



Mobile Space Robots Applications on Earth

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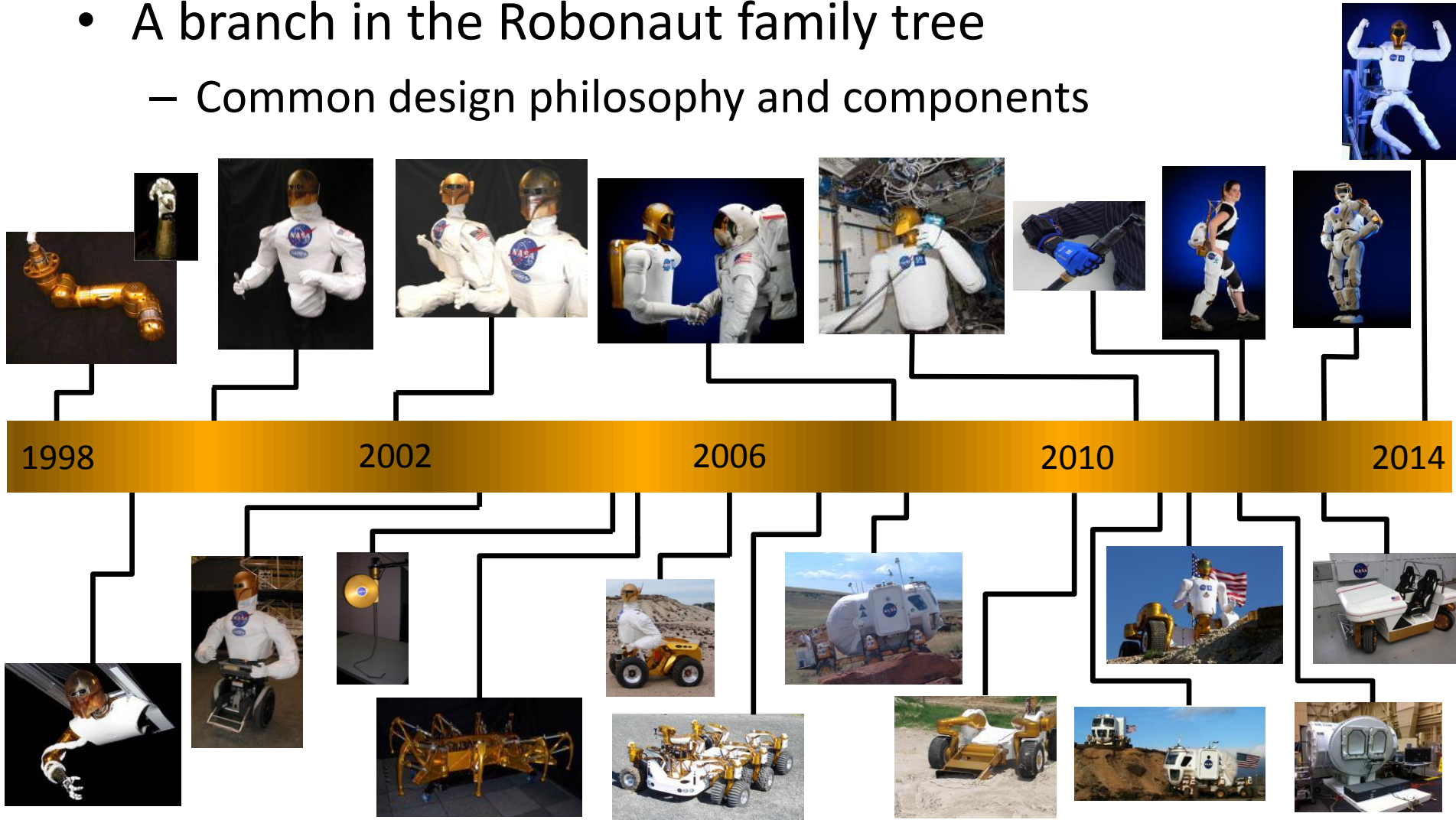
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Mobility: Introduction (videos)



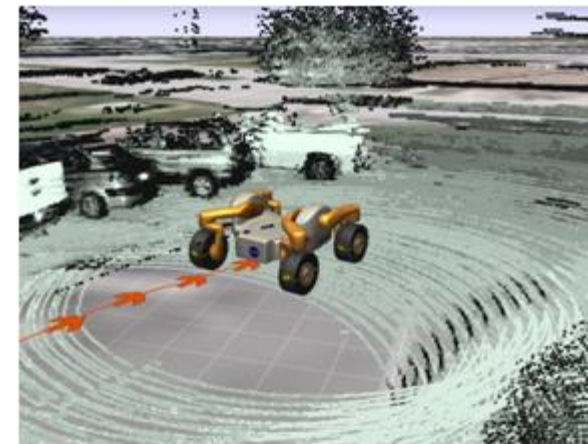
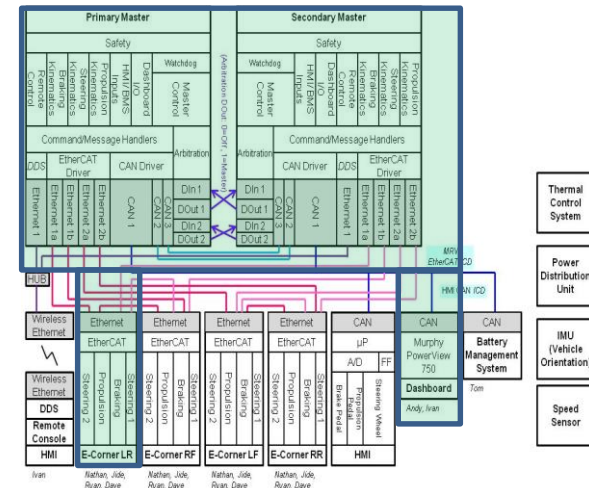
Mobility: Background

- A branch in the Robonaut family tree
 - Common design philosophy and components



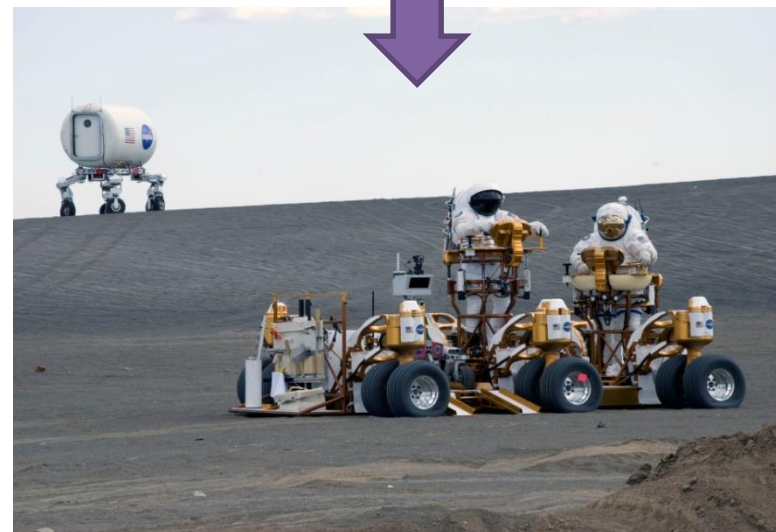
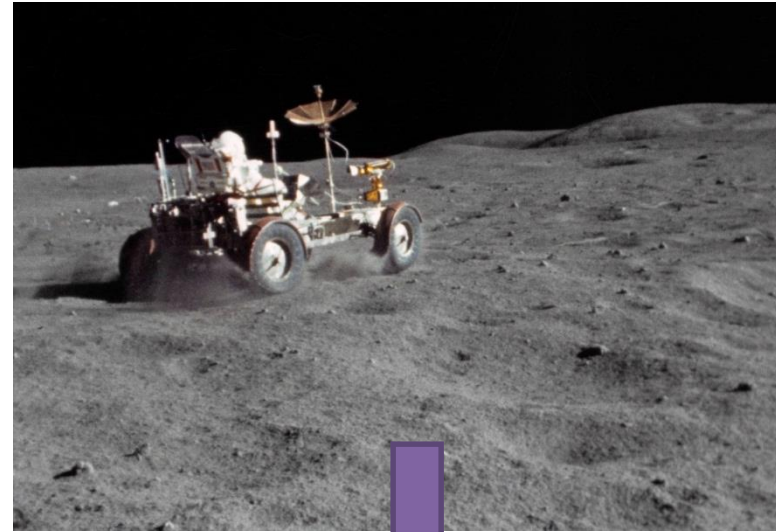
Mobility: Common Themes

- Safety is paramount
 - Getting crew home is top priority in space
 - Translates to earth
 - Functional redundancy
- Extreme dexterity
 - Independent wheel modules
 - Active suspension
 - Crab steering
- Re-use to cut development time and cost
- Multiple control modes
 - Ride-on
 - Teleoperated
 - Autonomous and shared control modes



Chariot Chassis

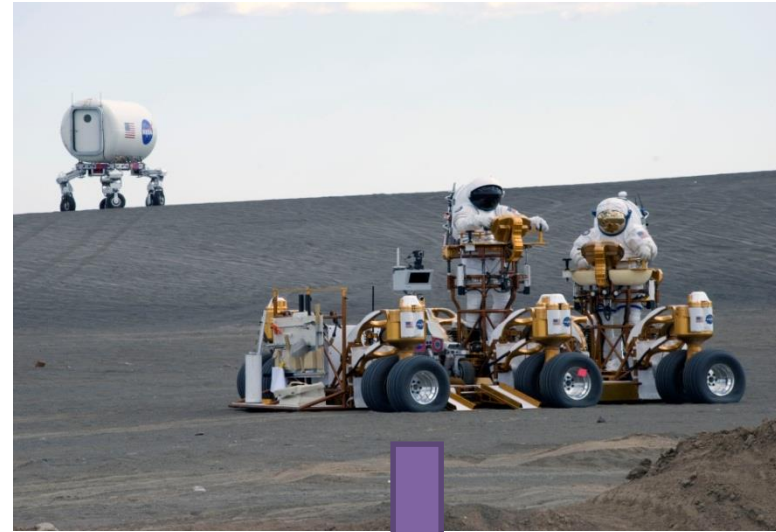
- Developed beginning in 2007
- Concept/prototype of crew rover developed for surface exploration
- Goal: challenge the conventional wisdom of crew rovers
- Designed for extreme terrain mobility
- Six wheeled rover with each wheel module having 3 motions
- Capable of being driven by on-board crew, tele-operation and ground control





Chariot Chassis

- Designed as a modular chassis carrying a variety of payloads
 - Crew in pressurized suits, standing up, Chariot style
 - Configured as a flat deck for general purpose payloads
 - Small Pressurized Rover Cabin (forming NASA's Lunar Electric Rover)
 - Science and surveying instruments
 - Supplementary power
- Currently two models in 1st generation series



Chariot Chassis: Video



Space Exploration Vehicle

- Pressurized Mobile Habitat consisting of:
 - Small Pressurized Rover cabin
 - Chariot chassis
- Crew explores in shirt sleeves
- Access to space through suit ports
 - No airlock
 - Direct access to suits from cabin
 - EVA in 15 minutes vs. 4 hours on Space Station
- Nominal operations: 2 astronauts for 3, 7 or 14 days
 - 4 crew for up to 24 hours



Space Exploration Vehicle

- Features:
 - 2 person cockpit
 - Redundant driving stations
 - Separate crew areas with privacy curtains
 - Storage for up to 14 days
 - Water system
 - Waste control system
 - Exercise devices
 - Hatches with docking ports
 - Aft driving station
 - Aft enclosure for suit dust and thermal protection





Space Exploration Vehicle



Modular Robotic Vehicle

- NASA developed unique skills in Astronaut rovers during NASA's Constellation program (2006-2010),
 - Focus on safety & reliability
 - R&D scale of investment
 - Highly maneuverable vehicles
 - Rigorous testing
 - Different requirements than Mars rovers
 - Dual purpose: Astronaut or robotically driven
- MRV projects spins technologies to terrestrial applications



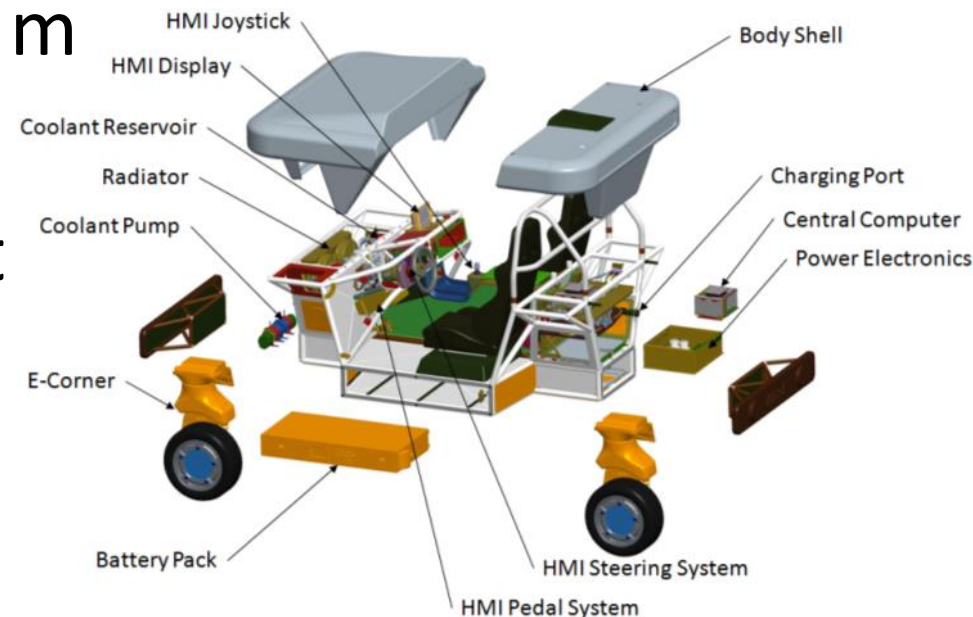


MRV: Unique Vehicle Capabilities

- Fail-operational *drive-by-wire* design
 - Focus on vehicle safety under fault conditions
- Independent, modular wheel systems
- Extreme maneuverability
- Battery electric vehicle
- Designed for robotic control: remote and autonomous driving

MRV: Vehicle Specs

- Design speed: 64 kph (40 mph)
 - Currently computer limited to 25 kph (15 mph)
- Curb weight: 900 kg (2000 lb)
- Footprint: 2.15 x 1.55 m (7' x 5')
- Drive-by-wire without mechanical backup



MRV: Video



Concluding Remarks

