

NASA

Office of
Aeronautics and
Space
Technology

EVA/MANNED SYSTEMS

A Presentation to the

Technology for Space Station Evolution:
A Workshop

James P. Jenkins, Ph.D.

JANUARY 16, 1990

N 93 - 27789

53-57
1103617
P-10

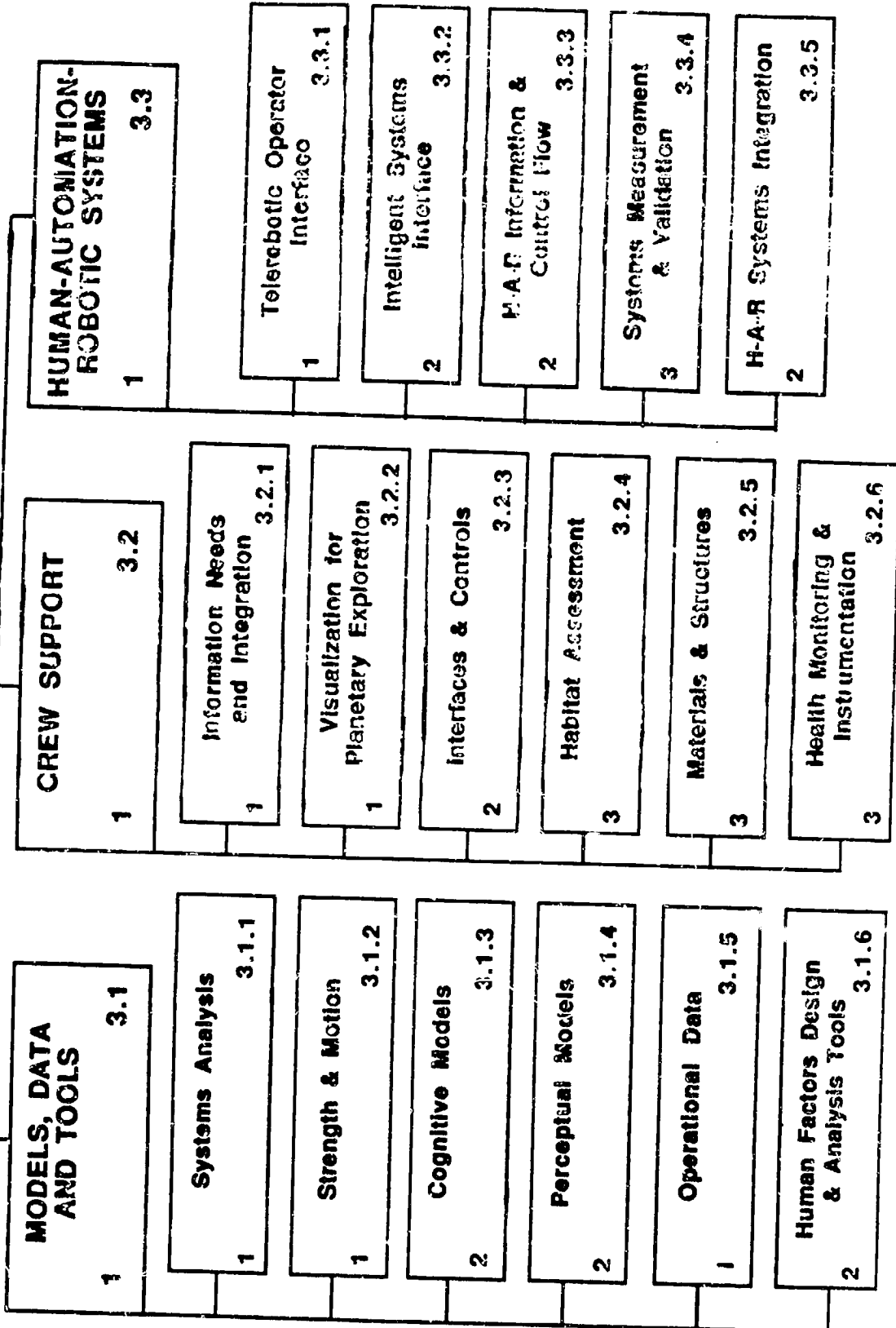
HUMAN FACTORS R&T (SPACE)

CRST

CREWSTATION DESIGN

- **Development of human-computer interface technology and graphical presentations, including multi-dimensional visual and aural displays**
- **Provide a technology base for autonomous vision and other perceptual systems, virtual workstation technology, and computational vision systems**
- **Develop databases and models of human strength, motion and body positions in micro-gravity environments**

SPACE HUMAN FACTORS PROJECT



CREWSTATION DESIGN

OAST

R&T SCOPE

Methods and tools for design, validation and use of human-system interfaces

PAYOFF

Safe, efficient and productive performance by astronauts in the space environment; orders of magnitude cost reduction in space systems through use of these methods and tools for design, validations, operational employment and training.

BENEFITS

Improved methods and interface design tools in support of Station and Shuttle
Database of human strength, motion and decisionmaking performance
Methods for conducting safe, productive work

TECHNICAL CHALLENGE

- Model human capabilities, such as strength, motion and cognitive tasks
- Translate available knowledge and experience about human performance into methods and tools for design of human-system interfaces
- Provide valid human performance prediction and assessment methods

CREWSTATION DESIGN

OAST

FUNDING: DETERMINED BY IMMEDIATE DECISIONS ON FY90 AND FY91 FOR BASE R&T AND EXPLORATION BUDGETS

FY 1991 Zero--gravity database for human motion
FY 1992 Advanced display media developed
FY 1993 Test of human strength prediction model
FY 1994 Expert system architecture and interfaces for SSF applications
FY 1995 Advanced information displays for Shuttle and Shuttle/Station maneuvers

AGENCY THRUST: Primary - Space Station
Secondary - Transportation

CENTERS: JSC, ARC

R&T HUMAN

FACTORS: EVA TECHNOLOGY

OAST

RC24

R & T SCOPE

EVA suit systems (i.e. suit, Portable Life Support System, helmet, gloves, mobility aids, displays and controls) for Station and exploration missions

PAYOFF

Enabling technology for all aspects of Station and Exploration Programs
Order of magnitude increase in EVA system capability

BENEFITS

Enables extensive construction/assembly in space environment
No pre-breathe, increased dexterity and mobility to increase productive EVA time
Reliability increased to match mission requirements; on-site maintainability

TECHNICAL CHALLENGE

- Protection while meeting mission requirements (no pre-breathe, maximum mobility radiation, debris and dust protection, weight reduction) and biomedical needs
- Serviceability and reliability
- Flexibility in design (single design base with multiple mission adaptations)

EVA TECHNOLOGY

OAST

**FUNDING: DETERMINED BY IMMEDIATE DECISIONS ON FY90 AND
FY91 FOR BASE R&T AND EXPLORATION BUDGETS**

FY 1992/93 Dexterous glove developed
FY 1994 Completion of suit display and information management design
FY 1995 Flight test of advanced PLSS components
FY 1998 Advanced Suit flight test

**AGENCY THRUST: Primary - Space Station
Secondary - Transportation**

CENTERS: JSC, ARC

EXTRAVEHICULAR ACTIVITY (EVA)

—OAS—

Development of technologies for:

- EVA suits
- end-effectors
- mobility concepts
- Portable Life Support Systems (PLSS)
- gloves
- information systems
- tools

for EVA activities and work for Space Station Freedom

EXTRAVEHICULAR ACTIVITY (EVA)

OASD

A PROPOSED STRATEGY FOR DEVELOPMENT OF NEXT GENERATION EVA SUIT/SYSTEM

- **Development of a consensus among NASA Offices and Centers that Shuttle EMU is a baseline**
- **Agreement that when technology or engineering deficiencies exist, a coordinated program will be followed by NASA Offices and Centers**
- **Recognition that technology development and engineering research proceeds from the evolutionary base**

EXTRAVEHICULAR ACTIVITY (EVA)

—OAS—

PROPOSED STRATEGY (continued)

- A set of analyses on EMU requirements for Orbiter and Station operations must be performed to identify baseline requirements (beyond what is known now)
- Technology and advanced development research proceed from these analyses, such that the technological or engineering deficiency is known
- A NASA Management Plan for EMU Technology and Advanced Development research will be developed and, after concurrence by NASA Offices and Centers, will be the roadmap for future research