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Human and Environment centred design
Airbus France Engineering

Airbus Human Factors Design Process

24 April 2014

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Agenda

- The role and organisation of Human Factors in Airbus
  - The rationale for HF
  - Understanding HF
  - HF key success factors
- Overview on the Human Factors Design process
- An extended view on the end-user:
  - The integration of the ATM perspective

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WHY HUMAN FACTORS

Why Human Factors: Benefits and Obligations

Benefits

- **Safety benefits (**aircraft experience)
- **Economical efficiency**
  - Reduced training need (but be careful of skill abrasion)
  - Increase of standardised operations (airlines) and flight performance optimisation
  - Increased traffic capacity (SESAR)
- **Life protection** in Dangerous Operations (military threats)

Obligations

- **Certification**

Drawbacks

- **Cost**
- **Time**

UNDERSTANDING HUMAN FACTORS

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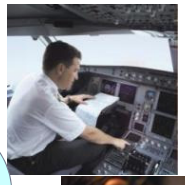
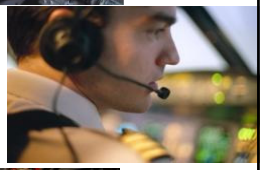
Understanding the end-users Work…in Aviation

- Manage the Mission: Cargo, passengers, airline, airport…
- Fly, Navigate, Communicate
- Manage the System: ECAM, Flight Attendant Panel…
- Be aware of: Weather, traffic, terrain…





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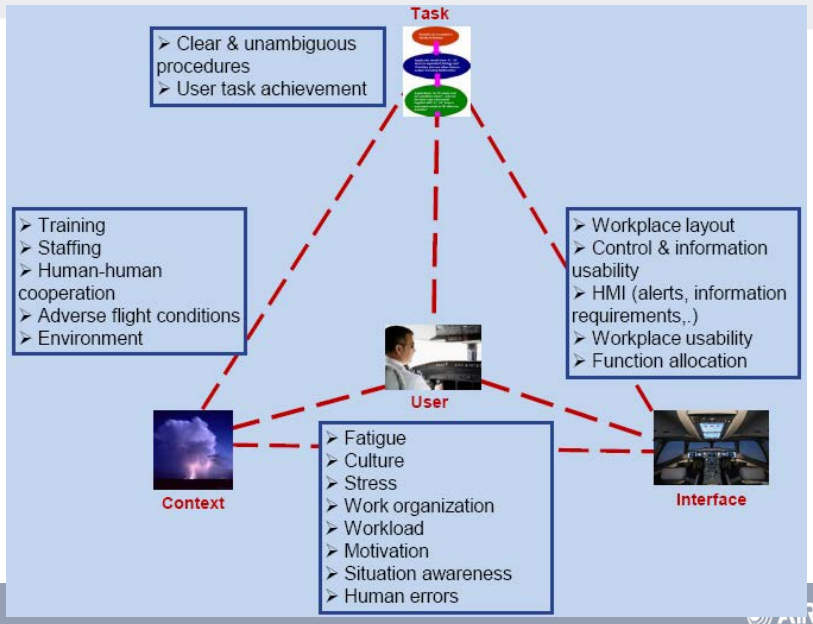
Human Factors mission in Airbus

"Understand the work
and
adapt the WORK to the HUMAN"
(Use knowledge of human behavior and HF methods to understand the work)

- Predict/understand the end users' behavior during real operations, when interacting directly or indirectly with the aircraft (normal and non normal situations)
- Ensure that the missions & modes of use are acceptable for the end users
- Ensure that the cockpit:
  - -is mature before Entry Into Service
  - -complies with Human Factors Regulations

EASY TO USE, SAFE, EFFICIENT and PLEASANT

Optimising relationships between end-users and operational tasks



KEY SUCCESS FACTORS

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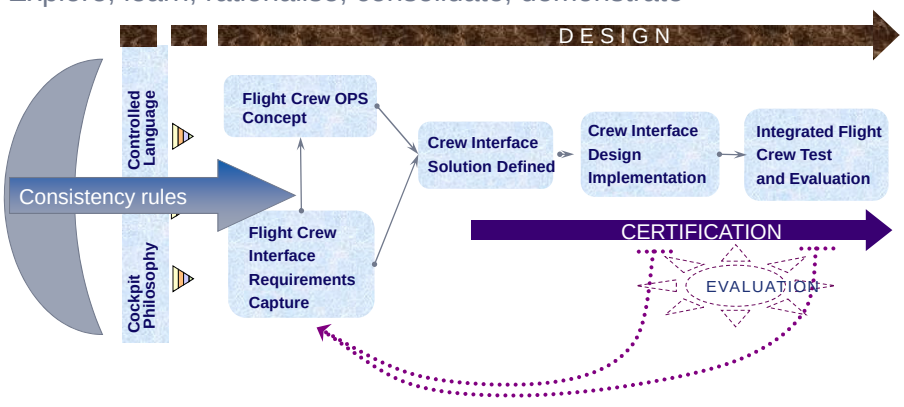
Key success factors: HF process and methods

Explore, learn, rationalise, consolidate, demonstrate



- **Systemic & systematic approach in realistic operational contexts**
- **Involvement of relevant End users: pilots , Air traffic controllers…..**
- **Human Factors methods complying with HF certification**

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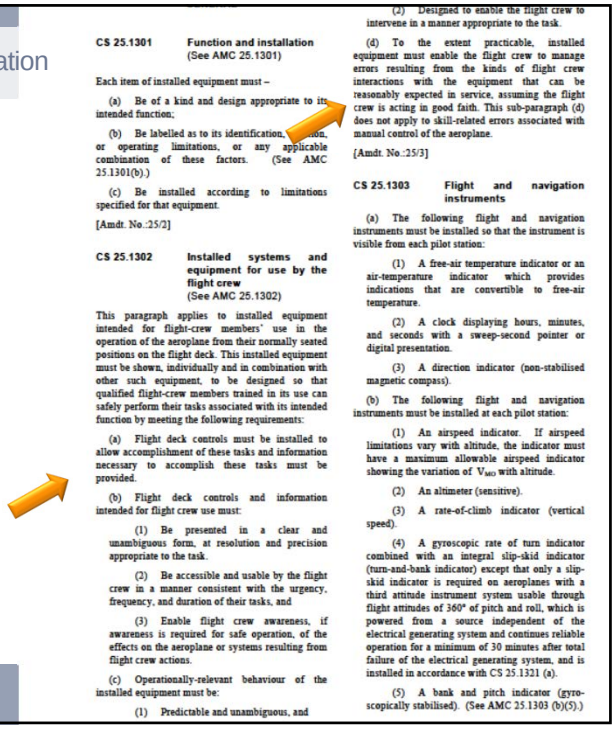
Key success factors: Certification

- CS 25.1302 and related sections of CS 25 including their Associated Means of Compliance
- HF process as a mean to answer certfication specification



CS 25.1301 Function and installation
(See AMC 25.1301)

Each item of installed equipment must –

(a) Be of a kind and design appropriate to its intended function;

(b) Be labelled as to its identification, [illegible], or operating limitations, or any applicable combination of these factors. (See AMC 25.1301(b).)

(c) Be installed according to limitations specified for that equipment.

[Amdt. No.:25/2]

CS 25.1302 Installed systems and equipment for use by the flight crew
(See AMC 25.1302)

This paragraph applies to installed equipment intended for flight-crew members' use in the operation of the aeroplane from their normally seated positions on the flight deck. This installed equipment must be shown, individually and in combination with other such equipment, to be designed so that qualified flight-crew members trained in its use can safely perform their tasks associated with its intended function by meeting the following requirements:

(a) Flight deck controls must be installed to allow accomplishment of these tasks and information necessary to accomplish these tasks must be provided.

(b) Flight deck controls and information intended for flight crew use must:

(1) Be presented in a clear and unambiguous form, at resolution and precision appropriate to the task.

(2) Be accessible and usable by the flight crew in a manner consistent with the urgency, frequency, and duration of their tasks, and

(3) Enable flight crew awareness, if awareness is required for safe operation, of the effects on the aeroplane or systems resulting from flight crew actions.

(c) Operationally-relevant behaviour of the installed equipment must be:

(1) Predictable and unambiguous, and

(2) Designed to enable the flight crew to intervene in a manner appropriate to the task.

(d) To the extent practicable, installed equipment must enable the flight crew to manage errors resulting from the kinds of flight crew interactions with the equipment that can be reasonably expected in service, assuming the flight crew is acting in good faith. This sub-paragraph (d) does not apply to skill-related errors associated with manual control of the aeroplane.

[Amdt. No.:25/3]

CS 25.1303 Flight and navigation instruments

(a) The following flight and navigation instruments must be installed so that the instrument is visible from each pilot station:

(1) A free-air temperature indicator or an air-temperature indicator which provides indications that are convertible to free-air temperature.

(2) A clock displaying hours, minutes, and seconds with a sweep-second pointer or digital presentation.

(3) A direction indicator (non-stabilised magnetic compass).

(b) The following flight and navigation instruments must be installed at each pilot station:

(1) An airspeed indicator. If airspeed limitations vary with altitude, the indicator must have a maximum allowable airspeed indicator showing the variation of V_{MO} with altitude.

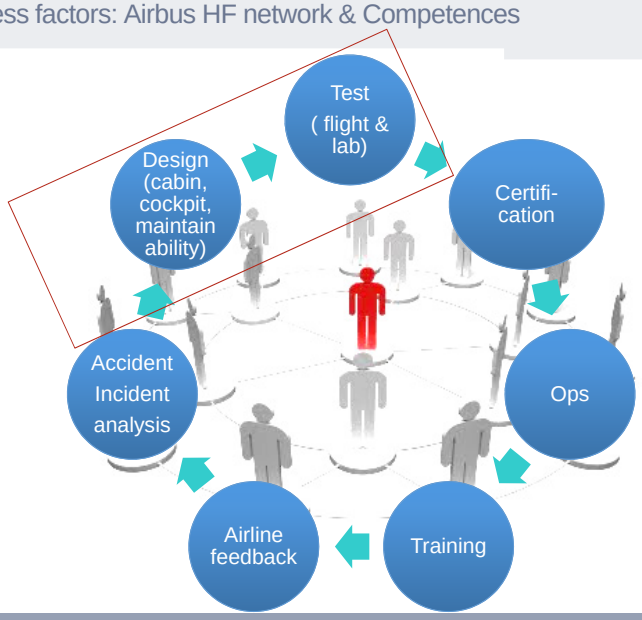
(2) An altimeter (sensitive).

(3) A rate-of-climb indicator (vertical speed).

(4) A gyroscopic rate of turn indicator combined with an integral slip-skid indicator (turn-and-bank indicator) except that only a slip-skid indicator is required on aeroplanes with a third attitude instrument system usable through flight attitudes of 360° of pitch and roll, which is powered from a source independent of the electrical generating system and continues reliable operation for a minimum of 30 minutes after total failure of the electrical generating system, and is installed in accordance with CS 25.1321 (a).

(5) A bank and pitch indicator (gyroscopically stabilised). (See AMC 25.1303 (b)(5).)

Key success factors: Airbus HF network & Competences



CS–25 BOOK 1

SUBPART F – EQUIPMENT

GENERAL

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Key success factors: Human Factors competences.

- Human perception
- Stress
- Alertness & Fatigue
- Hypoxia…

Physiology

Psychology

- Comprehension and decision making
- Automation
- Human error
- Workload & cognitive resources management …

- Terminology
- Syntax
- Controlled language

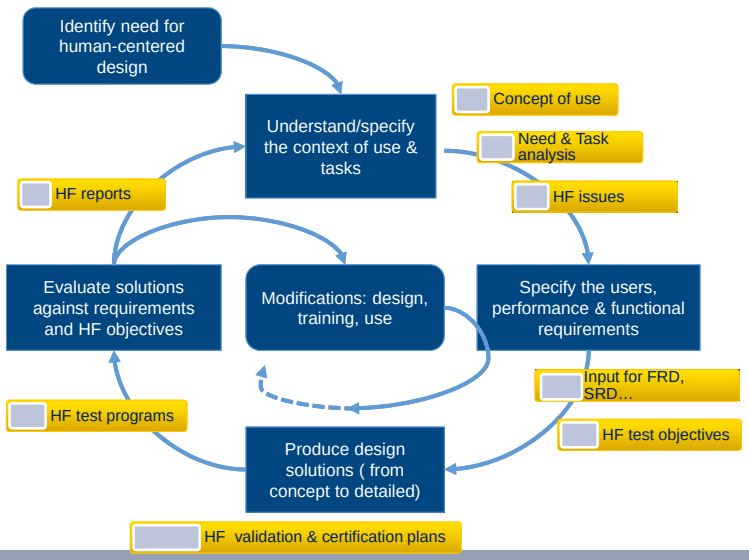
Linguistic

Sociology

- Team cooperation and communication
- Effect of culture..

Human: a complex system capable of adaptation in a dynamic & contextual manner but also with limitations that we have to consider.

Key success factors: HF methods embedded in other key processes.



Key success factors: Towards HF

Getting there….

PEOPLE

….Maintaining….

ARGUMENTS

….Evolving

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AN EXTENDED VIEW for evolving Air Traffic Management

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ATM Initiatives

- International Civil Aviation Organisation (ICAO)
- Europe: SESAR (Single European Sky Aviation Research) www.sesarju.eu
- US: Next-Gen
- Others…

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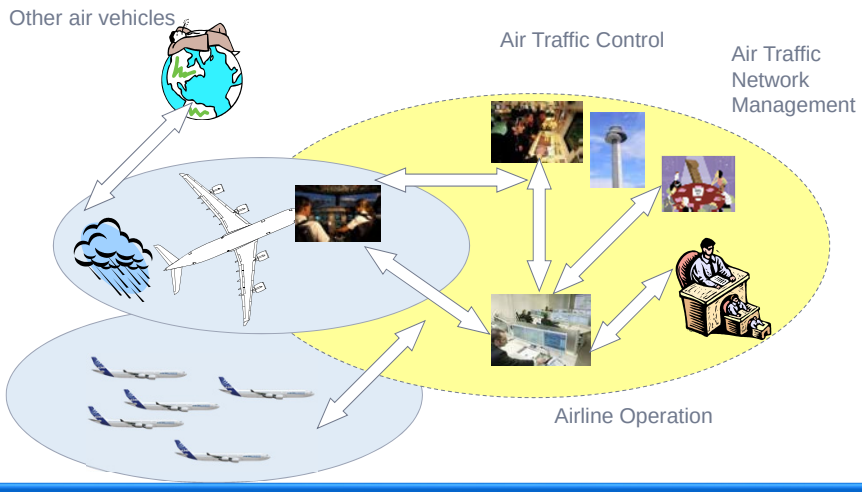
An extended view on the end-users



Increasing ATM Performance by adding new technologies
→New tools →Increased automation →New/changed tasks
→New roles & responsabilities

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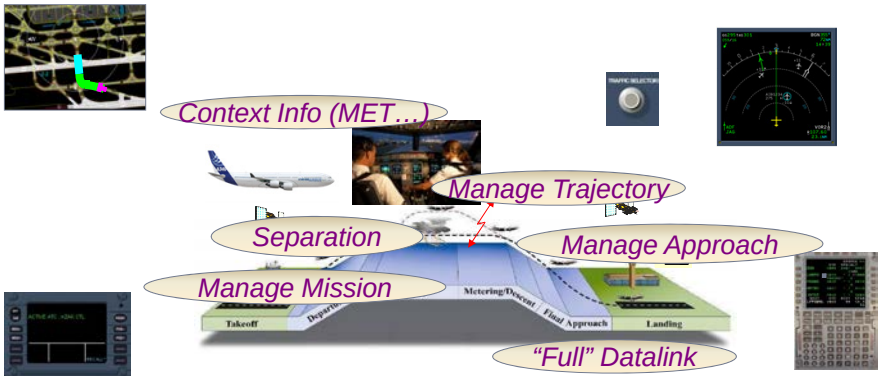
Future ATM functions in the aircraft



HF considerations for the integration of new ATM functions:

- **Functions represent modifications to pilots' tasks and their working environment**
- **Interaction with ATM is only one of the flight crew's many tasks**
- **Human Factors Design Process to evaluate modifications**

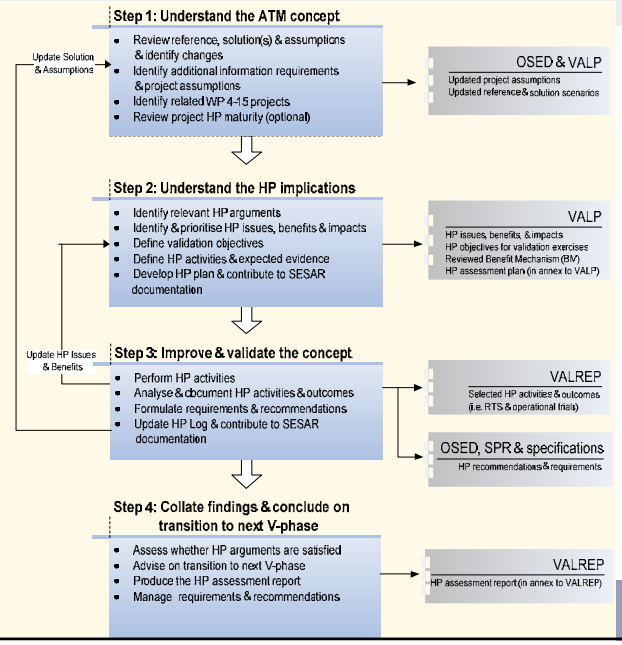
Aspects to be addressed in the extended ATM picture

- Diverse ATM environments
- Shared artefacts and suitable level of automation between air/ground
- Teamwork, communication and cooperation between air/ground functional teams with changed roles and responsibilties
- Qualification and training for future ATM demands
- Social and transition issues: to facilitate end-user acceptance
- Worldwide consistency of procedures and interoperability

Need for a Human Factors Design Process
Shared within ATM Community

→SESAR Human Performance Assessment Process
(Integrated in the SESAR System Engineering Process)

SESAR Human Performance Assessment Process → HP Case



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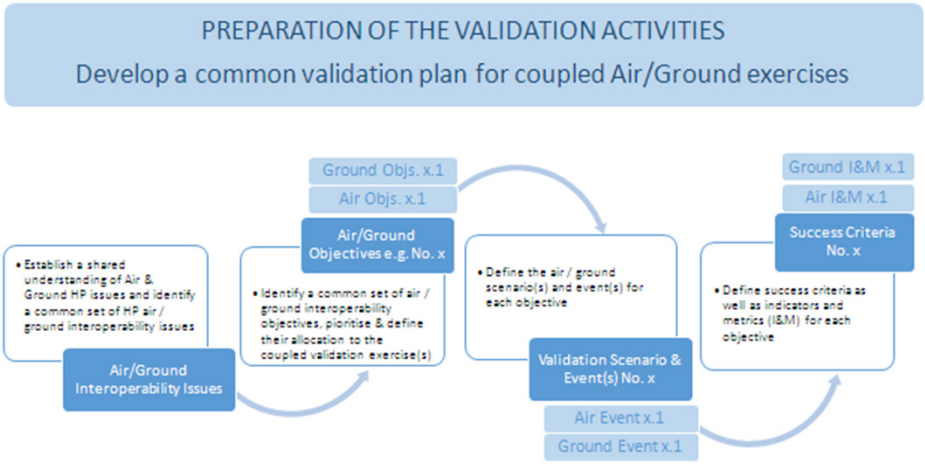
Example: Air/Ground validation of concepts from HP perspective (SESAR HP)



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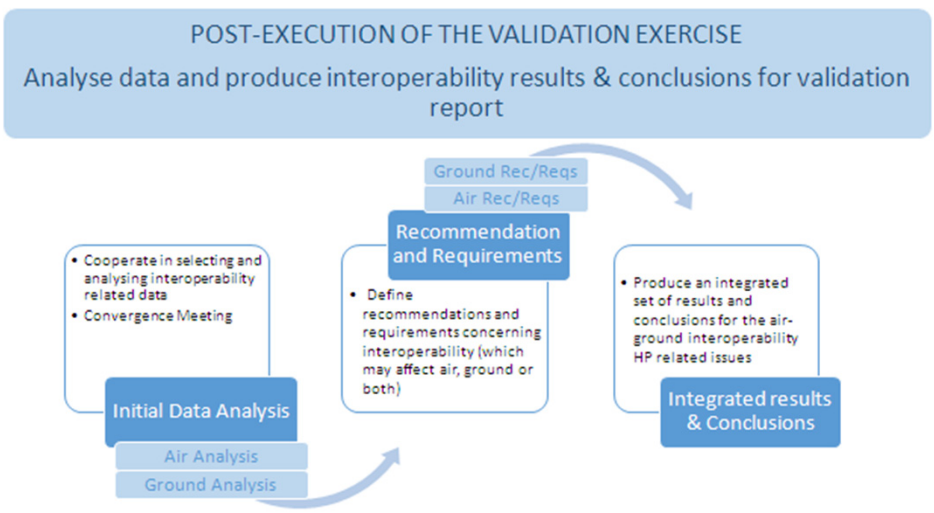

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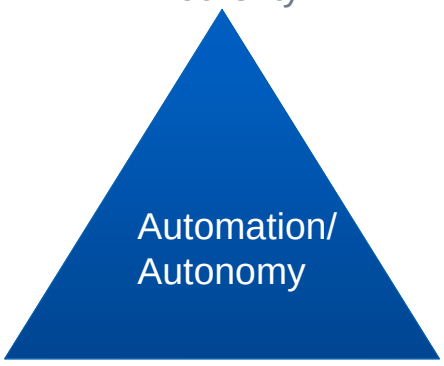
Airbus understanding of automation

Being able to influence the course of events

Authority



Responsibility

a duty or obligation to satisfactory perform or complete a task assigned to a specific role

Accountability

obligation to answer for an action, i.e. to justify actions or decisions

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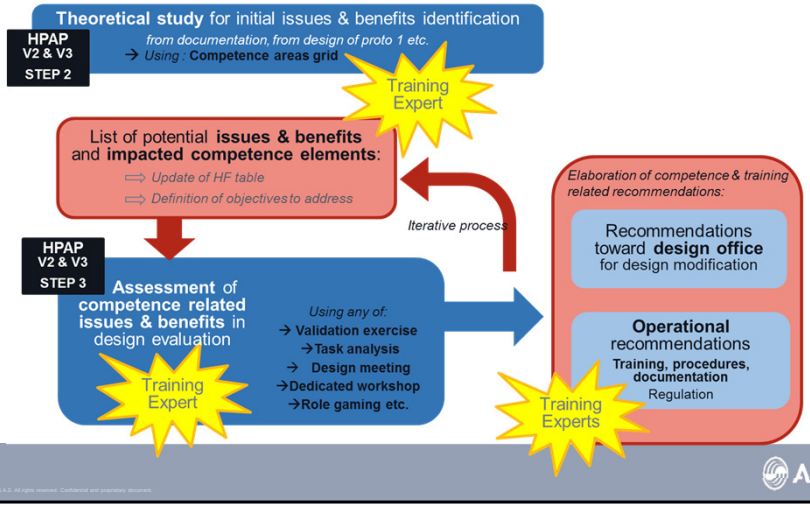
Example: Competence Impact Management (SESAR HP)

- Systematic collaboration with Training department
- Early identification and management of competences along the recently internationally agreed Key Competence Areas



Conclusion?

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