Human Systems & Robotics

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I'm no Gene Kranz

Robotics is Enabling the Architecture

Turning those Concepts into Reality
Lunokhod

- First Flight April 1970
- Lunokhod 1 & 2
- 840 Kg Mass
- 1 & 2 KPH
- 37 Km Life Range (L2)
Apollo Lunar Roving Vehicle (LRV)

- First Flight April 1971
- Apollo 15, 16 & 17
- 210 Kg Mass
- 1/6g Payload 490 Kg
- 15 KPH
- 100 Km Life Range
Apollo Lunar Roving Vehicle (LRV)
Robotic Perspective on NASA’s Exploration Architecture

Surface Mobility

Surface Handling

Human-Systems Interaction
LAT-2’s Architectural Options

- Option 1  Results from LAT-1
- Option 2  “Mini-Habs”
- Option 3  “Monolithic Hab”
- Option 4  “Mobile Lander”
Architecture Concept– Mobile Habitat

<20,000 Kg Payload
Integrated Power
Docking Together
1000+ Km Range
Architecture Concept—Small Pressurized Rover

Fast Out the Door
Radiation Protection
Hatch Docking
100+ Km Range
NASA’s Exploration Technology Development Program

Turning the Cartoons into Reality
The Exploration Systems Mission Directorate (ESMD) created this technology program in 2005.
- Exploration Technology Development Program (ETDP)
- ETDP Managed by ESMD Advanced Capabilities Division
- Program office located at NASA Langley Research Center (LaRC)
- Point of contact is Frank Peri (frank.peri-1nasa.gov)
- Dana Gould & Diane Hope are the Element Managers

Broad portfolio of projects, with engineering focus
- Propulsion, life support, power, human-robotics systems
- Focused on technology for exploration needs
  - Crew Launch Vehicle (CEV)
  - Launch Systems
  - Surface Systems

Driven by need dates and Technology Readiness Levels (TRL)
- Exploration systems have development milestones
- Technology is matured to be at TRL-6 by Preliminary Design Reviews (PDR’s)
HRS
Technology Description (ATHLETE)

- Leadership
  - NASA JPL
  - B. Wilcox

- Technologies
  - Wheel-on-limb Mobility
  - Mobility & manipulation
  - Active suspension
  - Payload offloading
  - Habitat docking
  - Hatch mating

- Collaborations
  - Stanford (Latome)
  - Michelin (Switzerland)
Leadership
- NASA JSC
- Ambrose, Bluethmann, Junkin

Technologies
- Novel chassis kinematics
- Active/Passive suspension
- Upright crew accommodations
- Chassis leveling
- Small Pressurized Rover Ops

Collaborations
- ETDP Advanced Suits
- ETDP Thermal Control
- ETDP ISRU
- ETDP Power
Leadership
- NASA GRC & CMU
- Whittaker, Caruso

Technologies
- Novel chassis kinematics
- Integrated drill
- Wheel spikes for drilling
- Dark navigation

Collaborations
- CMU
- NorCat
- ETDP ISRU
**HRS Technology Description (Centaur)**

- **Leadership**
  - NASA JSC
  - Ambrose, Diftler, Bluethmann

- **Technologies**
  - Autonomous Manipulation
  - Dexterity
  - Mobile Manipulation
  - Time Delayed Supervision
  - Astronaut Assistance
  - Surface Science

- **Collaborations**
  - UMass (Grupen)
  - MIT (Brooks)
  - Vanderbilt (Peters)
  - Many earlier grants
Surface Scenario Video (2 minute)
Crater Access Scenario Video (2 minute)
Plans for FY08

- **2008 Field Test**
  - ATHLETE, Chariot, Scarab, K-10’s, Crane
  - December Workshop
  - June Test

- **New Technologies for 2009**
  - Pressurized cabin mockup
  - New batteries & fuel cells
  - Chariot crew accommodations
  - 1/6g ATHLETE testing
  - New wheels
  - New drives
  - New supervision software
HRS Team
(7 NASA Centers and 10+ Companies)