

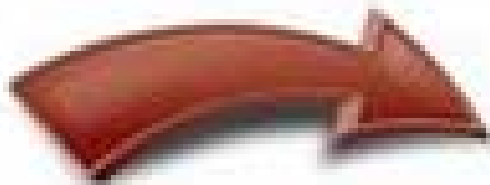


The Changing Face of Space

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MDA

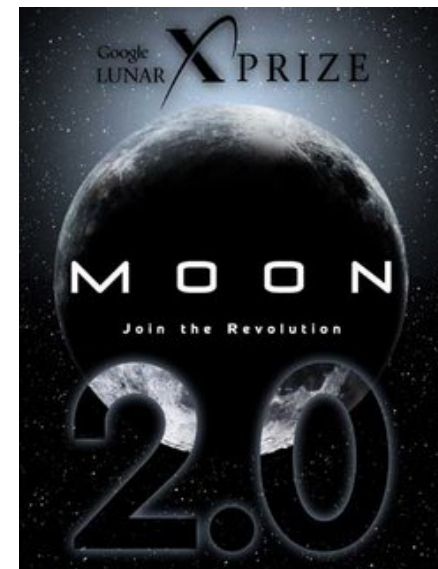
- The commercial interest in space is evolving
- Expectations are that a new industry is evolving much as ComSats did in the 1970's



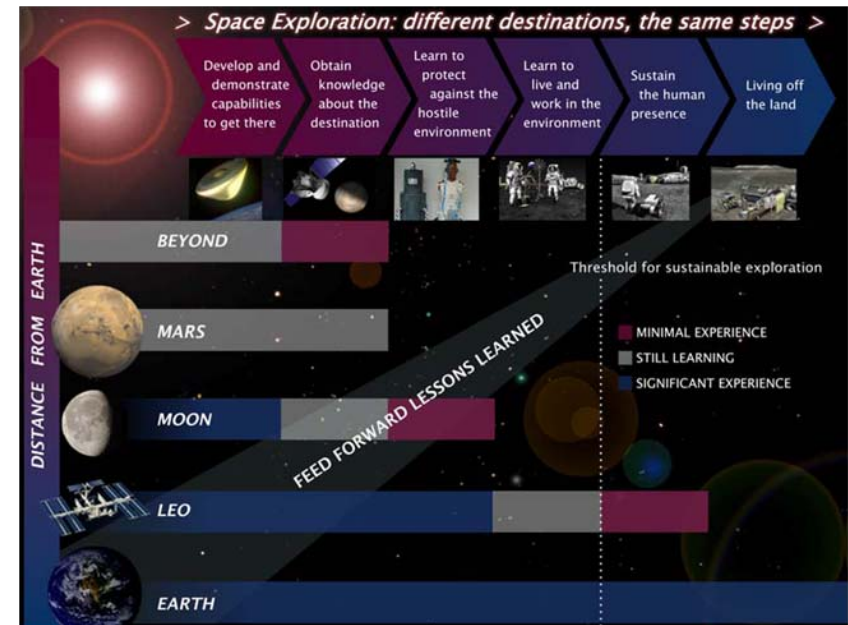
- Virgin Galactic
- Space-X
- Space Adventures
- Bigelow Aerospace
- Rocketplane
- Odyssey Moon
- ILOA
- Many more!



- Institutional and “Angel investor” interest in space
- Prizes exist to catalyze development
 - Ansari X-Prize for LEO
 - Northrop Grumman Lunar Lander Challenge
 - Google Lunar X-Prize for the Moon



- Development of the “Global Exploration Strategy”
 - Unprecedented global coordination
 - 13 space faring nations
 - ASI (Italy), BNSC (United Kingdom), CNES (France), CNSA (China), CSA (Canada), CSIRO (Australia), DLR (Germany), ESA (European Space Agency), ISRO (India), JAXA (Japan), KARI (Republic of Korea), NASA (United States of America), NSAU (Ukraine), Roscosmos (Russia)
- Emerging global consensus:
 - Everybody wants to go to the Moon!

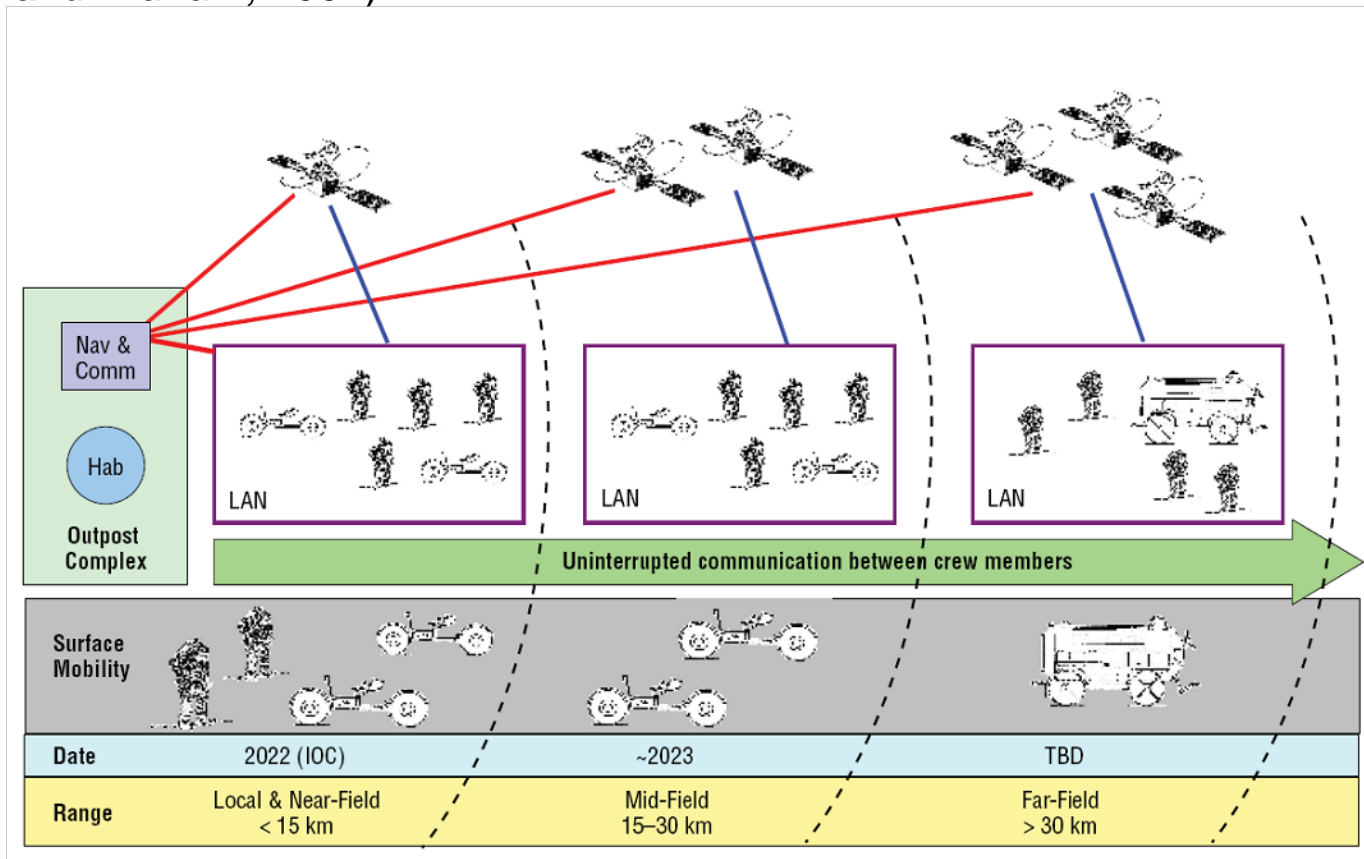


- NASA has expressed its desire to develop certain key elements
 - Primarily transportation infrastructure:
 - launch and landing
 - Other critical elements, e.g. life support, comms
- Other elements are open to external participation:
 - International
 - **Commercial**

- A switch in the acceptance of commercial vs government providers is taking place
 - Commercial Orbital Transportation Services (COTS)
 - Universal Space Network

- Current NASA Commercial Lunar RFI
 - “Communications, networking, and navigation capabilities required to support these efforts could be provided by the U.S. Government (USG), other international space agencies participating in the Science and Exploration initiatives, or by ***private companies***”.

- Current NASA Lunar architectures have many elements
- Growing interest in the transfer of Earth-based standards to space
 - (e.g. “Wireless Network Systems to Support NASA’s Exploration Vision” Gifford and Braham, 2007)



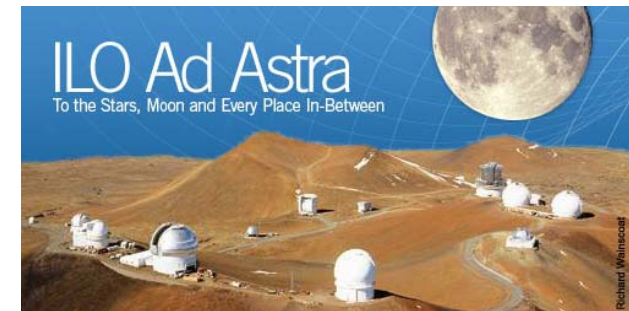
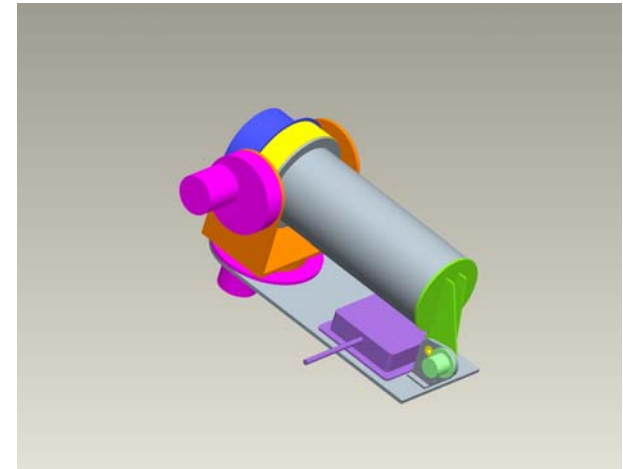
- Robotic Surface Communications
 - Autonomous Systems
 - Teleoperated from the Moon
 - Teleoperated from the Earth

- Element to Element Communications
 - Outpost
 - Astronauts
 - Mobility
 - Earth
 - Science Payloads
 - Lander

- ILOA has announced plans to send three missions to the Moon
- Astronomy and commercial lunar communications are among stated objectives
- First ILO flight will be a demonstration component on the commercial Odyssey Moon 2011 M-1 mission, currently participating in the Google Lunar X-Prize along with other lunar objectives
- Precursor payload known as ILO-X



- MDA contracted in 2008 by ILOA to help define precursor instrument ILO-X: objectives, requirements, design
- Commercial payload concept is currently under ILOA review, so only some details can be discussed
- Concept has science elements that target:
 - The Moon
 - The Earth
 - Astronomical Targets



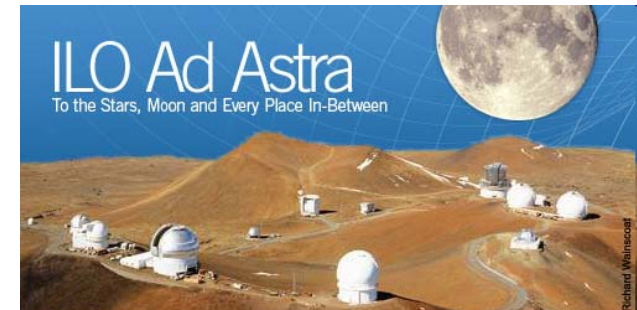
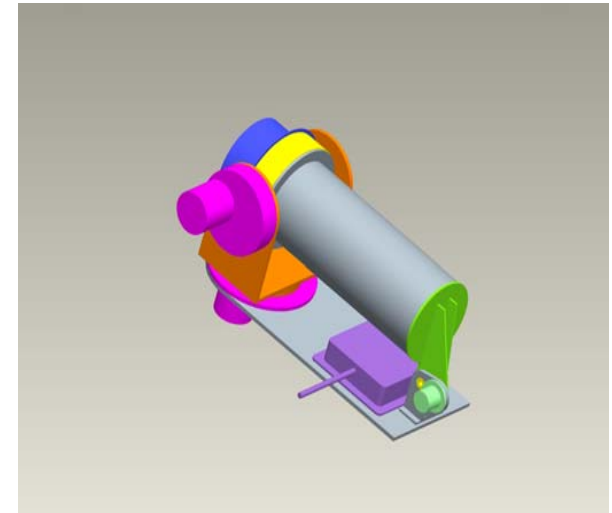
Lunar Telescope Survey

- Radio
- X-ray
- Space Weather
- Lunar Transit Telescope
- South Pole IR
- Geology
- Solar System
- Lunar Orientation
- Earth's Radiation Budget



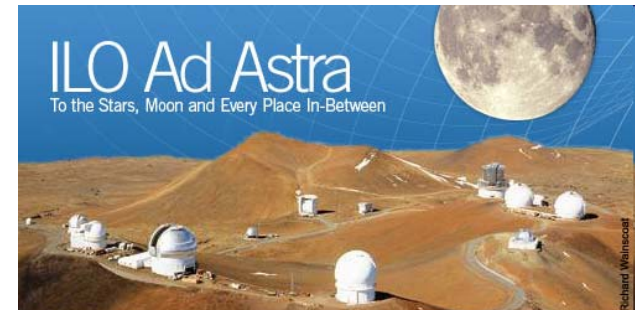
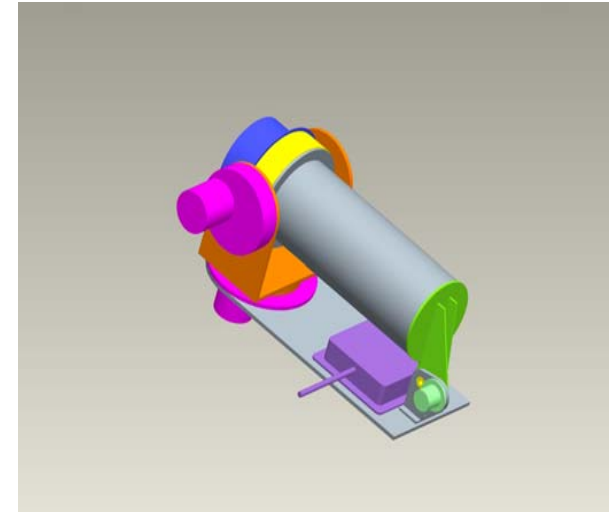
The Arecibo Observatory is part of the National Astronomy and Ionosphere Center (NAIC), a national research center operated by Cornell University under a cooperative agreement with the National Science Foundation (NSF).

- ILO-X concept also includes Lunar Commercial Communications component – both hardware and data delivery concepts
- Hardware component focuses on a lunar first and the use of terrestrial technology and protocols at the lunar surface
- Payload and mission role potential



Precursor Constraints

- Not a stand-alone mission
- 2 kg mass limit
- No specific lunar location
- 14-day life in sunlight
- Payload accommodation



ILO-X Goals

- Telescope and communications application
- First Light
 - Sensitivity, resolution, tracking, scientific
- Education
 - Interesting and in color
- Branding
 - Labeling, exclusive distribution, enabling
- Commercial
 - Data products, PR, follow-on infrastructure



Many new space players are getting in on the ground floor – some of them may end up on Mars.