

Procedure Evaluation and Validation with Pre-Production Databases - First Experiences, Challenges and future Aspects

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IFIS 2010
Beijing

Procedure Validation with Pre-Production Databases

Content:

- Introduction
- Procedure Design Process: from Design to Promulgation
- Flight Validation: Basic Principles
- Pre-Production Databases
- Case Studies of Flight Validation
- Challenges experienced so far
- Recommendations: Short Term
- Recommendations: Long Term



Why Proc

- Introd
- these p
- No mo
- Source

**Flight Checking P-RNAV
Procedures**

Edition	:	1
Edition Date	:	January 2004
Status	:	General Public
Class	:	Proposed Issue

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Procedure Validation with Pre-Production Databases

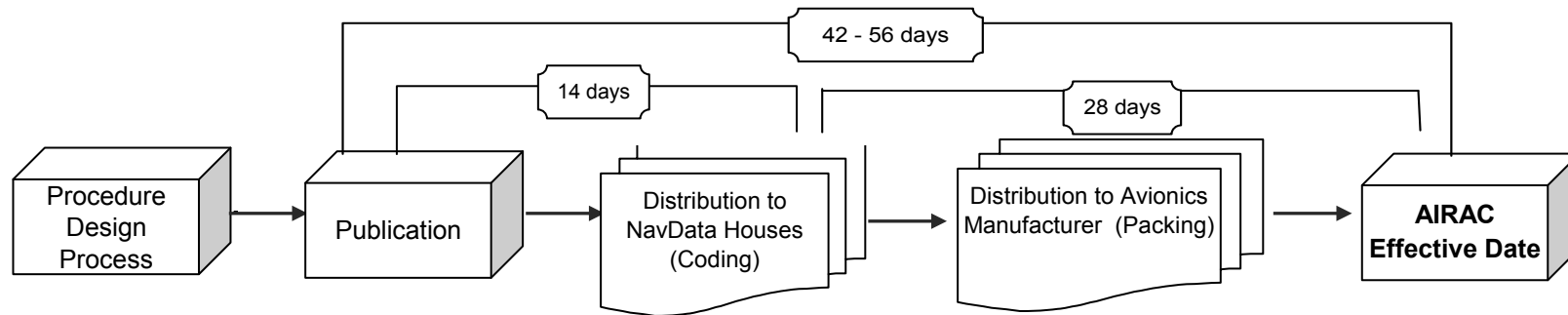
Why Pre-Production Databases?

- RNAV Procedures dependent on Flight Management System (FMS) databases
- These FMS databases should be validated prior promulgation
- Errors being identified and corrected prior distribution of new procedures
- Pre-Production Databases effectively a FMS Database as it should look like on the day of promulgation, just a number of weeks earlier

Procedure Validation with Pre-Production Databases

Rebrief: The Procedure Design Process: from Design to Promulgation

Timelines:

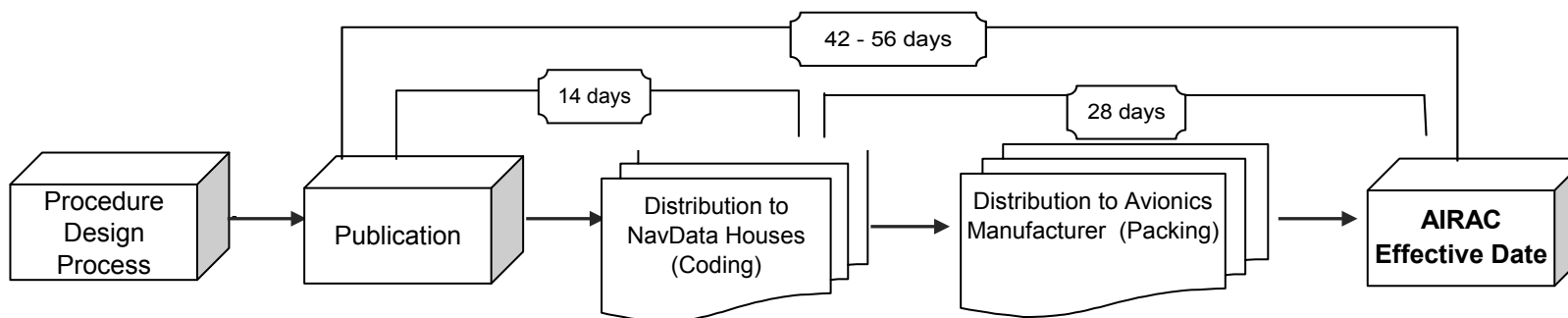


Stakeholders:

- Procedure Design Authorities (State / Private)
- Printing / Publications Agencies
- Navigational Database providers (Jeppesen, EAG, Lufthansa Systems Nav AG)
- Avionics Manufacturers for FMS (Universal, RockwellCollins, Honeywell, CMS etc)

Procedure Validation with Pre-Production Databases

Rebrief: The Procedure Design Process: from Design to Promulgation

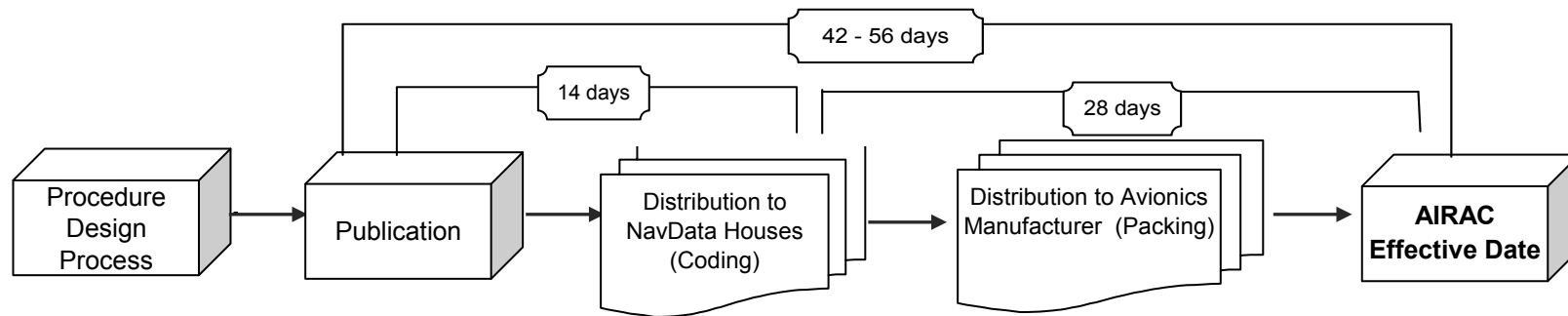


Legal / Document Basis:

- Procedure Design : ICAO 8168 PANS OPS
- Printing / Publications : ICAO Annex 4
- Navigational Database providers : ARINC 424
- Avionics Manufacturers for FMS : TSO 129, ED76, Do200a et.al.

Procedure Validation with Pre-Production Databases

Rebrief: The Procedure Design Process: from Design to Promulgation

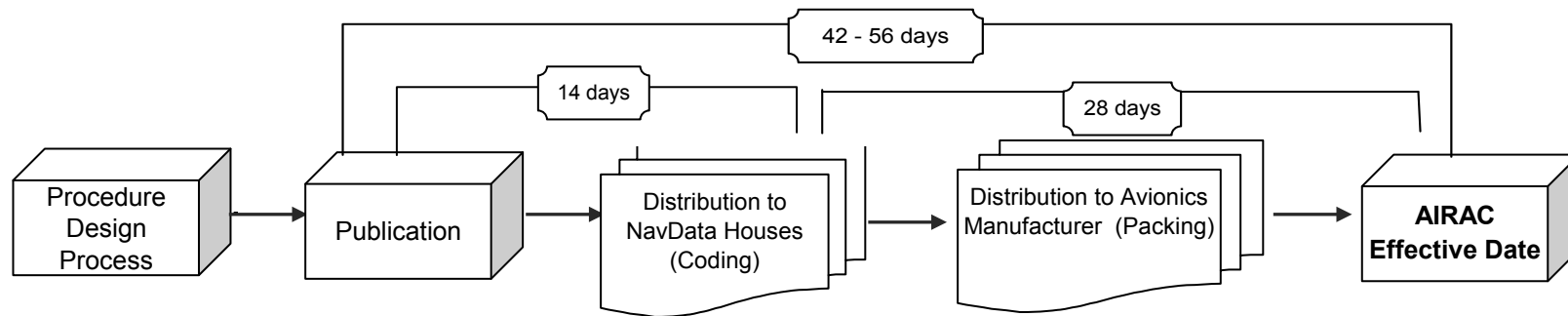


Challenges:

- ARINC 424 an Industry, not a Regulatory standard!
- Changes rather rapidly, currently Vers. 19 of 12 / 2008
- Changes might outpace Procedure Design and Packing capabilities
- Does the *coded* Procedure really reflects the *intended* Procedure Design?

Procedure Validation with Pre-Production Databases

Rebrief: The Procedure Design Process: from Design to Promulgation

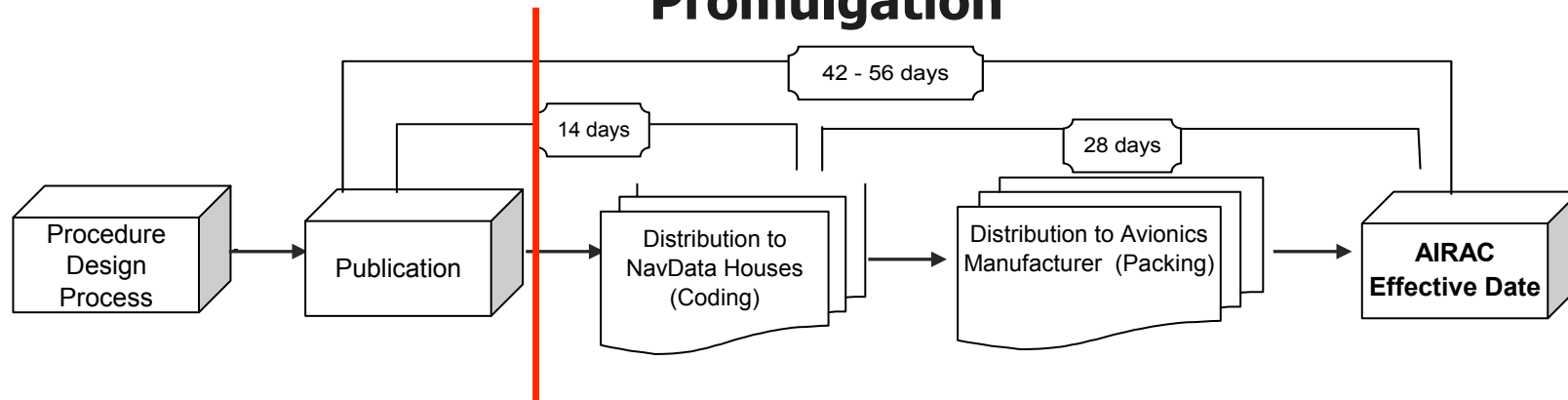


Challenges Packing:

- Numerous avionics standards
- FMS often limited in data memory
- FMS aircraft system = rigid certification criteria = natural reluctance to change (cost grounds)
- FMS capabilities lag behind (e.g. Radius-to-Fix)

Procedure Validation with Pre-Production Databases

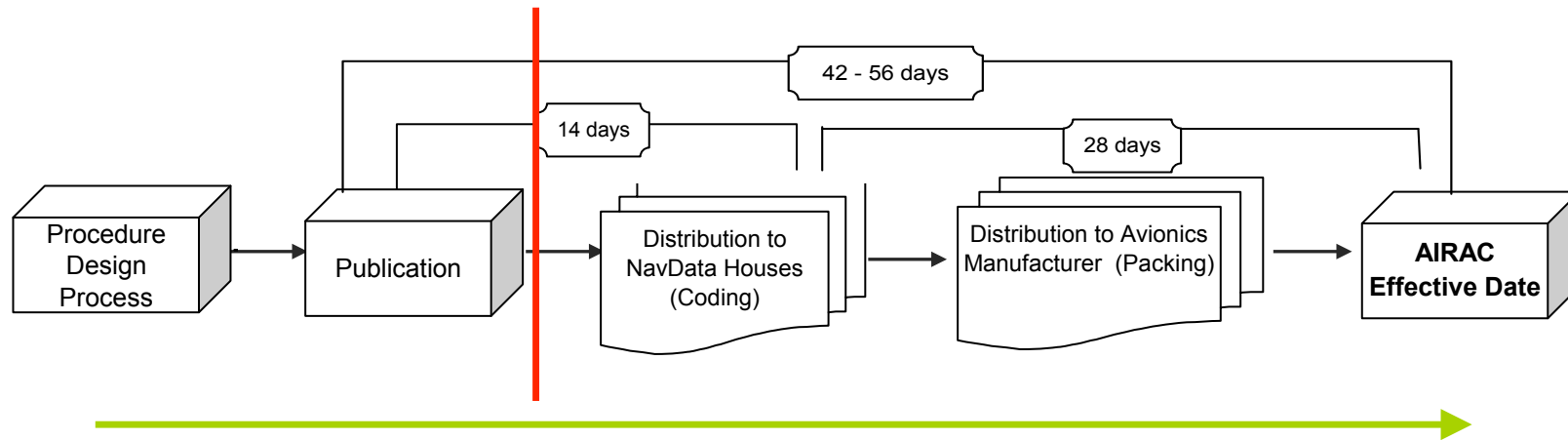
Rebrief: The Procedure Design Process: from Design to Promulgation



Challenges cont'd:

- Beyond publication no real control over process!

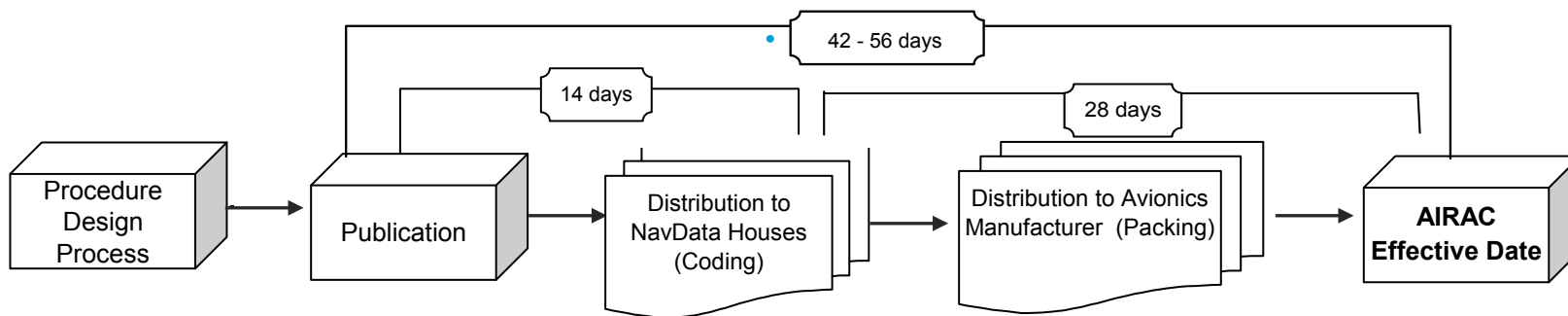
Flight Validation: Basic Principles



Ultimate Goal :

- Verify complete Procedure Design–Database–Path Integrity !

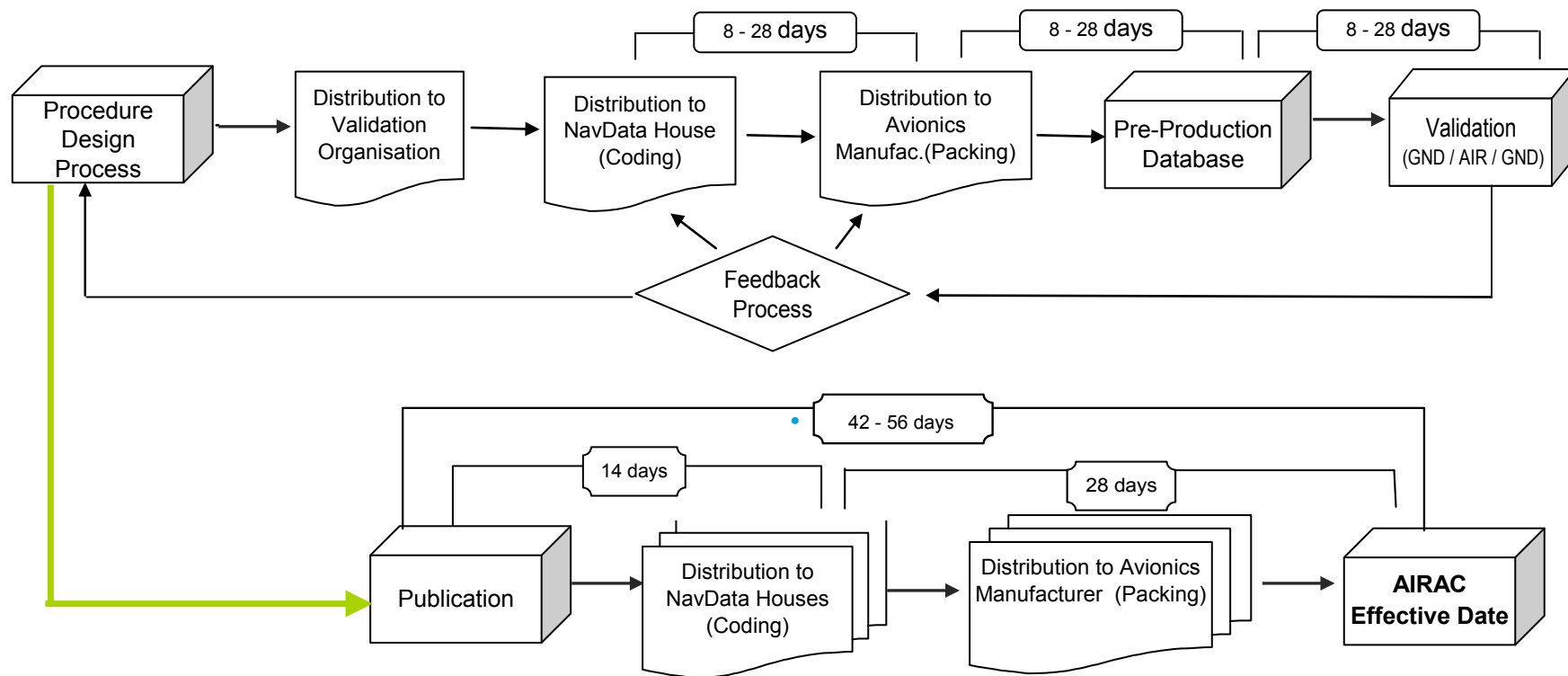
Flight Validation: Basic Principles - Timelines



Procedure Validation with Pre-Production Databases

Flight Validation: Basic Principles - Timelines

Timelines dependent on Production cycles of Stakeholders !



Flight Validation: Basic Principles – Prerequisites

- Establish Agreement with Database Provider / Database Packer
- Establish Standard Operating Procedures (SOPs) for using dual databases in FMS

Procedure Validation with Pre-Production Databases

Flight Validation

- Collect Data:
 - Charts
 - Waypoint Lists
 - Textual Description
- Check for Errors
- Get Database coded packed
- Crosscheck Database Coordinates

NOT FOR OPERATIONAL PURPOSES
FLIGHT CHECK ONLY

NDB A (CIRCLING) CAT. A-B OADR HERAT

Elev 3285	Var 3°E	TA 11000	HRT 412	N34°12'38" - E62°13'42"
HERAT APP		HERAT TWR		HERAT TWR LOCAL

STAR LIPX

ELTAR

ELTAR	45 38 51N - 10 37 40E
FIX R 319 VIL/D15	45 36 06.04N - 10 40 53.79E
FIX R 319 VIL/D4	45 27 35.47N - 10 50 48.56E
FIX INT	
TR200°/R224VIL	45 20 57N - 10 49 12E
IAF 1	45 11 55.2N - 10 36 09.3E
IAF2	45 18 54.7N - 10 46 16.5E

OSTEG

OSTEG	45 10 43N - 11 08 20E
FIX R 143 VIL/D4	45 21 13.5N - 10 57 40.3E
FIX INT	
TR250°/R224VIL	45 21 28.6N - 10 50 03.4E
IAF 1	45 11 55.2N - 10 36 09.3E
IAF2	45 18 54.7N - 10 46 16.5E

PAR

PAR NDB	44 49 20.24N - 10 17 35.77E
FIX INT	
QDR028°/R171BSA	44 57 26.1N - 10 24 12E
IAF 1	45 11 55.2N - 10 36 09.3E
IAF2	45 18 54.7N - 10 46 16.5E

SID LIPX

RWY 22 TO PAR

FIX TR 237°/D7 VIL	45 20 28.7N - 10 17 35.8E
PAR NDB	44 49 20.24N - 10 17 35.77E

RWY 04 TO PAR

PAR NDB	44 49 20.24N - 10 17 35.77E
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*Wrong!
= 260°/26 NM from LIPX!*

Procedure Validation with Pre-Production Databases

Flight Validation: Basic

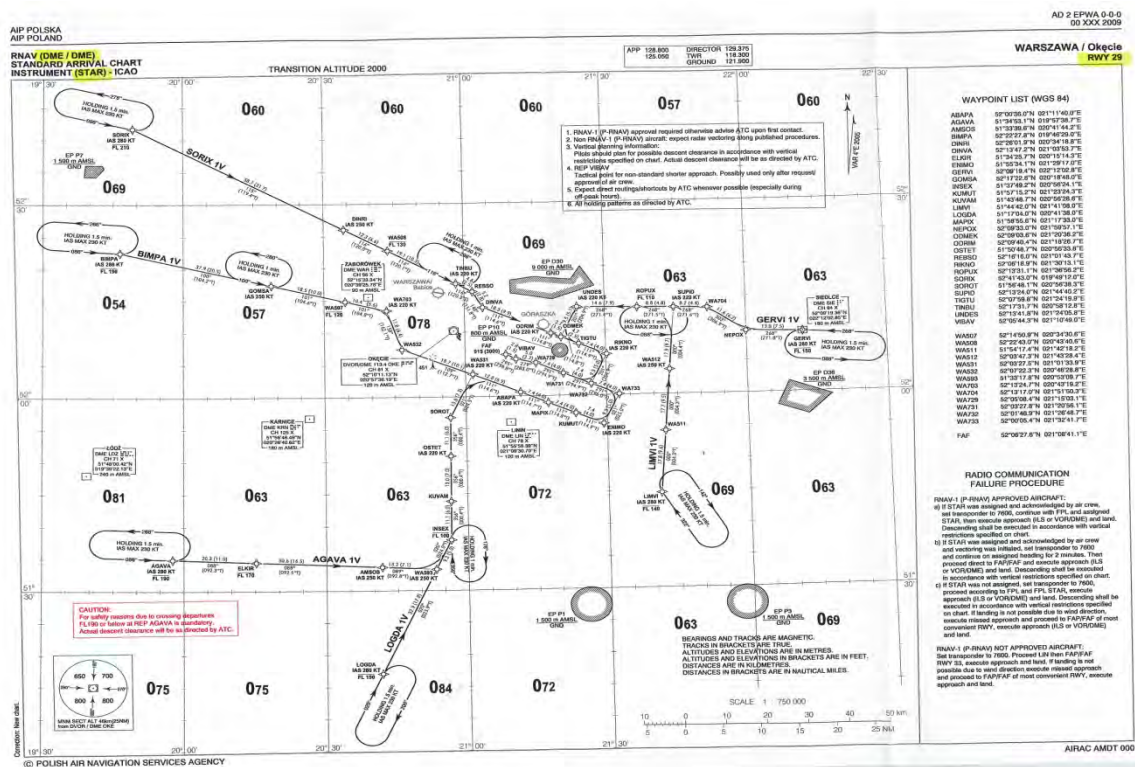
- Flight Validate new Procedure
- Communicate Results
- Promulgate Reports

AFI Checklist Procedure Design Verification			
Non Precision Approach Procedures			
Airport	Marmul	ICAO	OOMX Chart Date 20-12-2007
Rwy	14	Procedures	RNAV _(GNSS) RWY 14
Remarks after Flight Verification:			
<p>The following statement is based on the Draft Procedure Chart AIP AMDT 1-08, 20-12-2007 as handed out to the Calibration Crew by ESR Technology, and attached to this report.</p> <ol style="list-style-type: none"> The procedures as depicted are Flyable Findings: <ol style="list-style-type: none"> The FMS Database correctly labelled the Missed Approach Point (MAPt) in accordance with ICAO PANS OPS as RW14, whereas in the chart it was designated MX145. The final issue of the charts should take this into account. On the Chart the Initial Approach Fixes MX141 and MX142 were coded with different coordinates than on the Standard Arrival Chart and in the FMS. See attached Chart for details. A marked lack in configuration control of documents was identified: AFI was confronted with 3 sets of different charts for the same procedures, the third issue, again being different in format and layout, being handed over to us on the morning of the flight check by Muscat ATC. All version had the same version number (AIP AMDT 1-08) and the same date (20-12-2007). By exercising an educated guess, AFI decided on using one specific set of charts as reference for the flight trials. These charts, including our comments, are attached to this final report. We strongly recommend to use these charts as a starting point for all update / changes / corrections that might stem from the flight trials, and label any future issues of charts properly with updated date, version number etc. A waypoint list for each procedure was missing, where in a matrix-like form for each waypoint the associated coordinates are published both in AIP format (Degrees, minutes, Seconds) as well as in FMS-compatible format (degree, minutes, decimals of minutes). Publishing this waypoint list in the AIP will greatly facilitate the database checks each crew is required to perform prior commencing an RNAV procedure. Currently, on the charts, coordinates are only given in Degrees, Minutes and Seconds. Minor Findings: <ol style="list-style-type: none"> 3 minor rounding discrepancies in Track calculation were identified (see chart attached). Recommendations: <ol style="list-style-type: none"> The procedures are based on GNSS only. The GNSS-Signal-in-Space has been verified to be receivable along the prescribed flight path of the procedure, however, due to the very nature of that navigational source, this can only be a spot-check, valid at the time of the actual flight verification only. 			
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Procedure Validation with Pre-Production Databases

Flight Validation: Case Study 1 – Warsaw RNAV

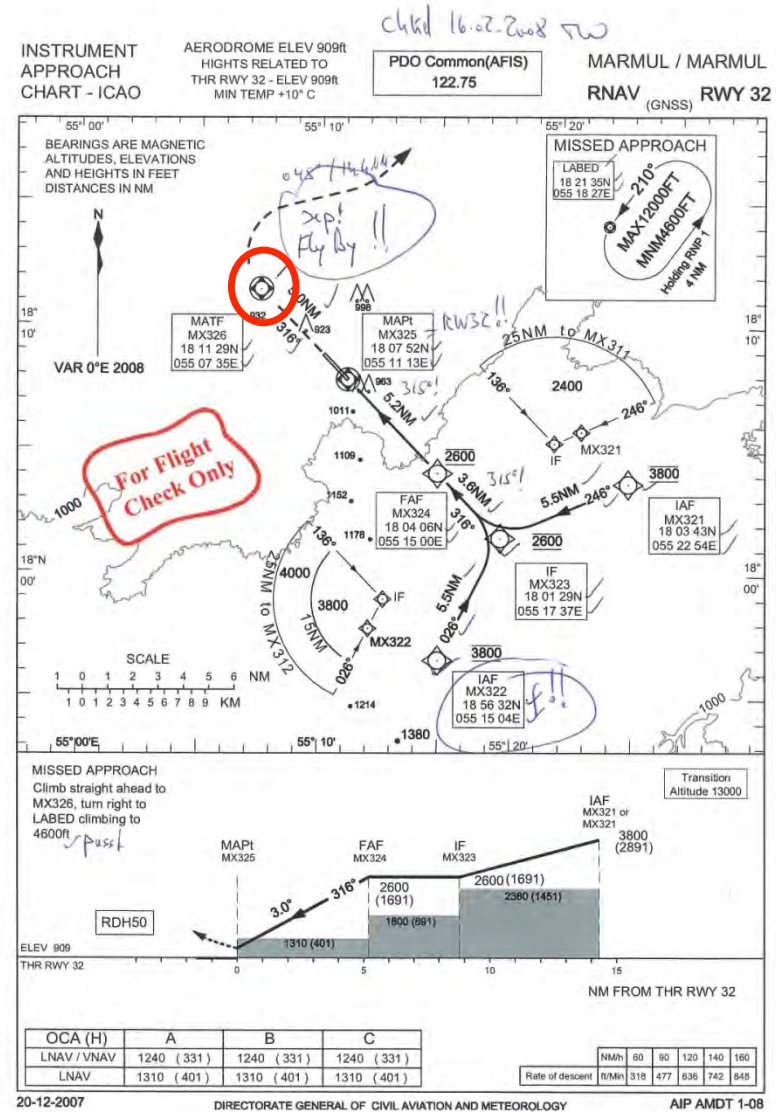
- Professionally executed Project
- Yet: some STARs went missing along the process !



Procedure Validation with Pre-Production Databases

Flight Validation: Case Study 2 Marmul RNAV

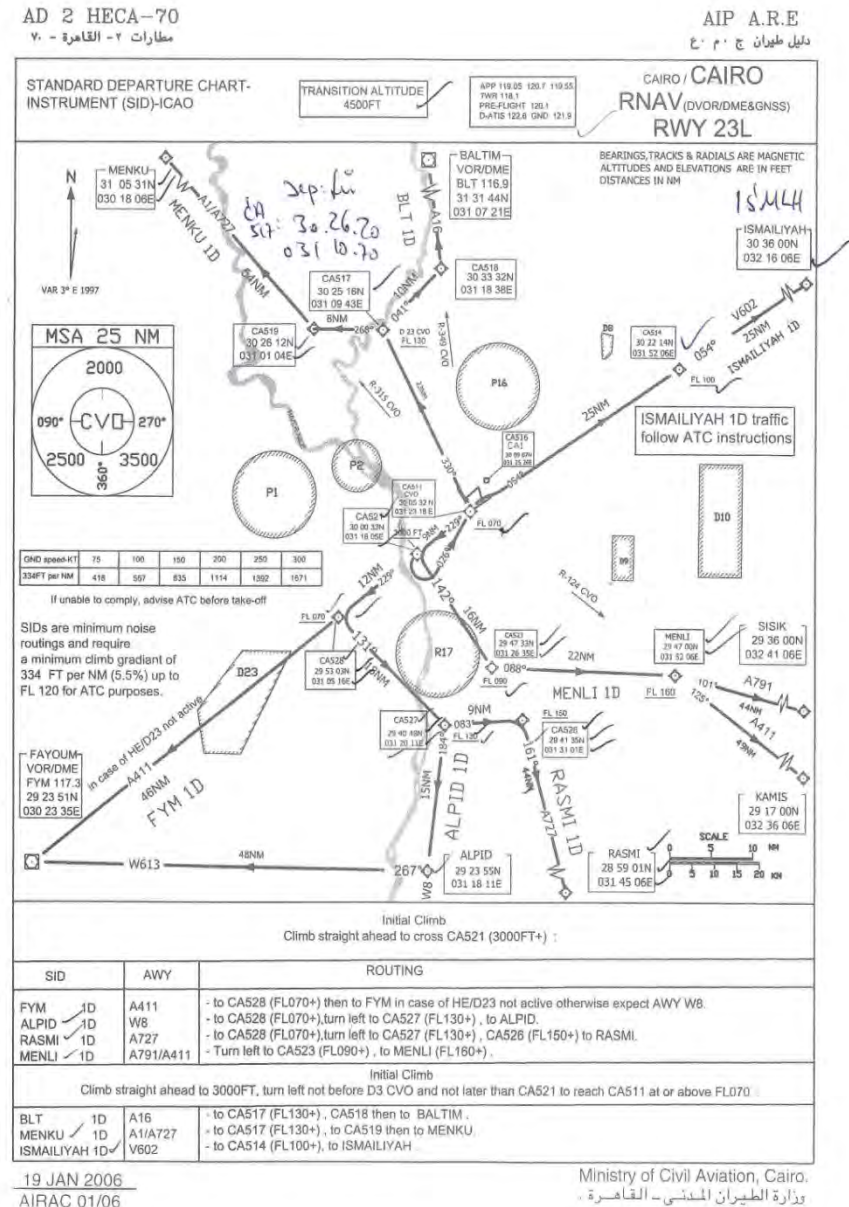
- Missed Approach Turning Waypoint (MATWP) not coded as Fly-Over Waypoint



Procedure Validation with Pre-Production Databases

Flight Validation: Case Study 3 RNAV SIDs Cairo

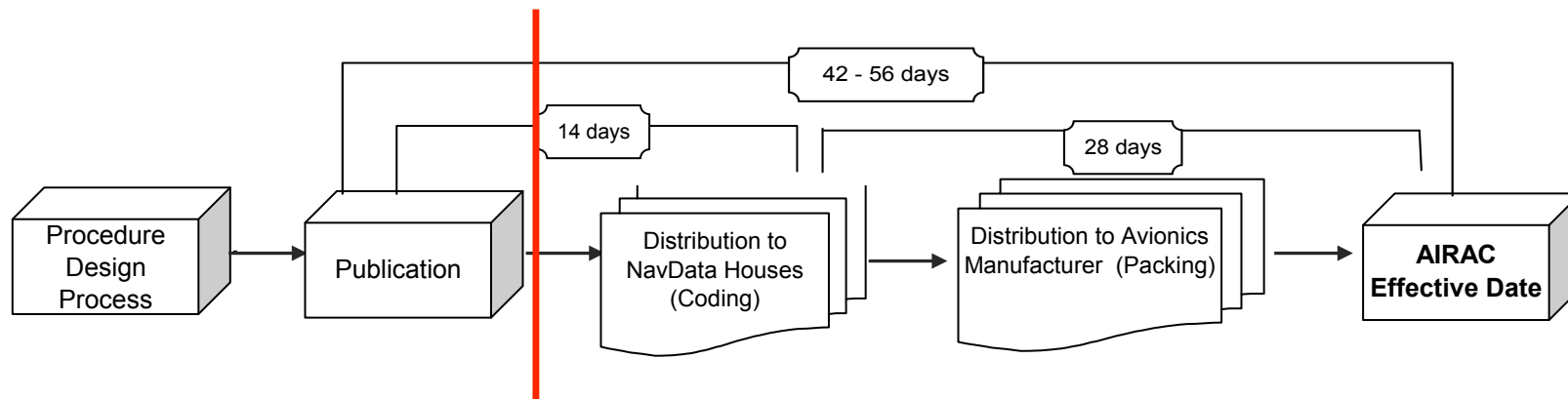
- Procedures per se nicely designed
BUT :
Not harmonised with Rest of
Airspace System
(STARs, Approaches)!



Procedure Validation with Pre-Production Databases

Challenges identified so far:


- Configuration Management key!
Incorrect / different version of Procedures caused ca. 80 – 90% of all problems experienced to date
- Many stakeholders involved – Who is in charge?



Procedure Validation with Pre-Production Databases

Challenges

- Individual systems
- Coding
- Relationships
- Miscellaneous
- Re-Coding



Report Procedure Design Validation

Precision Approach Procedures

Airport	Warsaw	ICAO	EPWA	Chart Date	undefined
Rwy	33	Procedures	SORIX 1U, BIMPA 1U, AGAVA 1U, LOGDA 1U, LIMVI 1U, GERVI 1U		

Remarks after Flight Validation:

4. General Statement / Disclaimer:

The scope of this flight validation was focussed on the procedures as listed above as such. It was not within the scope of the flight validation to verify the connectivity to, or the compatibility of, these procedures with the rest of the Polish Air Navigation System, such as the airway or airspace structure, ATC system set-up, or communications, etc. Neither was it a detailed re-calculation of the procedure design or detailed study of all obstacles according to PANS OPS, and their associated effects on the procedure design.

gn /

Recommendations – Short Term:

- Strictest Configuration Management!
 - All charts with date / version number!
 - Procedure Designer: ensure each time design is touched, new date / version number is added!
 - Flight Validation Organisation: Monitor Config Management! Establish communication with all stakeholders involved
- Identify Procedure Owner!
 - ANSP? Airport? Regulator?
- Enable Procedure Owner to monitor / control Procedure Design-to-Database Path Integrity!

Recommendations – Long Term:

- Freeze ARINC 424 for Avionics industry to catch up
- Harmonize -and mandate- minimum performance + memory requirements for FMS
- Encourage Procedure Owner to actively monitor / control Procedure Design-to-Database Path Integrity!

Procedure Validation with Pre-Production Databases



**Thank You
for Your
attention!**

Any comments?