International Lunar Observatory Association | Space Age Publishing Company

Galaxy Education & Galaxy Enterprise in the 21st Century

Galaxy Forum USA

The Tech Museum of Innovation, San Jose, California

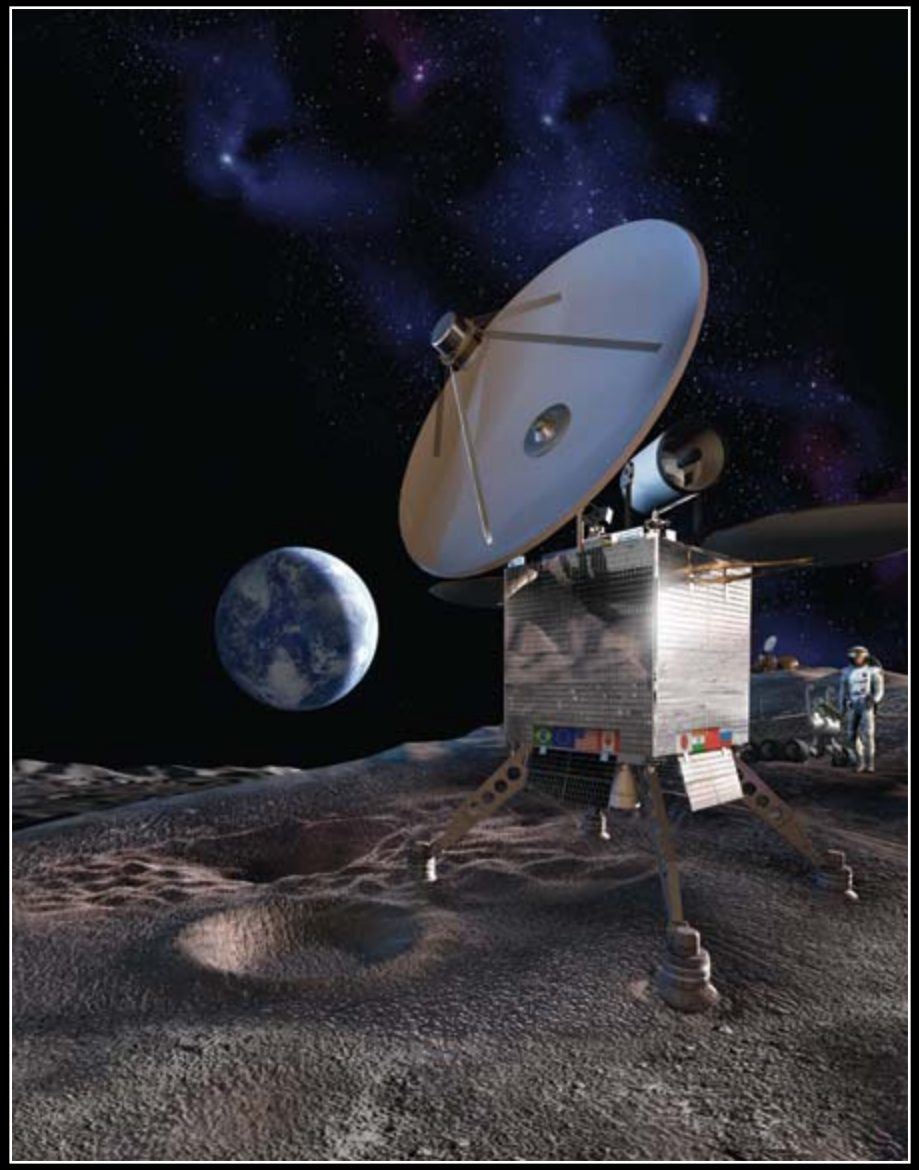
Sunday, July 4, 2010 – 09:30-11:30am

International Lunar Observatory Association (ILOA) July 2010 Update

Steve Durst, ILOA / Space Age Publishing Company
Hawai`i and California, USA

- Galactic / Inter-Stellar
- Earth-Moon / Inter-Global
- Hawaiian
- Multi-Functional

ILOA – 3 Missions

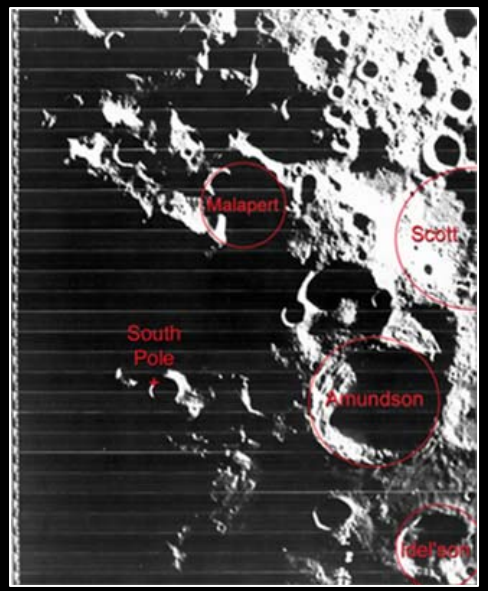


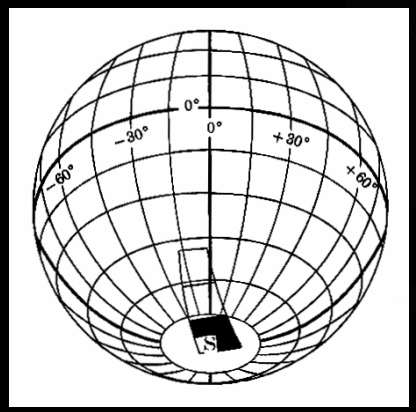
- **ILO-1 Polar Mission** (NET 2012)
- **ILO Precursor Mission** (NLT 2012)
- **ILO Human Service Mission**

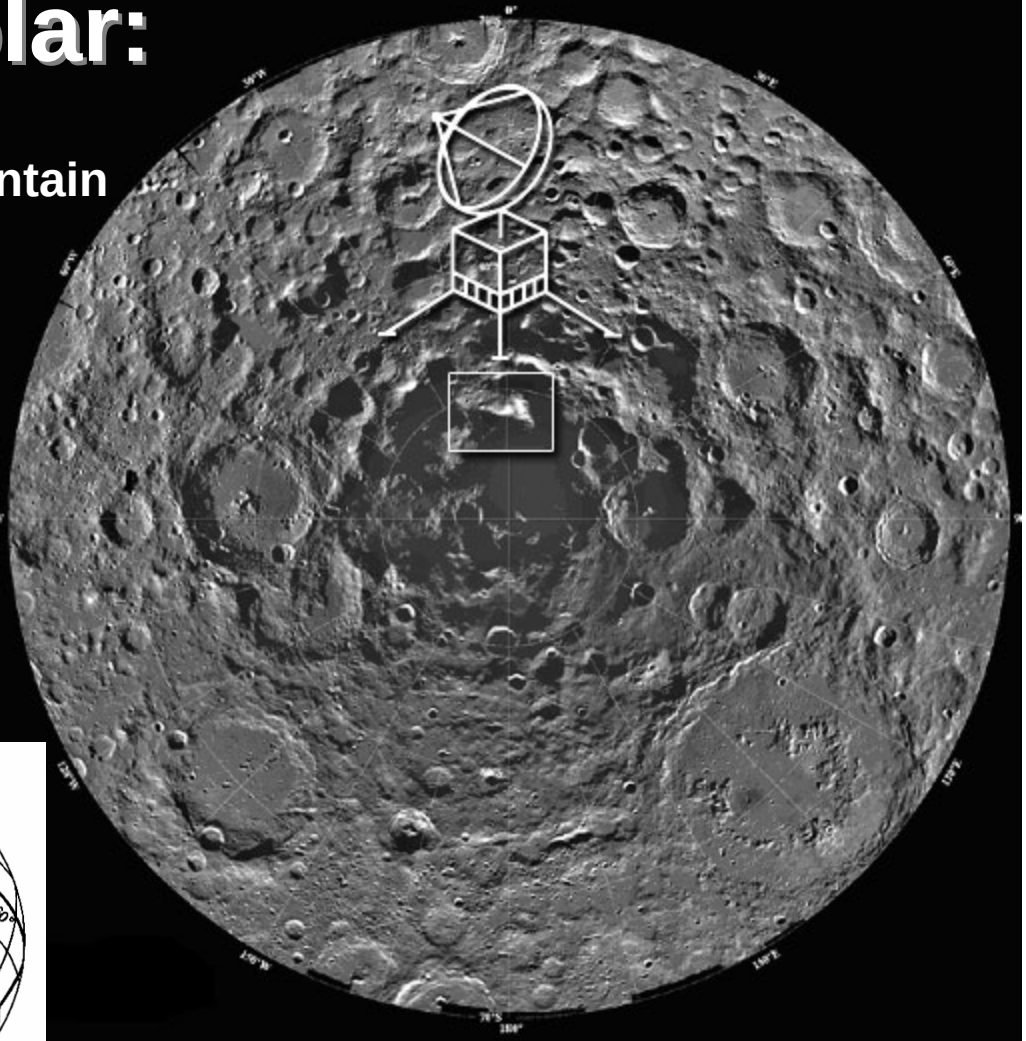
International Lunar Observatory (ILO)

ILO-1 Polar:

- ILO to be Located at ‘Malapert’ Mountain
- ‘Electrification’ of the Moon







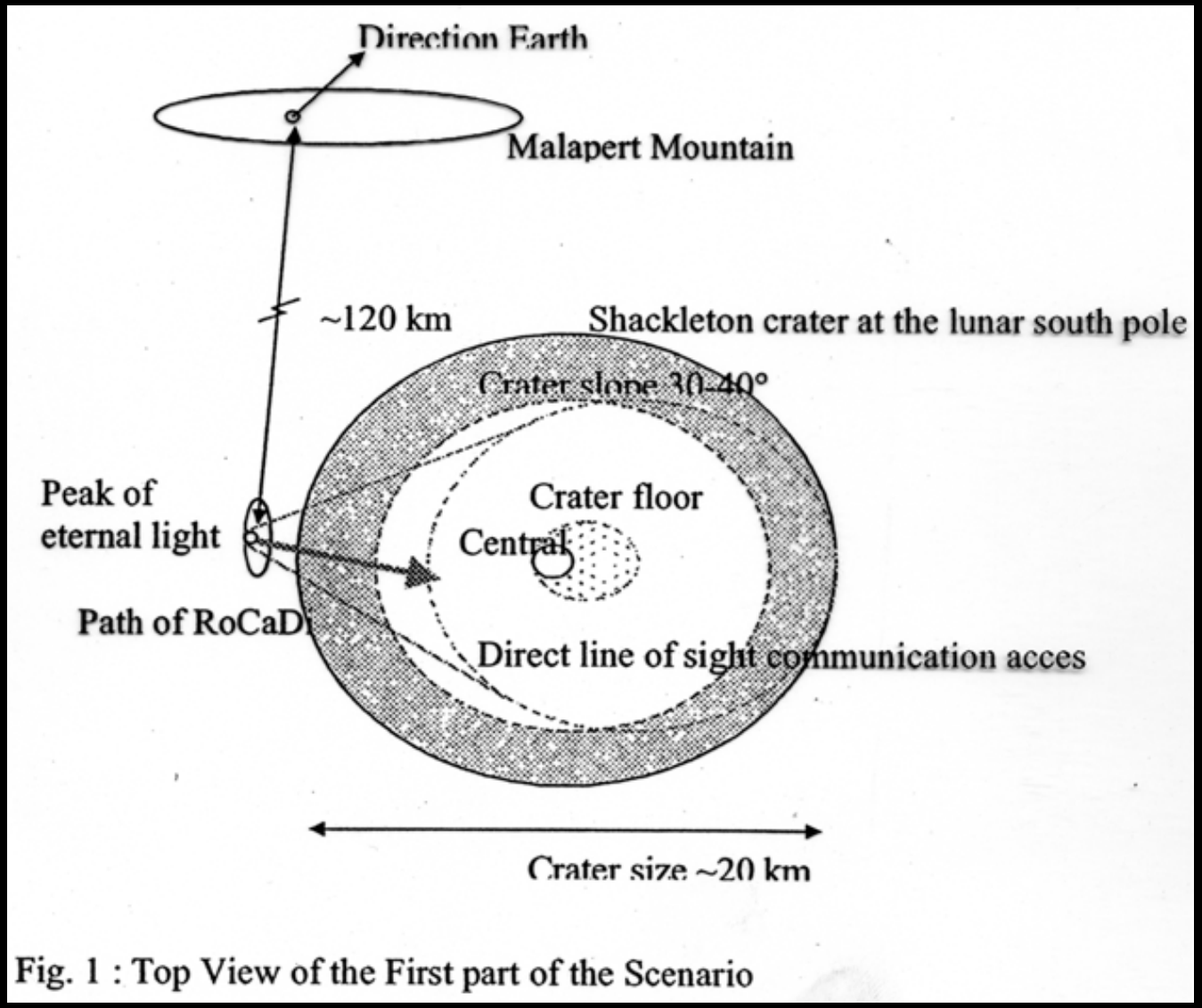
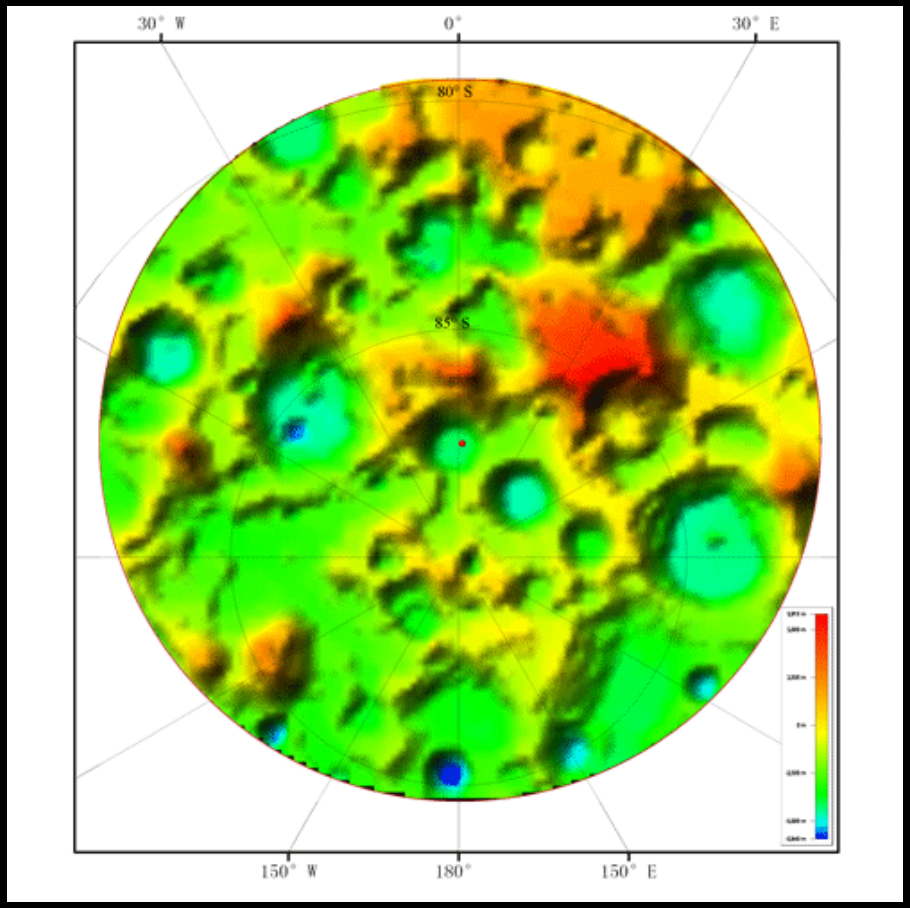
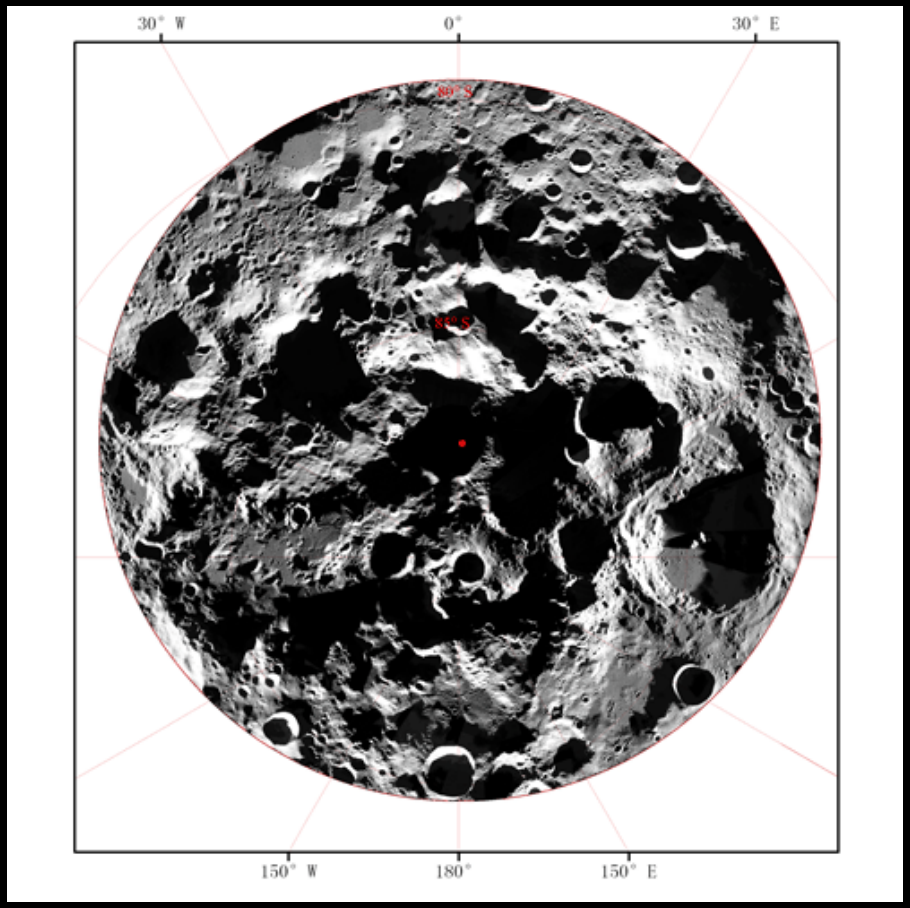


Fig. 1 : Top View of the First part of the Scenario

Graphic: Paul van Susante

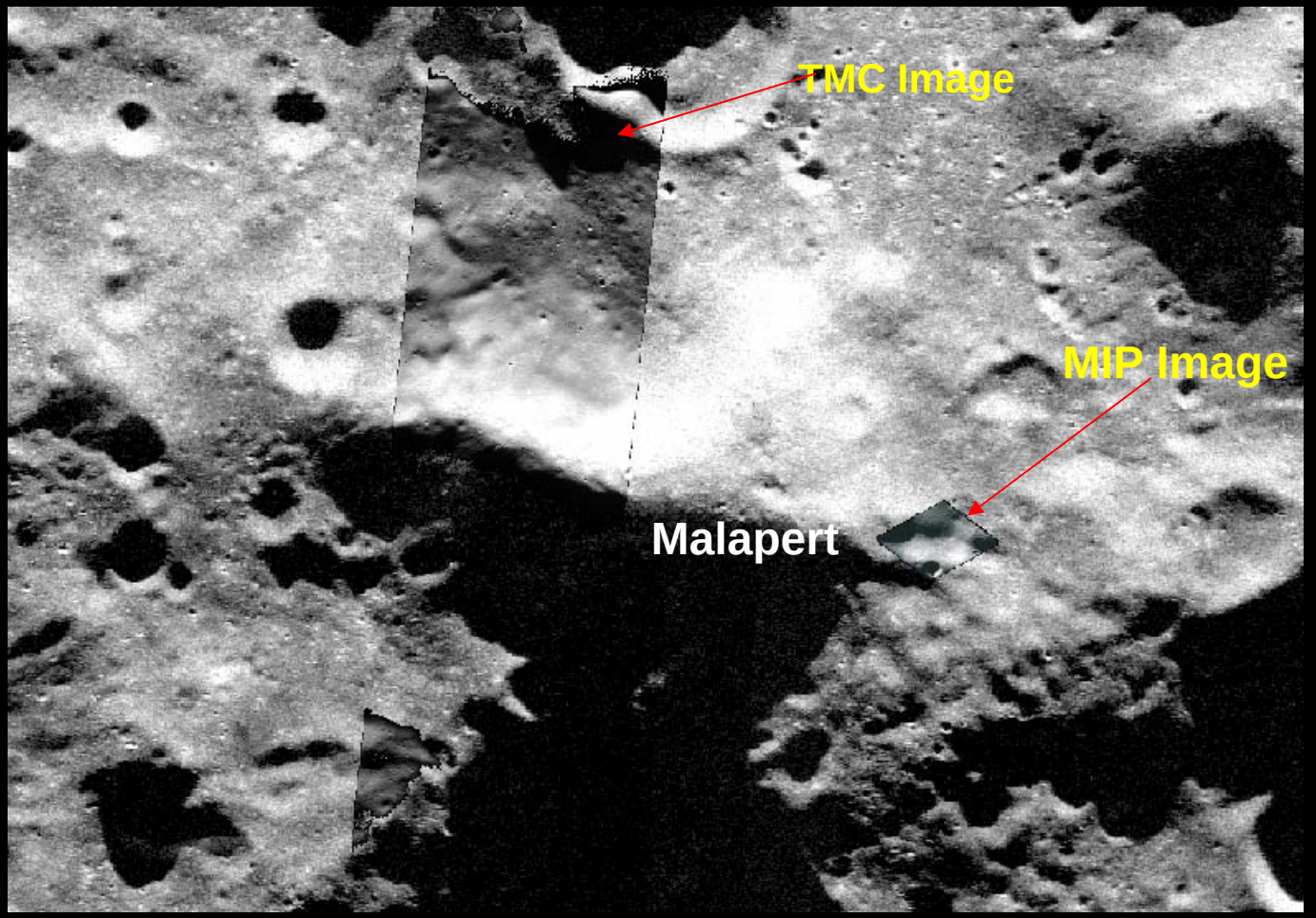
Lunar South Pole – Chang'e





Lunar South Pole – Kaguya

Lunar South Pole - Chandrayaan



Primary and Secondary ILO Mission Objectives:

- First Light Galaxy Imaging
- Initial landing site observation, local surveillance
- Earth observations: albedo, geocorona, etc.
- Search for Earth-like planets
- Search for Extra-Terrestrial Intelligence (SETI)
- Analyze interstellar molecules to determine origin of Solar System
- VLF observation
- Observe signs of life on Mars, Europa, Titan, etc.
- Search for dangerous NEOs
- Sun-Earth observations, solar storm warnings
- More

ILO Galaxy First Light Imaging

Why Galaxy Education, Consciousness & Awareness is Important for the 21st Century:

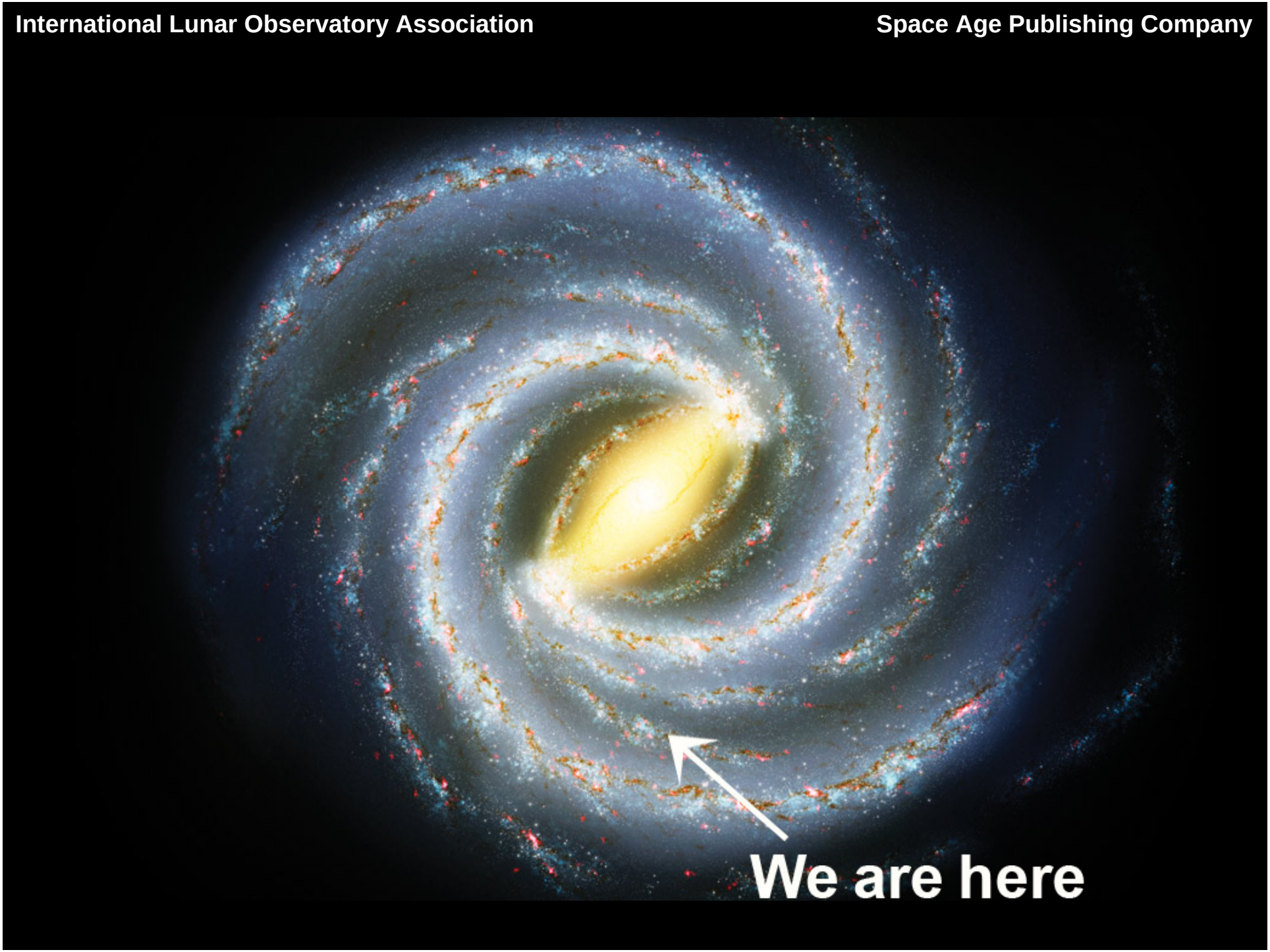
- **Education – for primary, secondary higher, and highest education: Knowledge, understanding of humanity's place in the Universe – our Milky Way Galaxy occupies a mid-position domain between Solar System finiteness and Cosmos infinity**

- **Astrophysics / Astronomy – Galaxy studies internationally are of increasing interest and value; study of our local stellar neighborhood for familiarity; center / central 10 parsecs with supermassive black hole is most dynamic region of Milky Way**

- **History of Human Civilization / Archaeoastronomy**

- **NASA, World Space Agencies – 21st Century Program and Policy Development Advance through Galaxy understanding**

- **Galacticity – may be as important for the 21st Century, as is Relativity to 20th**


We are here

Two Major Spiral Arms:

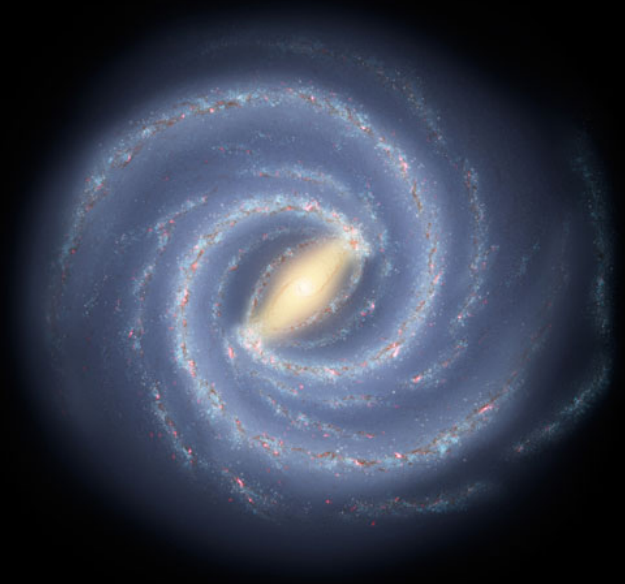
Scutum-Centaurus & Perseus

Two Minor Spiral Arms:

Norma & Sagittarius

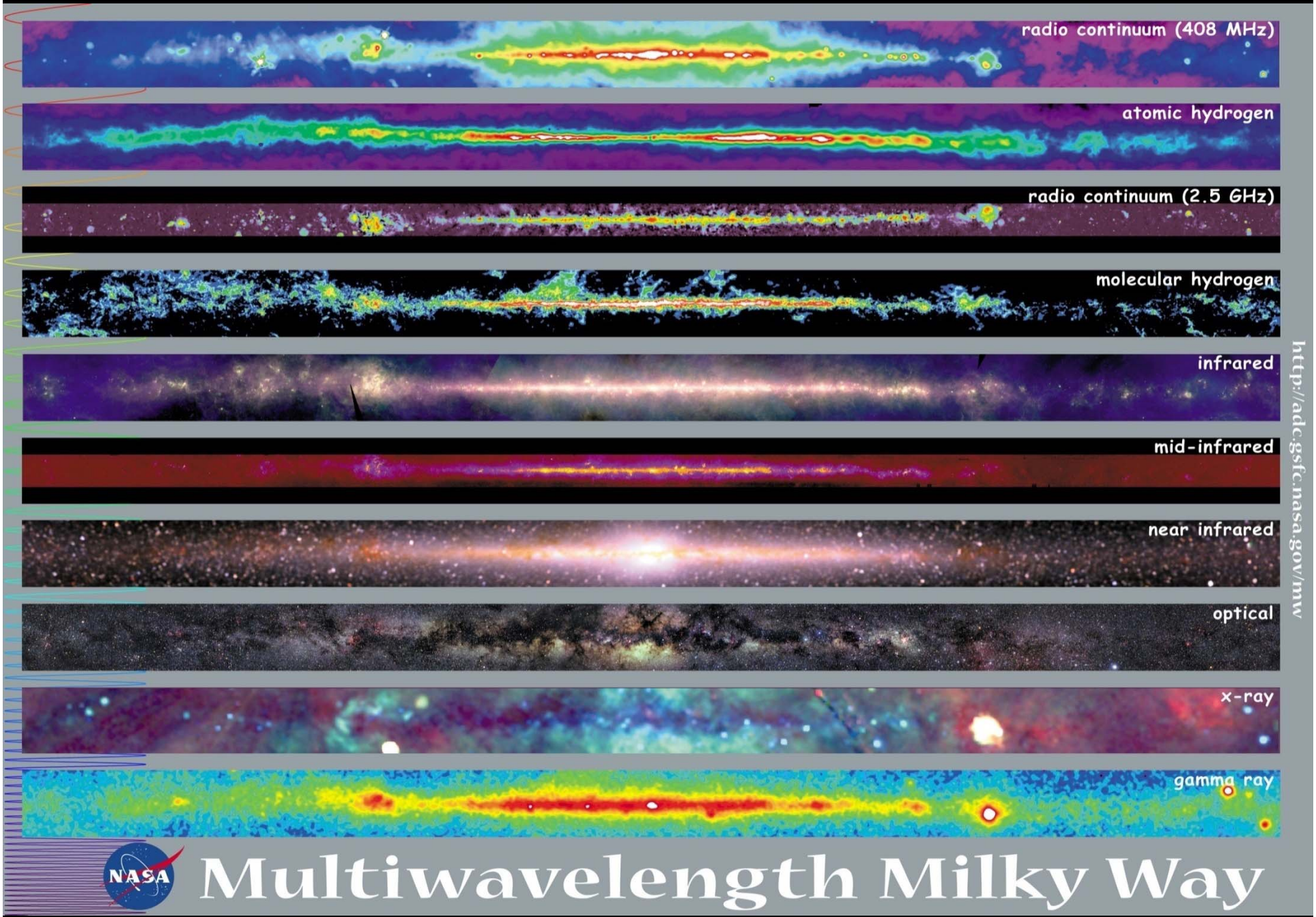
Far-3 Kiloparsec Arm Minor Spiral Arm just identified via radio-telescope Survey

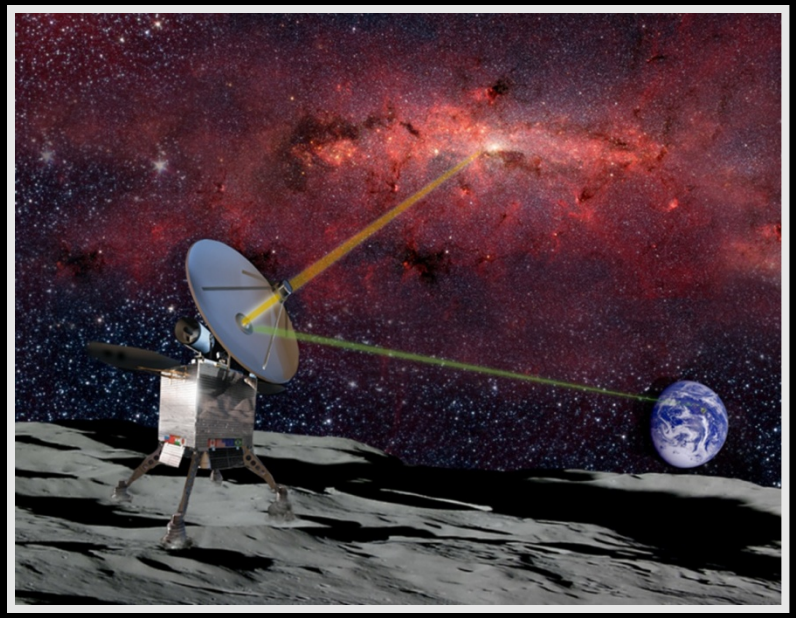
2008 – Robert Benjamin, University of Wisconsin, Whitewater



NASA/JPL-Caltech, artist's image

The Milky Way: Spitzer Infrared Space Telescope


radio continuum (408 MHz)
atomic hydrogen
radio continuum (2.5 GHz)
molecular hydrogen
infrared
mid-infrared
near infrared
optical
x-ray
gamma ray
http://adc.gsfc.nasa.gov/mw
NASA
Multiwavelength Milky Way



ILO Imaging Galaxy Center

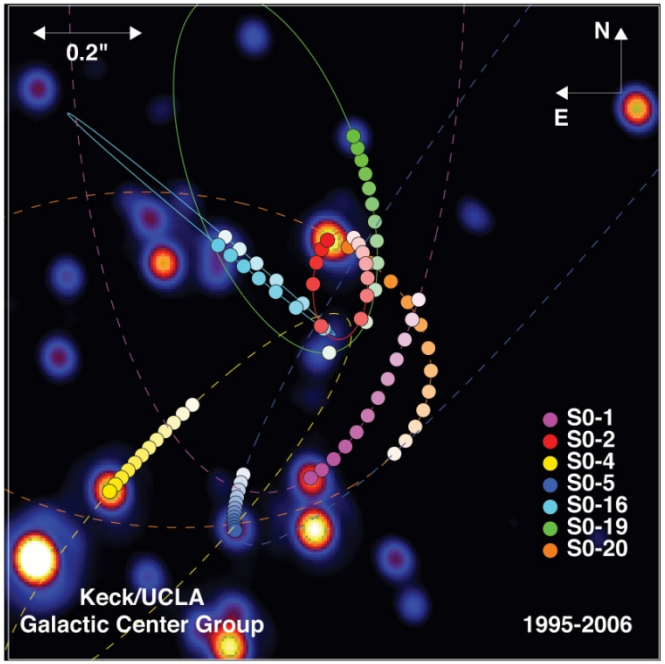
EarthRise Photo : 1968 / Apollo 8

Galaxy First Light Imaging Program – Average Color of the Galactic Plane

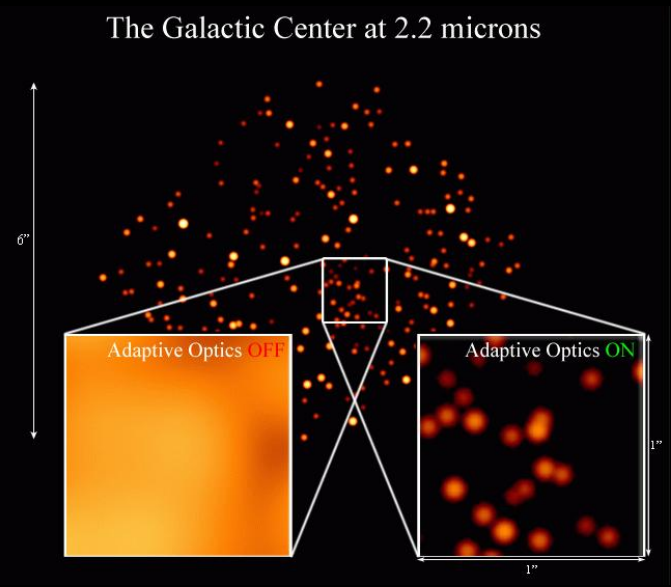
- 1 million pixel visible imager, 2.5º field of view, 2 polarizers and 6 color filters
- Limiting magnitude of ~12 for reasonable sample of Galactic plane from stars between 6th and 12th magnitudes
- Further weight of images by the known spectral response combined composite color image should be able to measure average color of galactic plane as perceived by human eye on a dark night

Andrea Ghez
UCLA Galactic Center Group
Keck Observatory

Stellar Orbits in the Central Arcsec



Adaptive Optics



Galaxy Education Resources:

1.Federation of Galaxy Explorers: Seeks to inspire and educate kids in space related science and engineering, including Moon Base One Initiative.
- Nicholas Eftimiades, Founder / Chairperson of the Board

2.Challenger Center: Learning Center Network gives students hands-on experience in science, engineering, research and space missions.
- June Scobee Rodgers, Founding Director and Chairman

3.International Space University: Graduate-level training to future leaders of the emerging global space community at locations around the world.
- Michael Simpson, President

4.Space Generation Advisory Council: Represents students and young space professionals to the United Nations, States, and space agencies.
- Alex Karl / Ben Baseley-Walker, Co-Chairperson

5. Students for the Exploration and Development of Space: Dedicated to expanding the role of human exploration through education.
- Joshua Nelson, Chair

Galaxy Education Resources:

6. Galaxy Zoo: ‘Citizen Science’ online astronomy project that invites members of the public to assist in classifying over a million galaxies.
- Dan Andreescu, Kate Land, Chris Lintott, etc.

7. UCLA Galactic Center Group: Leading Galactic Center research group, dedicated to researching the innermost regions of the Milky Way.
- Andrea Ghez, Principal Investigator

8. Teachers in Space, Space Frontier Foundation: Giving teachers the opportunity to experience space firsthand via NewSpace companies.
- Edward Wright, Project Manager

9. The Planetary Society: Inspires and involves the world's public in space exploration through advocacy, projects, and education.
- Louis Friedman, Executive Director

International Lunar Observatory Association

Space Age Publishing Company

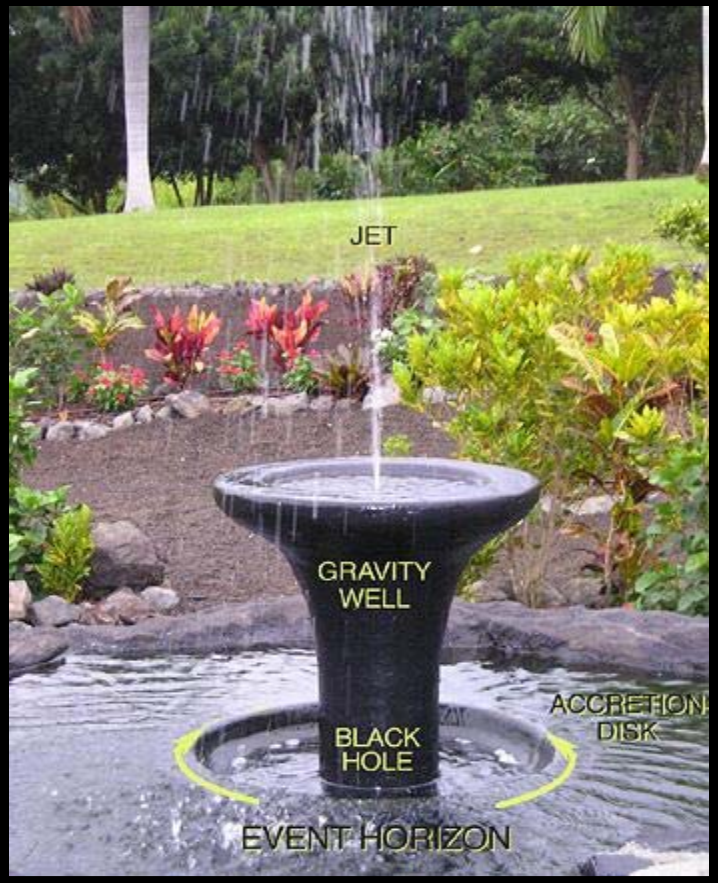
Galaxy Education Resources

Galaxy Garden / Jon Lomberg

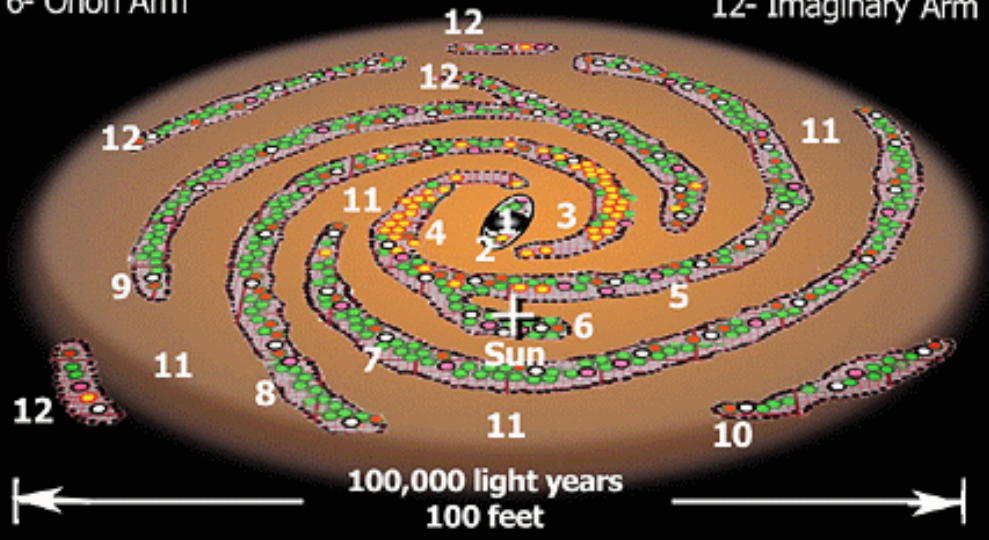
Kona, Hawai`i Island

Portrait of the Milky Way

International Lunar Observatory Association **Space Age Publishing Company**



1- Center of the Galaxy
2- Galactic Bar
3- Three Kiloparsec Arms
4- Sagittarius Arm
5- Carina Arm
6- Orion Arm
7- Perseus Arm
8- Norma Arm
9- Scutum Arm
10- Outer Arm
11- Galactic disk
12- Imaginary Arm



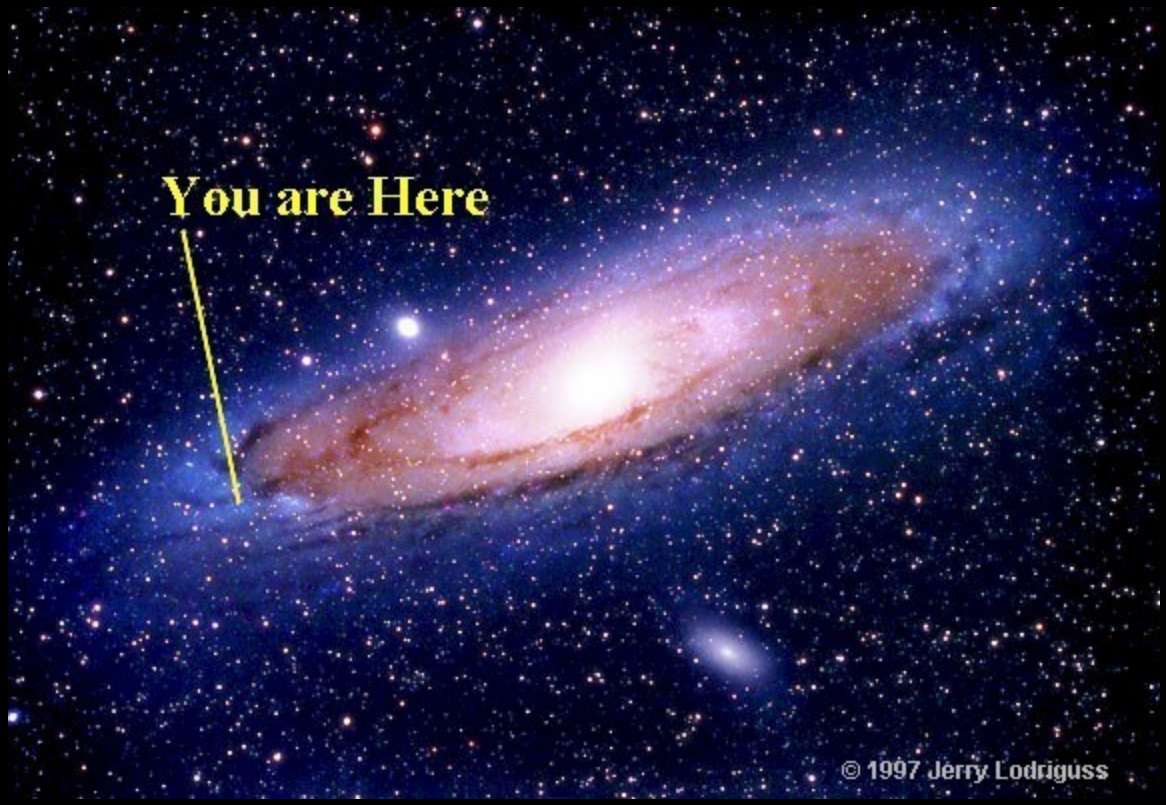
1 foot= 1000 light years

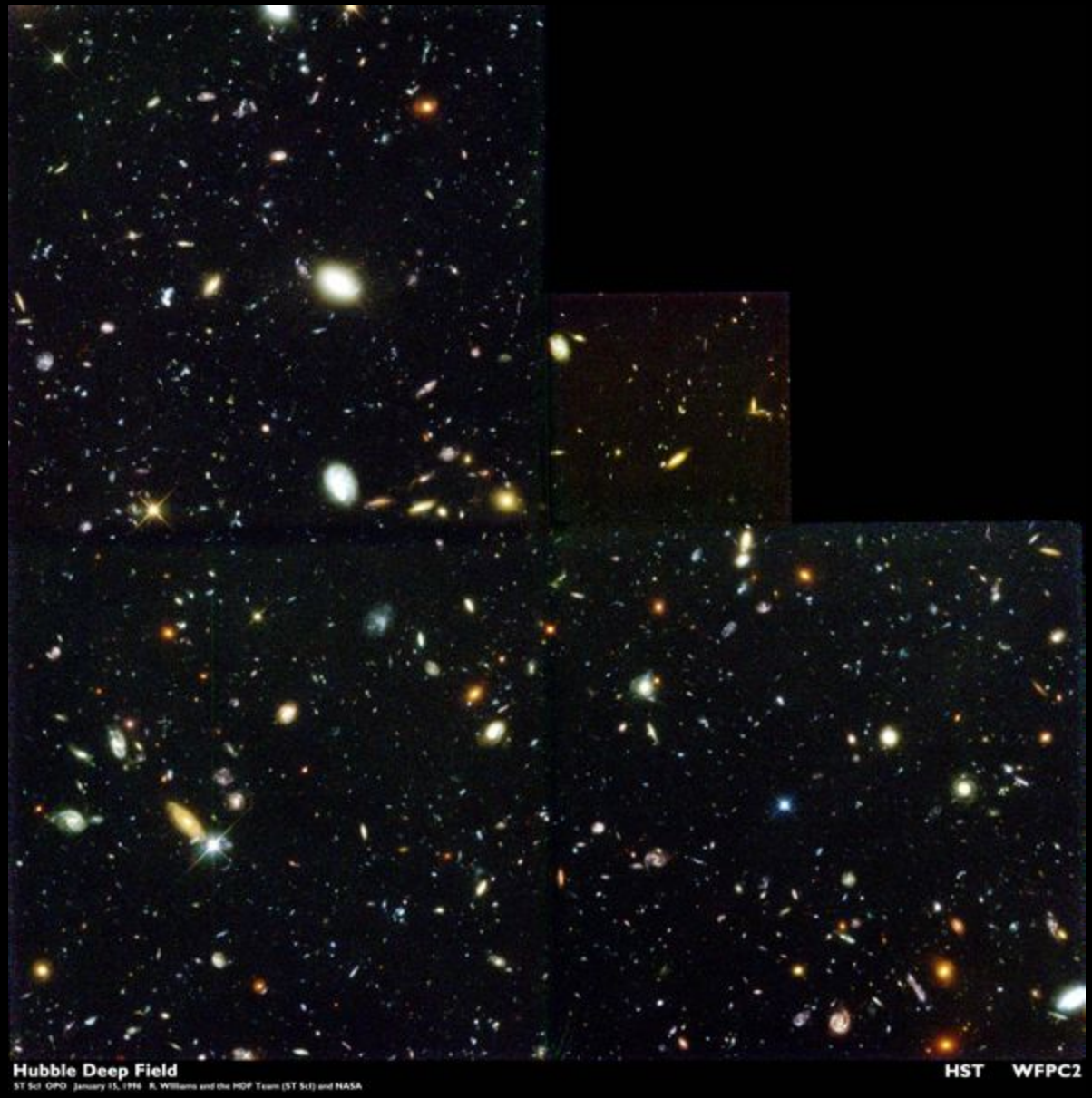
1 inch= 83 light years

Barbara Morgan

1st Teacher in Space

Challenger CENTER®


You are Here
© 1997 Jerry Lodriguss


Hubble Deep Field
HST WFPC2

Lunar Commercial Communications:

The International Lunar Observatory requires communications capacity to transmit astrophysical data to satisfy its primary mission. Bandwidth not utilized for astrophysical data transmission can be made available on a commercial basis.

Commercial Usage of Additional Bandwidth

Pre-sold Bandwidth	Bandwidth Available Upon Emplacement (May be pre-sold when launch date set)		Future Need
Space Calendar Broadcast This Space Calendar will be transmitted from the Moon. Advertisers will pay a premium rate for transmission of their ads from the lunar surface.	**Internet Search Engine Giants** Search engine giants, such as Google and Yahoo, as well as other internet businesses, will be able to purchase bandwidth and use it to provide special services from the lunar surface, which might include local imagery. Interactive games may be developed which actually take place on the Moon.	**Specialty Advertising Opportunities** Large corporations will be able to use a Moon email system to capture the attention and interest of consumers for products which may relate to any of the numerous associations modern culture attributes to Luna.	**In Situ Communications and Monitoring Capabilities for Robotic Project Operators** As the wave of robotic and mining/excavation missions arrive on the lunar surface, they will do so with the knowledge that communications and surface monitoring capabilities in the region of Malapert Mountain and Shackleton Crater will be in place and available for purchase.

'The First, Best Space Calendar in the Business'

SPACE CALENDAR
OCTOBER 5-11, 2009

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L.E. DAILY

"The First, Best Space Calendar in the Business" *Vol 28, No 40*

Hawai`i: 808-885-3473 | news@spaceagepub.com, www.spaceagepub.com | fax: 808-885-3475

Global Space Show Highlights International Space Week As Space Explorers Meet In Prague

2 important international celebrations of science and technology will engage the global community this week in appreciating the benefits of space research and exploration. The United Nations is coordinating the 10th annual 'World Space Week' from October 4-10, with a multitude of events planned in 39 countries. Focused on the theme 'Space for Education,' this year's celebration includes an unprecedented live show from Earth orbit and the 2nd annual Galaxy Forum China. Cirque du Soleil founder Guy Laliberté (B) will conduct a 120-minute show from the International Space Station on Oct 9. Sponsored by Laliberté's charity, One Drop Foundation, the production will focus on the life sustaining force of water. It will involve shows broadcast from 14 cities, featuring several eco-conscious celebrities. Galaxy Forum China will take place at the Beijing Planetarium on Oct 8. The event will feature Antarctica astronomer Zhou Xu (CL), Steve Durst of ILOA, Hans Starlife of Cosmica and Jin Zhu from the Beijing Planetarium. Another prestigious celebration occurring this week is the Planetary Congress of Space Explorers. Over 50 astronauts, cosmonauts and taikonauts will come together in Prague, Czech Republic from 4-10 Oct for the 22nd Congress organized by the Association of Space Explorers. Unified by the motto 'Outer Space - Chance for Everybody,' the space explorers will promote international cooperation and inspire youth to study science, technology and popularize cosmonautics. (Credit: WSW, ASE, ILOA, ODF, UNSW)

LCROSS Impact May Provide Conclusive Data of Polar Moon Water

On October 9, scientists, professional telescopes and amateur astronomers will partake in a worldwide observation campaign as the Lunar Crater Observation and Sensing Satellite (LCROSS) along with its upper stage Centaur Rocket are set to crash into the lunar surface at approximately 04:30 PDT. Developed by NASA Ames Research Center and launched on June 18, LCROSS main mission objective is to look for water ice at the lunar poles. The LCROSS mission team, led by Project Manager Daniel Andrews (TR), recently changed the target of impact from Cabeus A crater to the larger Cabeus crater. Located 84.9 degrees south, 35.5 degrees west of the Moon's South Pole and having a diameter of over 98 km, Cabeus contains the highest concentration of hydrogen compared to other craters. The Centaur is set to crash into Cabeus first and will create a spray of ejecta. Approximately 4 minutes later, the LCROSS will fly through any leftover debris kicked up from Centaur and relay data back to Earth before impacting the lunar surface. The International lunar science community is already excited about recent ISRO Chandrayaan-1 data confirming the presence of water molecules across the lunar surface. On Oct 8-9, NASA Ames Research Center will be hosting 'LCROSS Impact Night,' an all-night event open to the public. Presentations will be given by Ames Center Director Pete Worden (BR), Apollo 16 Astronaut Charlie Duke and NASA Mission Directorate Victoria Friedensen. (Credit: NASA)

THIS WEEK

OCTOBER

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

NOVEMBER

M	T	W	T	F	S	S
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

DECEMBER

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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

LEGEND

● All times for terrestrial events in local time unless noted.
○ All times for international terrestrial events in local time unless noted.
★ All times for space events, and...
☆ All times for international space / astro events in Hawaii Standard Time unless noted. Add 10 hours to obtain UT ('Universal Time;' Greenwich, England).

Weekly Planet Watch – *Morning Planets:* Mercury (E), Venus (E), Mars (E), Saturn (E) / *Evening Planets:* Jupiter (SE).

MONDAY

● **Oct 5 — 1% for NASA Ensures USA Multi World Civilization,** *Nationwide / Washington DC:* Boldness, Vision of a Jefferson or JFK for the New 2010 Decade; http://www.spaceagepub.com/calendar/SCarchive/SC-20090831.html.

☆ **Oct 5 — International Space Station,** *LEO:* Expedition 21 flight engineer Jeffrey Williams and flight engineer Maxim Surаev to replace E20 crew members Gennady Padalka and Michael Barratt who will depart the ISS with space tourist Guy Laliberté on Oct 10; http://www.nasa.gov/mission_pages/station/main/index.html.

☆ **Oct 5 — NASA Lunar Crater Observation and Sensing Satellite (LCROSS),** *Lunar Orbit:* LCROSS team refining exact point of Oct 9 impact within Cabeus crater to avoid rough spots and maximize solar illumination of debris plume for Earth-based observation; http://lcross.arc.nasa.gov/.

☆ **Oct 5 — International Lunar Observatory Association,** *Hawai`i Island HI / Global:* ILOA preparing for Oct 13 presentation at IAC 2009 in Korea; http://www.iloa.org/.

☆ **Oct 5 — Mars Reconnaissance Orbiter (MRO),** *Red Planet:* Scientists continue to study images from HiRise camera on MRO that reveal spider shaped features (araneiform) on Martian surface caused by vaporizing dry ice during a dynamic seasonal process; http://www.marsdaily.com

○ **Oct 5-7 — Tata Institute of Fundamental Research,** *Hyderabad, India:* 'Workshop on Interstellar Matter and Star Formation: A Multi-Wavelength Perspective;' http://www.tifr.res.in/~ismconf/.

● **Oct 5-9 — American Meteorological Society,** *Williamsburg VA:* '34th Conference on Radar Meteorology;' http://www.ametsoc.org/Meet/fainst/200934radar.html.

○ **Oct 5-9 — International Telecommunications Union,** *Geneva, Switzerland:* 'ITU Telecom World 2009;' http://www.itu.int/WORLD2009/.

○ **Oct 5-9 — International Conference on Advanced Technology and Particle Physics,** *Como, Italy:* '11th ICATPP Conference on Astroparticle, Particle, Space Physics, Detectors and Medical Physics Applications;' http://villaolmo.mib.infn.it/Conference2009.html.

☆ **Oct 5 — Asteroid 2009 SR103:** Near-Earth Flyby (0.053 AU).

Continued from . . .

● ***Jul 1* — NASA, X PRIZE Foundation,** *Open location USA:* 'Lunar Lander Challenge Competition;' through October 31; http://space.xprize.org/.

● ***Oct 1* — Astronaut Scholarship Foundation,** *Online:* ASF Final Destination Online Auction of 20 uniquely designed fiberglass space shuttle statues, through Oct 8; http://www.astronautscholarship.org/sosc_auction.py.

○ ***Oct 4* — National Institute of Space Research (INPE),** *Ubatuba, SP, Brazil:* 'International Living with a Star 2009: Influence of Solar Variability on Geophysical and Heliospheric Phenomena;' through Oct 9; http://www.dge.inpe.br/maghel/ilws/.

● ***Oct 4* — American Astronomical Society,** *San Juan, Puerto Rico:* '41st Meeting of the AAS Division for Planetary Sciences Meeting (DPS2009);' through Oct 9; http://dps09.naic.edu/.

○ ***Oct 4* — University of Southern California, University of Pisa,** *Tuscany, Italy:* '6th Interdisciplinary Transport Phenomena Conference: Fluid, Thermal, Biological, Materials and Space Sciences;' through Oct 9; http://ame-www.usc.edu/cff/volterra2009/.

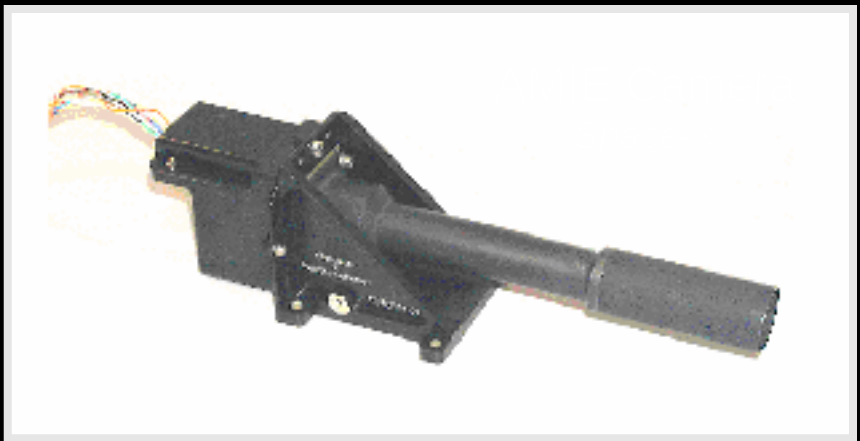
International Lunar Observatory (ILO)

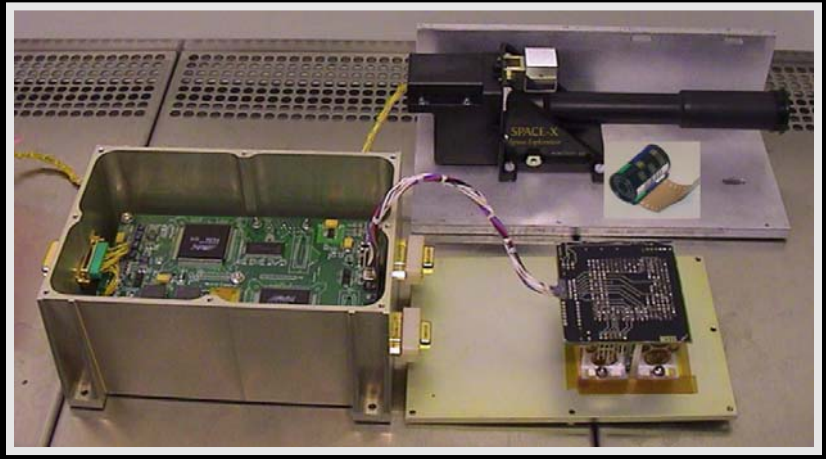
ILO-X Precursor:

- Odyssey Moon / MDA
- US$30M Google Lunar X Prize
- ILO 2 Kg Technology Demonstrator Payload
  - AMIE Camera / Space-X
- Equatorial Mission
- Galaxy First Light Imaging, Lunar / Earth Observation
- Communications / Broadcasting

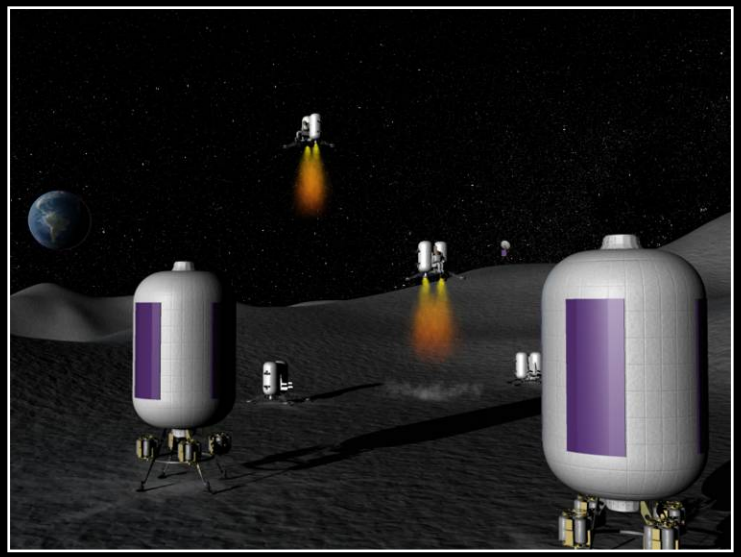
Instrumentation

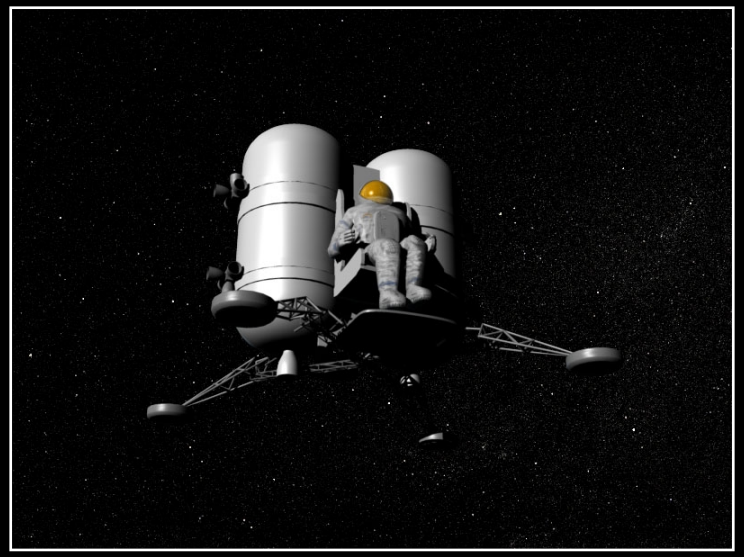
- Candidate Instrument – AMIE Camera
- UV / Vis / NIR CCD Imaging Array of 1024 x 1024 pixels
- Field of View – 5.3° x 5.3° = 738 parsecs on a side (0.72 pc / pixel)
- Mass = 2 kg





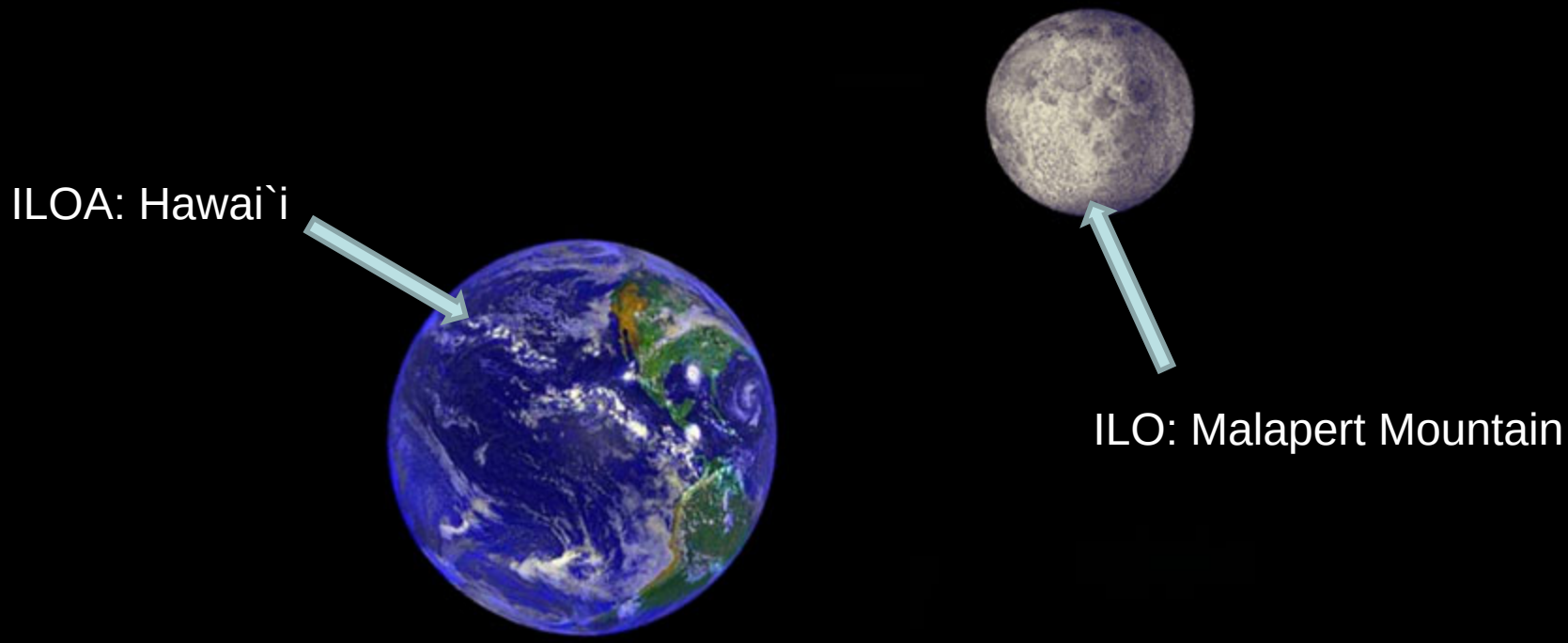
Human Service Mission



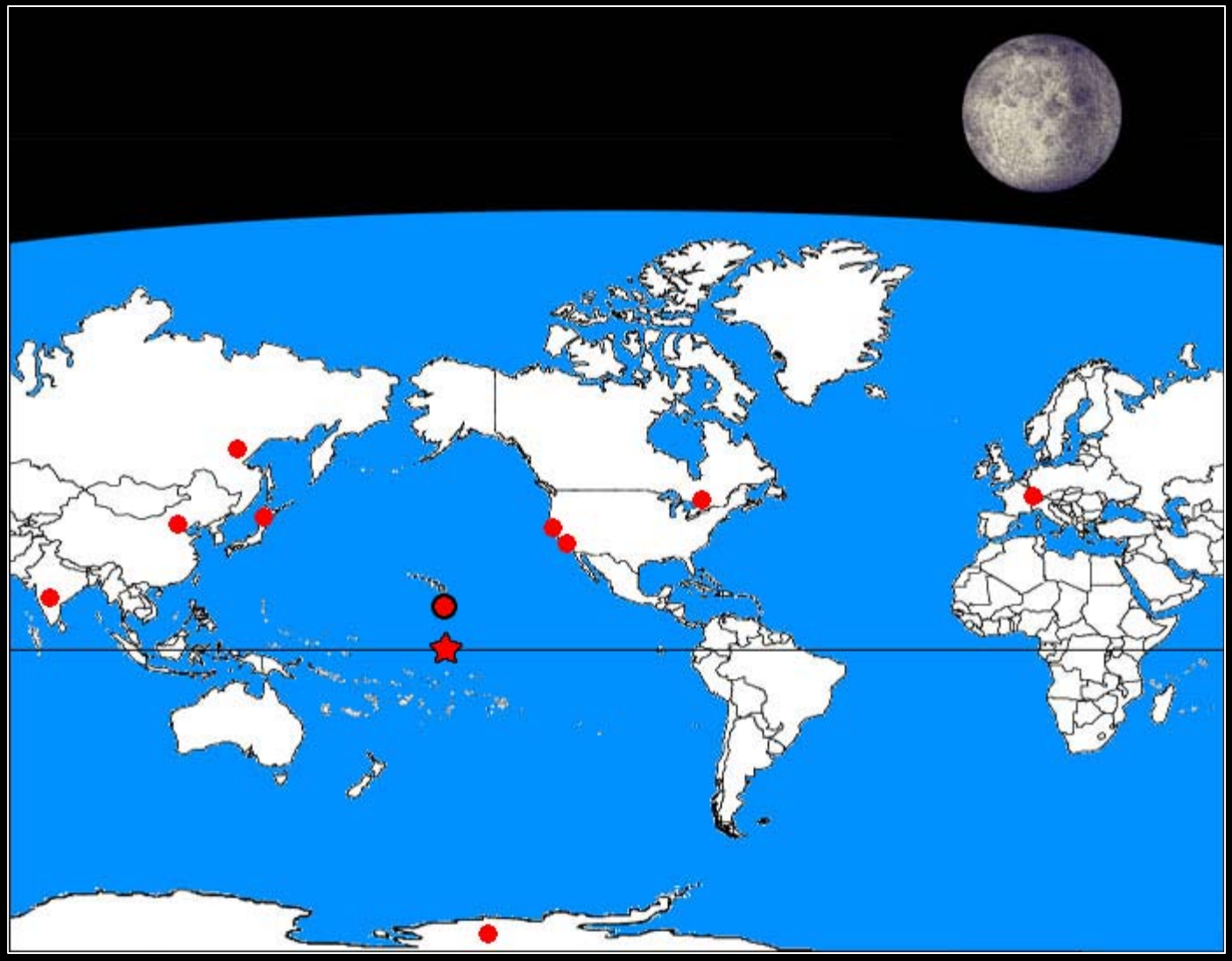


SpaceDev Inc – Dream Chaser, ALOHA Chair

Inter-Global / Earth-Moon / Cislunar System



A Global / Interglobal Mission



A Global / Interglobal Mission

- **Canada –**Canada France Hawai`i Telescope Corporation, MDA, Optech, University of British Columbia Astronomy Department, CASCA, National Research Council, Canada Space Agency
- **China –** National Astronomical Observatory of China, Chinese Academy of Sciences, Shanghai Astronomical Observatory, Chinese Society of Astronautics, CNSA, Beijing Planetarium
- **India –** India Space Research Organization, Physical Research Laboratory, Indian Institute of Astrophysics
- **Japan –** JAXA / JSPECS, Shimizu Corporation
- **Europe –** Space-X Space Exploration Institute, European Space Agency
- **Russia –** Keldysh Institute, Vernadsky Institute, Sternberg State Astronomical Institute, Russia Space Agency
- **Hawai`i / USA –** Kimo Pihana, UH Hilo Astronomy / Space Age Publishing Company, SpaceDev, NASA

ILOA Affiliates

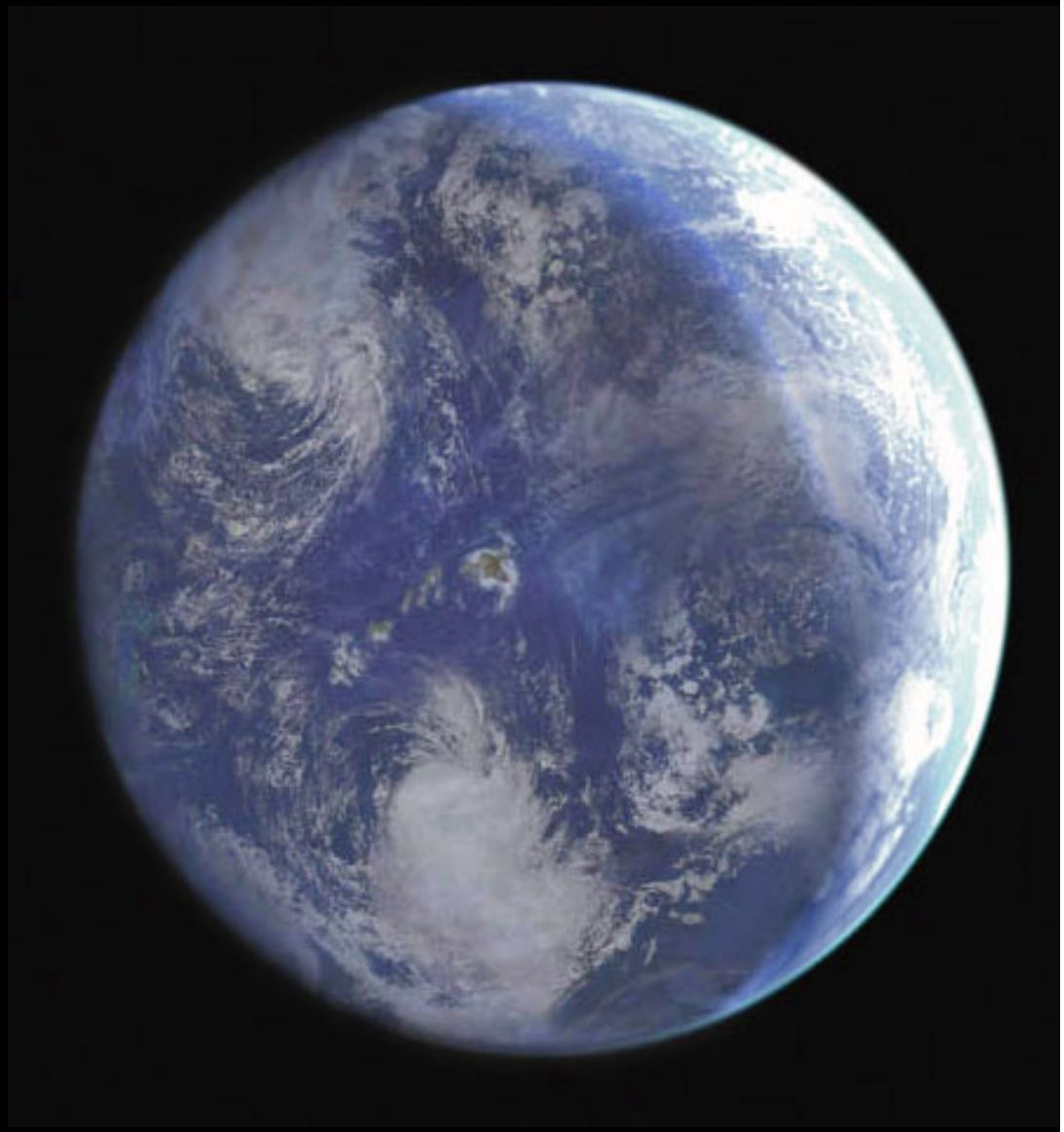
International Lunar Observatory Association

ILOA / ILO Assets …

- 6 SpaceDev Studies 2003-2008 (ILO / Human Service Mission)
- Master / Business Plan
- MoUs with CFHT, NAOC / International Partnerships
- AMIE Camera, Cisco Systems Router
- ILOA Updates / Website / Office
- Lunar Commercial Communications Workshops
- Galaxy Forum 2008, Galaxy Forum 2009
- Non-Profit 501(c)3 Status
- Board of Directors, Exec. Committee with Operating Reserves
- Next Board of Directors Meeting 5-6 December 2008, Hawai‘i Island

International Lunar Observatory Association

- ILOA to be Based in Hawai`i
- Center of Pacific Hemisphere
- Global Support Centers
- Maintain Hawai`i Preeminence in Astrophysics for Next 100 Years



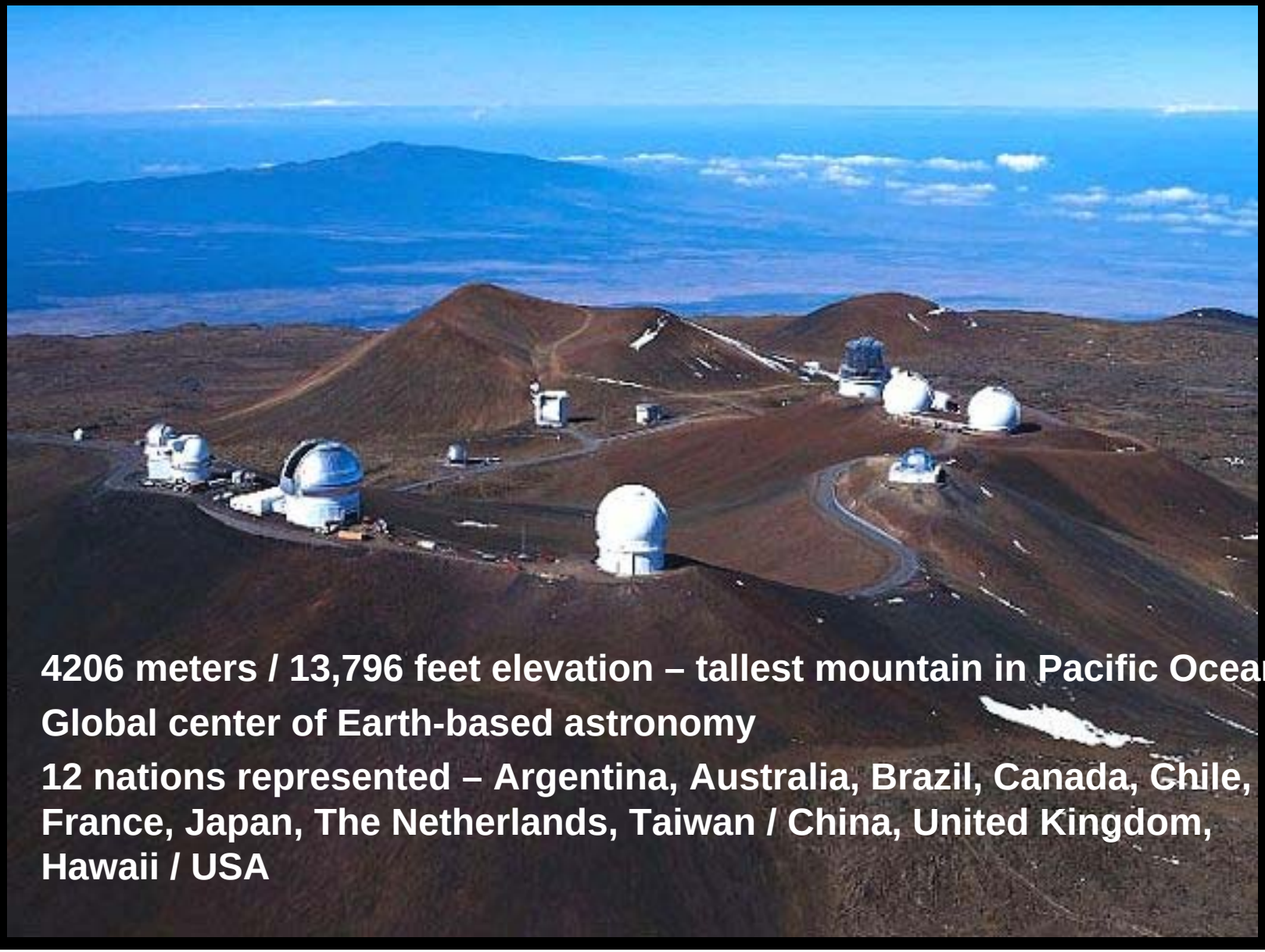
Why Is Hawai`i Important to Space Exploration?

Geographic Advantages:

- Center of Pacific Hemisphere
- Southern-most site in USA / equatorial proximity
- Mid-Pacific islands bi-directional launch capacity (equatorial or polar)
- Mauna Kea – highest point in Pacific

And Aloha!

Mauna Kea Summit Observatories



- 4206 meters / 13,796 feet elevation – tallest mountain in Pacific Ocean
- Global center of Earth-based astronomy
- 12 nations represented – Argentina, Australia, Brazil, Canada, Chile, France, Japan, The Netherlands, Taiwan / China, United Kingdom, Hawaii / USA

Multi-Functional

The ILO is a Multi-Functional …

- Astrophysical Observatory
- Power Station
- Communications Center
- Site Characterizer
- Property Rights Agent
- Virtual Dynamic Nexus Website
- Hawai`i Astronomy Booster
- Toehold for Human Lunar Buildout

ILOA Institutional Membership

- **Observation**: In-situ lunar characterization; Stars, Moon, Earth; Science, Research, Development
- **Communication**: uplink / downlink nodes for surface and Earth line-of-sight relay
- **Education**: supports Galaxy Forum 21st Century architecture

Open to: Science and astronomy institutes, space and government agencies, Aerospace and NewSpace companies, private individuals, universities

Enterprise: establish 21st Century permanent lunar presence

ALOHA!

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