EASA
European Union Aviation Safety Agency

Application of Standard Fasteners

CM-S-003

Presentation by:

Aiko Dühne

Rotorcraft Structures Workshop
18-19 February 2025

Your safety is our mission.

An Agency of the European Union

Disclaimer

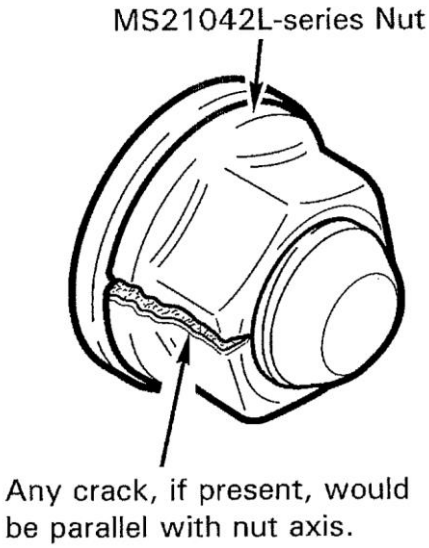
The content of this presentation is for information purposes only. All information provided is of a general nature only and is not intended to address the circumstances of any particular project, individual or entity. Any time there is a conflict or discrepancy between the information provided in this presentation and information in an official regulation or EASA document, the latter prevails.

Despite every effort to ensure the accuracy of the information provided, it may contain occasional inadvertent inaccuracies or typographical errors. Any error brought to our attention (vtol@easa.europa.eu) will be promptly corrected. In no event shall EASA be liable for any incidental or consequential damages, even if EASA has been informed of the possibility thereof.
The content may be subject to changes at any time without prior notice. To the maximum extent permitted by law, EASA is not liable (whether in contract, negligence or otherwise) for any loss or damage arising from the use of these materials. The information contained in this presentation should not be construed as legal advice.

All presentation material and other information provided by or on behalf of EASA are furnished on an "as-is" basis, without warranty of any kind, whether express, implied, statutory or otherwise especially as to its quality, reliability, currency, accuracy or fitness for purpose.

Introduction

- → Accumulation of failed standard fasteners was observed
- → Source:
  hydrogen embrittlement
- → Other non-conformities
  cannot be excluded

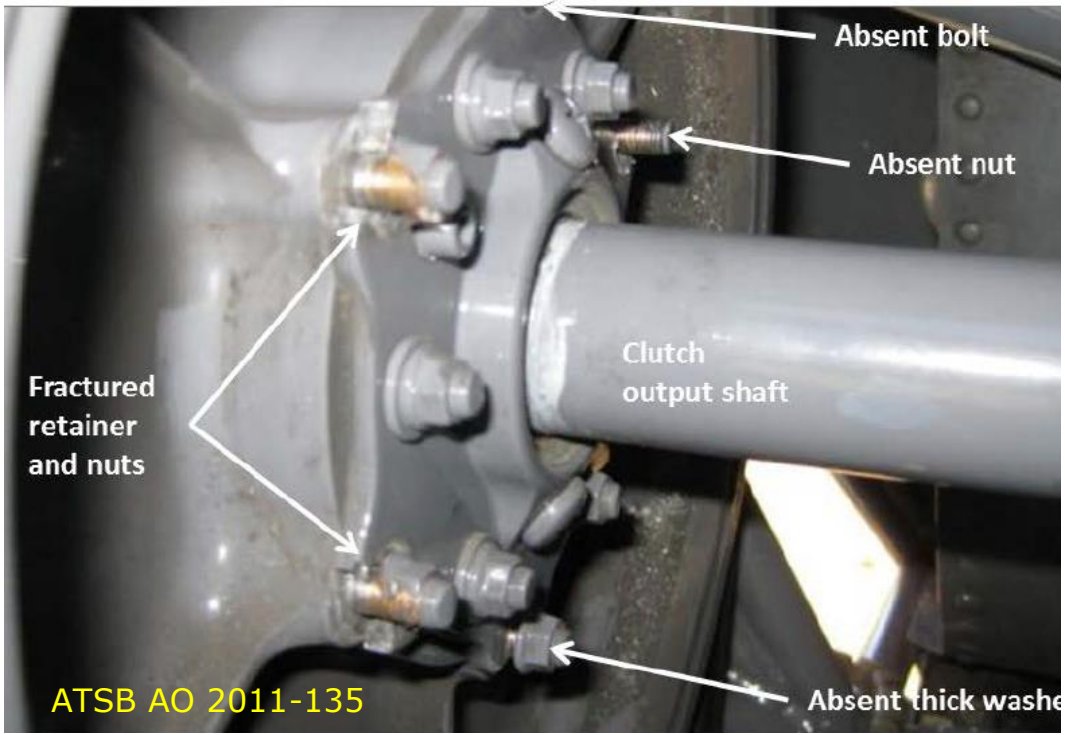


Example 1

Failed nuts on clutch assembly of small rotorcraft.

→ 5 out of 12 nuts failed

→ subsequently 1 bolt failed (no nut failure)



Example 2

- 2 fatalities, 1 severely burned
- Detachment of flight control fastener
- Root cause: Failed nut
- A number of cracked nuts were found on other hydraulic boost servos

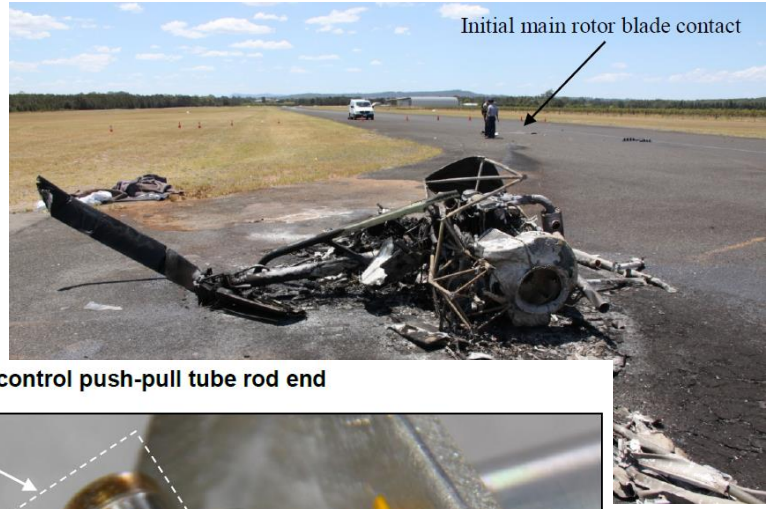
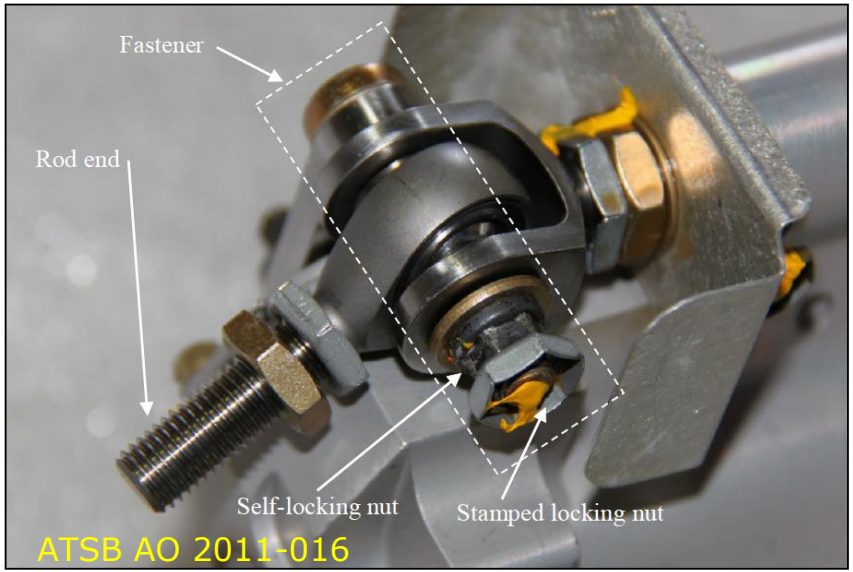
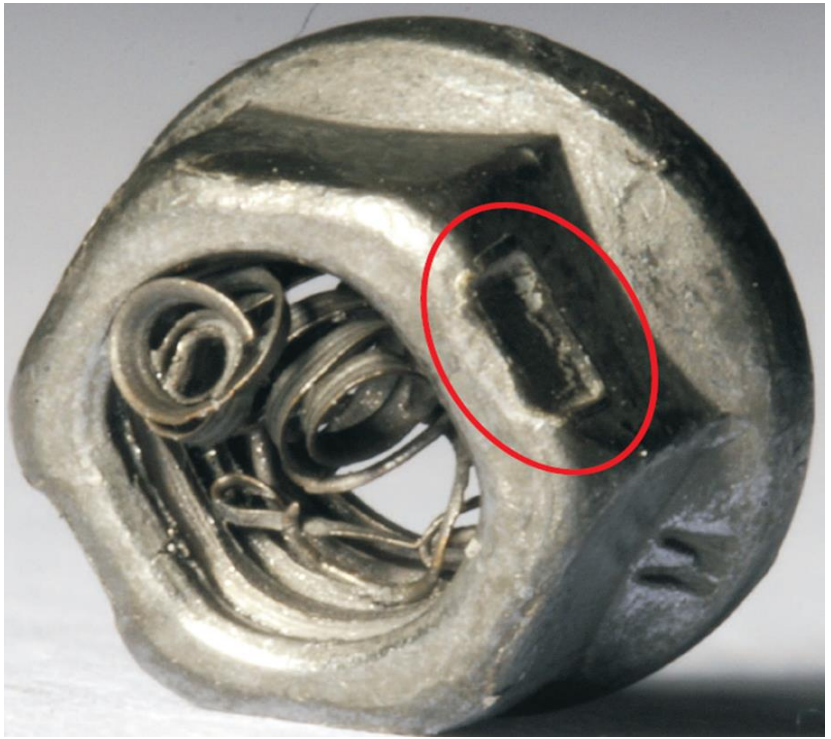


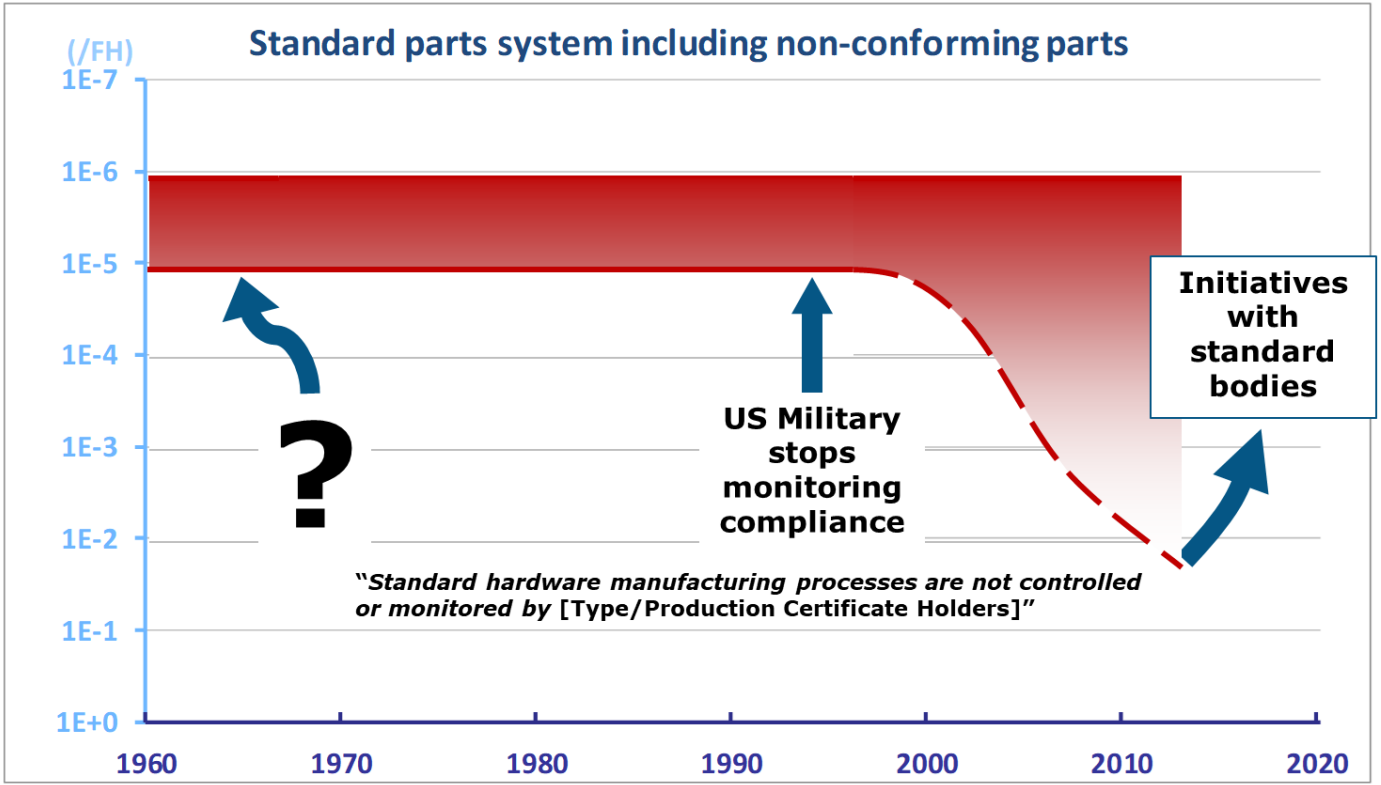
Figure 8: Lower flight control push-pull tube rod end



Defects observed



Origin:


Standard parts system including non-conforming parts
(/FH)
1E-7
1E-6
1E-5
1E-4
1E-3
1E-2
1E-1
1E+0
1960
1970
1980
1990
2000
2010
2020
?
US Military stops monitoring compliance
Initiatives with standard bodies
"Standard hardware manufacturing processes are not controlled or monitored by [Type/Production Certificate Holders]"

Problem

If **Standard Fasteners** are used in **Critical Installations**, deviations from the standard, such as manufacturing flaws and errors, may result in **unexpected failure** of the fastener with undesirable consequences at the aircraft level.

The **overall quality system** applicable to standard parts and the degree of **industry oversight** of the parts producers is not always adequate.

Is a standard fastener made according to the standard?

Has the manufacturer an adequate quality system?

Definitions

Standard Fastener

A fastener that is a Standard Part. Fasteners (nuts and bolts) being produced according to a certain standard which is not directly approved by the agency.

Qualified Standard Fastener

A Standard Fastener that requires additional verification of compliance to specification and/or control of their source, by methods defined by the DAH.

Critical Installation

A structural/mechanical assembly, which may include fasteners the failure of which (single or multiple due to common cause) is classified as **hazardous or catastrophic**.

General

- → Applicable to CS-VLA, CS-VLR, CS-23, CS-25, CS-27, CS-29, CS-P and CS-E
- → Addresses DAH to
  - → Provide guidance to the designer
  - → To instruct POSs and MOAs as necessary to ensure CAW

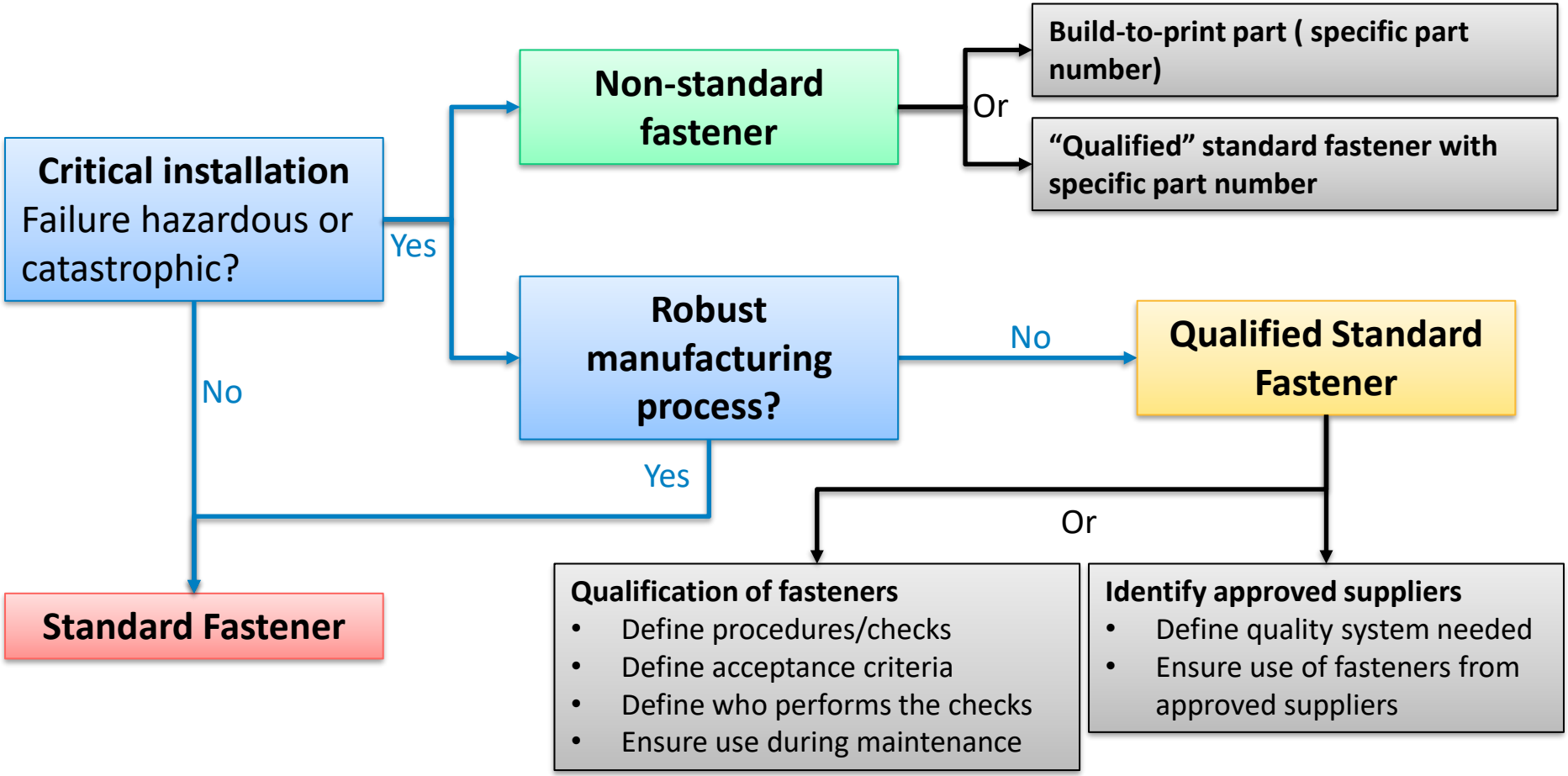
Typically standard fastener are not appropriate for use as critical part

How can you know you get what you ordered ?

→ You cannot!

BUT

→ You can ensure, by additional procedures, ensure that the risk of the fastener failing during service is reduced


Critical installation
Failure hazardous or catastrophic?
Yes
No
Non-standard fastener
Or
Build-to-print part (specific part number)
"Qualified" standard fastener with specific part number
Robust manufacturing process?
No
Yes
Qualified Standard Fastener
Or
Standard Fastener
Qualification of fasteners
• Define procedures/checks
• Define acceptance criteria
• Define who performs the checks
• Ensure use during maintenance
Identify approved suppliers
• Define quality system needed
• Ensure use of fasteners from approved suppliers

How to identify the risk

- → Identify all critical installations
  - → Failure with hazardous or catastrophic consequence
- → Identify if standard fasteners are used
- → Identify the consequence of loss of fastener(s)
  - → Redundancy of fasteners alone may not be sufficient, since they all can suffer from the same defect
  - → For double locking it needs to be checked if the fail safe philosophy is still maintained
- → Identify consequence of manufacturing process variation

Measures to mitigate the risk without new P/N

- → Use qualified standard fasteners
  - → Define additional procedures/checks to ensure appropriate characteristics
  - → Define acceptance criteria
  - → Define who needs to do the checks
  - → Ensure that during maintenance only qualified standard fasteners are used
- → Identify approved suppliers
  - → Define the quality system needed for approved suppliers
  - → Ensure that during maintenance only fasteners from approved suppliers are used in critical installations

Measures to mitigate the risk with new P/N

- Preferred: Do not use standard fasteners
  - Order fasteners according to your own drawing (built-to-print part)
    or
  - Order Standard Fasteners
    - Ensure by additional checks that the fasteners are meeting the required characteristics
      and
    - Allocate a new part number to the fastener

EASA
European Union Aviation Safety Agency

Join at
slido.com
#RSW2025

Your safety is our mission.

EASA
European Union Aviation Safety Agency

Thank you for your attention!

easa.europa.eu/connect

Your safety is our mission.

An Agency of the European Union