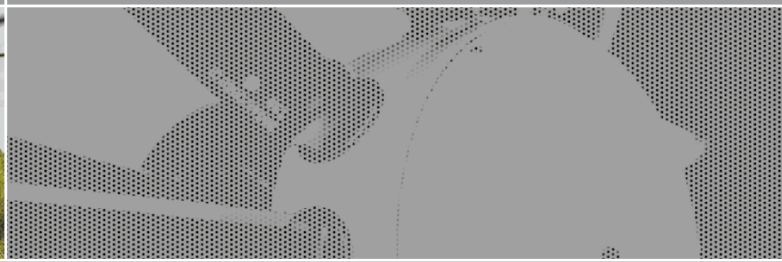




Design Assurance Guidance for Airborne Electronic Hardware

EASA Helicopter Forum, 4th and 5th Dcember 2013, Prepared by S Barbagelata

thinking without limits

EUROCOPTER
AN EADS COMPANY

Chapter I
Electronics in Airborne Equipment's
ED 80 /DO 254 standard

"*Design Assurance Guidance for Development of Airborne Electronic Hardware*"

April 2000

Introduction

- As the **amount and complexity of electronic content** has grown in commercial aircraft, it became necessary for the Authorities to establish a baseline of minimum design flow steps for airborne equipment.
- **ED 80 / DO-254 was formally recognized** as a standard for ensuring the highest level of safety in electronic airborne systems.
- Initially written to cover complex items such as Line replaceable Units, Programmable logic devices and Commercial Off The Shelf components
- It includes **five levels of compliance**, known as Design Assurance Levels (DAL), that range in severity from A (where hardware failure would result in catastrophic consequence of an aircraft) to E (where failure would not affect safety).
- As expected, meeting a “DAL A” level of compliance requires significantly more **effort** and greater attention to verification than would “DAL E”.

Chapter II
What happened since 2000

,,, Electronic Evolution

2012

1972

Cell Phone

Courtesy : Don McMillan

,,, Electronic Evolution

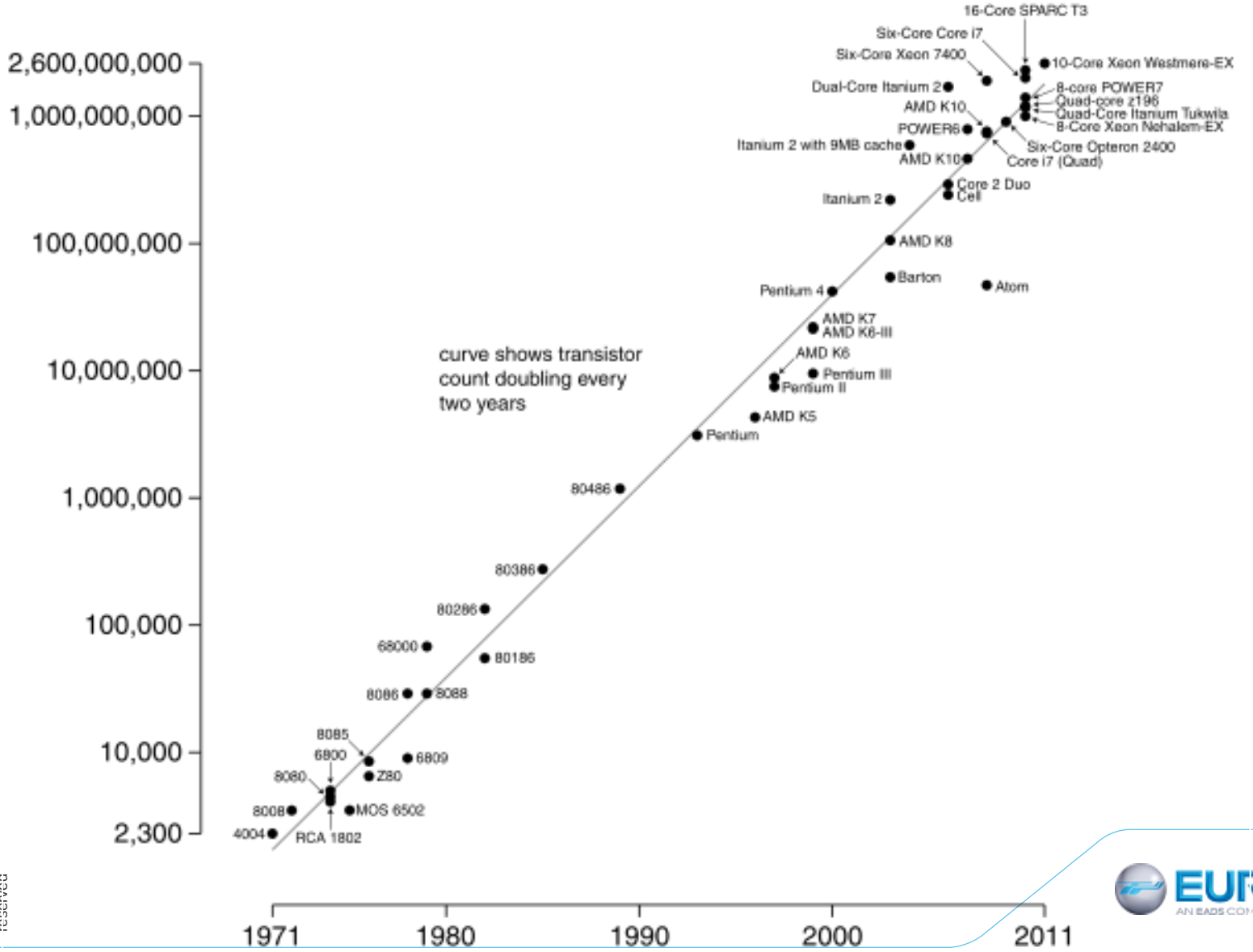
2012

1992

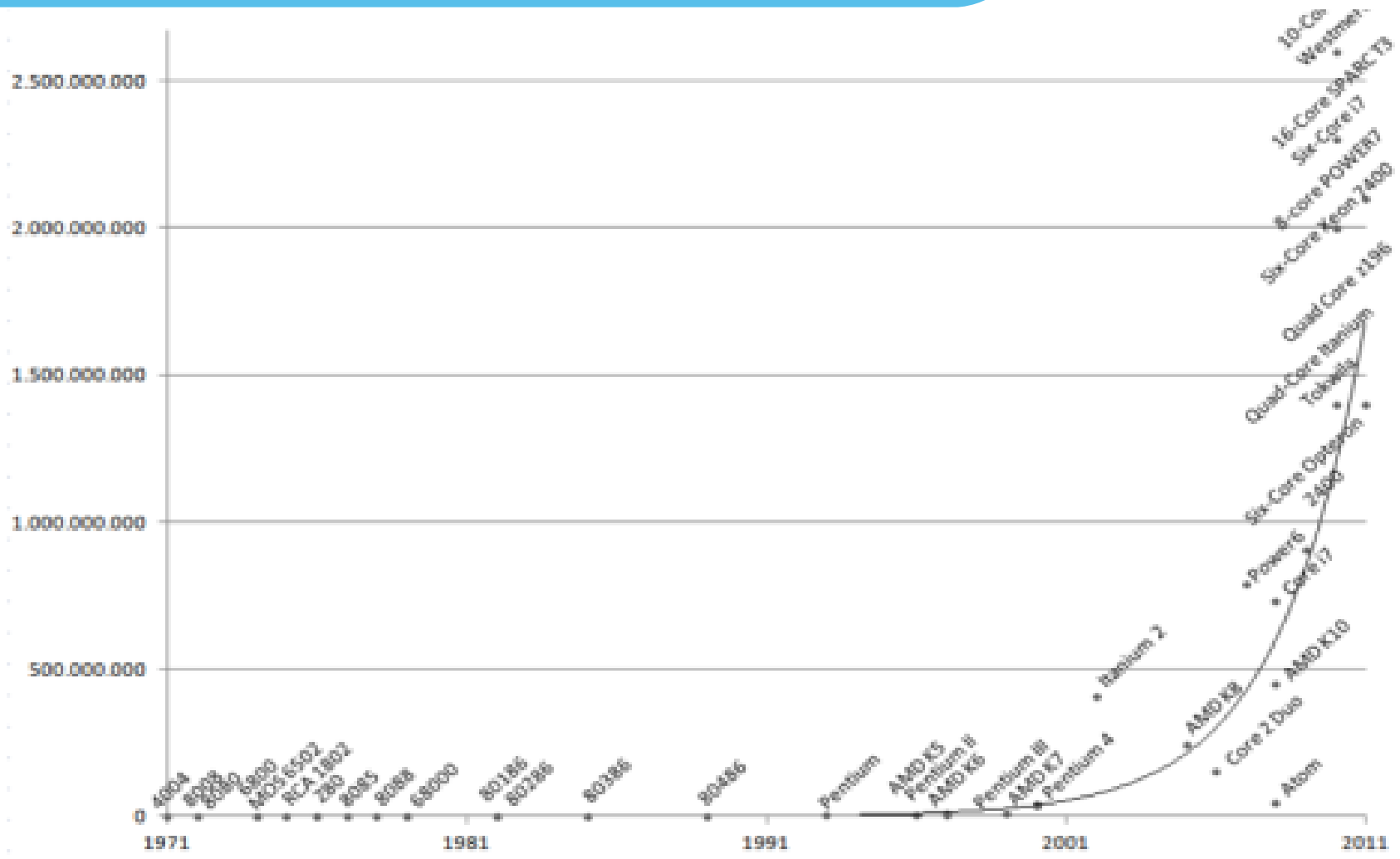
Blackberry

Courtesy : Don McMillan

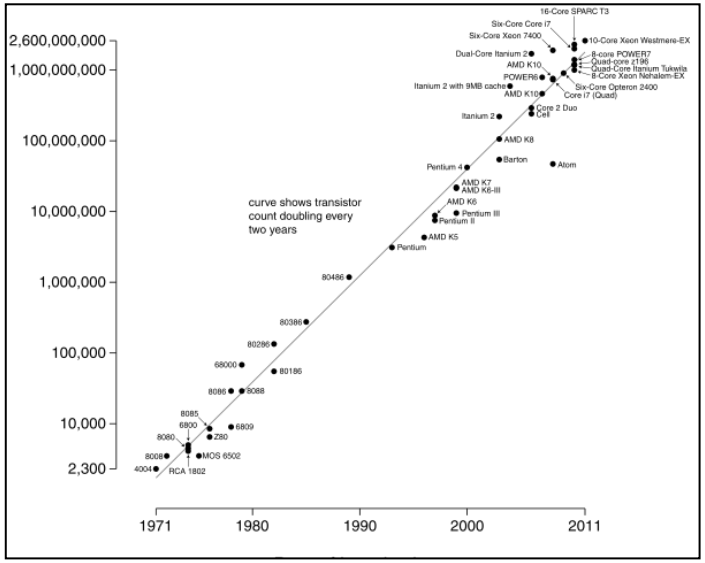
… Microprocessor Transistor count

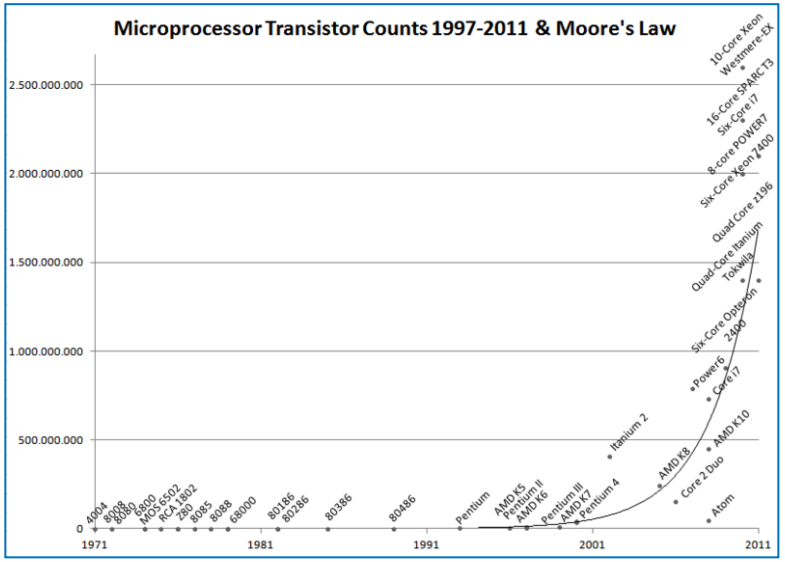


… Microprocessor Transistor count



,,, Electronic Evolution





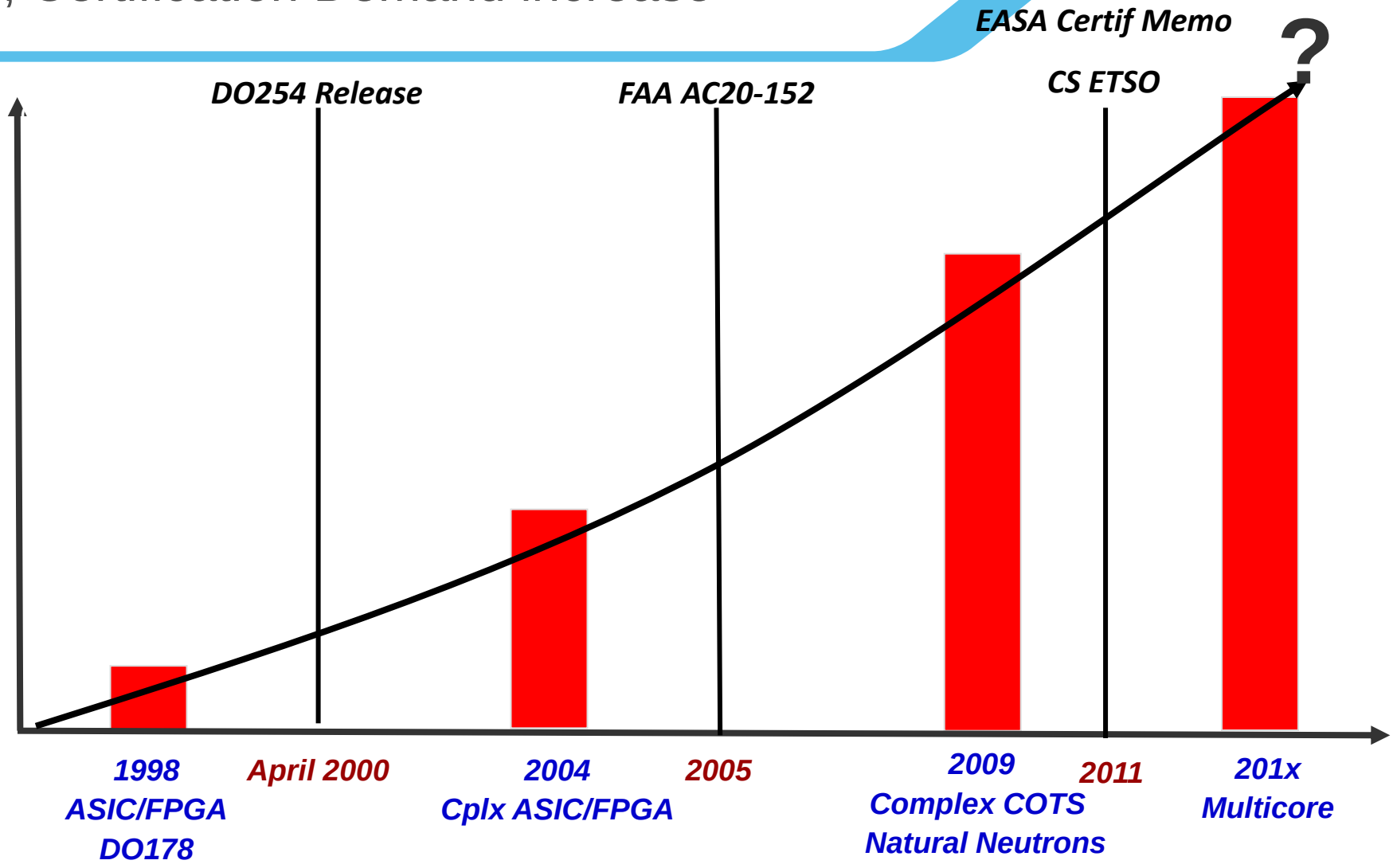
Moore's Law

Number of transistors on integrated circuits multiplied by 2 approximately every 2 years

➔ **Number of Functions and Complexity of COTS components has dramatically increased**

➔ **COTS are not controlled by OEM (design level) and follow Consumer market**

,,, Certification Demand increase



… Aeronautic Stakeholders Activities

- Authority Side
  - Certification Authority Software Team: Papers and discussions
  - DO 254 Recognized by FAA in 2005
  - CRIs and Issue Papers sent to Aircraft manufacturers
  - CS ETSO introduced ED80 in 2011
  - FAA HW/SW Conferences (USA Side)
  - Research Projects
- Industry Side
  - DO 254 User Groups (best practices, common understanding, new tropics, technologies)
  - HW/SW Conferences (European Side)
  - Research Projects
- Standardization Bodies Side
  - Works Painfully on SW Standard update during 7 years (*ED 12C/DO 178C Story*)!

… What is the situation in 2013

- Industry and Authorities have a common understanding on how to Develop/Qualify programmable components (ASIC FPGA)
- Electronic used in Airborne Equipment uses more and more complex COTS (SoC, Dual Core Processors)
- New issues to be taken into account
  - Single Event Effects (Natural Neutrons)
  - Obsolescence
  - Counterfeiting
  - Lead Free Soldering and RoHS compliance
  - Complex LRU design: Digital Buses, Resource sharing, high functional integration
- EASA Discussion Paper proposed to Eurocae in April 2013

Chapter III

Situation at TC applicants and ETSO applicants

Type Certificate Versus ETSO

- DO 254 recognized by FAA in 2005
- TC are based on CRIs/Issue papers mentioning ED 80/DO 254 and new electronic issues since 2001
- 2011, EASA introduced Certification Memorandum on HW

And

- CS ETSO recognized ED 80 in 2011
- CS ETSO does not include other topics requested at TC level (SEU, Complex COTS, System on Chip, Lead Free, etc…)

Re Open ED80 / DO 254 is the only way to share common references at Aeronautical industry level from Authorities to Original Equipment Manufacturers

Chapter IV

IEC TS 62239-1

"*Preparation and maintenance of an electronic components management plan*"

Ed: 2012

IEC TS 62239-1 content

- *This part of the IEC/TS 62239 series provides the minimum requirements for system development assurance levels according to levels A, B and C of the DO-254 A, B and C for flight equipment*

- Component selection
- Component application
  - Electromagnetic compatibility (EMC)
  - Derating and stress analysis
  - Thermal analysis
  - Mechanical analysis
  - Testing, testability, and maintainability
  - Avionics **radiation environment**
  - Management of **lead-free** termination finish and soldering
  - **Counterfeit**, fraudulent and recycled component avoidance

COTS : DO 254 / ED 80 Versus IEC TS 62239-1

First Edition Dates

- ED 80 has been published in April 2000
- IEC 62239-1 has been published in 2003 and updated in July 2012

ED 80/DO 254 is recommending Electronic Component management for COTS components

- 11.2.1 **Electronic Component Management for COTS Components**

  Electronic component management for COTS components is an important supporting process associated with the design and development of hardware. The processes of electronic component management apply to COTS electronic components. While there are both business and technical aspects of this process, this section only deals with the technical aspects as they impact certification.

  Certification credit may be gained by (…)

IEC 62239 -1 will detail later what is written in ED80/DO254 11.2.1

- See next slide

IEC 62239 -1 will detail later what is written in ED80/DO254 11.2.1

ED80/ DO 254 §11.2.1

The component manufacturer can demonstrate a track record for production of high quality components.

Quality control procedures are established at the component manufacturer.

There is service experience supporting the successful operation of the component.

The component has been qualified by the manufacturer or by means of additional testing, which establish the component reliability.

The component manufacturer has control of the component quality level or that this is assured by means of additional component testing.

The components have been selected on the basis of technical suitability of the intended application, such as component temperature range, power or voltage rating, or that additional testing or other means has been used to establish these.

The component performance and reliability are monitored on a continuous basis, with feedback to component manufacturers concerning areas that need improvement.

IEC 62239-1 table of content extract

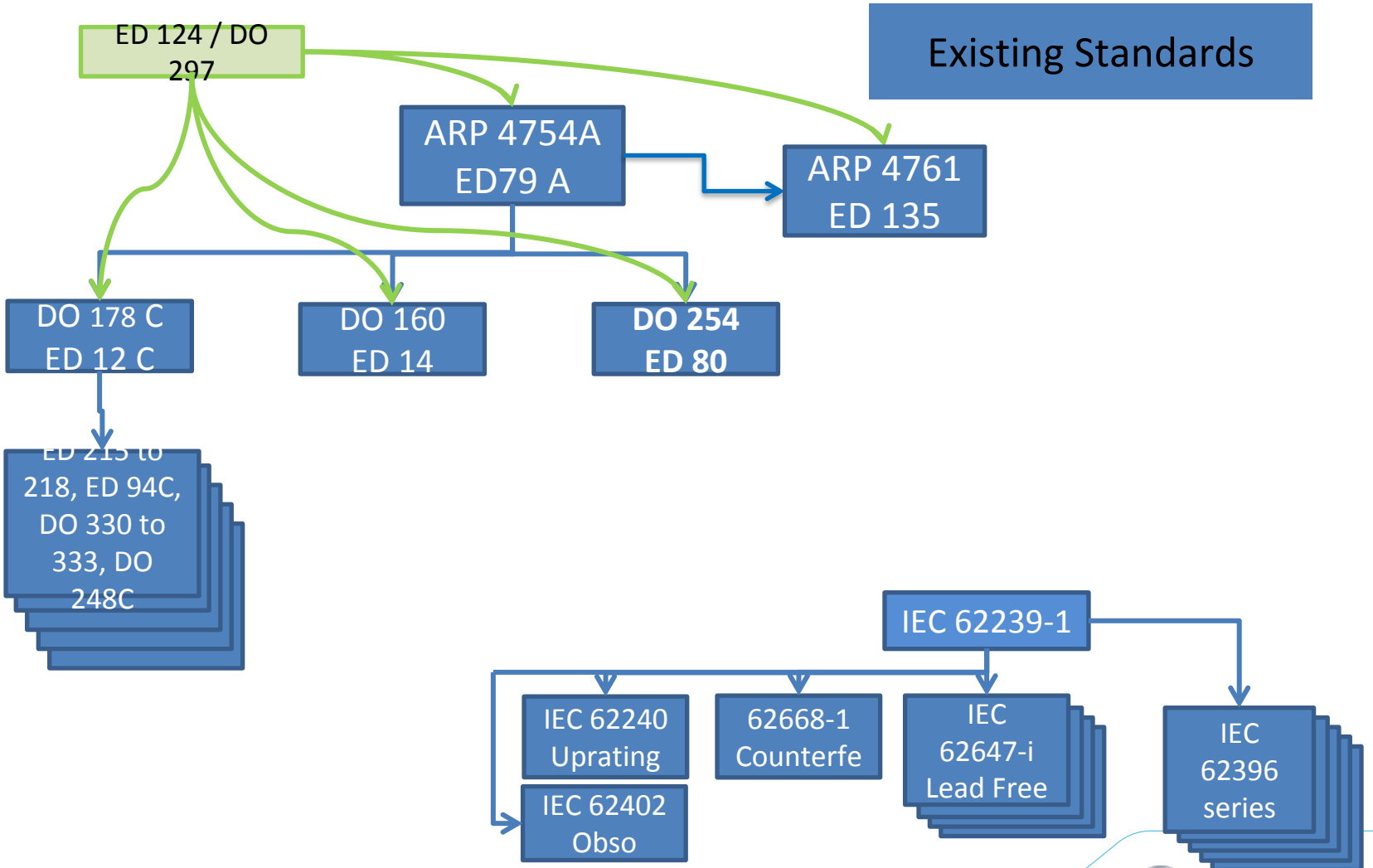
- *Component selection*
- *Component application*
- *Component qualification*
- *Continuous component quality assurance*
- *Component dependability*
- *Component compatibility with the equipment manufacturing process*
- *Component data*
- *Configuration control*

Do 254 (11.2.1) p 85

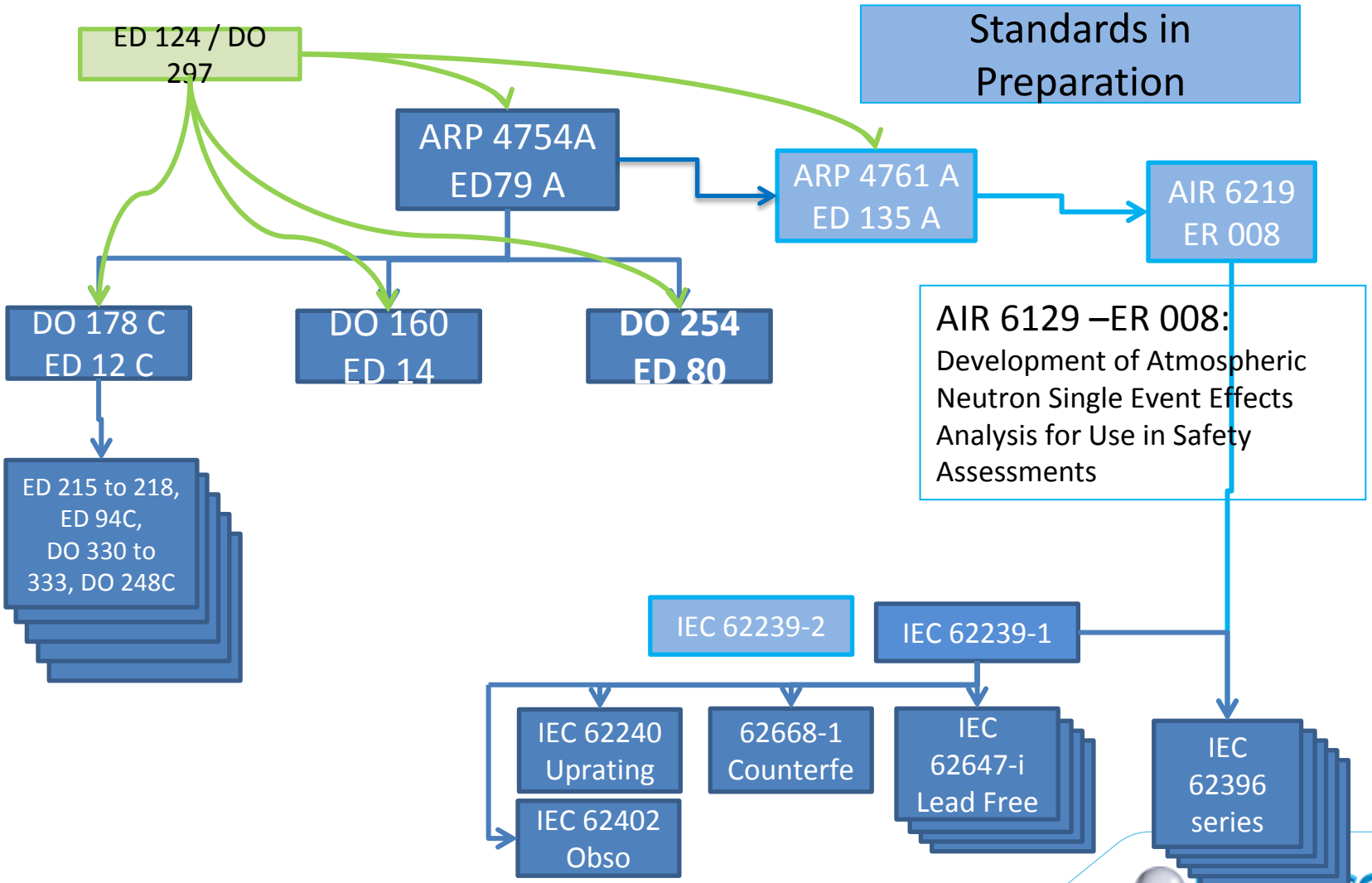
ECMP (4.3) p18

Chapter V
Standardisation situation

Standard situation



Standard situation



Chapter VI
Eurocopter Proposal
for ED 80 / DO 254 evolution

General Position

Eurocopter proposes

- To review and augment ED 80/DO 254 with some selected topics
- To keep main chapters as is, except for limited targeted clarifications
- To limit time frame to 3 to 5 years
- To set up **permanent** WG addressing regular and limited evolutions (IEC example)

Quick release of major Evolutions

Approach

- Supplements/separate documents is the preferred way to add topics to existing ED80/DO 254.

  - List of topics to be included has to be decided **prior** to the Launch of the WGs.

  - Preparation work has to be done by Aeronautical stakeholders within Eurocae and RTCA through dedicated technical teams
    - Authorities
    - Original Aircraft Manufacturer
    - Original Equipment Manufacturers

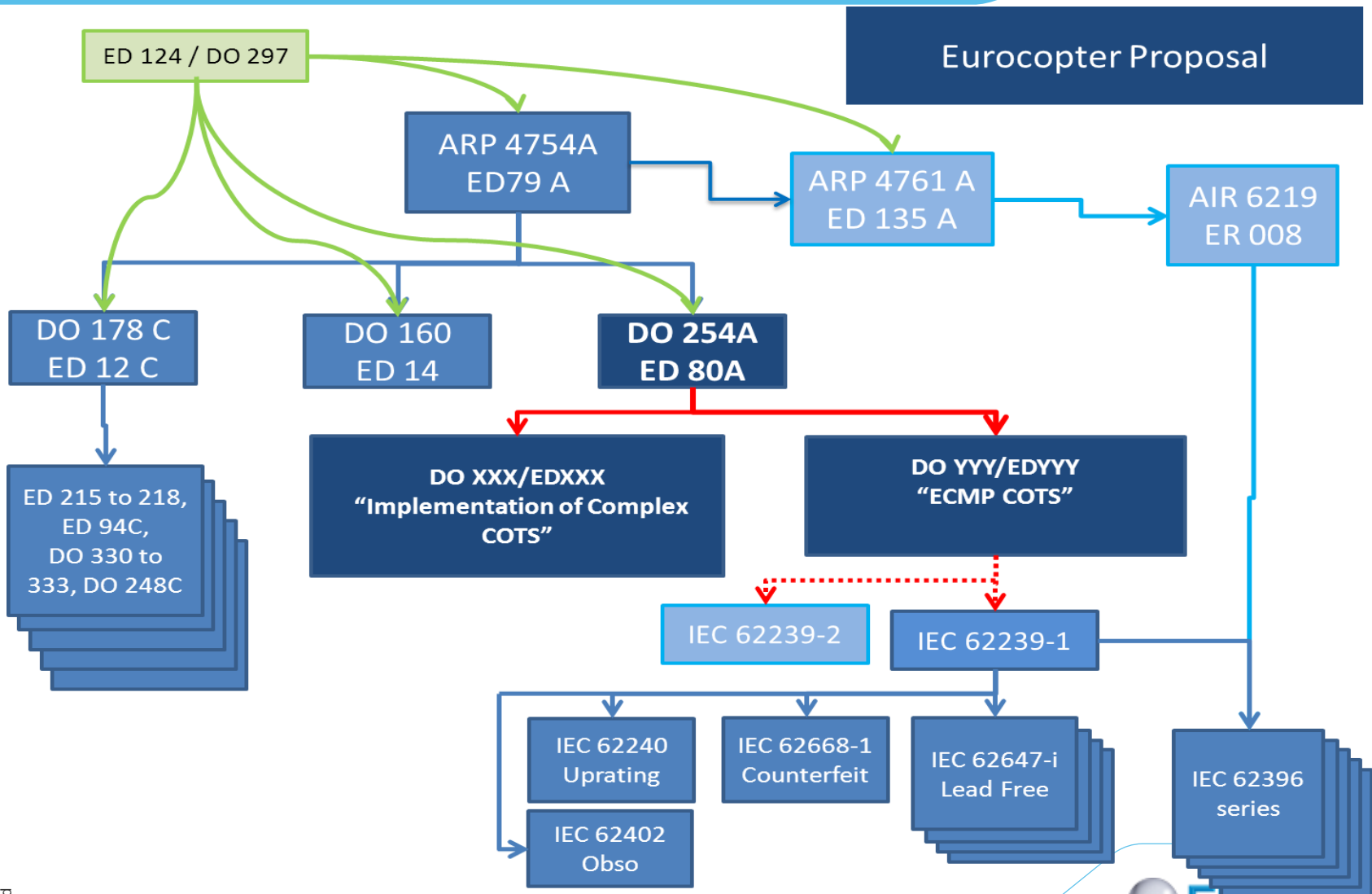
Approach

Technical Team Objectives

- Eurocopter strongly recommends to write detailed, clear, limited ToR **prior** to launch the WGs in order not to reproduce ED 178C story.
- ToR will have to define:
  - Topics in and Topics out
  - Documentation Tree,
  - Priority of the different topics based on criteria (novelty, easiness, effort, Research, clarification, etc..)
  - Schedule
  - Deliverables
- Terms of Reference of ED 80 A/DO 254 A has to be **jointly** written by Eurocae and RTCA

Detailed ToR prepared at Eurocae and RTCA level prior to launch activities will pave the way to prevent unconsidered expenses

Potential Standard Supplement organisation



Chapter VII

… Under Construction

Thank you for attention

Courtesy Lucas Films