NASA
National Aeronautics and
Space Administration

# ON-ORBIT PERFORMANCE RISKS
# SPACE STATION ADVISORY COMMITTEE

## SAFETY AND PRODUCT ASSURANCE OFFICE

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# On-Orbit Performance Risks

- **Space station guiding principles**
  - Mission success is number one
  - Quality is planned in, designed in, and built-in -- not inspected in
  - Keep it simple
  - Minimize organizational and hardware interfaces, and maximize clear hardware and software accountability
  - Maximize margins
  - Maximize redundancy, but manage it
  - Automation, robotics, and AI capability not built in will be accommodated by hooks and scars
  - Space station is not an end-product but a key element of NASA and our nation's future
  - The international elements are vital to space station success

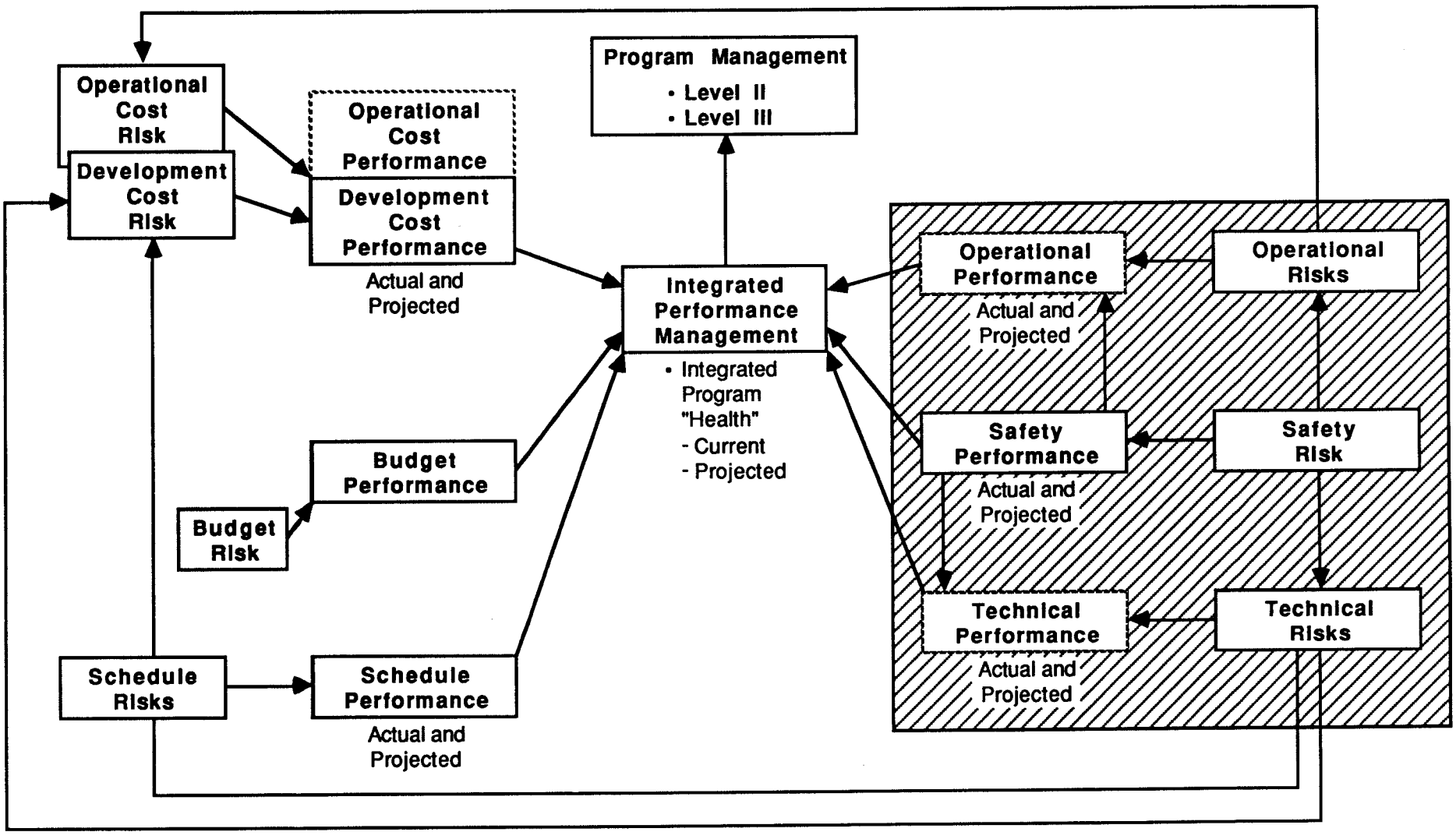
# On-Orbit Performance Risks (Cont"d)

- **Space station guiding principles (cont'd)**
  - Space station Levels I and II manage the program; Level III and prime contractors design, develop, and fabricate the space station
  - Space station requirements are:
    - -- Developed and managed by Levels I and II
    - -- Satisfied and verified by Level III
  - Authority will be delegated to the lowest level practical and commensurate with the demonstrated real accountability
  - Life-cycle cost will always be a key decision driver starting with development cost
  - The TMIS will be the key management tool -- the sooner the better
  - Every person in the space station organization must think and perform as a systems engineer or manager

# On-Orbit Performance Risks
# What Is Program Risk?

- **Likelihood that a program performance goal/allocation will not be met and the resultant consequences**
- **Program performance categorized into five areas**
  - Safety
  - Technical
  - Operational
  - Cost
  - Schedule
- **Program performance areas are inter-related**
- **Safety and Product Assurance Office is primarily interested in safety, technical, and operational risks**

# On-Orbit Performance Risks
# Integrated Program/Risk Architecture

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# On-Orbit Performance Risks

- **Safety, technical, operational risks defined**
  - Functional risks
  - Anything that compromises
    - -- Safety
    - -- Mission success
      - Housekeeping
      - User support

# On-Orbit Performance Risks

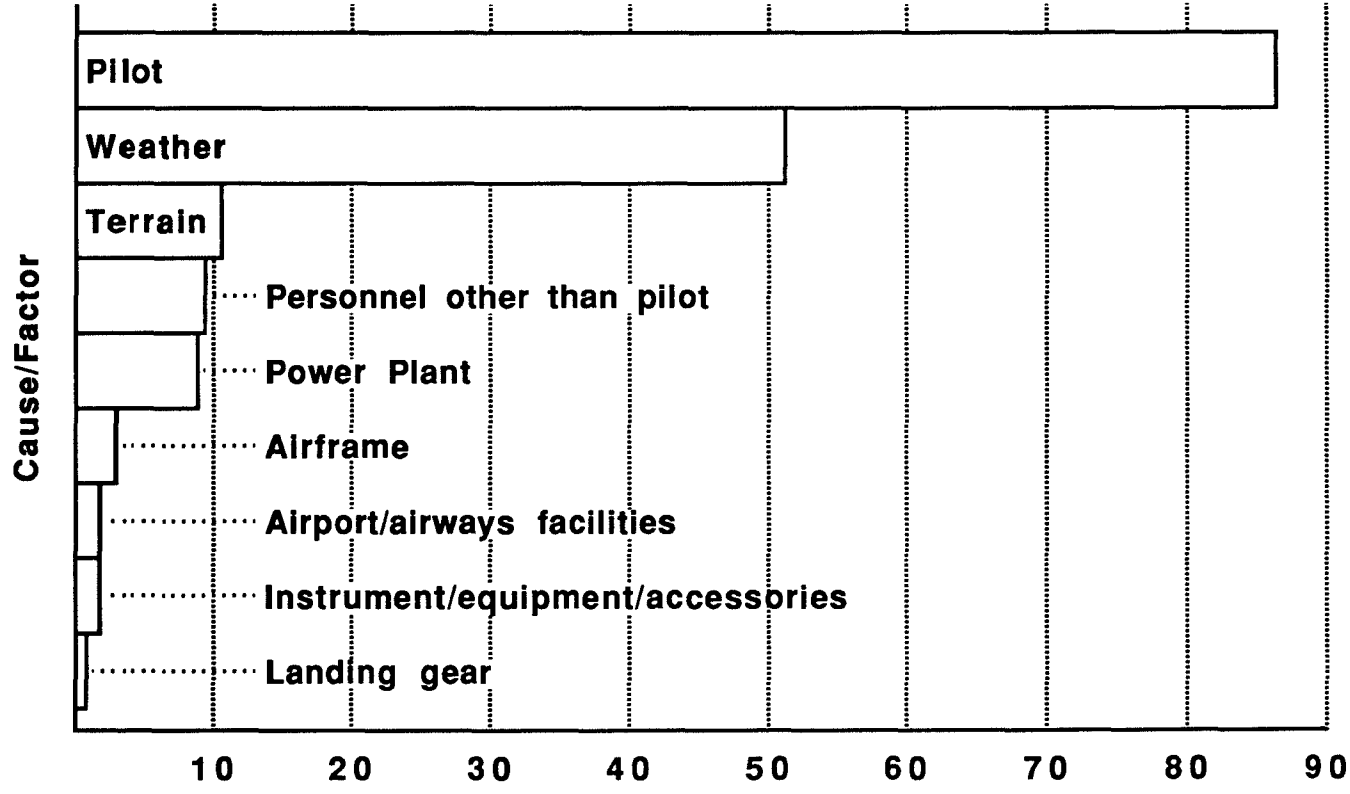
- **Risk contributors**
  - Man - less than perfect
  - Hardware/software reliability - less than perfect
  - Lack of functional redundancy
- **Risk drivers**
  - Cost (inadequate funding)
  - Unrealistic schedule requirements
  - Human error (inadequate training/certification/retraining)

# On-Orbit Performance Risks

- **Managing risk**
  - Design solutions
  - Procedural solutions
  - Combination of above
- **Order of precedence in managing/mitigating risks**
  - 1) Design
  - 2) Combination Design/Procedural
  - 3) Procedural

# On-Orbit Performance Risks

**FAA analysis of leading causes or related factors in fatal aircraft accidents – 1978 (totals here add up to more than 100% because more than one cause or factor may be cited per accident)**



# On-Orbit Performance Risks

- **Northwest Airline Flight 255 accident -- Detroit, 1988**
  - Cause -- flaps not extended for takeoff
  - Preflight checklist not performed in accordance with procedures
  - Automatic takeoff warning system was inoperative
    - -- Could not determine cause due to damage

# On-Orbit Performance Risks

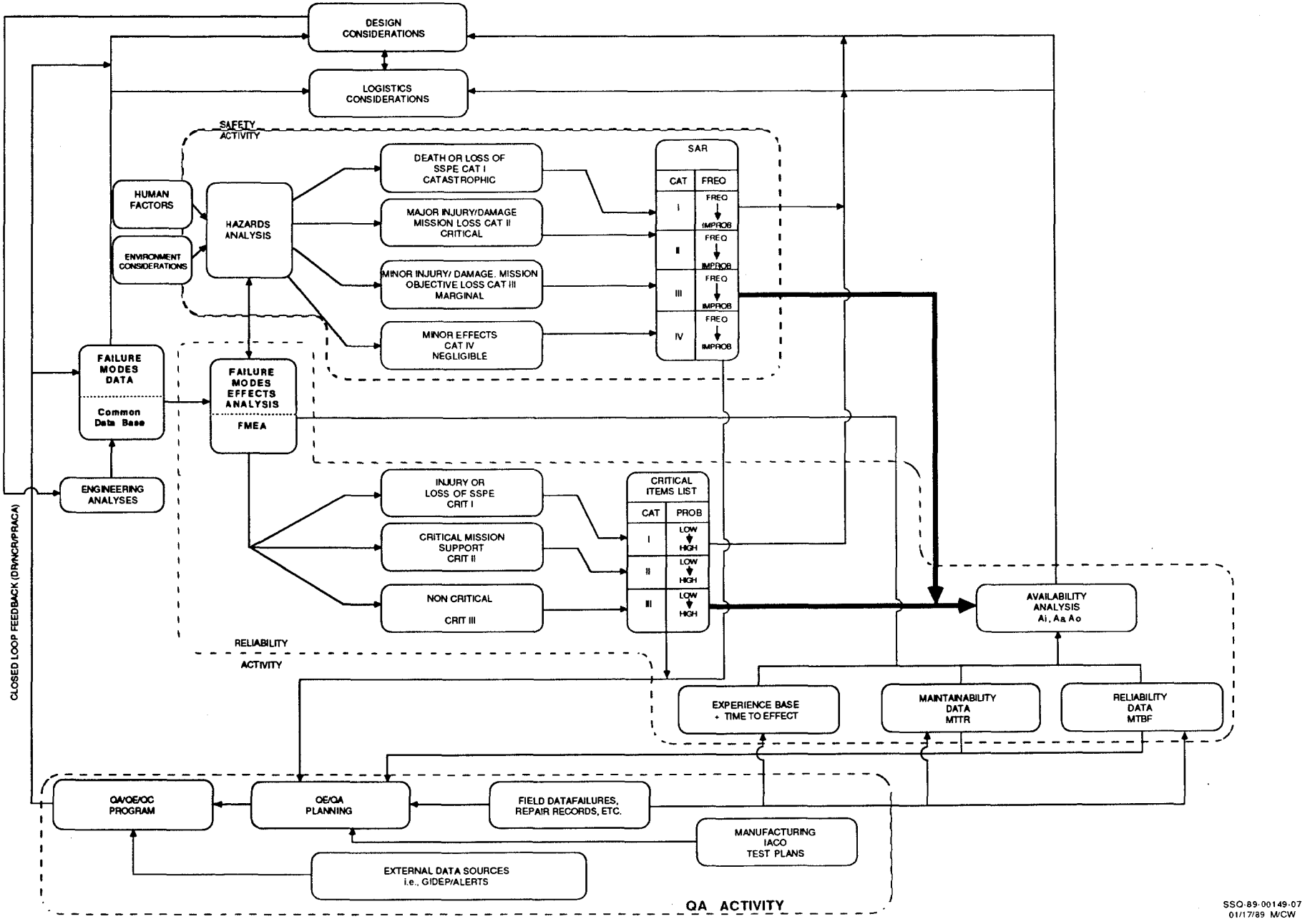
- **Risk mitigation examples in SSF Program**
  - Assembly - procedural/design
  - Crew rescue - procedural (NSTS L.O.N.)
  - Safe haven - procedural/design (provisioning)
  - Emergency egress - procedural/design

# On-Orbit Performance Risks

- **Risk management philosophy**
  - Design done by man is imperfect
  - Roadmap is needed to guide design towards minimum risk

# On-Orbit Performance Risks

## SPACE STATION FREEDOM SRM&QA ORGANIZATIONAL & DATA INTERACTIONS AS CURRENTLY DEFINED

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# On-Orbit Performance Risks

- **Goal**

**Preclude risks by design**