SIMULATION FOR HUMAN FACTORS RESEARCH

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A CENTRAL QUESTION: FIDELITY

VERY RECENT TRENDS IN AERONAUTICAL SIMULATION

- For Training: lower fidelity
- For R D: greater fidelity (including full mission)

CRITERIA FOR TRAINING DEVICES:

TRAINING EFFECTIVENESS

- Usual Methods of Evaluation
  - Transfer of training (costly & rare!)
  - Judged effectiveness (generally fidelity - perhaps irrelevant)
- In Aviation, Little Empirical Support for Incremental Effectiveness of Hi VS Lo Fidelity (& Very High Cost)
- Increased Emphasis on Training System Effectiveness - Not Training Device Effectiveness
- Developing Strategy is to Concentrate on Low Cost Devices, & Improved "Instructors" & Curricula Using Advanced Instruction Notions

  (knowledge of results, adaptive systems, perceptual learning, S/R, & motivational principles, knowledge engr, ...)

CRITERIA FOR R&D DEVICES:

ABILITY TO GENERALIZE RESULTS

- Usual Methods of Evaluation
  - Engineering fidelity
  - Psychological fidelity
- In Aviation, Great Deal of Evidence Linking Fidelity to "Effectiveness"
- Problems
  - Engineering fidelity costly & sometimes extremely difficult to achieve.
  - Psychological fidelity is multidimensional (perceptual, cognitive, social, workload, ...)
  - Some necessary human measurement models don't exist.
  - Fidelity criteria typically are unknown, costly to determine (requires verification in flight, similar to transfer paradigms)

AVIATION R&D SIMULATION

- Resulting Trend is to Rely on Empirical Results (re-effectiveness) and Increasing Task & Mission Fidelity

FULL SYSTEM/FULL MISSION SIMULATION FOR HUMAN FACTORS RESEARCH

- In Aviation
  - Becoming increasingly indispensable tool for variety of human factors studies (operational problems, crew-system integration, ...)
- In Space
  - True full mission simulation very costly.
  - Fidelity of mockups should reflect a priori requirements for degree of confidence needed.
  - Full system (not mission), part system, & lower degrees of fidelity may be enough for many study areas.

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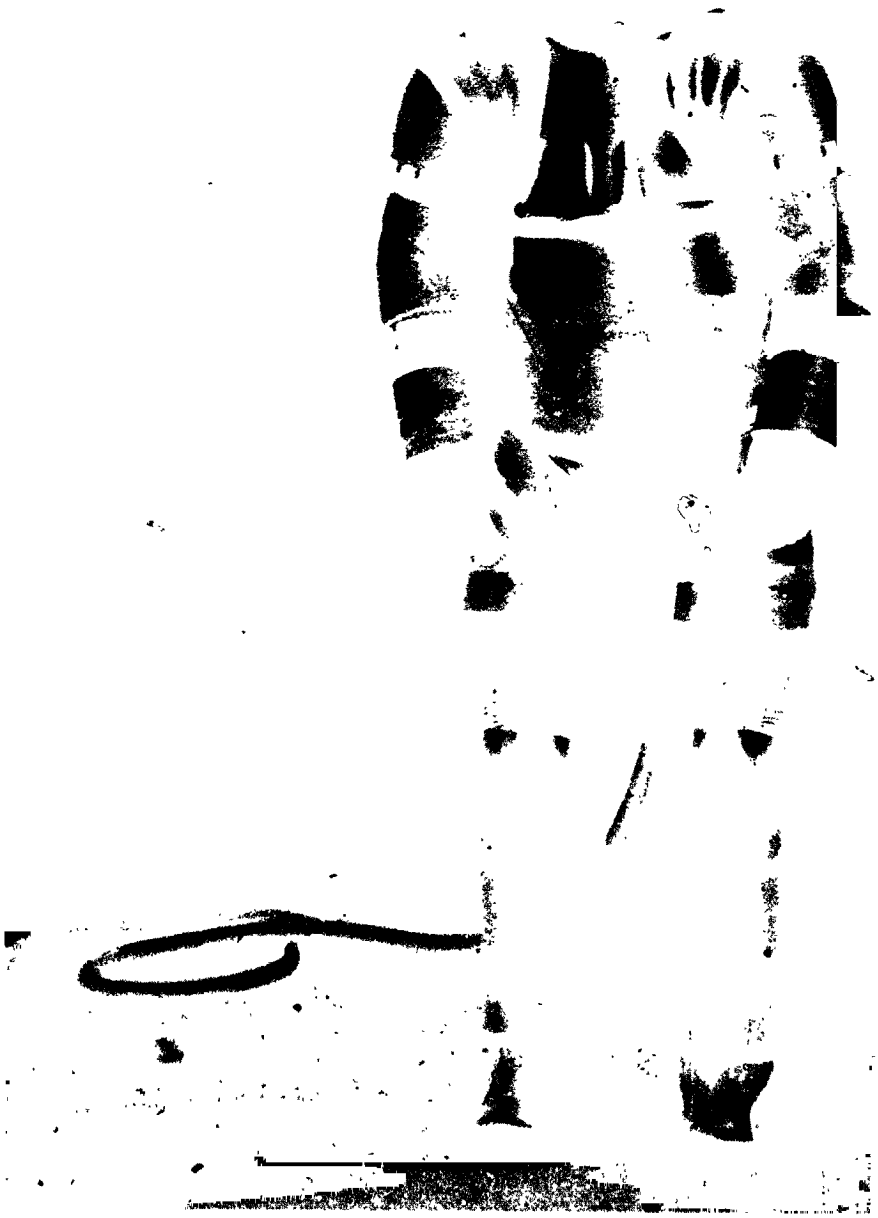
AX-5 DESIGN OBJECTIVES

- PERFORMANCE
  - 14.7 PSI PRESSURE
  - HIGH MOBILITY
  - LOW TORQUE JOINTS
  - LOW LEAKAGE (<50SCC/MIN)
  - COMFORT
  - EASE OF DONNING/DOFFING

- MECHANICAL DESIGN
  - ALL HARD STRUCTURES
  - MULTIPLE WALL W/MATERIALS OPTIONS
  - [redacted]
  - [redacted]
  - DRY LUBRICANTS
  - TOTAL MODULARITY
  - LOW MAINTENANCE/LONG LIFE JOINTS
  - HAZARD PROTECTION
    - RADIATION
    - DEBRIS
    - PROPELLANTS
    - THERMAL
    - SHARP CORNERS
  - MANUFACTURING REPEATABILITY

FIRST VARIATION ON AX-5 DESIGN



SECOND VARIATION ON AX-5 DESIGN