Human Error and Safety Risk Analysis

HESRA

A Proactive Tool for Assessing the Risk of Human Error
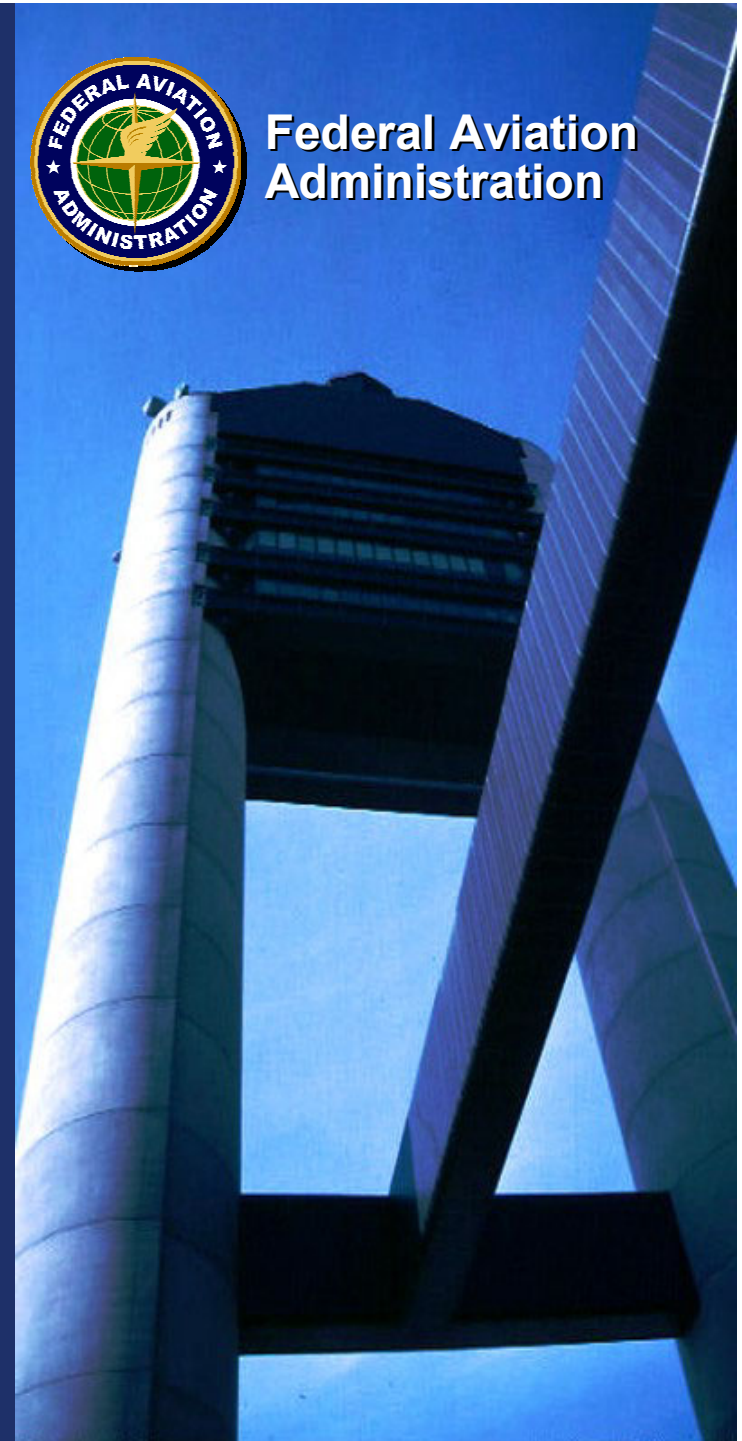
Federal Aviation Administration

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Basis for HESRA

- Need for error reduction tool in FAA
- Market survey conducted to provide alternative concepts
- Shortfall in "prospective" human error analysis capability
- HESRA:
  - Based on engineering model (FMEA)
  - Looking at human errors rather than component failures
  - Based on tasks rather than component functions
  - Three scales for each potential error mode:
    1. Likelihood of occurrence
    2. Severity of outcome
    3. Likelihood of detection/mitigation
  - Scales use nominal anchors
  - Goal is to produce ordered list of errors/outcomes

Objectives of Adapting HESRA to the FAA

- Provide tools to support the FAA Safety Management System (SMS)

- Support Safety Risk Management (SRM) component of SMS

  1. Hazard identification

  2. Safety risk assessments

  3. Hazard tracking and risk mitigation

- Provide FAA with a method to evaluate system design and to predict proactively the elements of design that negatively impact human performance and safety

- Enable FAA to field better and safer systems that will protect passenger and crew safety, and improve the ability of maintainers to successfully perform the job

HESRA Attributes

- Identifies the relative likelihood of particular errors

- Does not depend on past history, but can use this information

- Relies on relative, ordinal scaling

- Rank orders error modes

- Identifies critical single component failures

- Can utilize detection/mitigation (or not: similar to FMEA)

- Produces a task breakdown as a byproduct

Major Components of HESRA

- Starts with procedural and task breakdown
- Relies on analysts to identify possible error modes
- For each error mode, analysts assign ratings for:
    - Likelihood of occurrence
    - Severity of outcome
    - Likelihood of detection/mitigation
- Rating scales are 1-5, with 1=good, 5=bad
- Ratings are multiplied to yield
    - Hazard Index (HI) = Likelihood X Severity
    - Risk Priority Number (RPN) = Likelihood X Severity X Detection
- Error modes are sorted by HI, RPN, or both

HESRA Results

- Categorize results, e.g.,
  - Slight
  - Moderate
  - Severe
  - Extreme

- Assign actions based on category, e.g.,
  - Slight - Accept risk in short term. Evaluate for further action when time and budget permit
  - Moderate – Evaluate mitigation controls for continued system development or controlled use
  - Severe – Implement mitigation controls for continued system development or limited use (e.g. backroom prototype)
  - Extreme - Do not continue development or deploy system until risk is reduced

- Commit resources where they will do the most good.

Steps in the HESRA Process
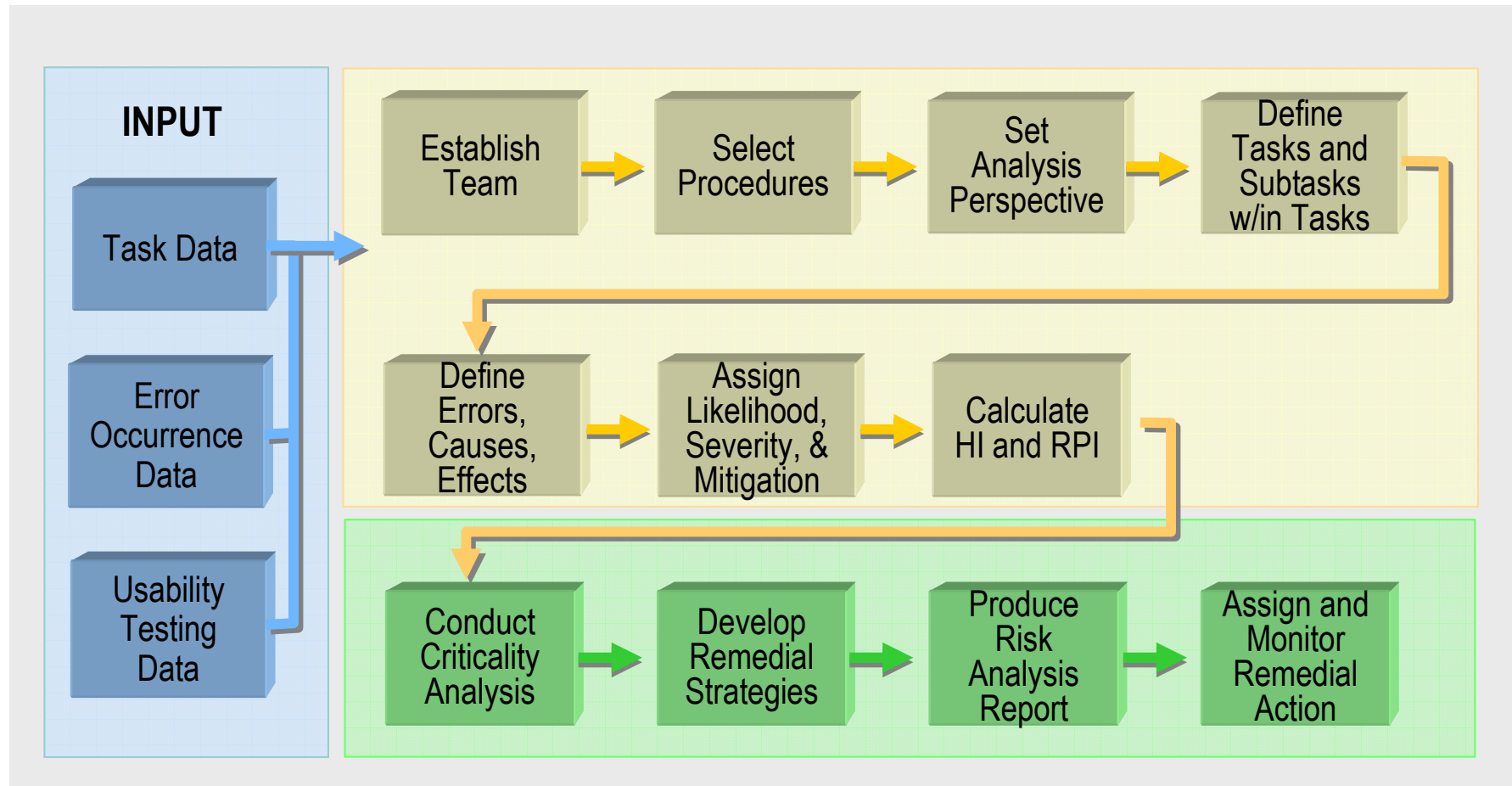
Current HESRA Development

Completed:

- Adaptation to FAA

- Small scale prototype application to maintenance environment (i.e., VSCS)

- Modification based on lessons learned (e.g., labor intensive, need in early acquisition phase)

On-going Activities:

- Define prioritization method for procedure screening

- Modify HESRA to include prioritization process

- Incorporate advantages of Eurocontrol human error risk assessment methods

- Complete application to VSCS

  - ➢ Develop mitigation strategies

 - ➢ Re-evaluate risk with various mitigation strategies

Future HESRA Development

Planned Activities:

- Apply HESRA to developmental system
  - ➢ Identify developmental system (e.g., wake vortex alerting system)
  - ➢ Work in ATC operational environment
  - ➢ Work at concept level vs. procedural task level
  - ➢ Work within FAA's Safety Management System
- Modify HESRA based on experience with developmental system
- Revise and deliver HESRA training program
- Conduct Validation
  - Apply same procedures, different people
  - Apply to different system(s) and procedures
  - Conduct risk/error tracking and comparison
- Populate error data base
  - Connect to error reporting system
  - Capitalize on safety culture development

The World without Human Factors
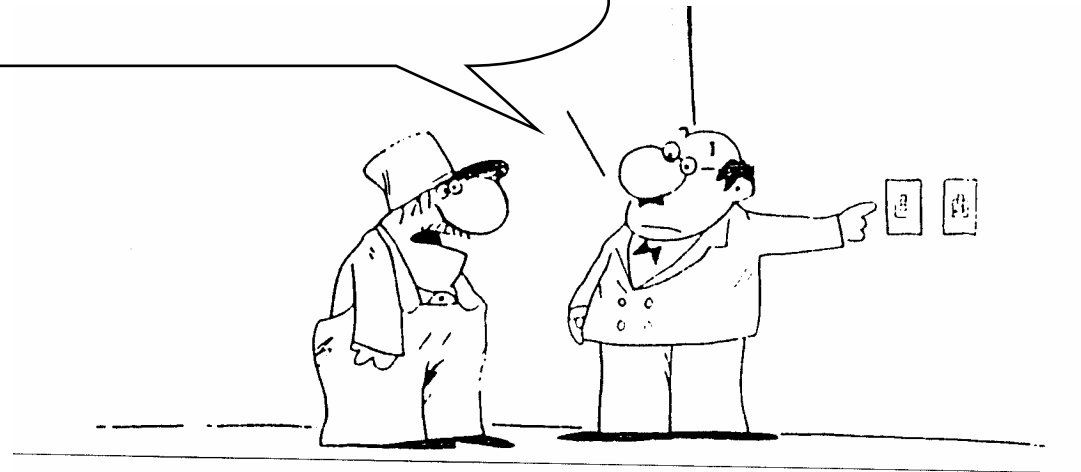
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