(m)/DH(ft)]					x	x	x	
2.2 CAT IIA [RVR(m)/DH(ft)]					x	x	x	
2.3 CAT IIB [RVR(m)/DH(ft)]					x	x	x	
2.4 CAT IIC [RVR(m)/DH(ft)]	x	x			x	x	x	
D Approach:								
1 Precision	✓						✓	
1.1 ILS/CAT I [RVR(m)/DH(ft)]					550/200	550/200	550/200	
1.2 RNAV(GNSS/GPS)	✓	✓	✓			✓	✓	
2 Non Precision	✓	✓				✓	✓	
3 Circling	✓	✓	✓			✓	✓	
E PBN (Performance Based Navigation):								
1 RNP 0.1	x	x	x			x	x	
2 RNP 0.3						x	x	
3 RNP 1	x					x	x	
4 RNP 3						x	x	
5 RNP 4						x	x	
6 RNP 5						x	x	
7 RNP 10						x	x	
8 BRNAV						x	x	
F CNS (Com, Nav & Surveillance):								
1 ETOPS(Engine)			x	CF34 10E7-B	x	x	x	
[Range(hm)/Time(mins)]			x	568/90	x	x	x	
2 RVSM	✓	✓	✓	✓	✓	✓	✓	
3 MNPS	✓	✓	✓	✓	✓	✓	✓	
4 CPDLC/ADS	x	x	x	x	x	x	x	
5 Polar Operations	x	x	x	x	x	x	x	
6 Metric Altimetry	✓	✓	✓	✓	✓	✓	✓	
G Authorized Aircraft								
Aircraft Registration								
Prefix: A6 -								

- B. Type of Ops**
Passenger
Cargo
Aerial
Ext Load
EMS
- D. APPROACH**
ILS CAT I
RNAV
(GNSS/GPS)
Circling)
- E. PBN**
RNP 0.1,
0.3, 1, 3, 4, 5, 10
, BRNAV)
- F. CNS**
ETOPS
RVSM
MNPS
ADSB CPDLC
POLAR
METRIC

G. AUTHORISED AIRCRAFT

H Destinations (ICAO Aerodrome Designators)		
1	Scheduled Operator Not Authorized	
H. Destinations 1. Scheduled Operator: Airport 2. Non scheduled: Region		
2 Non scheduled or charter operators may be conducted in accordance with the scope of the certificate. All operators shall be in accordance with the scope of the certificate.		
K ULR Operations:		
Not Authorized		
L Maintenance:		
Aircraft shall not be operated unless it is maintained in accordance with the maintenance program approved by the FAA.		
M Telephony & Three Letter Designators:		
1	ICAO Three Letter Designation: EJD	
2	ICAO Radio Telephony-Call Sign: MQUJET	
3	The use of designators other than the above require:	
N Aircraft Lease:		
Following are the authorized: Not Authorized		
P Other Approval		
1	EFB Not Approved	
2	HUD/HGS Not Approved	
3	Dangerous Goods Not Approved	
4	Special PIC Not Approved	
5	PRM/SOIA Not Approved	
6	ADS-B Not Approved	
7	RNP AR Not Approved	
Q Remarks:		
No		
R Personnel approved by Authority		
Position	Name	Phone
1	Accountable Manager	Mark [redacted] +1 714 352-1000
2	Continuing Airworthiness Manager	Mathew [redacted] 952-938-0000
3	PH Flight Operations	Dan [redacted] 952-938-0000
4	PH Ground Operations	David [redacted] 952-938-0000
5	PH Quality Assurance	Robert [redacted] 952-938-0000
6	PH Safety / SMS	Robert [redacted] 952-938-0000
7	PH Security	KHALID [redacted] 952-938-0000
8	Quality Assurance Maintenance	Robert [redacted] 952-938-0000
9	Quality Assurance Operations	Robert [redacted] 952-938-0000
S Point of Contact		
Position	Name	Phone
1	Cabin Safety Point of Contact	[redacted] +1 714 352-1000

Legend: - others: see remarks section



Q. Remarks: Off Shore

R. Personnel accepted by Authority
 1. Accountable Manager, 2. PH Flight Operations, 3. PH Maintenance, 4. PH Crew Training, 5. PH Ground Operations, 6. PH Aviation Security, 7. PH Quality Assurance, 8. PH SMS / Safety,

S. Point of contact
 1. Cabin crew, 2. Dangerous Good Officer,

SAFETY ENHANCEMENT

- SDR (Software Defined Radio)
- ADSB Receiver
- Sharing data
- AIRCRAFT TRACKING (New)
- ELECTRONIC FLIGHT BAG (New)

NO TRACKING
60 minute reporting environment

Incident at 1 minute

Elapsed Time from Incident: **89** min

EMERGENCY PHASE

RESCUE COORDINATION CENTER

NORMAL TRACKING
60 minute reporting environment

AOC tries to establish contact

Incident at 1 minute

Elapsed Time from Incident: **44** min


Elapsed Time from Incident: **89** min

EMERGENCY PHASE

RESCUE COORDINATION CENTER

GADSS

HLSC2015



Upcoming Normal Tracking

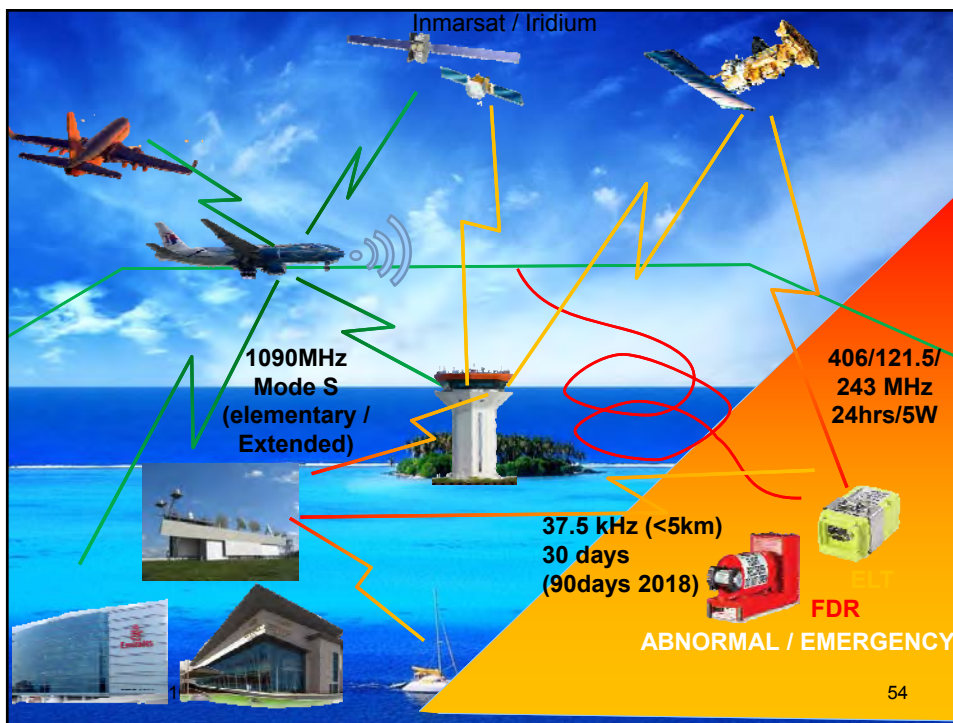
SARPs

Performance-based Standards and recommended practices for normal flight tracking

- No change to ATC procedures
- Establish operator responsibility to track
- Not technology-specific
- Establish communication protocol between Operator and ATC
- Oceanic areas where ATC gets position information more than every 15 min (Recommendation for remote areas)
- Aeroplanes with a take-off mass in excess of 27,000 kg and more than 19 seats

Timelines

- **January 2015**
 - Preliminary review by ICAO ANC
- **March 2015**
 - State Letter
- **November 2015**
 - Adopted
- **November 2016**
 - Applicable (if adopted)





ICAO Annex 6 Part I

APPENDIX 8. FLIGHT RECORDERS

1.1 Non-deployable flight recorder containers shall:

c) securely attached an automatically activated underwater locating device **37.5 kHz < 1 January 2018, operate > 90 days. (Amendment 36 2012 8.8 kHz. 30 days)**

1.2 Automatic deployable flight recorder containers:

c) have an **integrated automatically activated ELT.**

ICAO ANNOUNCE MONTRÉAL, 3 FEBRUARY 2015

Adoption of **new 15-minute aircraft tracking Standard.**

30 Mar, 2016

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EFB Another Cost Saving


- Weight and Efficiency
- Application that replace paper in to electronic
- EFB

Background

Saving ?



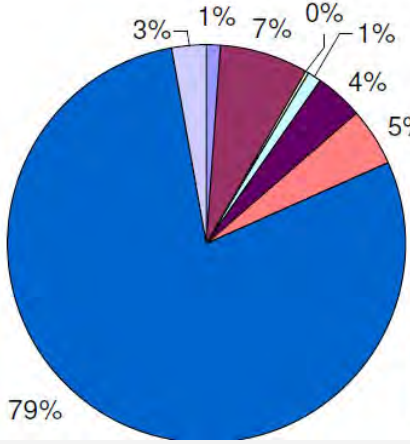
- + 1 % Mass = 0.5 % FF (fuel flow)*
- Narrow body = +/- 5 GPH
- For 300Hr/mo @ 2US\$/USG = USD3k/mo
- 500 + AC = USD 18 Million / yr
- Man power required to handle Paper documentation , manuals and Charts



*WARNING: Do not use for flight calculation

Background

Saving ?

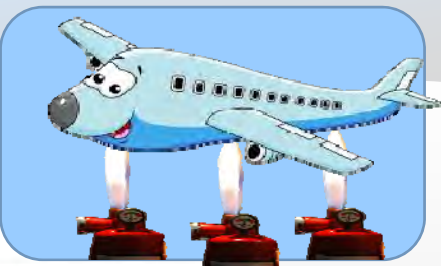


Fuel 8%

Weight 10%

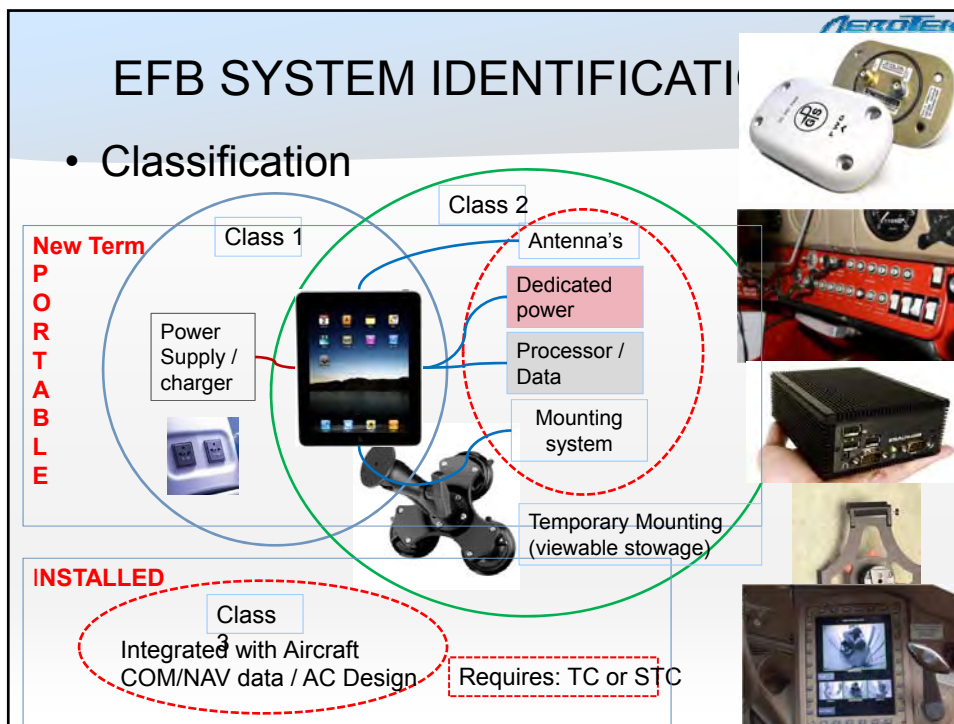
Winglet 79%

Zonal Drying 3%



- Single Engine Taxi
- Contingency Fuel
- Lightweight Galley Carts
- Removing Chillers
- Lightweight Carpets
- Potable Water Tanks
- Winglets
- Zonal Drying System*

• Source: Malardalen university, Tobias Berglund Thesis TUIFly



B. Identify Class & Type

Old

- Class 1:** POI review application Type A or B
- Class 2:** Notify AWI (Mounting, Power/ data)
- Class 3:** Notify AWI & Engineering for STC

New

- Portable** (Class 1 / 2) Stored / Viewable storage
- Installed** (Amendment TC/STC Separate CAA TC/STC online application)



Questions

- All other questions welcome
- Please fill in
- Attendant data
- Survey and comment welcome

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