ITALIAN MINISTRY OF DEFENCE
Secretariat General for Defence - National Armaments Directorate
AIR ARMAMENTS DIRECTORATE

The Benefits of Harmonising Airworthiness Certification Criteria to Achieve Recognition of Certification (EMACC, UASs STANAGs)

Lt.Col. GArn Alessio GRASSO
Italian MoD - DAA Vice Technical Direction
Alessio.grasso@am.difesa.it
+39 06 4986 6812

Larnaca (Cyprus), 27 September 2012

AIMs

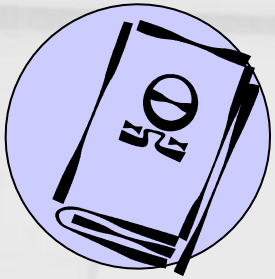
- To provide examples of successful harmonisation activities in the field of airworthiness

- To “Socialize” these products that some of you may not be aware of

OVERVIEW

- **Harmonisation processes in the field of military airworthiness**
- **Case Studies**
  - ✓ **EMACC**
  - ✓ **STANAG 4761, 4702, 4703**

The Concept of Harmonisation in the field of Airworthiness of Military Aircrafts





INTRODUCTION

CIVIL WORLD

The operational environment and the mission profiles are limited and almost always the same

Airworthiness is regulated by law e.g. CS 25 / FAR 25

INTRODUCTION

MILITARY WORLD

CONCEPT OF OPERATION

- ✓ **The mission requirements are as important as airworthiness when providing the requested military capability**
- ✓ **The benefits for the State are related both to military aircrafts performances as well as their safety**

Military aircrafts are characterized by great variety of:

- ✓ **operational environments**
- ✓ **mission profiles**
- ✓ **new technology (evolving rapidly)**

Performance requirements are in the CONTRACT

Airworthiness is done by the same CONTRACT setting performance requirements

INTRODUCTION

MILITARY WORLD





CONCEPT OF OPERATION

Different types of capabilities are required

Different Design Usage Spectra are envisaged

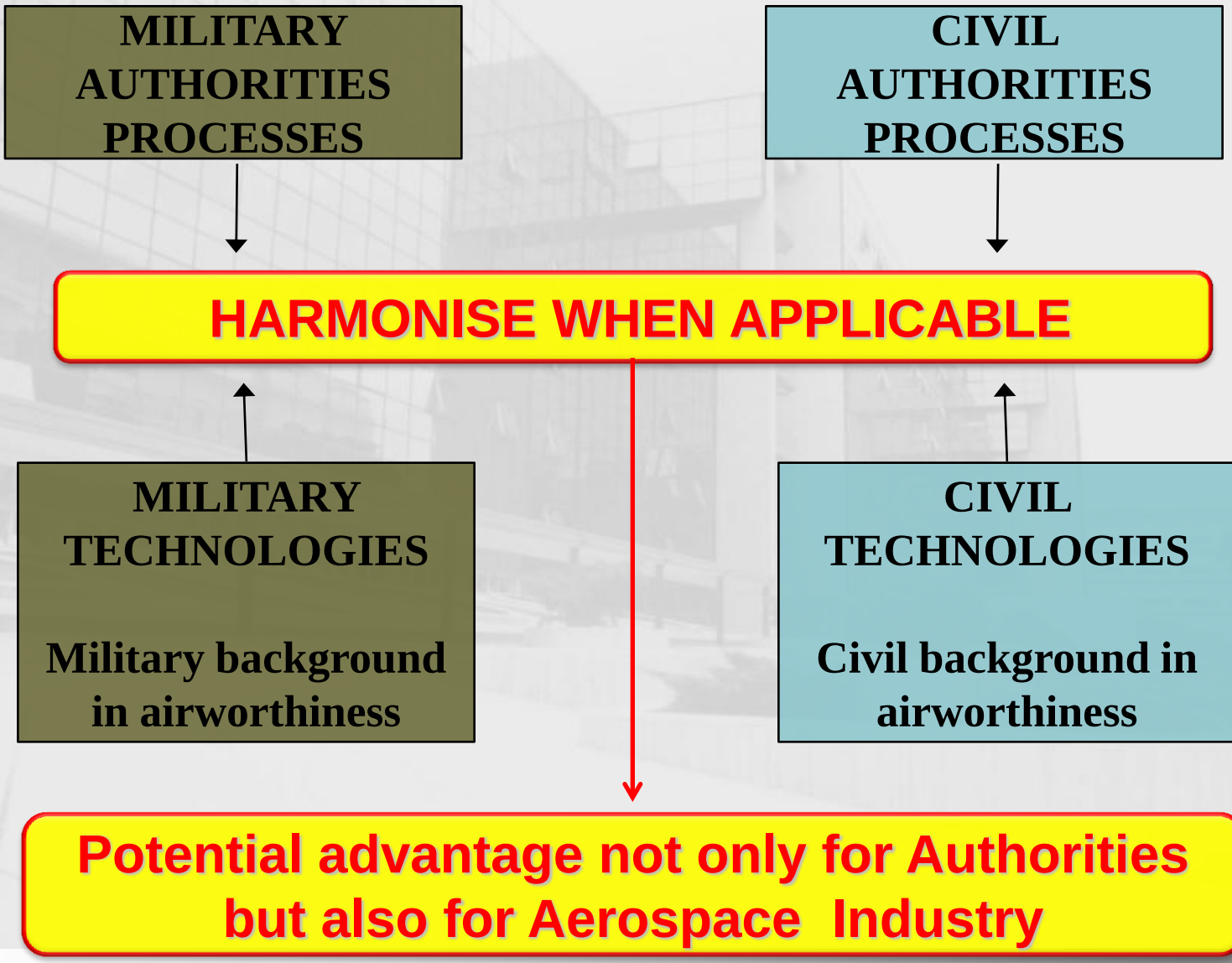
Different and new technologies are involved



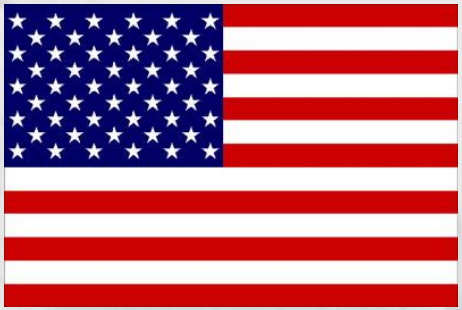
Performance and airworthiness requirements are intercorrelated

=> TAILORING IS THE BEST PROCESS IN MILITARY WORLD

INTRODUCTION



INTRODUCTION



In the field of military airworthiness, a lot of resources are being spent in harmonisation initiatives within EU (EDA), NATO and US Services

! SHARE EXPERIENCE AND HARMONIZE !
(trying to avoid redundances when feasible)

Potential advantage not only for Authorities but also for Aerospace Industry

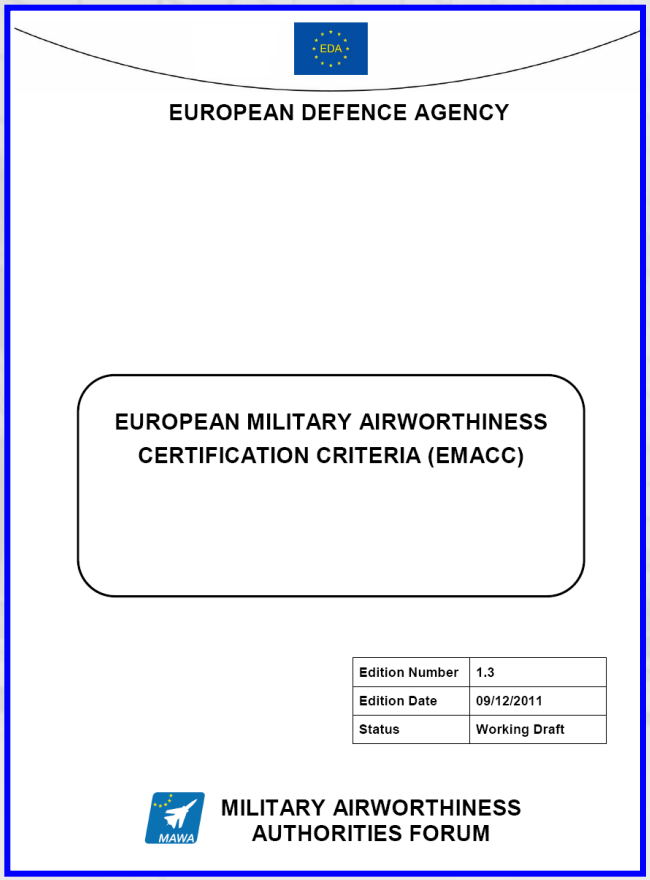
THE EXAMPLE

OF

EMACC

(European Military Airworthiness Certification Criteria)

THE EXAMPLE OF EMACC



- Under MAWA, a specific Task Force (TF4) is established to produce harmonised European Military Airworthiness Certification Criteria (EMACC).

- EMACC is an European handbook detailing technical military airworthiness certification criteria, intended to be used to tailor the airworthiness basis for Military Type Certification activity.

THE EXAMPLE OF EMACC

- EMAAC is NOT intended to be a Certification Specification containing the specific quantitative REQUIREMENTs to which the product is to be certified.

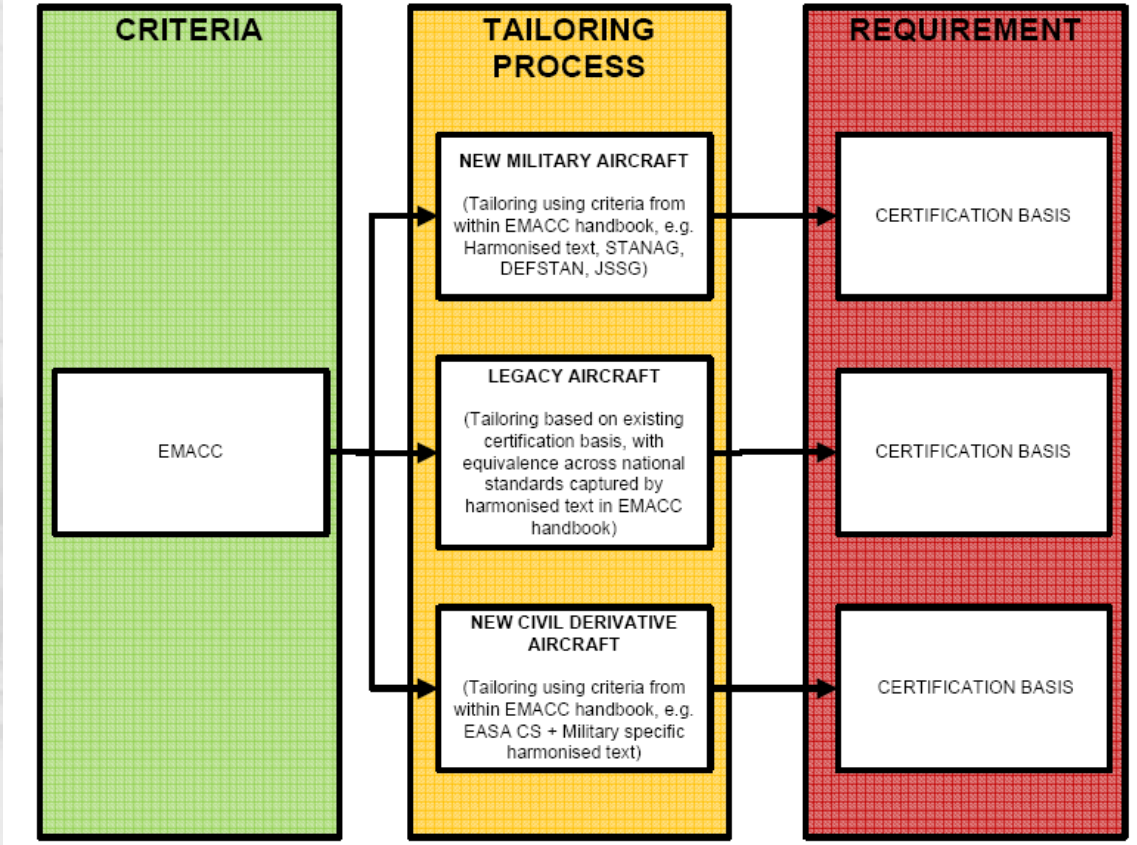
- EMACC provides
  1. a complete set of airworthiness criteria to be considered (like an airworthiness checklist)
  2. a complete sources list of state of the art rules and standards applicable to each criterion
  3. an expanded text harmonized among previous standards to help in the tailoring process of defining quantitative airworthiness requirements

THE EXAMPLE OF EMACC

MILITARY

USAGE

MISSION



Step 0 → Step 1 → Step 2 → Step 3

THE EXAMPLE OF EMACC

Approach in two steps

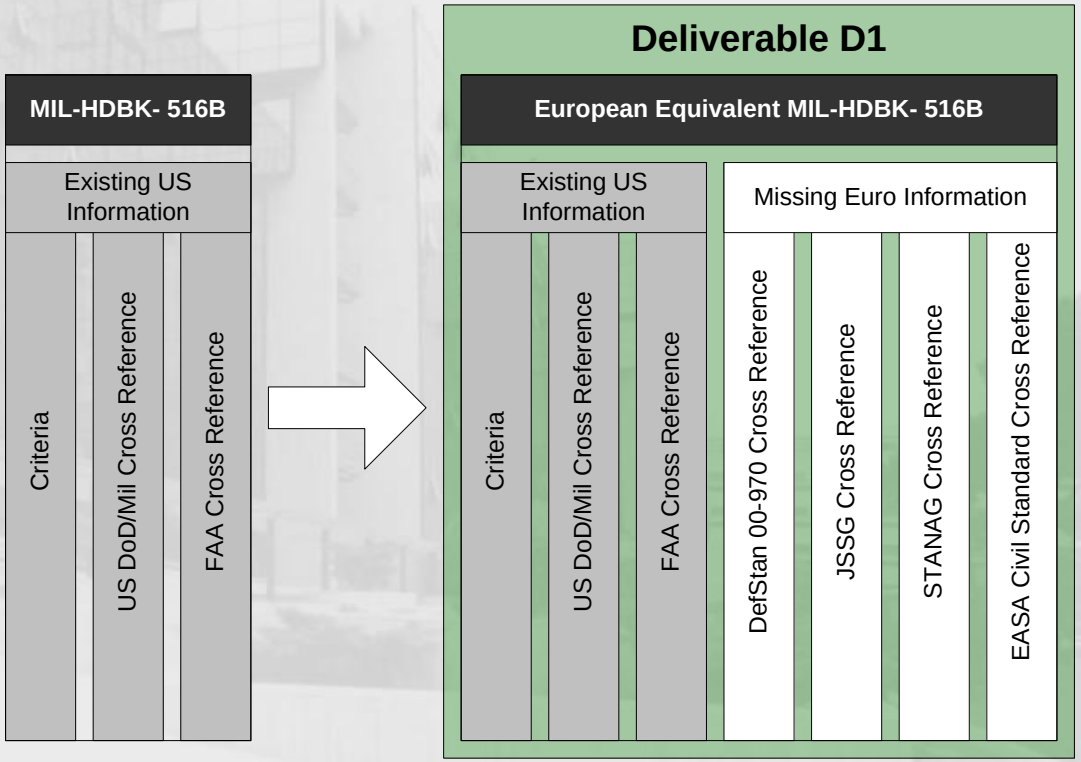
- Starting point:

  MIL-HDBK-516B Change 1

- DOORs database with existing 516B criteria, US DoD/Mil and FAA cross-references

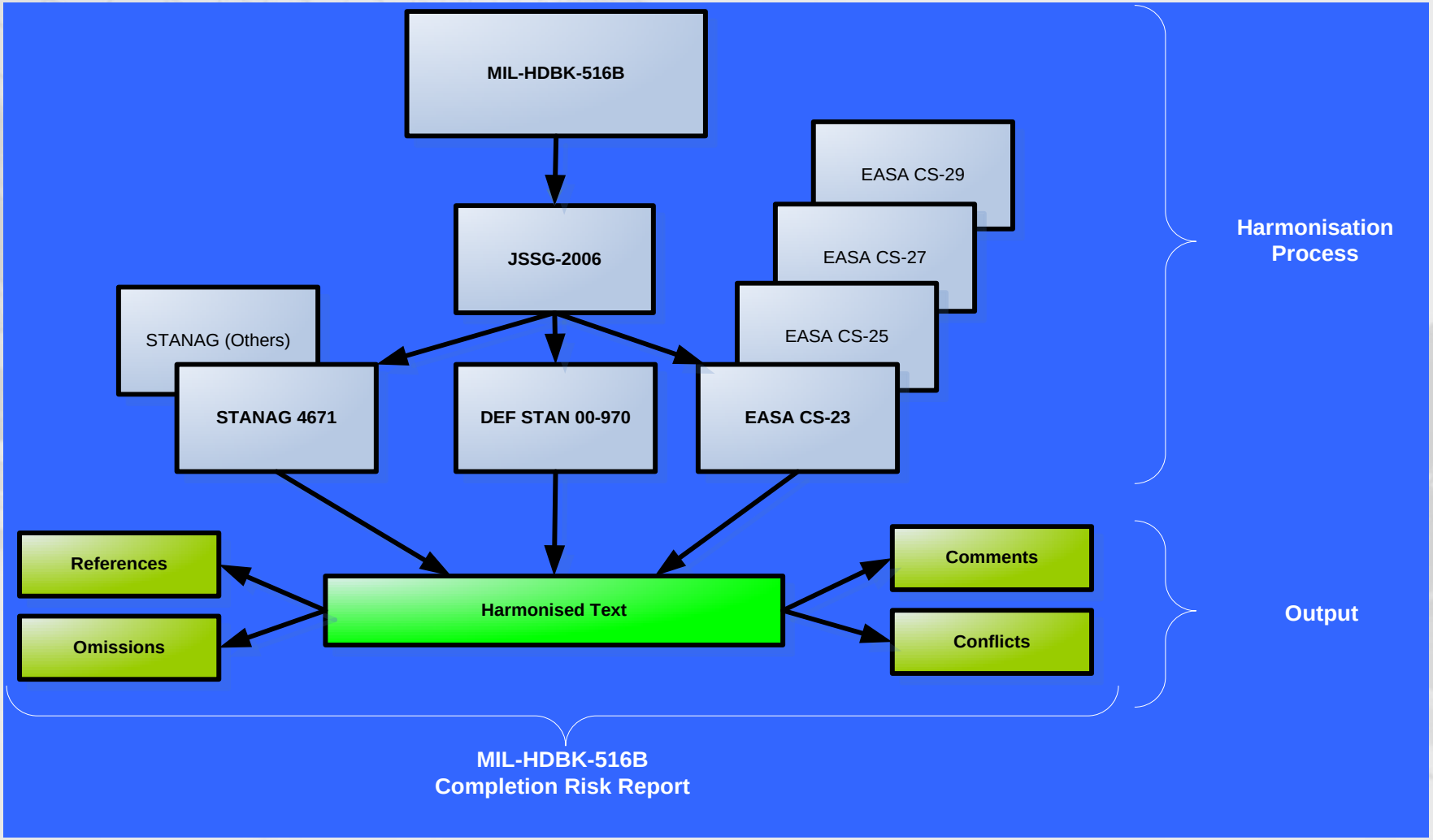
STEP 1

- Adding cross-references to European and NATO documents where equivalence is deemed possible:
  - Def Stan 00-970
  - STANAGs
  - EASA CSs



THE EXAMPLE OF EMACC

STEP 2: Harmonisation among different standards



THE EXAMPLE OF EMACC

FRAMEWORK

INFORMATION SOURCES

HARMONISED CRITERIA

5.4. DAMAGE TOLERANCE AND DURABILITY (FATIGUE).

5.4.1 Verify that all safety-of-flight (SOF) structure, including dynamic components, have adequate safe life or damage tolerance capability (depending on certification authority).for the required service life.

US Cross References		European Cross References	
Comm'l Doc:			
DoD/MIL Doc:	JSSG-2006: A.3.12 Damage Tolerance, pg 398 JSSG-2006: A.4.12 Damage Tolerance, pg 400 (for compliance development)	*Def-Stan 00-970 Reference:*	00-970 3.2.3 00-970 Part 1 Sec 3 3.2.2 00-970 Part 1 Sec 3 3.2.3 00-970 Part 1 Sec 3 3.2.8 00-970 Part 1 Sec 3 3.2.9 00-970 Part 1 Sec 3 3.2.10 00-970 Part 1 Sec 3 3.2.11 00-970 Part 1 Sec 3 3.2.12 00-970 Part 1 Sec 3 3.2.13
		STANAG Reference:	4671 305 4671 570 4671 572 4671 573 4671 575
FAA Doc:	14CFR reference: 23.571, 23.572, 23.573; 25.571; 27.571; 29.571.	*EASA CS Reference:*	CS 23.571 CS 23.572 CS 23.573 CS 23.575 CS 25.571 CS 27.571 CS 29.571
Harmonised Text:	The airframe structure and associated components, whose failure would be catastrophic, must be shown by analysis supported by test evidence and, if available, service experience, to meet the fatigue requirements of a damage tolerant or, if not applicable a safe life design methodology over the design service life of the aircraft. The fatigue evaluation must include the requirements of subparagraph (1), (2), and (3) and also must include a determination of the probable locations and modes of damage caused by fatigue, considering environmental effects, intrinsic/discrete flaws, or accidental damage.		

THE EXAMPLE OF EMACC

- **EMACC will be ready by the beginning of 2013**
- **EMACC Custodian Support activity for next years**
- **Refinement based upon changes within information sources**
- **Potential future TF4 opportunity: Harmonisation with US process (MIL HDBK 516B team)**

International rules to integrate a military aircraft in the airspace

Military Aviation

NATO NORTH ATLANTIC COUNCIL

OTAN CONSEIL DE L'ATLANTIQUE NORD

UAV Flight in Non-Segregated Airspace (FINAS) Military Working Group

THE EXAMPLEs of

STANAG 4671, 4702, 4703

Harmonization of airworthiness requirements for UASs in NATO

THE EXAMPLE OF STANAGs

Derived from CS23

Added specific sections for UASs (eg Data Link, Ground Station)
Included a lot of experience from various NATO Nations

Ed 1 ratified
Ed 2 non ratifiable is the last version
Ed 3 will start ratification in fall 2013

STANAG 4671 (Ed2)

Fixed Wing UAS from 150 to 20,000 kg

Cross walk exercise with MIL-HDBK-516
Identified gaps not covered by a CS23 derived STANAG (eg in the Vehicle Control Functions field)

A lot of effort is being dedicated to harmonize safety requirements for Edition 3 => above a weight breakpoint safety will be increased of an order of magnitude

THE EXAMPLE OF STANAGs

Derived from CS27

Added specific sections for UASs (eg Data Link, Ground Station), taken from STANAG 4671
Included a lot of experience from various NATO Nations

Ed 1 started ratification this year

STANAG 4702 (Ed1)

Rotary Wing UAS from 150 to 3750 kg

THE EXAMPLE OF STANAGs

Invented from the Essential Requirements of Airworthiness

Ed 1 started ratification this year

EXCELLENT EXAMPLE OF HARMONIZATION

STANAG 4703 (Ed1)

Fixed Wing UAS below150 kg

Reciprocating/Electrical/Turbine engines

Contribution from previous certification programs of light UASs and form all participant Nations

Harmonized Military Essential Requirements are used as starting point to develop new STANAG 4703
+ CS_VLA + CS_22 + ASTM F2245-06
+ STANAG_4671 + DEF_STAN_00_56
+ EN_9100

EU Regulation (EC) N°216/2008 defines Essential Requirements for Airworthiness of civil aircrafts

OCCAR Procedure for Airworthiness finalized in 2009 included Military version of Essential Requirements for Airworthiness (harmonized also with industry - ASD)

EDA adopted the Military Essential Requirements in the Basic Framework Document

STANAG 4703

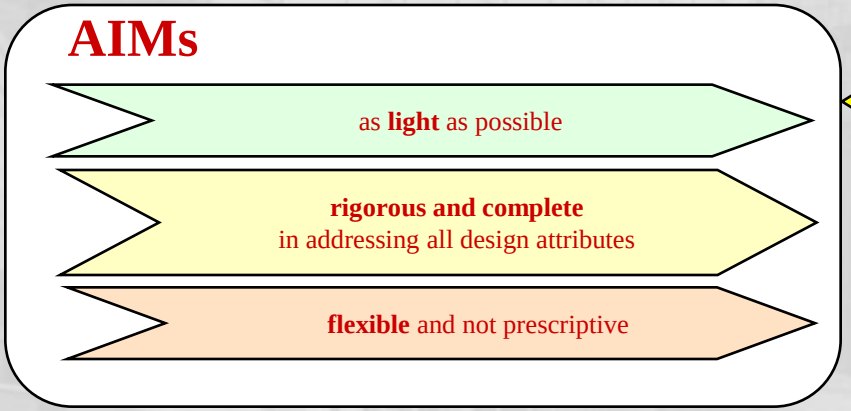
AIMs

the amount of certification evidences required should be as **LIGHT** as possible

USAR-LIGHT must be **RIGOROUS** and **COMPLETE** in addressing those design attributes which may endanger safety

being **FLEXIBLE** and not prescriptive, in order not to limit the Manufacturers design solutions

STANAG 4703



A set of Airworthiness Codes doesn't exist for any type of aircraft < 150 kg

A single complete set of Airworthiness Codes cannot be flexible enough to consider all the variety of configurations in this UAS category

A complete set of airworthiness codes would result to be excessively prescriptive to this UAS category Manufacturers.

Nevertheless a minimum set of basic Airworthiness Codes could help both the Applicant and the Authority in performing UAS certification activities

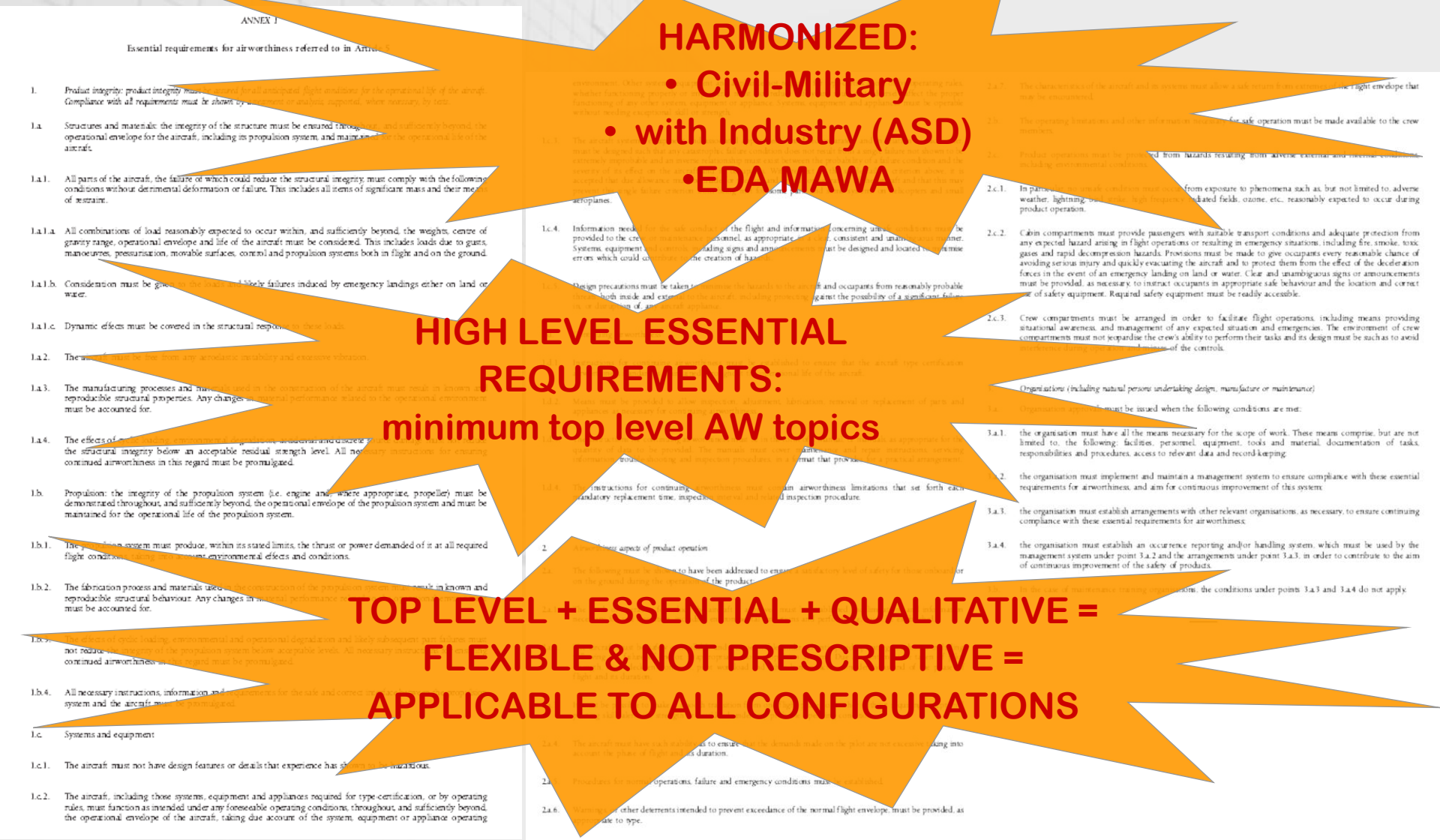
STANAG 4703

1) What are the minimum requirements required by law to be fulfilled in order to recognize a type design as airworthy?

In EU Civil Aviation the minimum Essential Requirements for Airworthiness are established by **Regulation (EC) N°216/2008 (Annex 1)** of the European Parliament and of the Council

OCCAR-JMAG (BE+DE+FR+IT+SP+UK) agreed among themselves and with ASD (the association of EU Aerospace Industries) a military version of the Essential Requirements adopted then by **MAWA** as the basis of their regulatory framework.

STANAG 4703



HARMONIZED:

- **Civil-Military**
- **with Industry (ASD)**
- **EDA MAWA**

HIGH LEVEL ESSENTIAL REQUIREMENTS:
minimum top level AW topics

TOP LEVEL + ESSENTIAL + QUALITATIVE = FLEXIBLE & NOT PRESCRIPTIVE = APPLICABLE TO ALL CONFIGURATIONS

2) How to demonstrate compliance with the Essential Requirements for Airworthiness?

For UAS<150 kg the best proposed solution is a ***hybrid approach*** in which compliance with Essential Requirements is demonstrated through detailed arguments made of the following:

- a clear definition of the design usage spectrum
- a minimum set of airworthiness codes
- verification of the design criteria by the Authority
- process evidences (e.g. Safety Management System)

STANAG 4703

MANDATORY AIRWORTHINESS ESSENTIAL REQUIREMENTS	DETAILED ARGUMENTS	MEANS OF EVIDENCE
ER.1 Product integrity ER.1.1 Structures and materials ER.1.2 Propulsion ER.1.3 Systems and equipments ER.1.4 Reqs for Continued airworthiness ER.2 Airworthiness aspects of product operation ER.3 Organisations	Compliance with the Essential Requirements may be shown by the Applicant through these detailed arguments or by any other argument which meets the intent behind them with comparable level of safety to be agreed with the Certifying Authority, wherever a "should" statement appears FLEXIBILITY= Few "must" statements Many "should" statements	Acceptable type of evidence to be presented to the Authority

STANAG 4703

Direct arguments

STANAG 4671

CS-22
(Certification Specifications for Sailplanes And Powered Sailplanes)

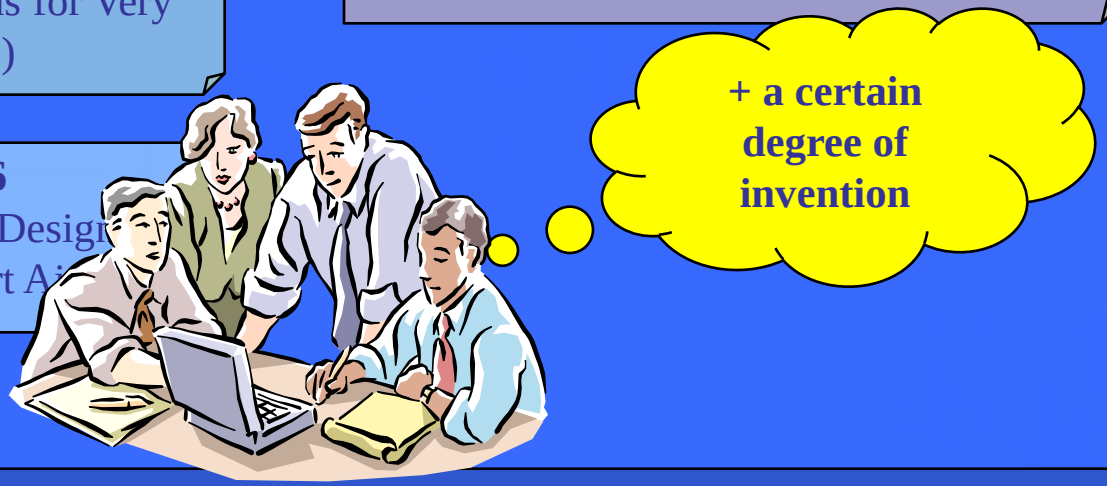
CS-VLA
(Certification Specifications for Very Light Aeroplanes)

ASTM F2245-06
(Standard Specification for Design Performance of a Light Sport Ai

Indirect process arguments

DEF STAN 00-56
(Safety Management Requirements for Defence Systems)

Quality Management System + Product Safety declared as an objective in the Quality Policy
(ISO 9100 + ISO 9004)



3) Can some requirements be relaxed for very Light UAS?

official medical studies:
any vehicle under **25 ft-lb**

PhD dissertation:
any vehicle under **49 ft-lb**

(Very Low Energy threshold that cannot cause fatalities)

… Lethality Threshold of 66J

NEW STANAG 4xxx

STANAG 4xxx

Rotary Wing UAS < 150 kg

A new team has been established to develop a new STANAG, similar in structure to the 4703, applicable to rotary wing UAS< 150kg
START IN SPRING 2013

CONCLUSIONS (1/2)

- MILITARY AIRWORTHINESS HARMONISATION IS NOW A NEED UNDER THE WILL OF NATIONS
- DUPLICATION OF EFFORT MUST BE AVOIDED (LACK OF NATIONAL SPECIALISTIC RESOURCES)
- THERE ARE BENEFITS IN USING A COMMON APPROACH IN THE AIRWORTHINESS
  - TO PROVIDE MILITARY AIRCRAFTs CAPABLE OF PERFORMING THEIR MISSION SAFELY
  - THE POTENTIAL SAVINGS IN TIME, COST AND EFFORT FOR BOTH AUTHORITHIES AND INDUSTRY.
- USE THE SUCCESS OF THE EARLY STAGEs TO ENABLE STRONGER HARMONISATION

CONCLUSIONS (2/2)

- EU EFFORTS TO DEVELOP EMACC SHOULD BE HARMONIZED WITH US PROCESS OF REVISION OF THE MIL-HDBK-516, POSSIBLY SHARING BACKGROUND EXPERIENCES AND KNOW-HOW

- RELEVANT NATIONS AROUND THIS TABLE ARE RECOMMENDED TO CONSIDER NEW STANAGS 4702 AND 4703 FOR CONSIDERATION AND RATIFICATION

ITALIAN MINISTRY OF DEFENCE
Secretariat General for Defence - National Armaments Directorate
AIR ARMAMENTS DIRECTORATE

The benefits of harmonising In the field of airworthiness

Any question?

Lt.Col. GArn Alessio GRASSO
Italian MoD - DAA Vice Technical Direction
Alessio.grasso@am.difesa.it
+39 06 4986 6812

Larnaca (Cyprus), 27 September 2012