

Human Factors on CS25 aircraft EASA expectations

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Objective

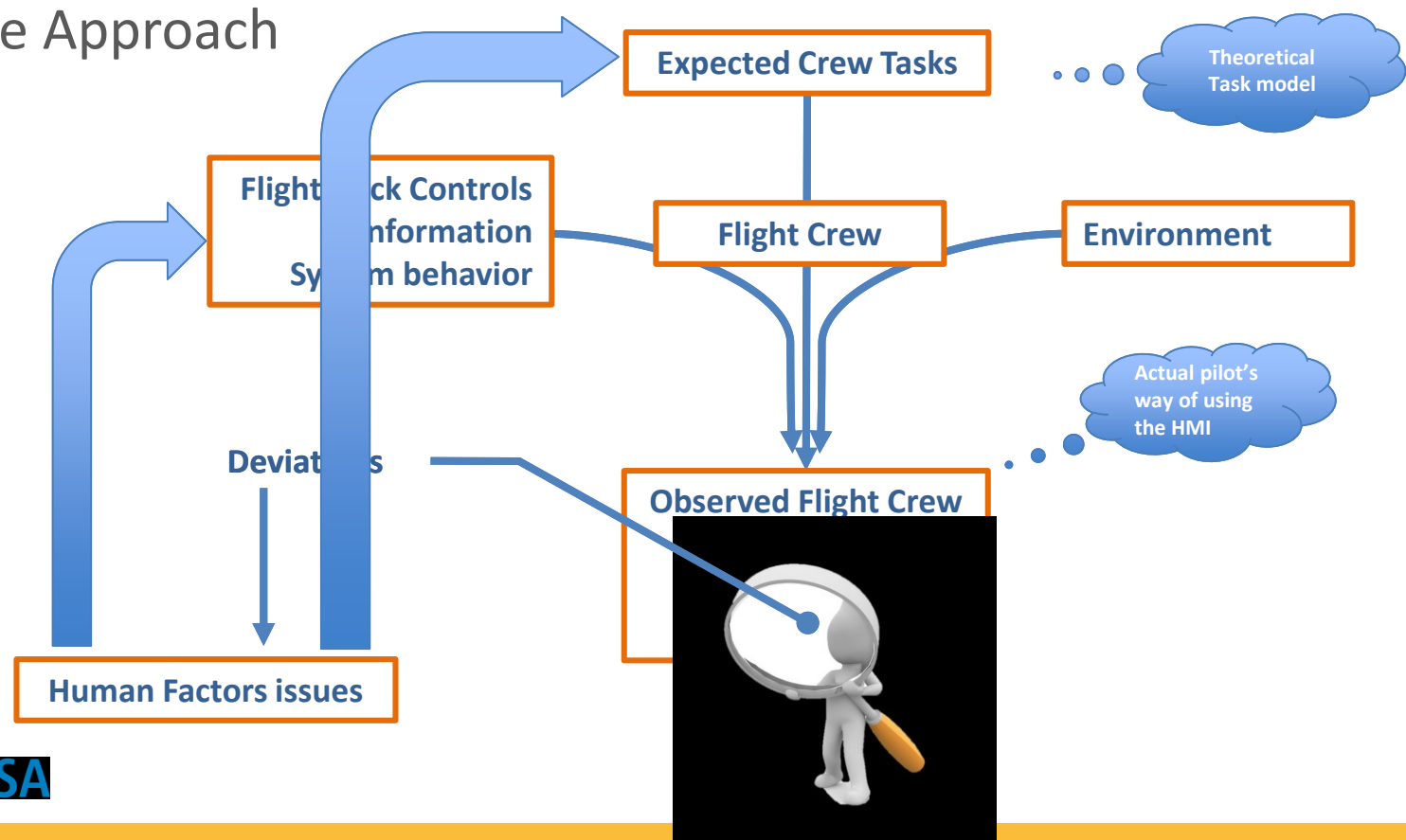
- Demonstrating compliance with design requirements that relate to human abilities and limitations is subject to a great deal of interpretation but... rigorous process can be applied
- Give the process expected by EASA... step by step...with examples and tips to follow

Preamble

- Human Factors, also called Ergonomics, is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance and safety¹.
- The term human-factors is used to designate equally:
 - a body of knowledge,
 - a process,
 - a profession.

General approach

The Approach



CS25.1302: intent of the rule

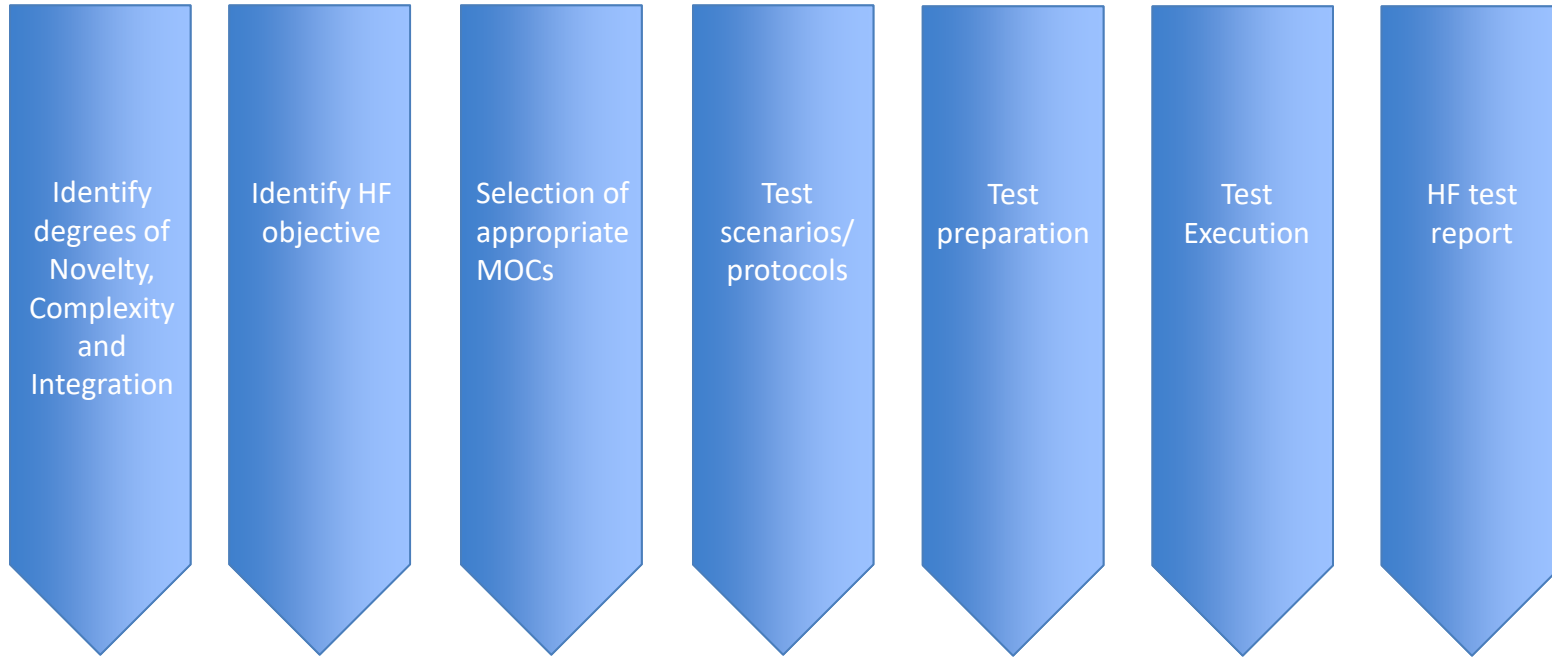
In essence:

- 25.1302 (a)(b)(c): Intended to reduce design contribution to human error by improving general flight deck usability
- 25.1302 (d): The design must support error management in order to avoid safety consequences

Approach expected by EASA

In line with AMC 25.1302

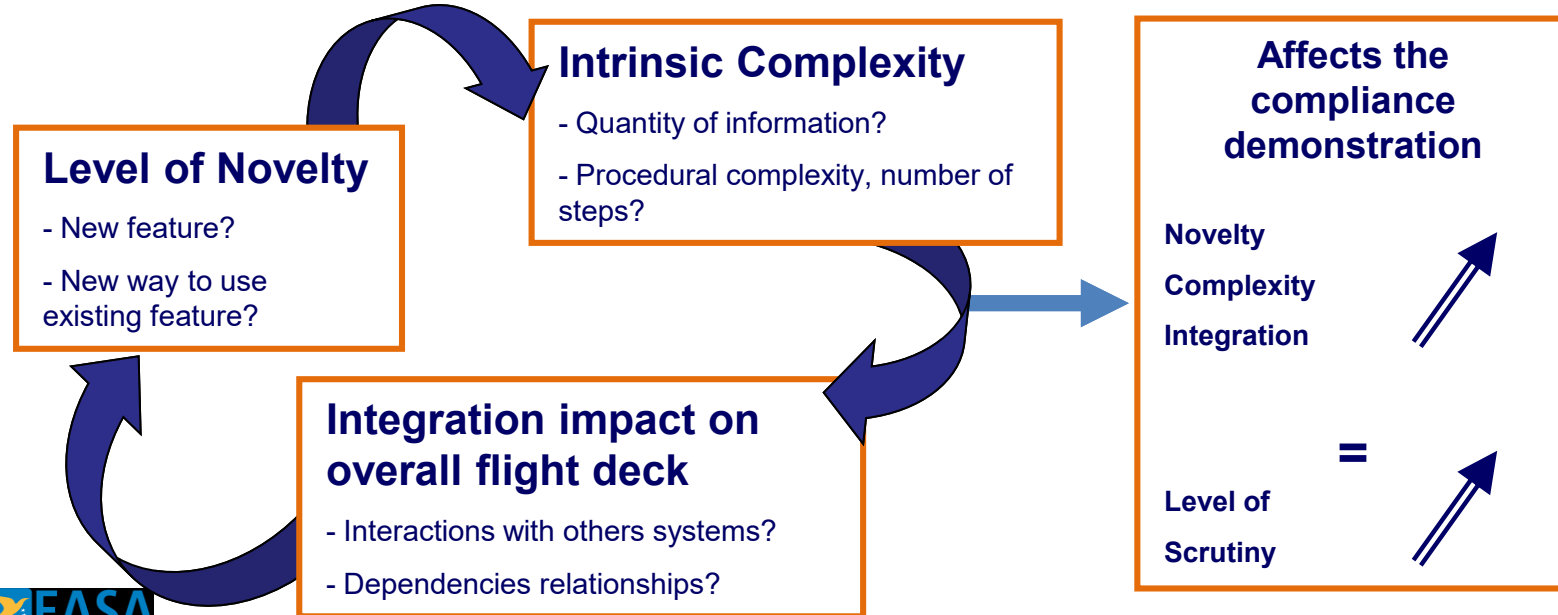
The 7 steps



Identify Novelty/Complexity/Integration

CS-25.1302 Compliance Demonstration

A good demonstration, starts with the good questions...



Identify Novelty/Complexity/Integration

Tips:

- Assess some HMI even though the equipment/HMI is “slightly” modified: **ex a new HMI in an already certified display**
- Do NOT overlook integration component: integration is not limited to systems but also to the task
- The absence of in-service events should not be used to exclude an item from the scope of investigation

Identify
degrees of
Novelty,
Complexity
and
Integration

Identify HF objective

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Function	Sub-function	Focus	Reference to requirement	Description of requirement	HF objective	MoC	Reference to the related deliverable
Electronic checklist (ECL) function	Display electronic checklist	Electronic checklist quick access keys (ECL QAKs)	CS 25.1302(a) AMC 25.1302 § 4.2 (e)(1) AMC 25.1302 § 4.2 (d)(1)(2)	Flight deck controls must be installed to allow the accomplishment of these tasks, and the information necessary to accomplish these tasks must be provided.	Assess appropriate control is provided in order to display ECL.	MoC1 ECL implementation description for XXXX.	ECL implementation description document for XXXX.
			CS 25.1302(b)(1)	Flight deck controls and information intended for flight crew use must be presented in a clear and unambiguous form, at a resolution and	Assess appropriate access of ECL QAKs labels.	MoC8 HFs campaign #4 Scenario #1	Human Factors test Report XXX345

Identify
HF
objective

Identify HF objective

Tips:

- Avoid too high level HF objective: **ex the flight deck is usable in all conditions**
- Do **NOT** only look at abnormal conditions **ex: failure of a display**
- Do **NOT** only look at normal conditions

Identify
HF
objective

Selection of appropriate MOCs

- Expert review
- Scenario-based evaluations using representative simulation means
- Ground and Flight testing

All the possible MoCs are useful and have to be used in a complementary way

- ❑ Analysis-based MoCs is good at the beginning of design process, while scenario-based MoCs is good for validation purpose

Selection of
appropriate
MOCs

Selection of appropriate MOCs

Tips:

- Do **NOT** make too much use of analysis (MOC2)
 - While analyses are useful to start investigating the potential for design-related human errors, this demonstration usually needs to be complemented by observations through assessments
- Avoid using a single test aiming at covering too high number of HF objectives

Selection of
appropriate
MOCs

Development of test scenarios and protocols

- Depending on the HFs objectives to be addressed, development of test scenarios may be required
- Precise scenario based approach should be used:
 - Event (failure, weather, intruder...) with expected timing
 - Expected crew reaction
 - Expected ATC communication

Test
scenarios/
protocols

Development of test scenarios and protocols

Tips:

- Build operationally relevant (and realistic) operational scenario
- Link the scenario with HF objective

Test
scenarios/
protocols

Test preparation

- Flight crews training, according to the evaluation scope
- Briefing
- Presentation of test vehicle limitations

Test
preparation

Test preparation

Tips:

- Highlight this is the design which is under evaluation and NOT the crew
- Ensure appropriate level of training in line of the HF objective and the test scenario
- Ensure limitations are acceptable in order to assess the HF test objective

Test
preparation

Test execution

- During test, the applicant HF observer collects the following data:
 - Non optimal strategies
 - Misunderstanding
 - Hesitations
 - Human errors
- Can be complemented by:
 - Physiological measures (e.g. workload assessment)
 - Rating scales
- Verbalizations during test execution
- Pilots' rationale gathering during debriefings



Test
Execution

Test execution

Tips:

- The applicant is responsible for data collection
- Ensure a sufficient number of crew to be exposed
- Avoid an HF observer that has designed the evaluated function
- Ensure adequate experimental team (HF observer, Simulator operator, ATC)
- The test conductor should be as neutral as possible (no intrusion)
- The presence of HF observer is required (included in flight testing)

Test
Execution

Test debriefing

Tips:

- Do **NOT** orient answers when conducting debriefing
- Extract the maximum information from the pilot verbalization
- Do **NOT** use exclusively rating scale or questionnaires
- Use of state of the art interview techniques

Test
Execution

HF test report

- A description of the data gathered related to every HF's objective;
- In-depth analyses of the observed HF's issues;
- Conclusions regarding the related HF's test objective; and
- If applicable, a description of the proposed way to mitigate the HF's issue (by a design modification, improvements in procedures, and/or training actions).

HF test
report

HF test report

Tips:

- A crew error is not a conclusion by itself
- Do **NOT** systematically mitigate detected human performance issues by training recommendations
- Consider a mitigation even though there is no safety issue

HF test
report

Thank you for your attention

Questions?

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