# MSTC process for Military Civil Derivative Aircraft in the EMAR environment - lessons learnt

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# Scope of the Presentation

1. Introduction
2. EMAR 21 implementation via pilot programs
3. Organisations approval process
4. Selected aspects of MSTC process
5. Summary & Conclusions

# 1. Introduction

# What is a Military Civil Derivative Aircraft?

- Military Civil Derivative Aircraft (MCDA) is a military aircraft[1], derived from a civil type certified aircraft
- Military Commercial Derivative Aircraft (MCDA) is a civil aircraft procured or acquired by the military [*Commercial Derivative Aircraft (CDA) Acquisition Guide, USAF; FAA Order 8110.101A Type Certification Procedures For Military Commercial Derivative Aircraft*]
- Commercial Derivative Aircraft (CDA) is defined as a commercial type certificated aircraft converted for operational use by the U.S. Armed Forces or other U.S. government agencies, with associated mission modifications or equipment approved to civil airworthiness standards through the FAA type certification process [*FAA AC 20-169, Guidance for Certification of Military and Special Mission Modifications and Equipment for Commercial Derivative Aircraft (CDA)*]

[1] See EMAD 1 for military aircraft definition

# Government of Poland head-of-state aircraft order

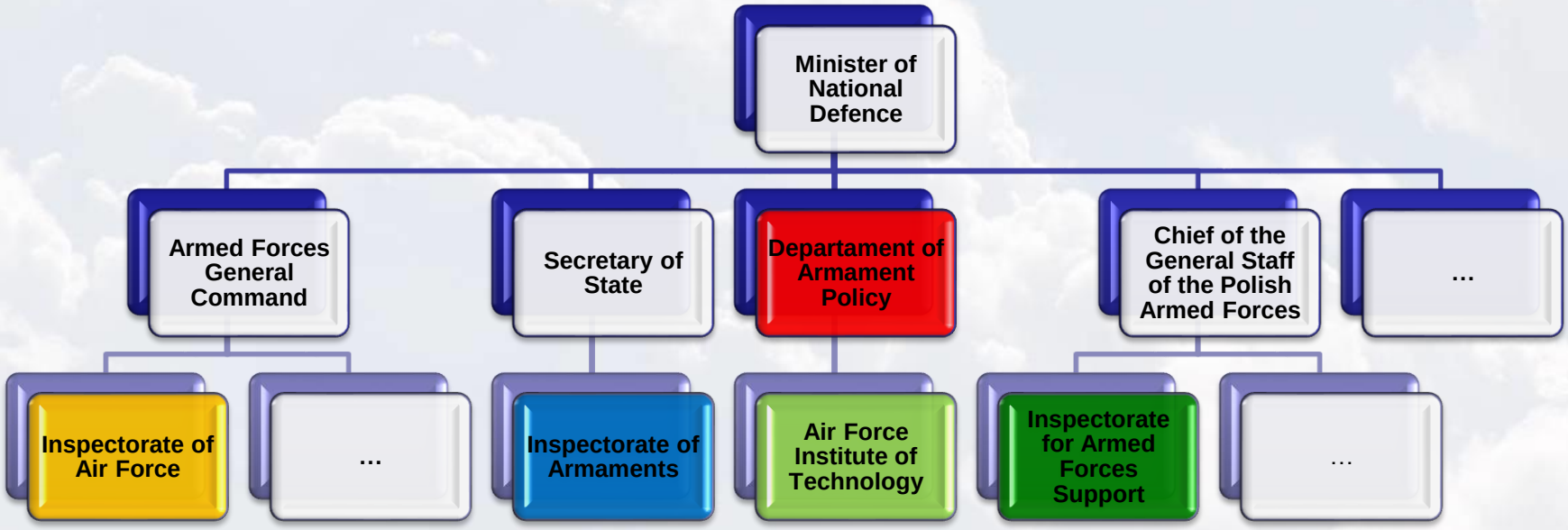
- The Government of Poland has ordered two new Boeing 737-800 BBJ airplanes and one 737-800, which will be operated as head-of-state aircraft for our President and top government officials
- The order includes two military Special Mission Equipment modifications: Self Defence System (SDS) & NAV/COM/ID
- The above mentioned modifications require (M)STC to be issued – the Programme


Polish 737-800[1]

[1]Source:0110 Polish Government Boeing 737-86X(WL) Photo by Petr Simacek | ID 1188727 | Planespotters.net

# 2. EMAR 21 implementation via pilot programs

# Operational, logistic support and airworthiness roles in PL MOD




Logistic support & airworthiness {**Chief Engineer of the Military Aviation (GIWL)**} is equivalent of Military Airworthiness Authority}

Operating Organisations

New weapon systems acquisition

NAD

Independent airworthiness advisory, EDA MAWA Forum ARAG, DPAG & CAWAG experts

# Initial phase of EMARs implementation via pilot programs

*Everything which is not forbidden is allowed*

**Parliament**

- **Polish Aviation Law Act of 3 July 2002, Journal of Laws of 2002, No. 130, item 1112**
- **Art. 1 Paragraph 6, MofND exercises supervision over the activities of the military aviation**

**MofND**

- **Minister of National Defence Decision No 26/Log./P4 of 13.04.2016**

**MofND**

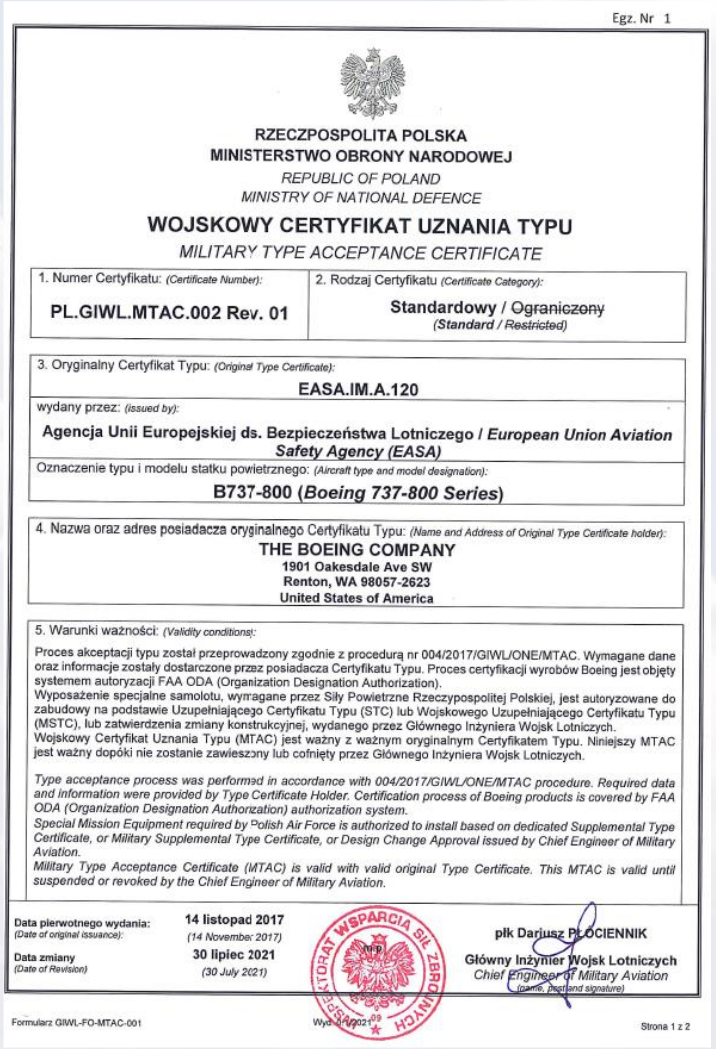
- **Attachment to MofND Decision No 26/Log./P4 of 13.04.2016: *Instruction on Development and Implementation of Technical Bulletins in Armed Forces Aviation of the Republic of Poland***

**GIWL**

- **Bulletin MT/6228/I/2020 (including PLMAR Forms)**
- **Bulletin MT/6249/I/2020 (including pilot program of MSTC issuance for major changes to B737-800, implementation of EMAR 21 as PLMAR 21*)***

# Military Type Acceptance Certificate (MTAC) For Imported Aircraft

- MTACs are issued to enable Military Certificates of Airworthiness (MCofA) to be issued to imported aircraft
- The MTAC is issued in respect of the aircraft type and model
- There is neither Applicant's name on the MTAC nor MTAC holder, only TCH name is mentioned
- Inspiration for MTAC came from CASR AC 21-30(2) and CARC Guidance Procedure AWS 01
- MTAC GIWL's Internal Procedure



Egz. Nr 1

RZECZPOSPOLITA POLSKA
MINISTERSTWO OBRONY NARODOWEJ
*REPUBLIC OF POLAND*
*MINISTRY OF NATIONAL DEFENCE*

**WOJSKOWY CERTYFIKAT UZNANIA TYPU**
*MILITARY TYPE ACCEPTANCE CERTIFICATE*

| 1. Numer Certyfikatu: *(Certificate Number):* | 2. Rodzaj Certyfikatu *(Certificate Category):* |
|---|---|
| PL.GIWL.MTAC.002 Rev. 01 | Standardowy / ~~Ograniczony~~ *(Standard / Restricted)* |

3. Oryginalny Certyfikat Typu: *(Original Type Certificate):*
EASA.IM.A.120

wydany przez: *(issued by):*
Agencja Unii Europejskiej ds. Bezpieczeństwa Lotniczego / *European Union Aviation Safety Agency (EASA)*

Oznaczenie typu i modelu statku powietrznego: *(Aircraft type and model designation):*
B737-800 (*Boeing 737-800 Series*)

4. Nazwa oraz adres posiadacza oryginalnego Certyfikatu Typu: *(Name and Address of Original Type Certificate holder):*
THE BOEING COMPANY
1901 Oakesdale Ave SW
Renton, WA 98057-2623
United States of America

5. Warunki ważności: *(Validity conditions):*

Proces akceptacji typu został przeprowadzony zgodnie z procedurą nr 004/2017/GIWL/ONE/MTAC. Wymagane dane oraz informacje zostały dostarczone przez posiadacza Certyfikatu Typu. Proces certyfikacji wyrobów Boeing jest objęty systemem autoryzacji FAA ODA (Organization Designation Authorization).
Wyposażenie specjalne samolotu, wymagane przez Siły Powietrzne Rzeczypospolitej Polskiej, jest autoryzowane do zabudowy na podstawie Uzupełniającego Certyfikatu Typu (STC) lub Wojskowego Uzupełniającego Certyfikatu Typu (MSTC), lub zatwierdzenia zmiany konstrukcyjnej, wydanego przez Głównego Inżyniera Wojsk Lotniczych.
Wojskowy Certyfikat Uznania Typu (MTAC) jest ważny z ważnym oryginalnym Certyfikatem Typu. Niniejszy MTAC jest ważny dopóki nie zostanie zawieszony lub cofnięty przez Głównego Inżyniera Wojsk Lotniczych.

*Type acceptance process was performed in accordance with 004/2017/GIWL/ONE/MTAC procedure. Required data and information were provided by Type Certificate Holder. Certification process of Boeing products is covered by FAA ODA (Organization Designation Authorization) authorization system.*
*Special Mission Equipment required by Polish Air Force is authorized to install based on dedicated Supplemental Type Certificate, or Military Supplemental Type Certificate, or Design Change Approval issued by Chief Engineer of Military Aviation.*
*Military Type Acceptance Certificate (MTAC) is valid with valid original Type Certificate. This MTAC is valid until suspended or revoked by the Chief Engineer of Military Aviation.*

| | | |
|---|---|---|
| Data pierwotnego wydania: *(Date of original issuance):* | 14 listopad 2017 *(14 November 2017)* | płk Dariusz PŁOCIENNIK |
| Data zmiany *(Date of Revision)* | 30 lipiec 2021 *(30 July 2021)* | Główny Inżynier Wojsk Lotniczych *Chief Engineer of Military Aviation* *(name, position and signature)* |

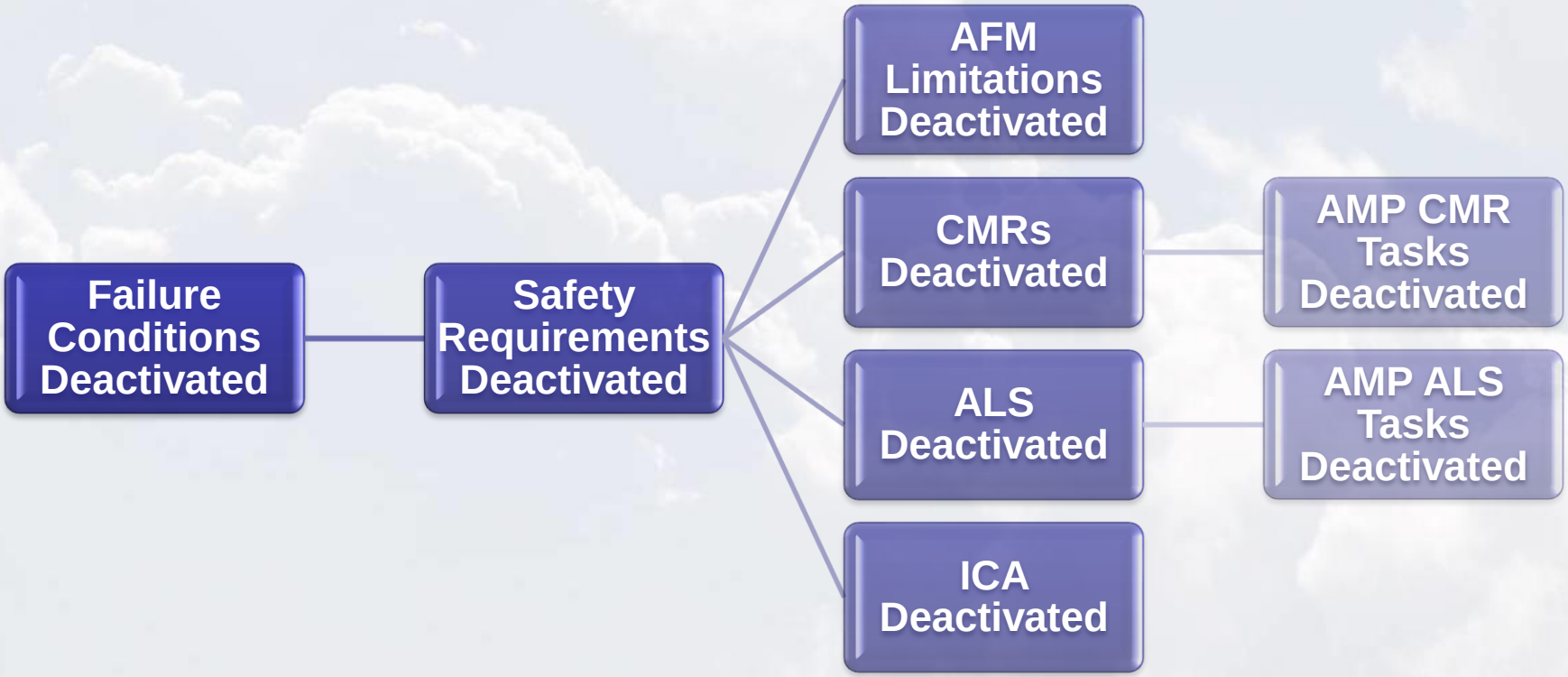
Formularz GIWL-FO-MTAC-001 Wyd. 5/A/2021 Strona 1 z 2

# The Programme: STC vs MSTC Boundaries - SDS MSTC Compliance Demonstration

Military activation of SDS including installation of pyrotechnics and a/c safety impact due to pyrotechnics dispensing loads:

- Mechanical analysis for dispensing (Stress, Fatigue & DT analysis)
- Flight tests + CFD trajectory analysis
- System safety assessment
- ALS
- ICA
- AFM Supplements
- …

# The Programme: STC vs MSTC Boundaries – Things to be considered



# 3. Organisations approval process

# Organisational approvals provided within the framework of the Programme

| | MDOA PLMAR 21/J | MPOA PLMAR 21/G | MMOA (PL)EMAR 145 | MCAMOA (PL)EMAR M |
|---|---|---|---|---|
| Company 1 (FR) | MDOE Supplement | N/A | MOE Supplement | CAMOE Supplement |
| Company 2 (US) | MDOE | MPOE | N/A | N/A |

Remarks

1. All audits were conducted on-line (VTC) due to COVID-19 pandemic restrictions in accordance with provisions of MT/6249/I/2020 bulletin (special procedure included).
2. PLMAR 21 (based on EMAR 21 Ed. 1.3) - implemented via Annex 1 to MT/6249/I/2020 bulletin.
3. (PL)EMAR 145 & (PL)EMAR M - approvals provided based on EMAR 145 Ed. 1.2 requirements and EMAR 145 AMC & GM Ed. 1.3 and EMAR M Ed. 1.0 requirements and AMC & GM Ed. 1.0) in accordance with provisions of MT/6249/I/2020 bulletin.

# 4. Selected aspects of MSTC process

# Application of EMACC for military Modification Airworthiness Certification Criteria

- For MSTC *SDS activation* military Modification Airworthiness Certification Criteria (MACC) were applied based on EMACC Ed. 3.1
- Most of the applicable criteria came from Section 17.2
- For the MSTC Applicant it was the first but successful experience with EMACC based MACC

| EMACC Section | Compliance |
|---|---|
| 17.2.1 Store clearance {a-e, g-j} | Compliant |
| 17.2.1 Store clearance {f} | N/A |
| 17.2.2 Safe separation {b,d} | Compliant |
| 17.2.2 Safe separation {a,c} | N/A |
| 17.2.3 Store, suspension and release equipment structural integrity | Compliant |
| 17.2.4 Electrical interfaces {a-d} | Compliant |
| 17.2.6 Safe store operations {a-d} | Compliant |
| 17.2.7 Store configurations {a-d} | Compliant |
| 17.2.9 Lost link | N/A |

# Civil vs military approach to safety assessment (1)

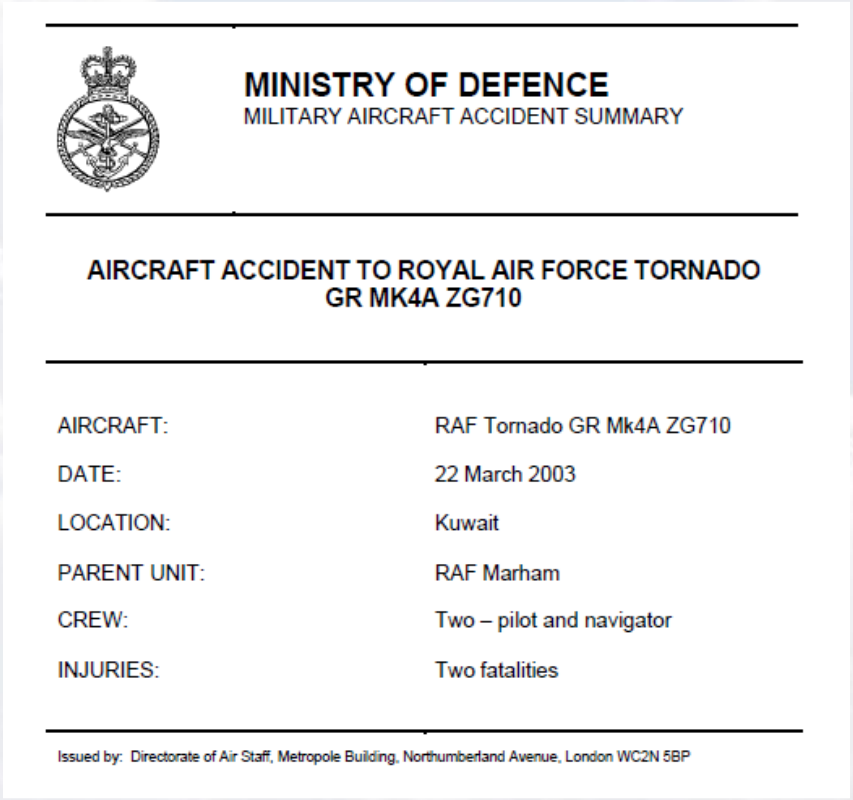
1. **Effect of the Failure Condition (FC)**

- According to civil approach based on JAR 25/SAE ARP 4671 effect of the FC on the Aircraft, Crew and Occupants, which would prevent the **continued safe flight and landing** are considered only
- In the military approach **Risk to Life** (DEF STAN 00-56) or **death, permanent total disability, irreversible significant environmental impact, or monetary loss** (MIL-STD-882E, H SystSäk E, Armed Forces' Handbook on System Safety) are taken into consideration
- Therefore dedicated MCRIs were issued to address this problem to cover both risks incurred by people on ground during maintenance inspection and risks incurred by overflown population and aircraft

# Civil vs military approach to safety assessment (2)

## 2. Failure Condition Classification

- Some military specific systems have a defensive role whereby inaction under hostile environment may constitute a hazard e.g. Loss of/Misleading IFF Mode 5 in a hostile environment
- Loss/malfunction of Self Defence System could be potentially classified as a Minor FC. However this loss/malfunction could cause loss of the airplane because no warning would result in neither evasive nor protection action, and thus it should be classified as Catastrophic FC.



**MINISTRY OF DEFENCE**
MILITARY AIRCRAFT ACCIDENT SUMMARY

**AIRCRAFT ACCIDENT TO ROYAL AIR FORCE TORNADO GR MK4A ZG710**

| | |
|---|---|
| AIRCRAFT: | RAF Tornado GR Mk4A ZG710 |
| DATE: | 22 March 2003 |
| LOCATION: | Kuwait |
| PARENT UNIT: | RAF Marham |
| CREW: | Two – pilot and navigator |
| INJURIES: | Two fatalities |

Issued by: Directorate of Air Staff, Metropole Building, Northumberland Avenue, London WC2N 5BP

Source:maaszg710.doc (publishing.service.gov.uk)

# 5. Summary & Conclusions

# Summary & Conclusions

- Consider that some issues are out of the MAA control e.g. the different priorities and speeds may exists between civil STC process vs military MSTC process
- Pay attention to STC vs MSTC boundary
- Consider certifying the modifications to the aircraft using civil airworthiness standards to the maximum extent practical
- Consider certifying the Military Specific System (MSS) modifications via Modification Airworthiness Certification Criteria (MACC) based on EMACC, when necessary
- Pay attention to: your LOI, FAA PMA, GFE, CCMR vs CMR etc.
- Consider MIL-STD-882E approach for safety assessment for the MSS, when civilian approach is not applicable/not possible but define the risk acceptance authorities ASAP
- Beware of the situation when MAA may have different approach for certification substantiation in particular subareas e.g. MIL-HDBK-217F vs FIDES, CFD models validation approach, Fatigue & DT factors and models etc.

Thank you very much for your attention!