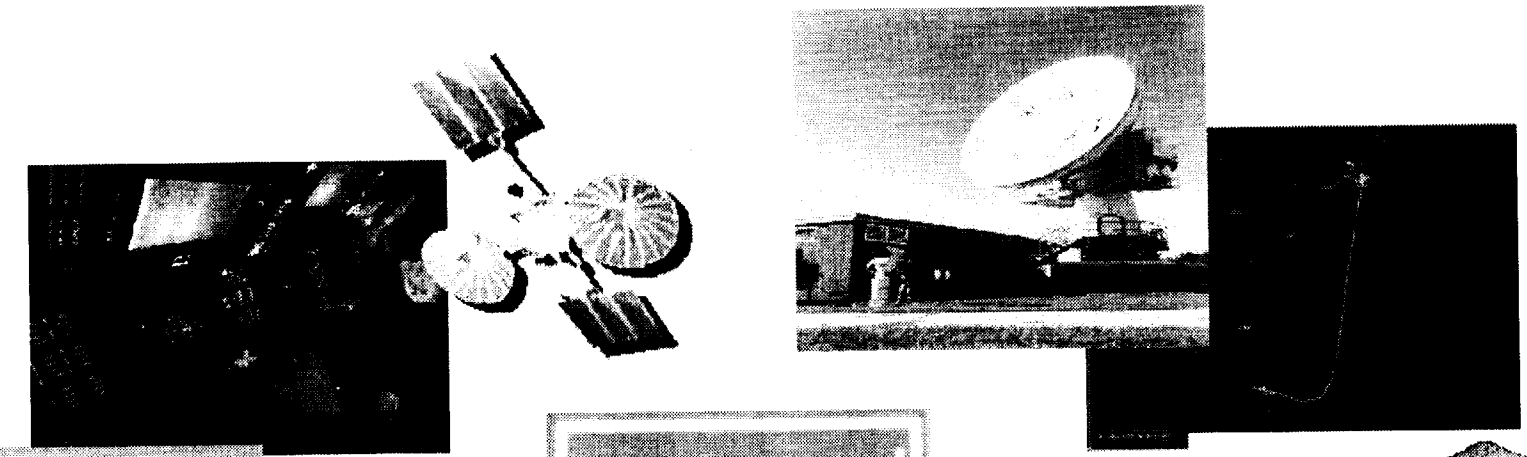
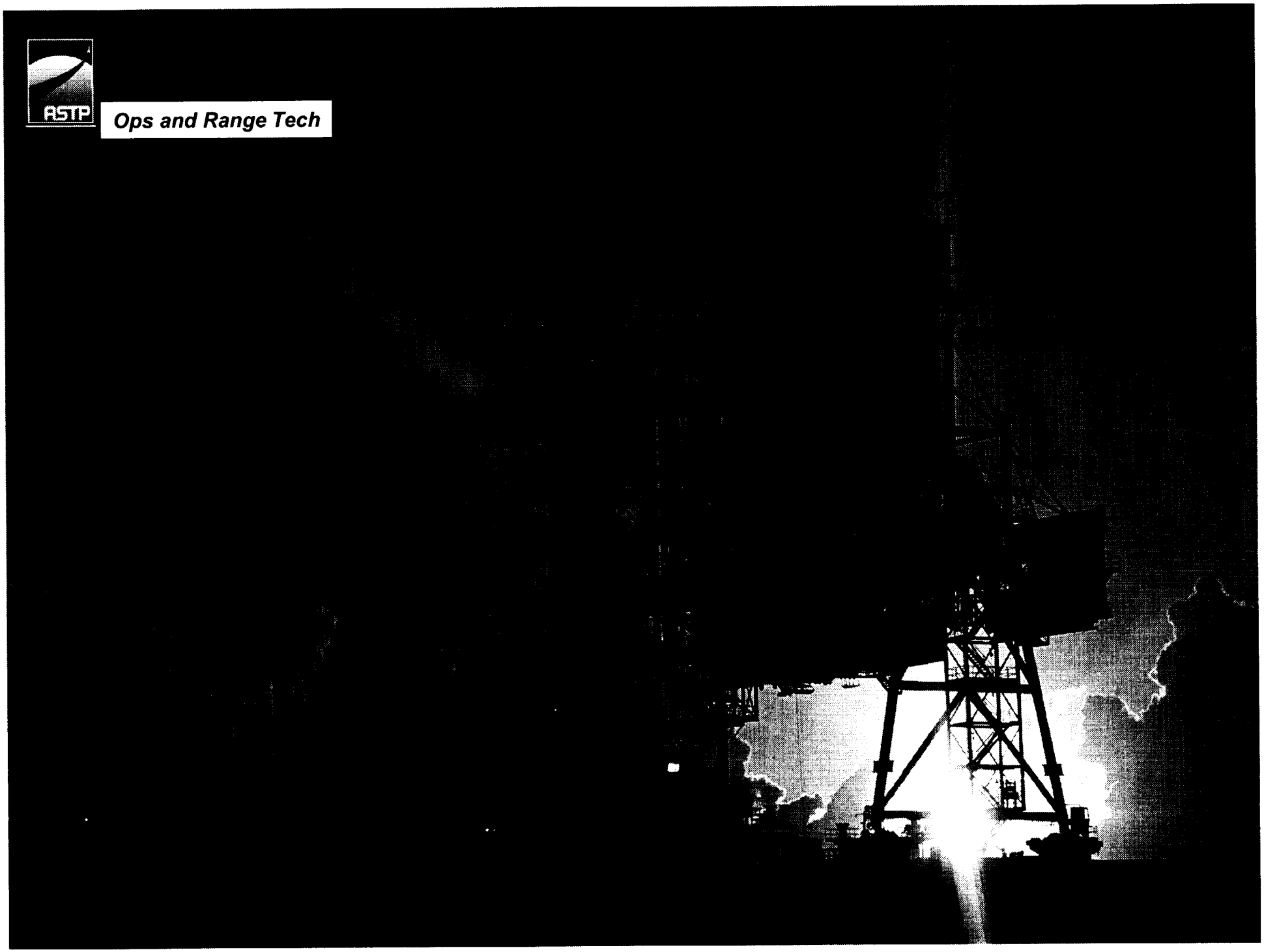


Operations and Range Technology Development

October 12, 2000

Dave Taylor - KSC


ASTP
Ops and Range Tech

Operations and Range Technology Development

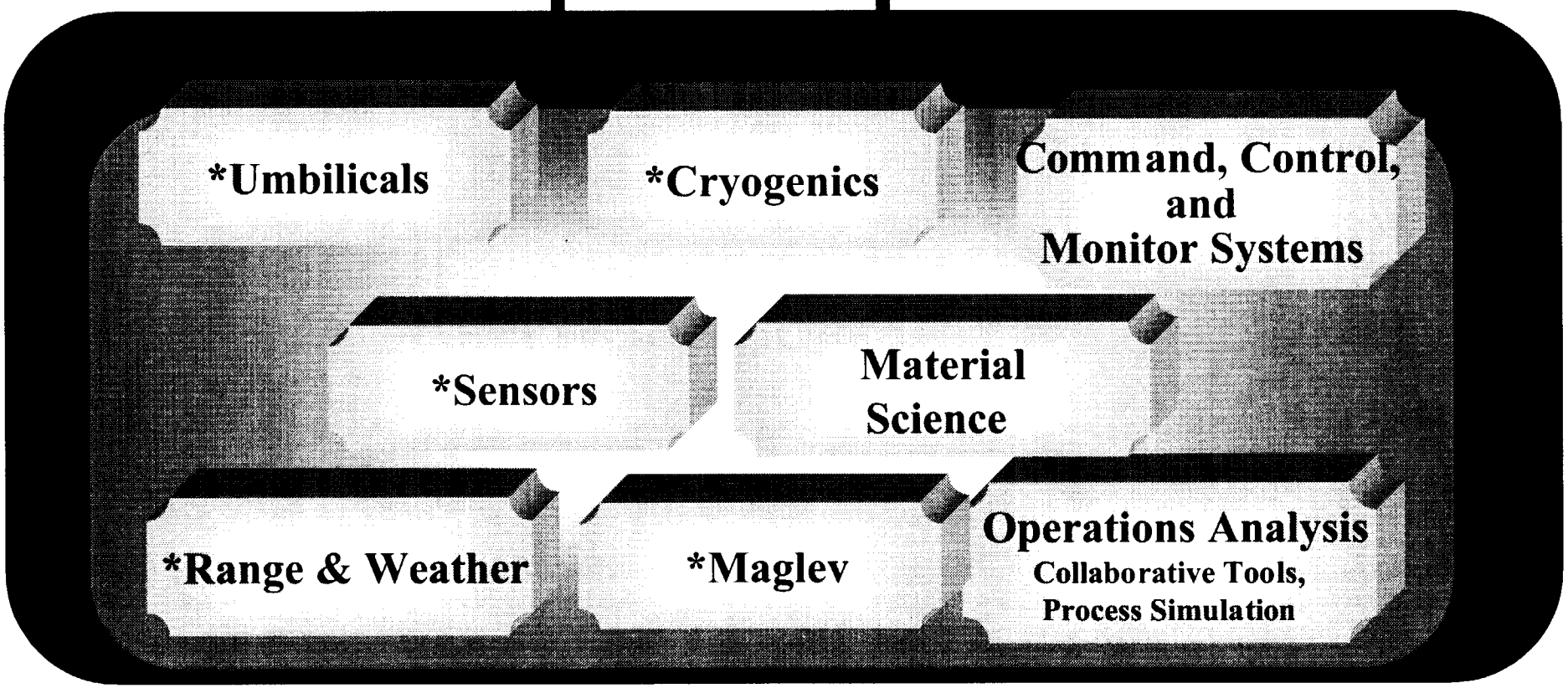
- **Operations and Range technologies are being developed by both the 3rd Generation RLV Program (ASTP) and the 2nd Generation RLV Program**
  - Space Transportation Architecture Studies (STAS) and the Integrated Space Transportation Plan (ISTP) defined requirements and prioritized technologies that needed further development to accomplish the goals of the 2nd and 3rd Gen. Programs.
  - Both the 2nd and 3rd Gen. operations technology development efforts are currently managed for the Programs by the Kennedy Space Center
    - KSC has been involved in a wide range of activities aimed at developing "spaceport" technologies

Spaceport Technology Areas

Ops and Range Tech

Current Customer Base

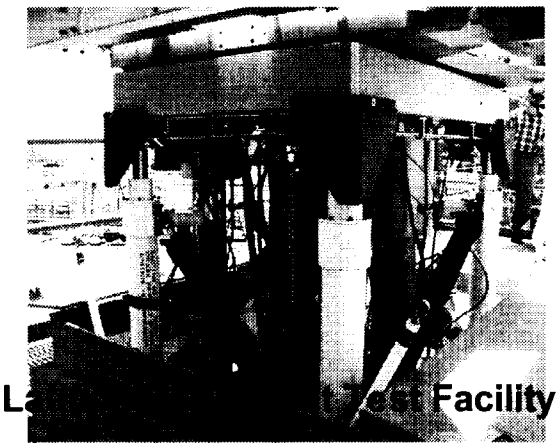
Shuttle	Expendable Launch Vehicles	Commercial Launch Industry	HEDS Exploration	Next Generation Launch Vehicles



* - Presentations Today

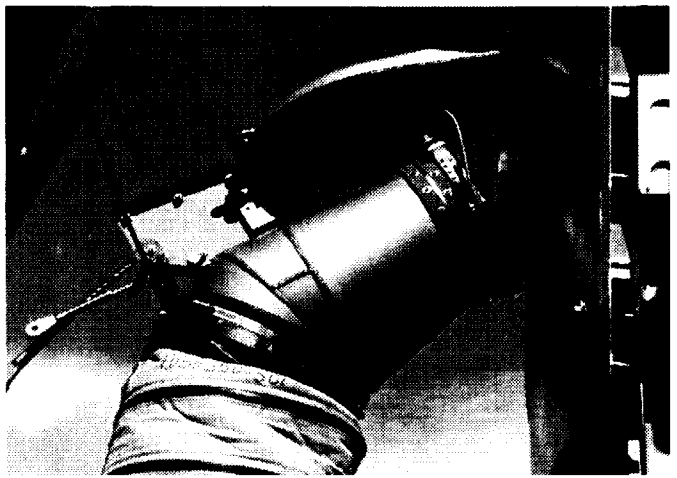
Umbilical Systems Development

Ops and Range Tech

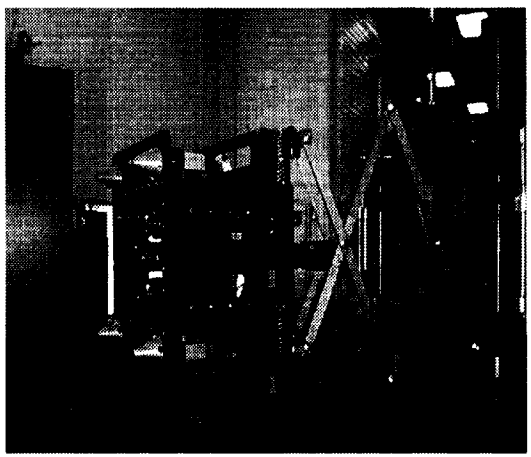


L[illegible]ject Facility

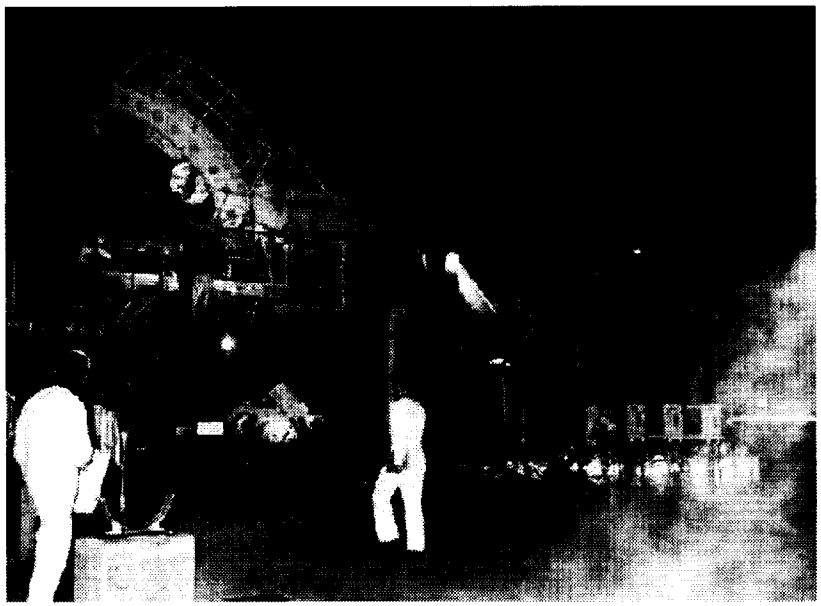
•Design & Test of X-33
Rise off Umbilicals
•*Partnership with Lockheed Martin*



•Delta IV EELV ECS Duct Design, Fab and testing
•*Partnership with Boeing*



•Fluid & Electrical Automated
Umbilical Mate & Checkout
•*SBIR Partnership*

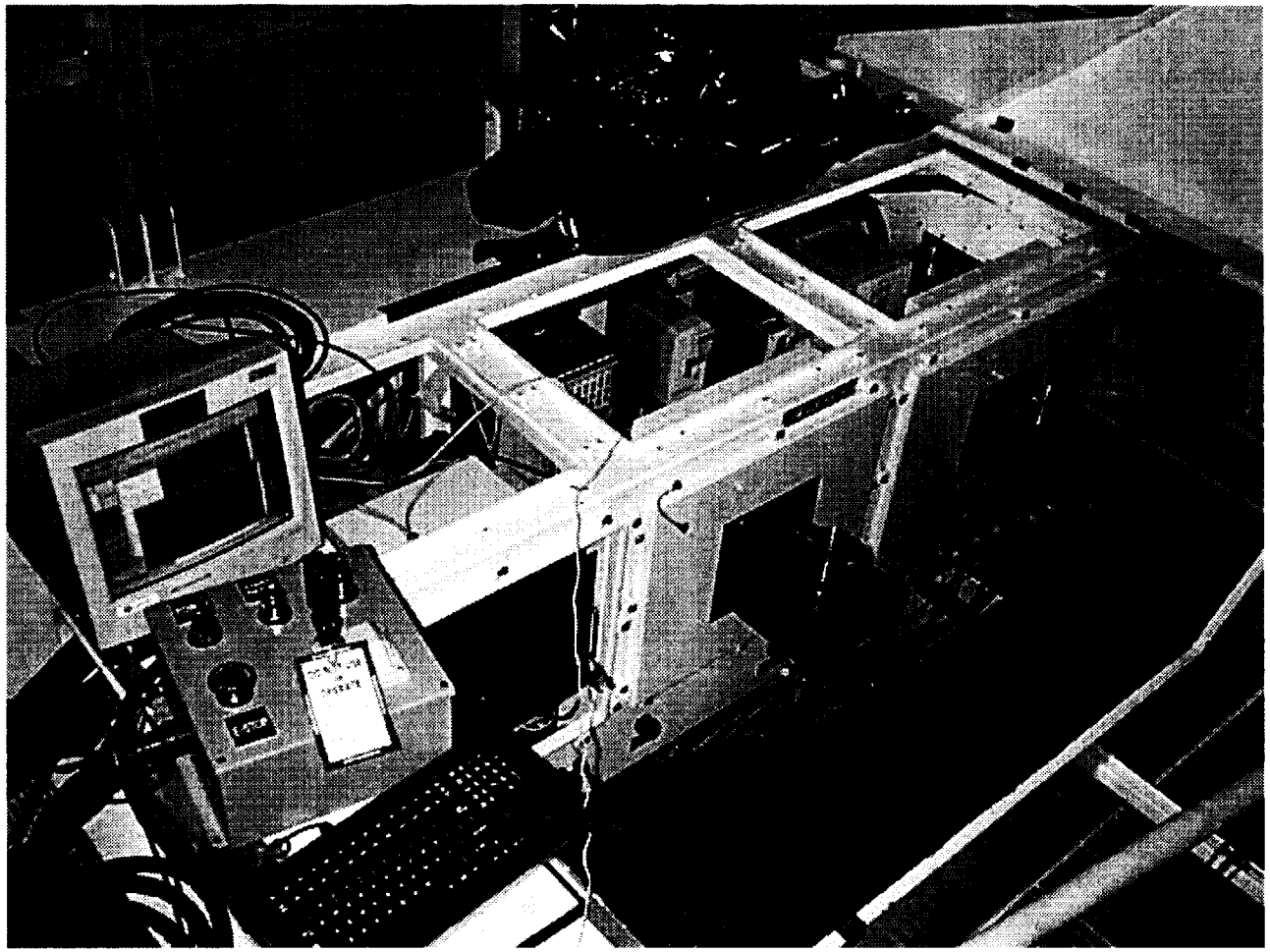


•Gox Vent/Composite Nose Cone testing setup to test the New composite nose cone for Shuttle

•*Partnership with KSC, MSFC, & Lockheed Martin Michoud*

Automated Payload Handling Systems

Ops and Range Tech



•Design and Development of an automated control System for the Payload Ground Handling Mechanism At LC-39

•*USA Patnership*

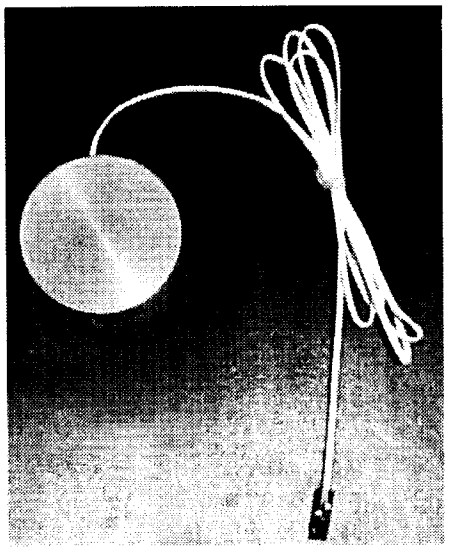
Command, Control & Monitor Systems

Ops and Range Tech

•HEDS Technology Demo - Shuttle Flight Experiment to demonstrate new instrumentation technologies (fiber optic, micro-electro mechanical sensor)

•Flight Experiment on STS-96

•Multi-Center, Industry & Academia Partnership: KSC, JSC, MSFC, LaRC, GRC, Boeing North American, USA, Sanders Division of Lockheed Martin, Rockwell Science Center, Oklahoma State University, University of Maryland, Dynacs Engineering Company



•Autonomous Micro-Temperature Recorder was part of the SpaceHab Oceaneering Space Systems Payload (SHOSS) used to characterize on-orbit temperature environment. Each unit can be programmed to "wake up" at a user defined time at which it begins sampling temperature.

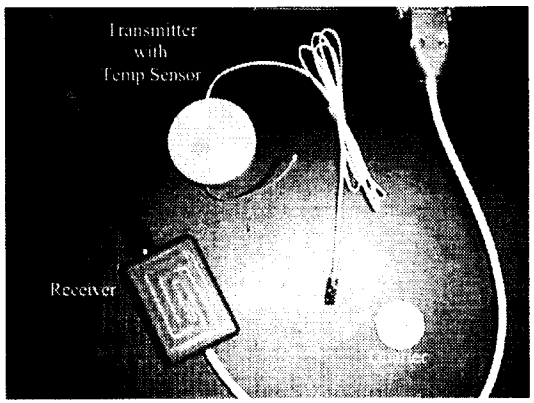
•Partnership with Invocon Inc., KSC and JSC

• Experiment flew on STS-101

•Partnership with Ivacon Inc., KSC and JSC

Command, Control & Monitor Systems

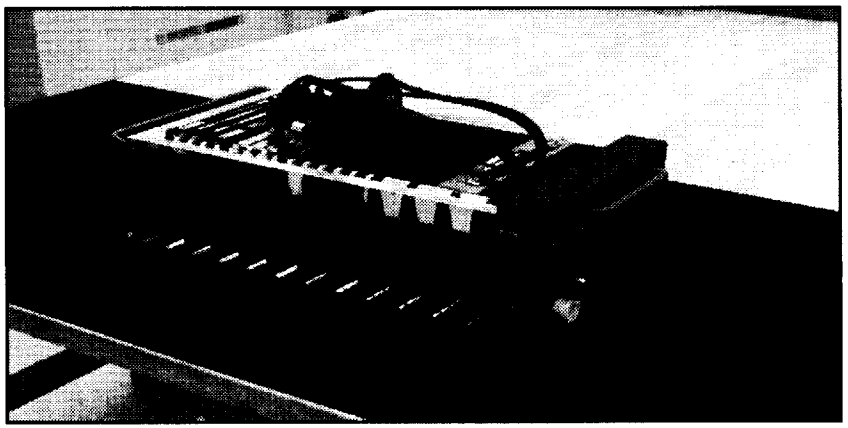
Ops and Range Tech

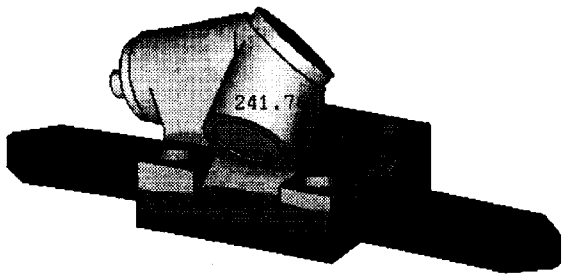


- Micro Wireless Instrumentation System is a small Battery operated temperature sensor system Comprised of transmitter and receiver units. The Transmitter units measure temperature at various Locations in the crew module and send data to Receiver via RF.

- **Experiment flew on STS-101**

- *Partnership with Ivocon, Inc., KSC and JSC*





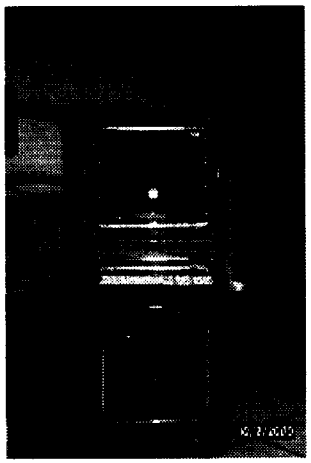
- Optical Plume Anomaly Detection OPAD - Shuttle Flight Experiment to demonstrate technology to monitor ultraviolet and visible light spectrum in rocket engine plume, detect metallic presence in the parts per billion range, and provide indication of hardware mass loss

- Partnership with *MSFC*

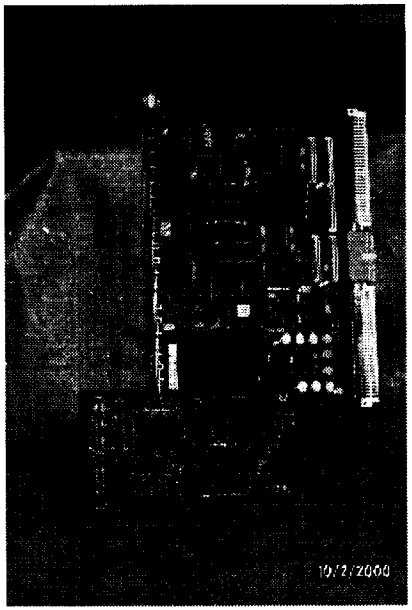
- **Scheduled to Fly on STS-113**

Command, Control & Monitor Systems

Ops and Range Tech



Portable Ground Station for Monitoring Experiment



Electronic Components For the Experiment

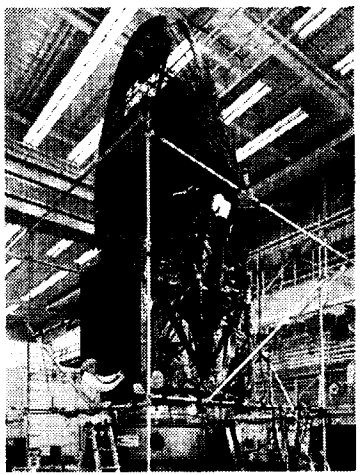
•NASA IVHM Technology Experiment - X-34 Flight experiment to demonstrate software techniques for modeling & monitoring main propulsion system, reaction control system, and fast track engine system

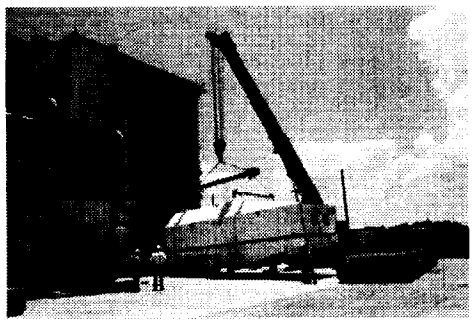
•*Partnership with ARC, GRC, and MSFC, Orbital Sciences Corporation*

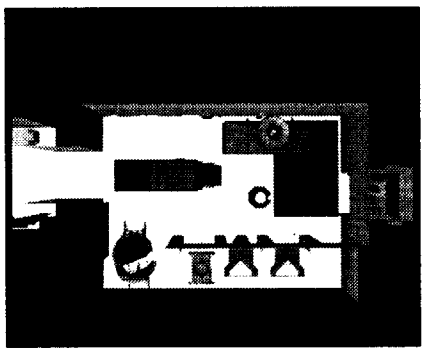
Intelligent Synthesis Environment

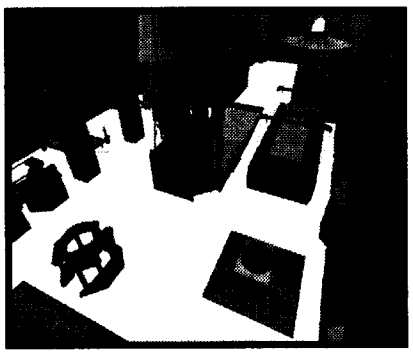
Ops and Range Tech

TDRSS Processing Simulation



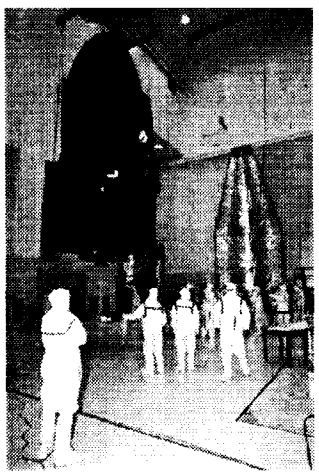


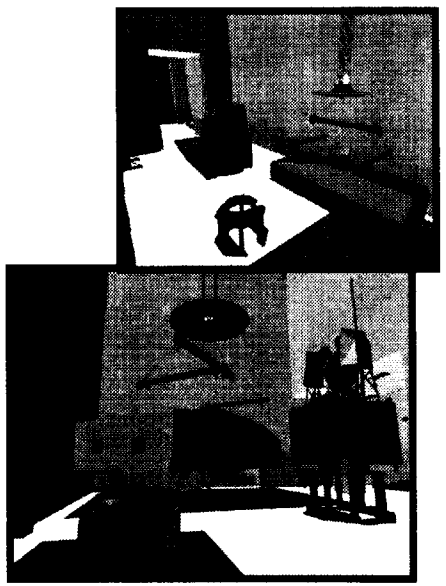




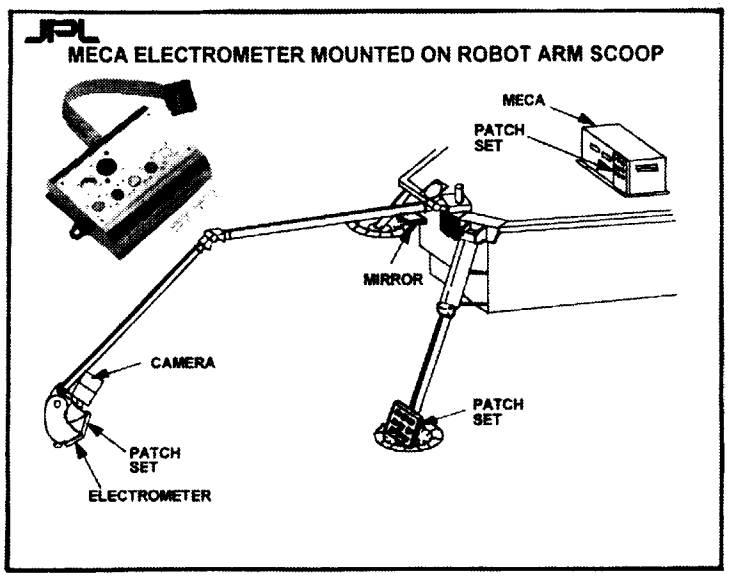
Future Plans

- Integrate engineering and operations analysis codes into this ISE tool.
- Finish modeling complete representation of ground processing environment
- Use tools to design and develop new launch and payload processing systems and to assess their operational approach



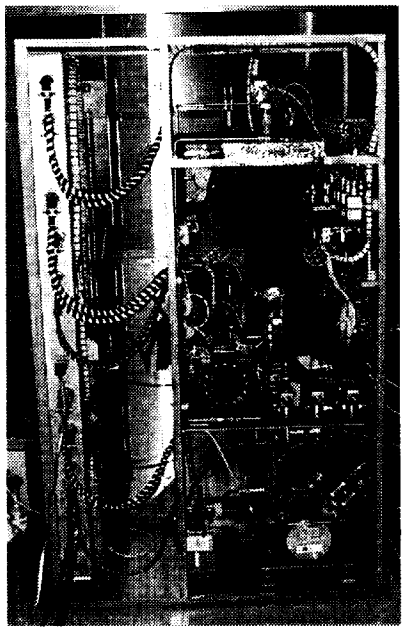


Low TRL Development

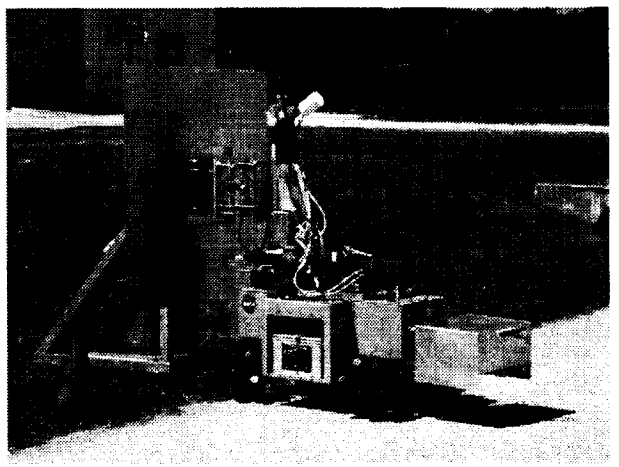


The ***Mars environmental compatibility assessment*** project's electrometer was jointly developed at JPL & KSC to facilitate the characterization of the electrostatic properties of different types of insulating materials that are likely to be used on future unmanned and manned explorations of Mars.

Reverse water Gas Shift - A cyclic process Technology for Oxygen Production



Mars Umbilical Technology Demonstrator Robotic Mate of Electrical Power



2nd Gen. Project Organization

- **The 2nd Generation RLV operations and range technology efforts include the following areas:**
  - Automated Umbilicals
  - Modular Payload Systems
  - Spaceport Range Technologies
  - Propellant production, handling, and storage
  - Standardized interfaces
  - Advanced checkout and control systems
  - Intelligent Instrumentation
  - Optimization and Analysis tools

ASTP Project Organization

- **ASTP (3rd Gen.) Ops and Range Technology Project is divided into four Elements:**
  - Range
    - Decision Models, Weather Instrumentation & systems, Ground-based Range systems, Space-based Range systems
  - Ground Ops
    - What are the systems issues driving ground-ops costs as we know then today? What new technologies could reduce ground ops costs?
  - Spaceport Ops
    - Based on an airport analogy, what would a spaceport of the future look like … what are the issues to get there?
  - Launch Assist
    - Maglev and others?