Galaxy Forum 2010 O‘ahu

International Lunar Observatory Association (ILOA)

Tuesday, November 16, 2010, 4:15pm – 6pm

Bishop Museum Planetarium, Honolulu

International Lunar Observatory Association (ILOA) November 2010 Update

Steve Durst, Charles Bohannan, Joseph Sulla

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

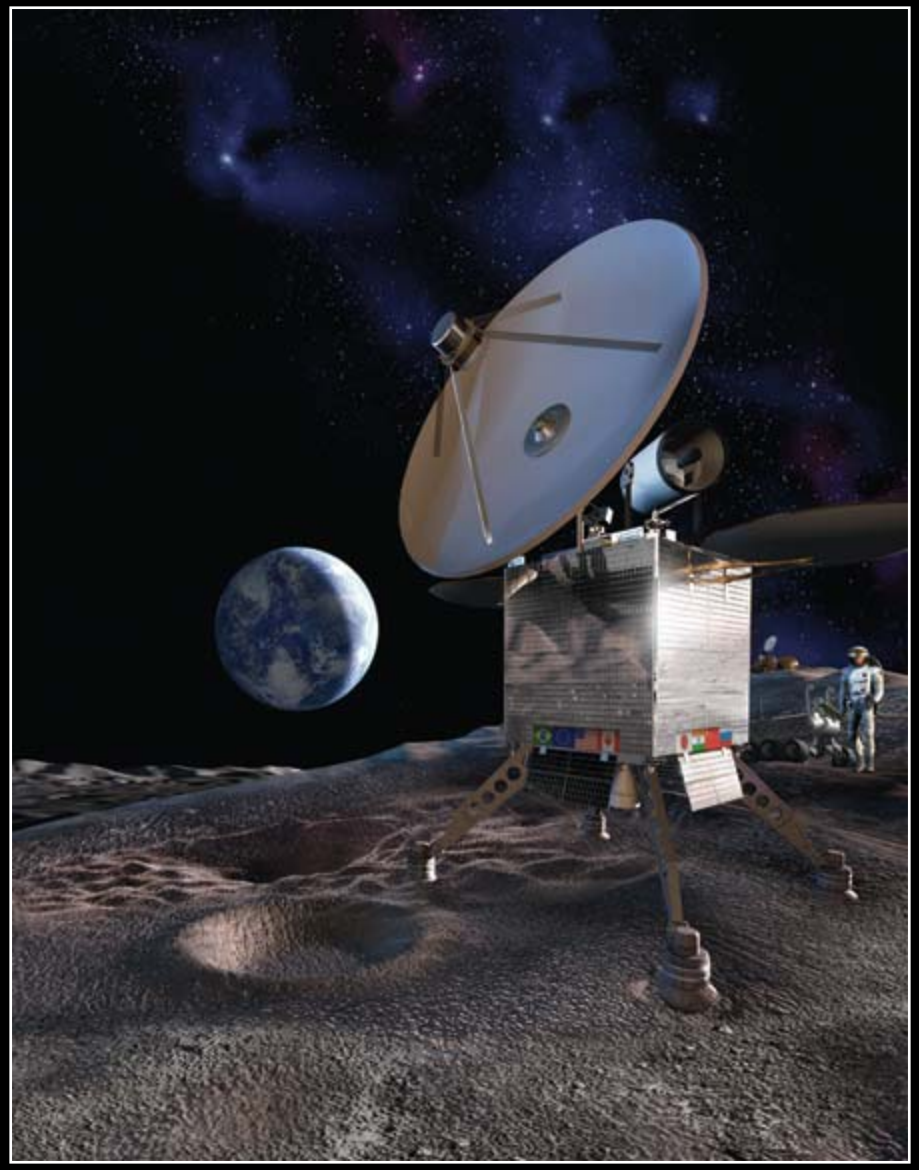
- **Galactic / Inter-Stellar**
- **Earth – Moon / Inter-Global**
- **Hawaiian**
- **Multi-Functional**

Galaxy Forum Architecture

21st Century Education

- **Hawai‘i, USA: Kona, Waimea, Hilo, Oahu**
- **Vancouver, Canada**
- **Beijing, China**
- **Bangalore, India**
- **Prague, Czech Republic**
- **Tokyo, Japan (4 December 2010)**
- **Silicon Valley, California, USA**
- **Kansas, USA**

ILOA – 3 Missions

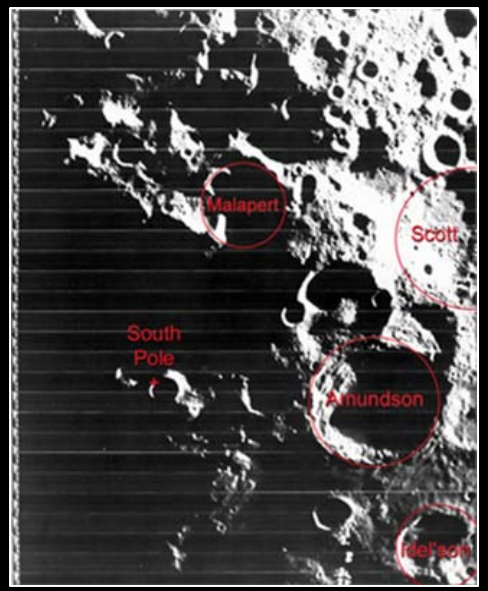


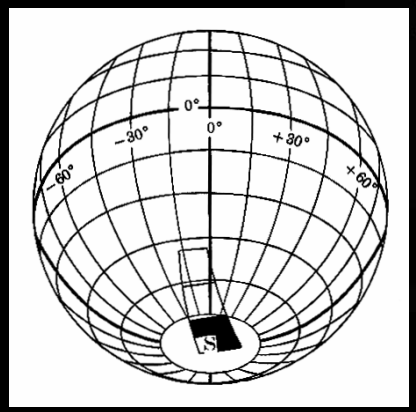
- **ILO-1 Polar Mission** (NET 2013)
- **ILO-X Precursor Mission** (NLT 2013)
- **ILO Human Service Mission**

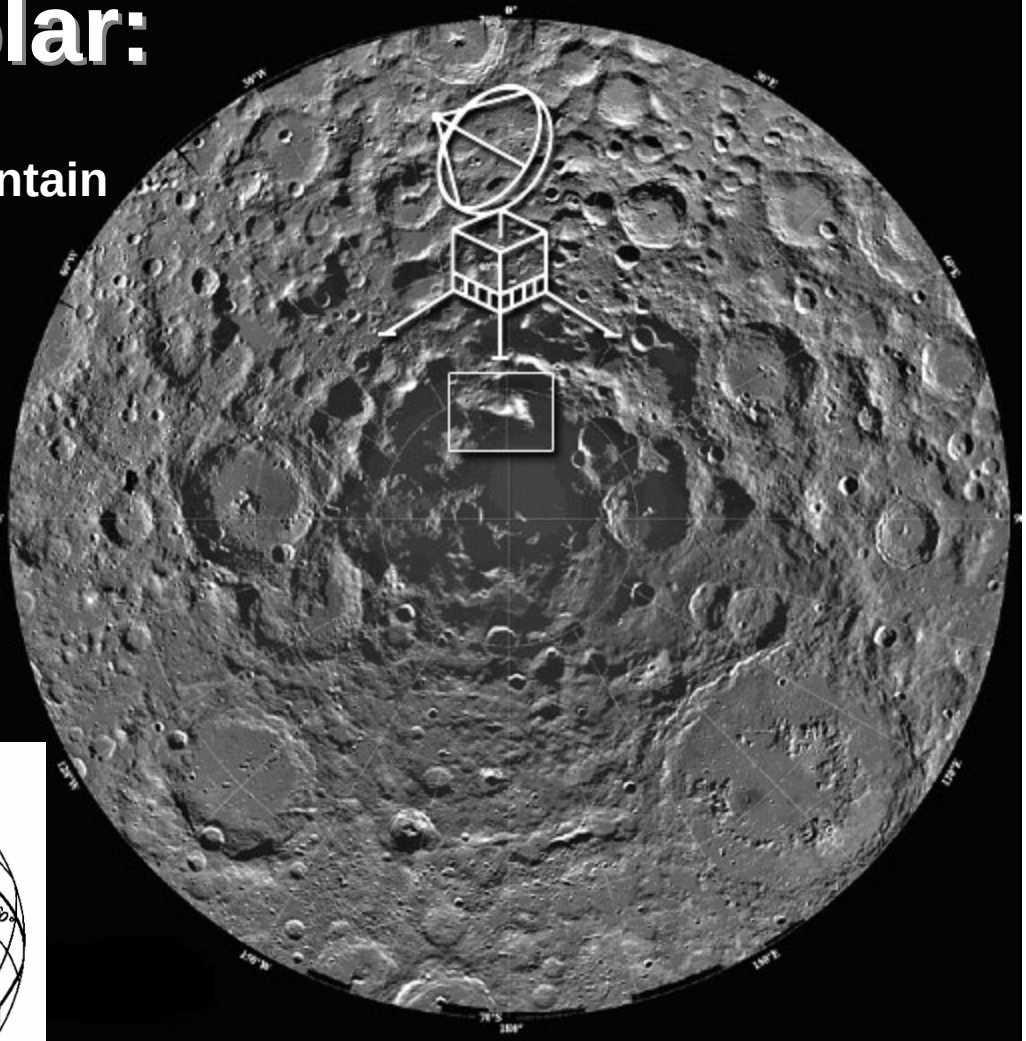
International Lunar Observatory (ILO)

ILO-1 Polar:

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







Shackleton / Malapert Mountain Crater Location

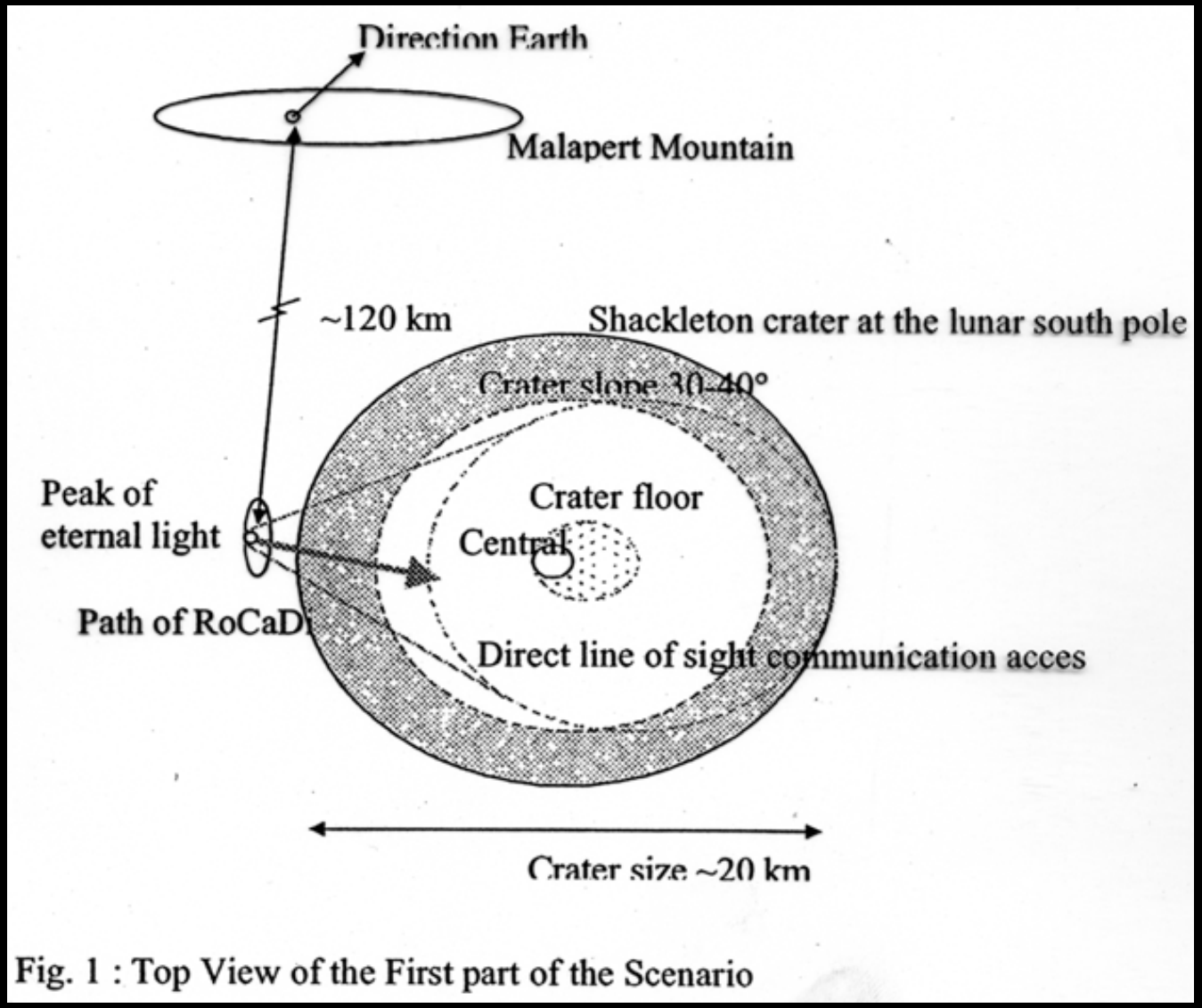
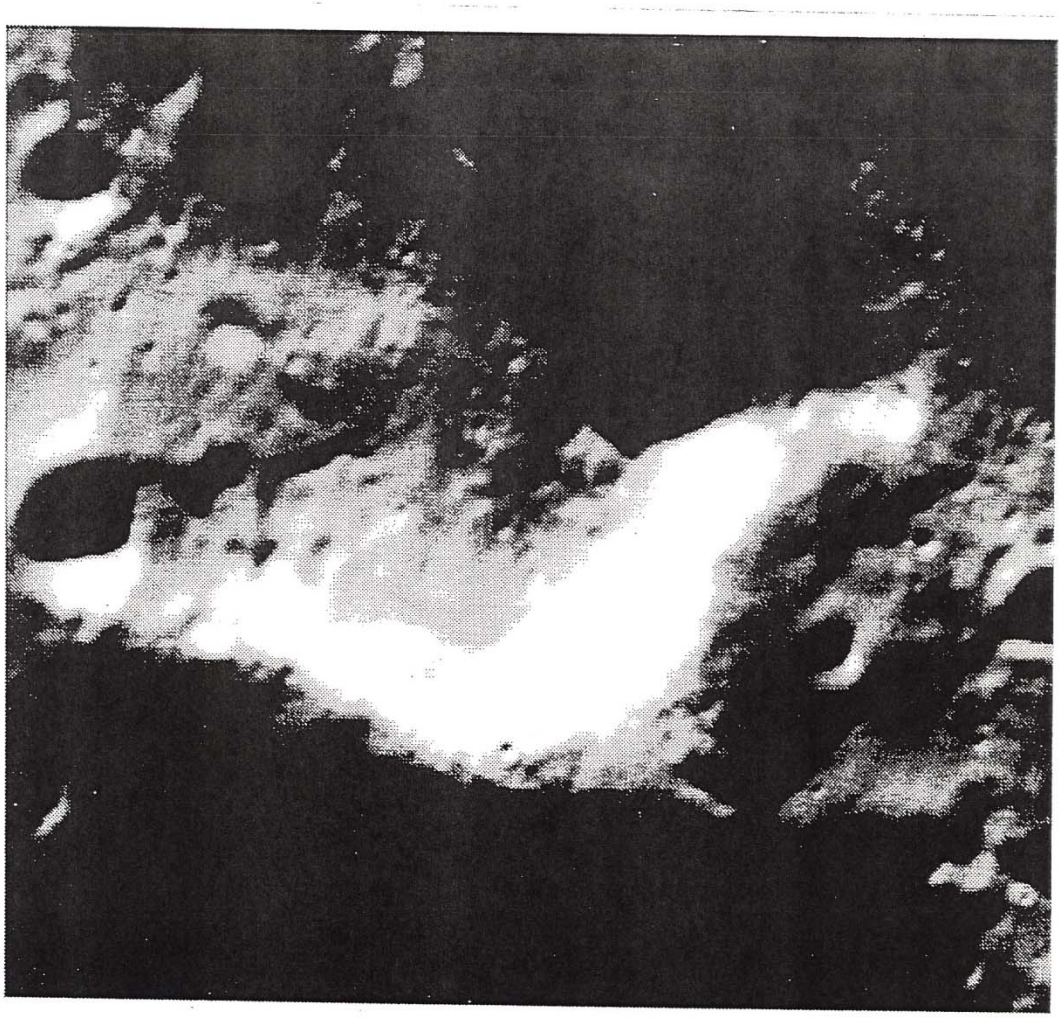


Fig. 1 : Top View of the First part of the Scenario

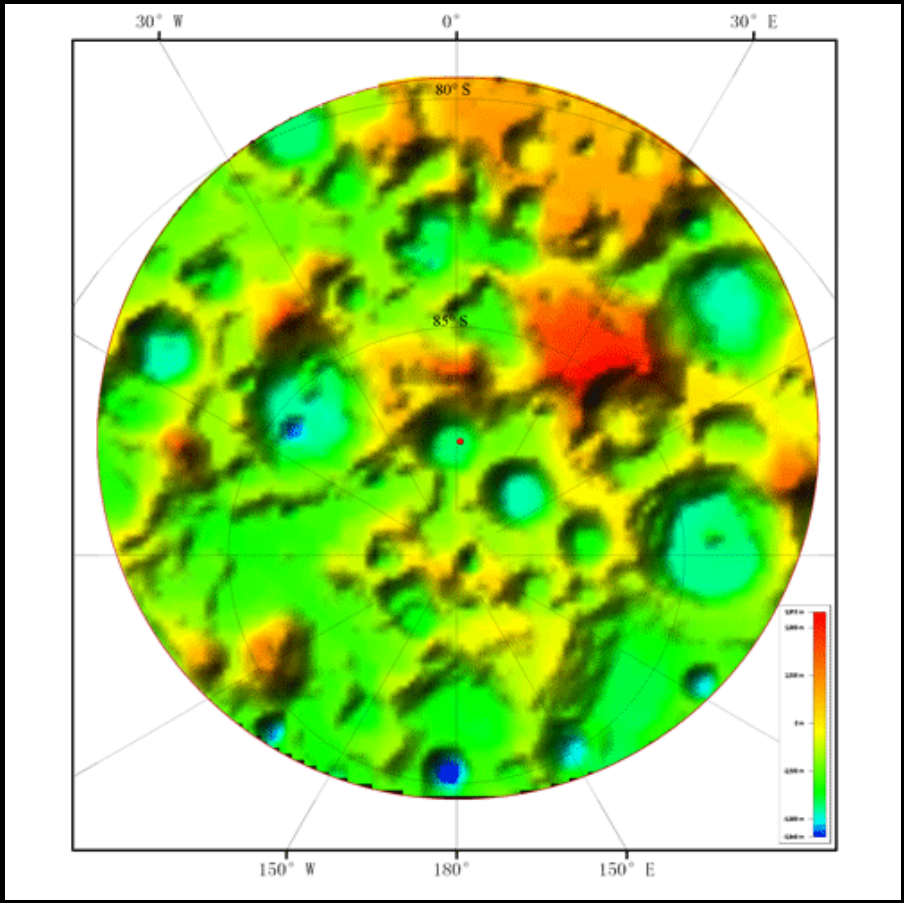
Graphic: Paul van Susante

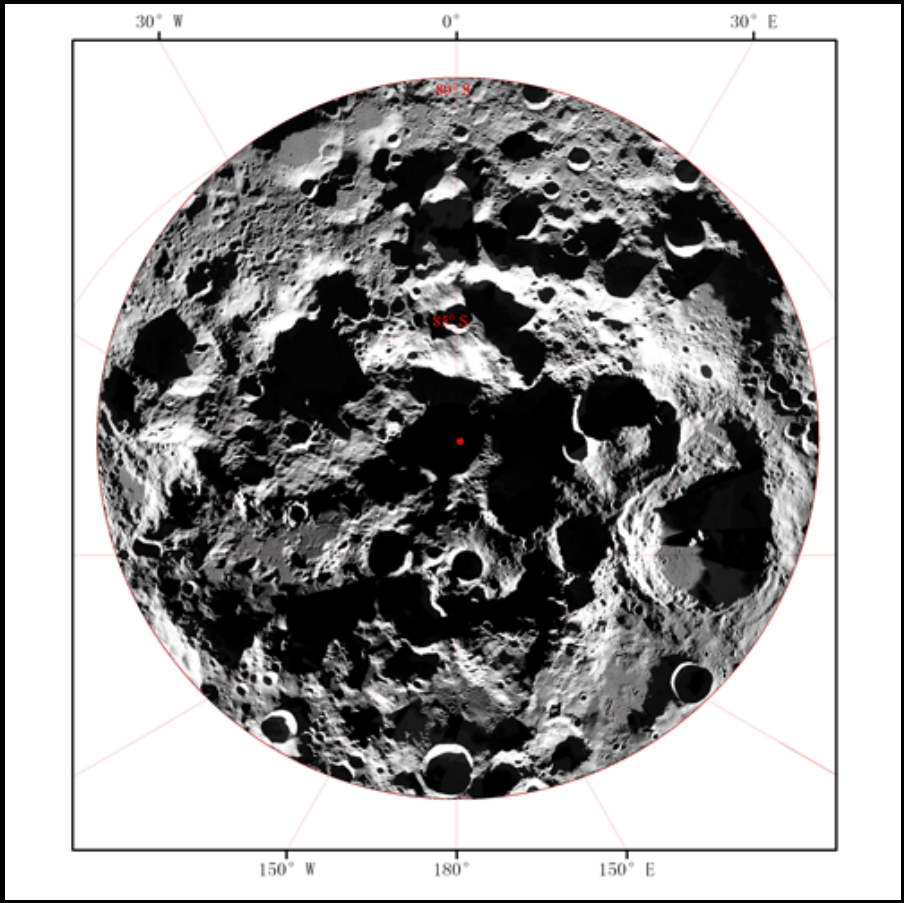
Lunar Orbiter 4 Close-up of Malapert Mountain



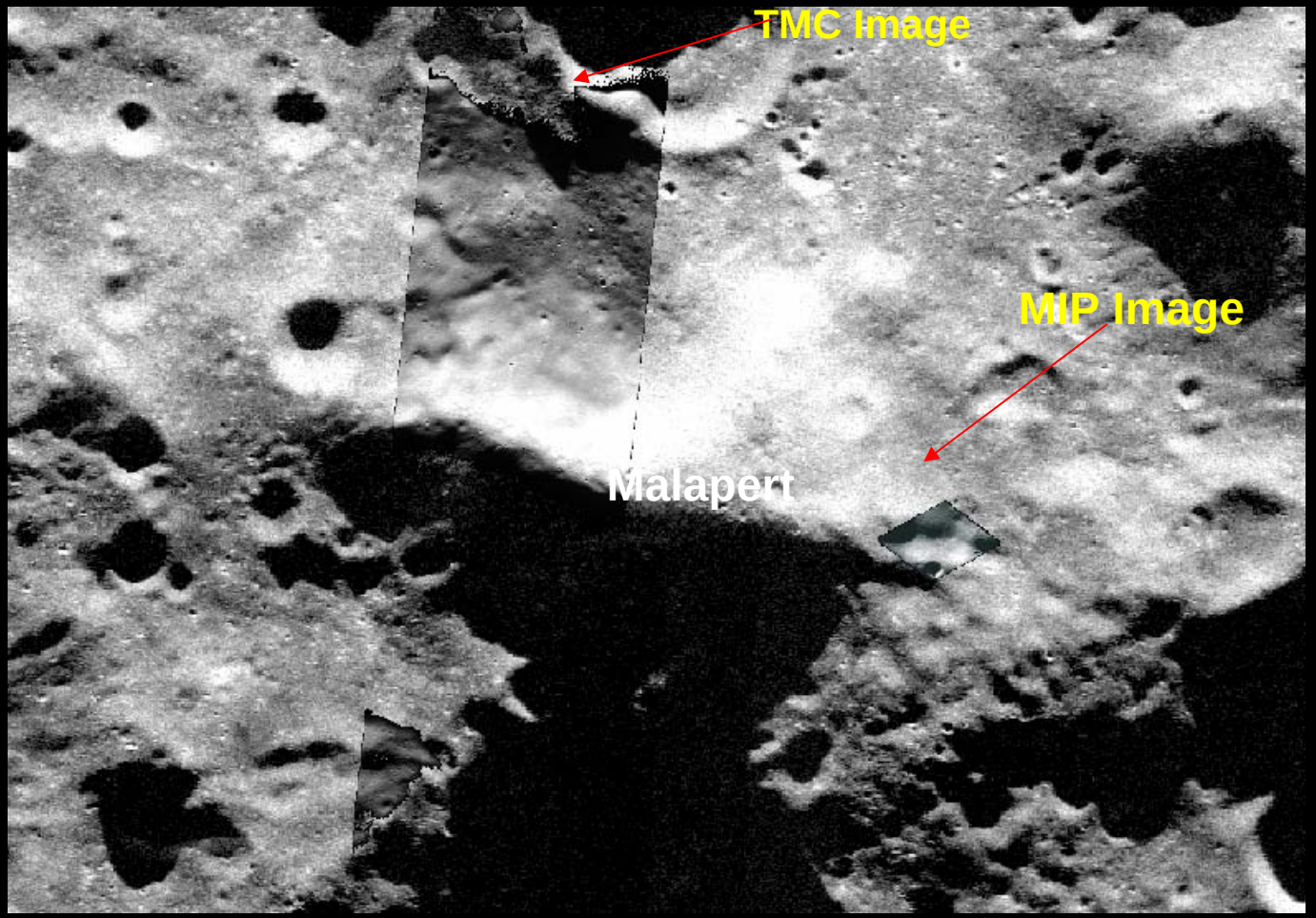
Lunar South Pole – Kaguya

Lunar South Pole – Chang'e-1

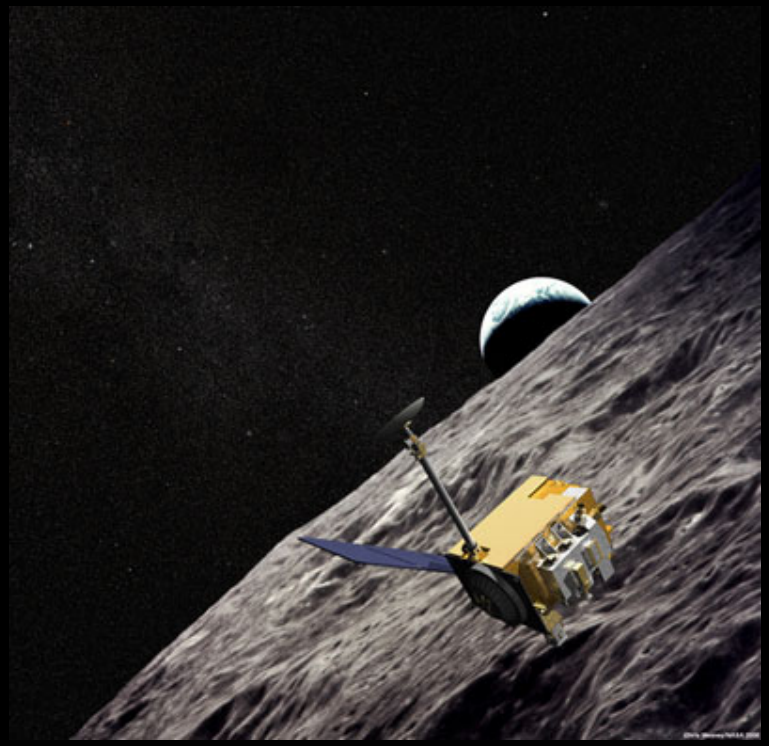




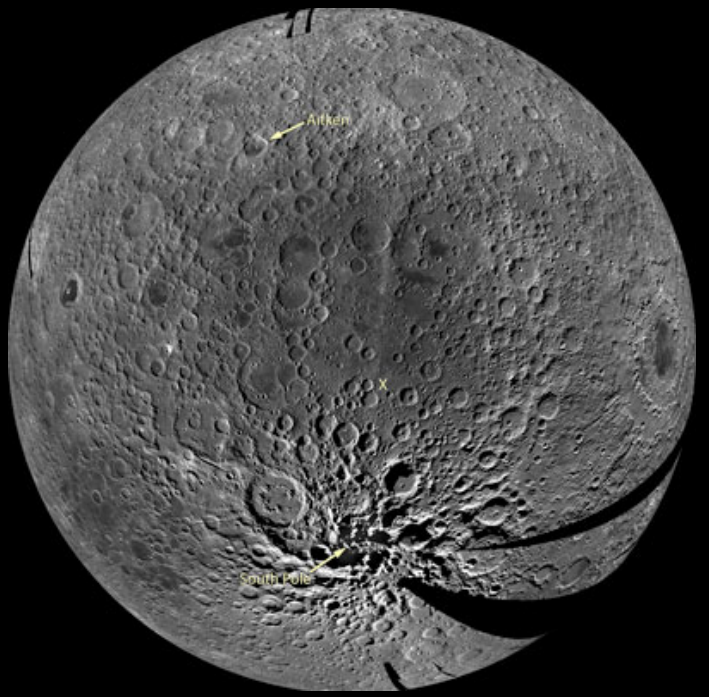
Lunar South Pole – Chandrayaan-1



Lunar South Pole – USA Lunar Reconnaissance Orbiter (LRO)



LRO – artist's conception



South Pole with Aitken Basin
via LROC Wide angle camera - 50km

Lunar South Pole GIS Landing Site Data Set

- Reconcile lunar data from the orbiters of USA (LRO, Prospector and Clementine), China (Chang-e 1), India (Chandrayaan-1), Japan (Kaguya / SELENE), Europe (SMART-1) and other ground-based data including Arecibo.
- Engaged on Hawaii Island, USA by the ILOA, Canada France Hawaii Telescope, University of Hawaii at Hilo and independent GIS experts.
- Identify promising areas for an ideal landing site for the NET 2012 South Polar Moon ILO-1 mission

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:

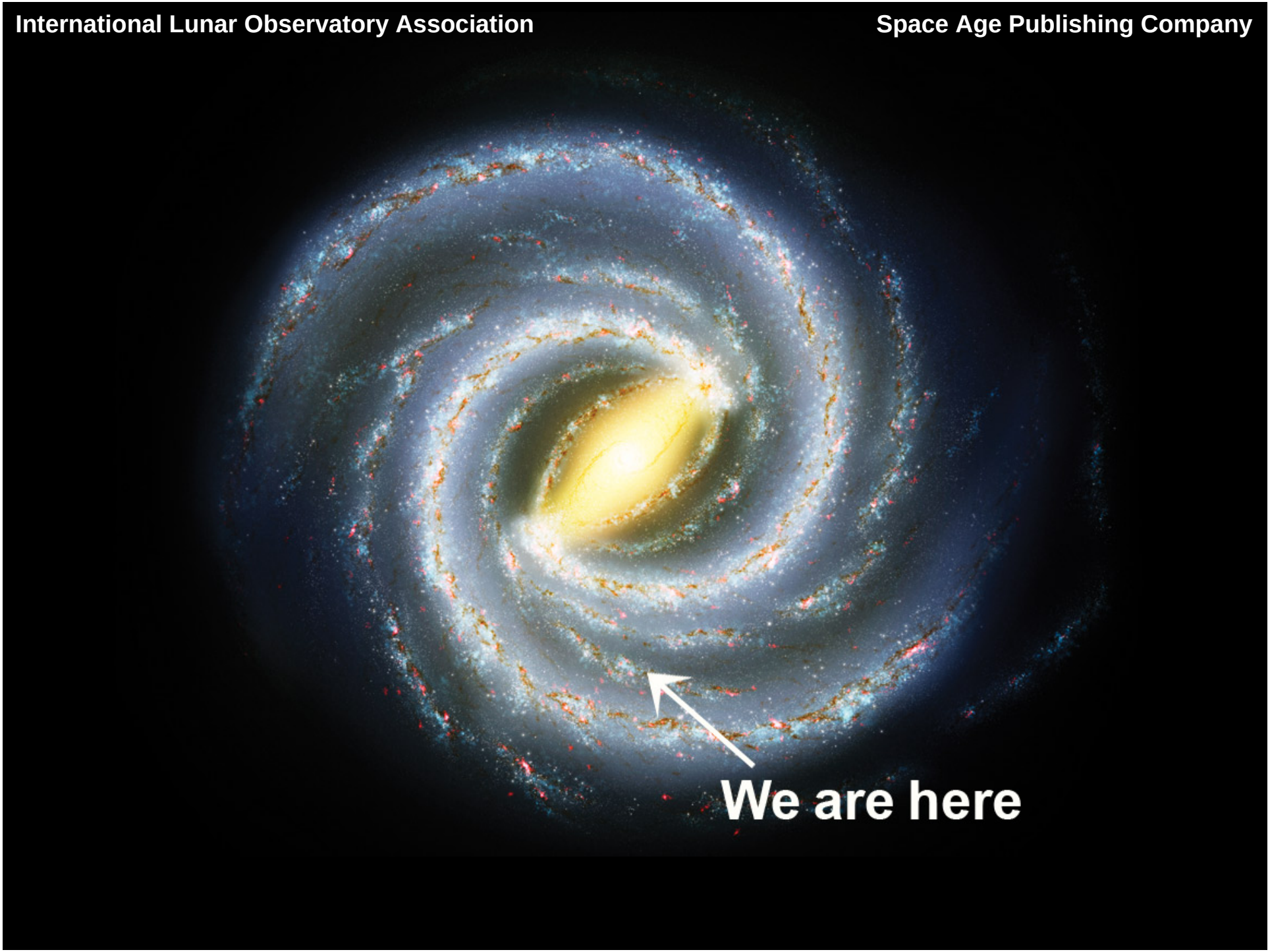
- **Education – for primary, secondary higher, and highest education: Knowledge, understanding of humanity's place in the Universe – our Milky Way Galaxy occupies a mid-position domain between Solar System finiteness and Cosmos infinity**

- **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:

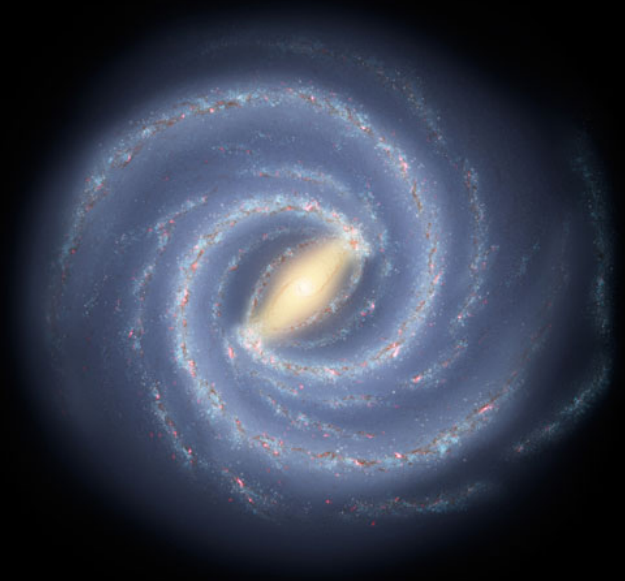
Scutum-Centaurus & Perseus

Two Minor Spiral Arms:

Norma & Sagittarius

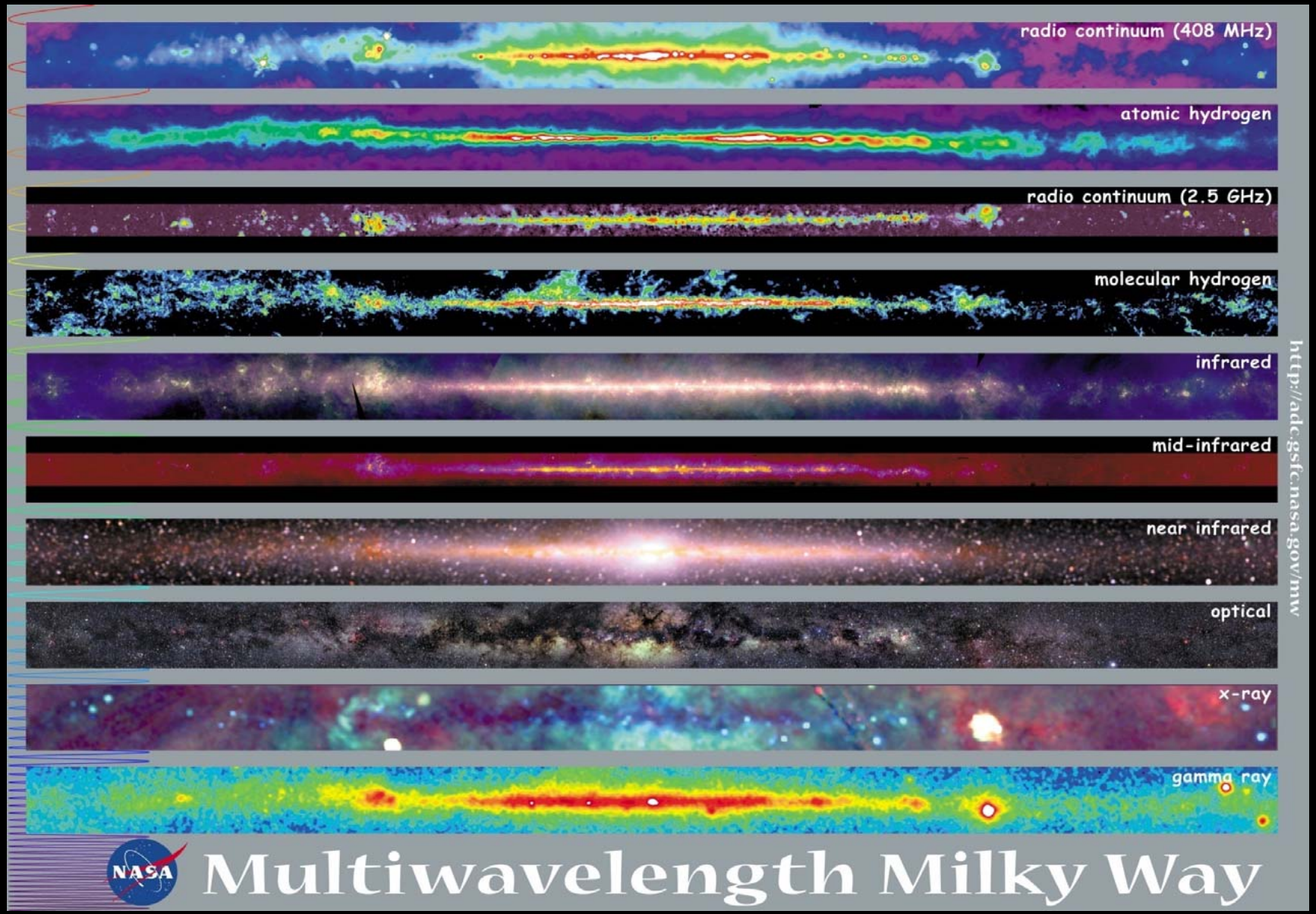
Far-3 Kiloparsec Arm Minor Spiral Arm just identified via radio-telescope Survey

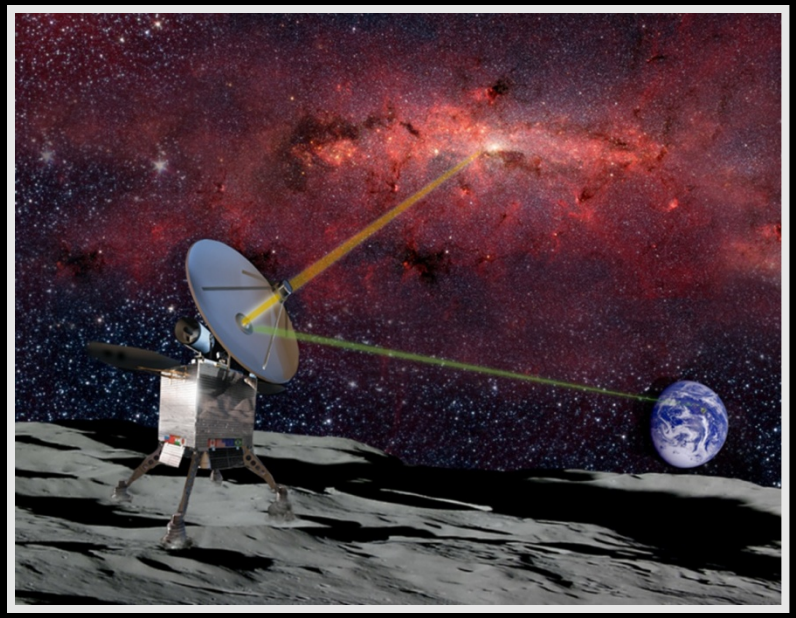
2008 – Robert Benjamin, University of Wisconsin, Whitewater



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

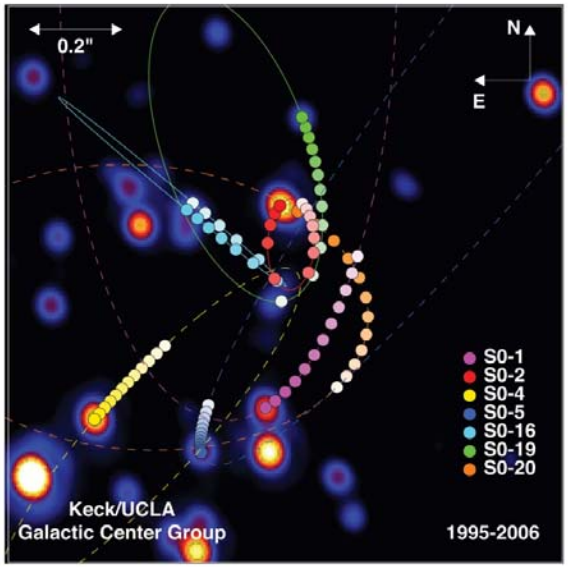
EarthRise Photo : 1968 / Apollo 8

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

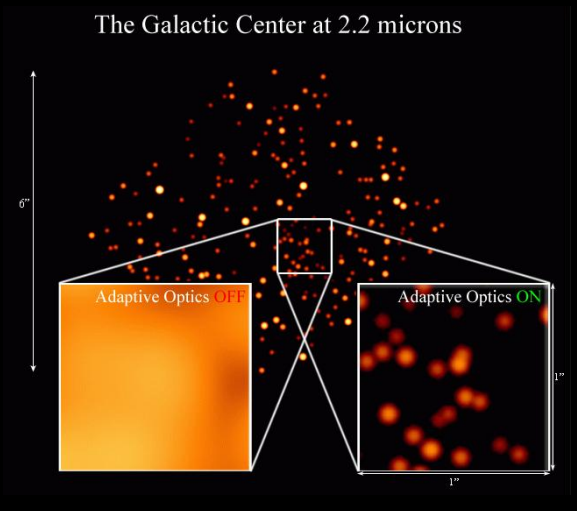
- 1 million pixel visible imager, 2.5º field of view, 2 polarizers and 6 color filters
- Limiting magnitude of ~12 for reasonable sample of Galactic plane from stars between 6th and 12th magnitudes
- Further weight of images by the known spectral response combined composite color image should be able 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

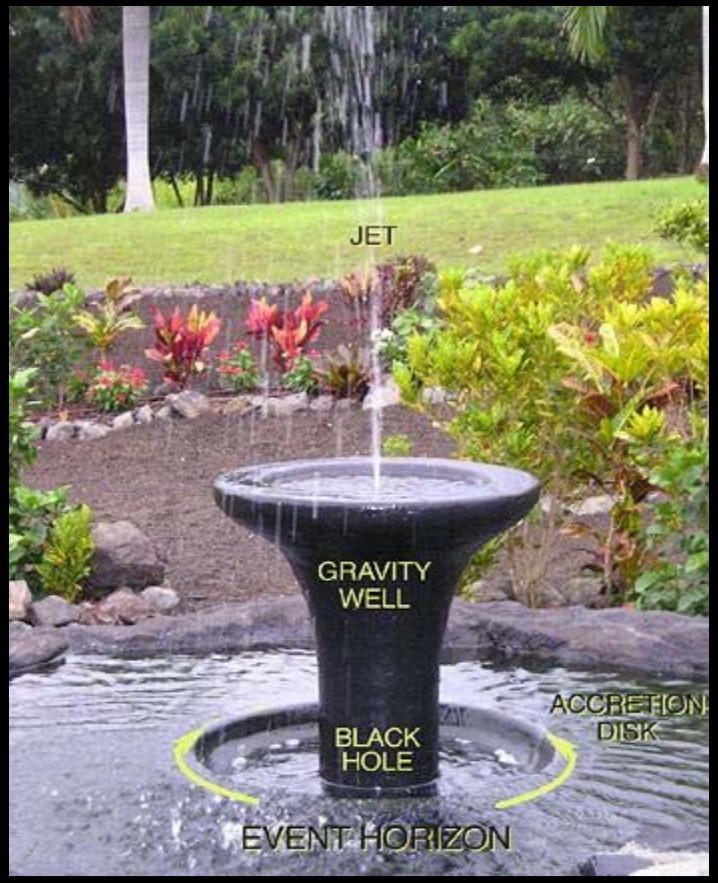
9. The Planetary Society: Inspires and involves the world's public in space exploration through advocacy, projects, and education.
- Louis Friedman, former Executive Director

Galaxy Education Resources

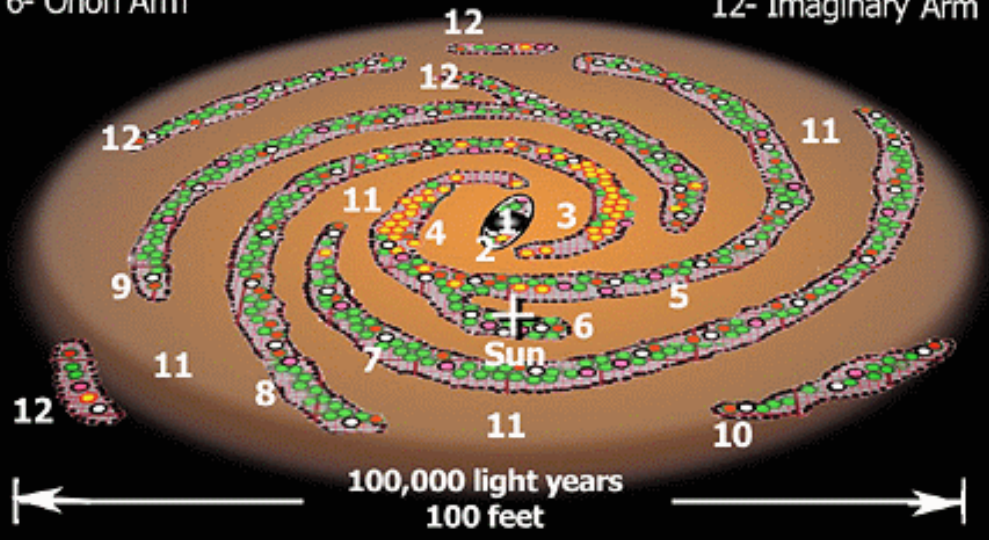
Galaxy Garden / Jon Lomberg
Kona, Hawai`i Island

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



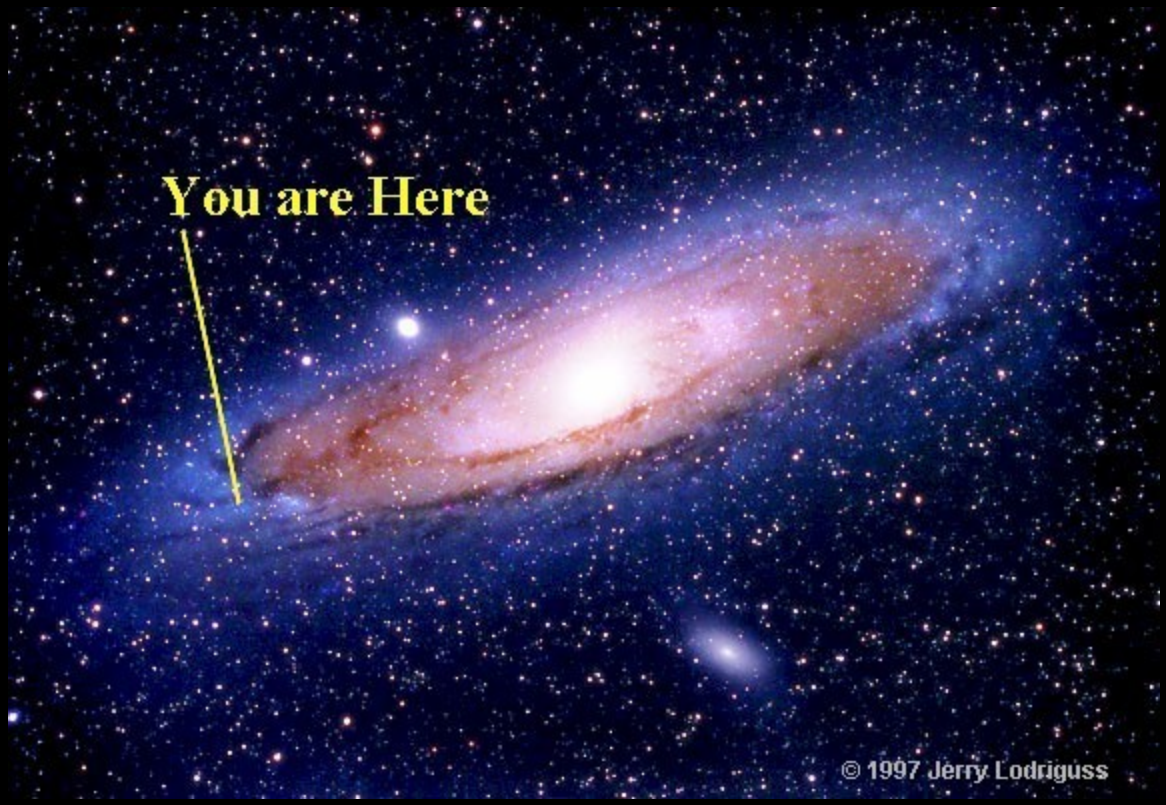
1 foot= 1000 light years

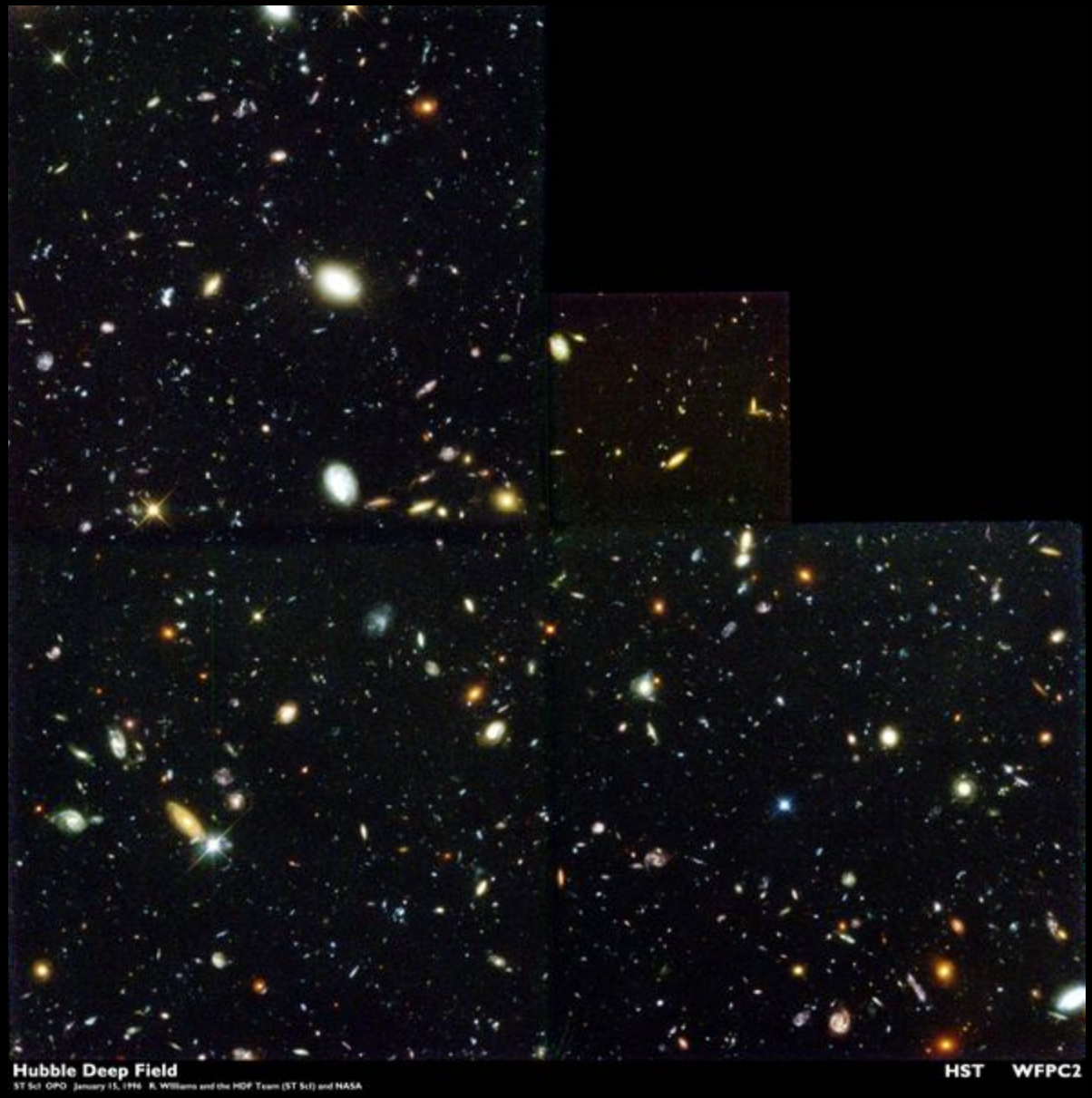
1 inch= 83 light years

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.

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

'The First, Best Space Calendar in the Business'

www.spacecalendar.com

International Lunar Observatory (ILO)

ILO-X Precursor:

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

ODYSSEY MOON™

ILO-X 'Moon Express' Rapid Development Program

ILOA NASA

INTEK ADVANCED COMMUNICATIONS LTD.

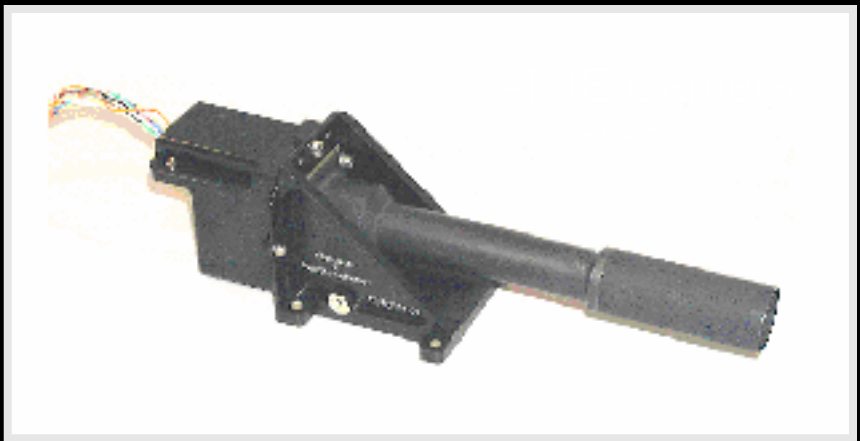
STANFORD ENGINEERING

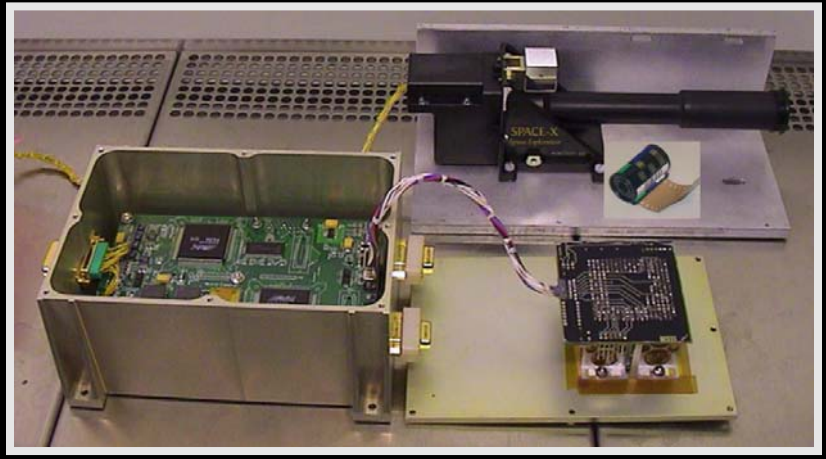
- **PHASE 1: Prototype unit with hyperspectral**
- **PHASE 2: Prototype system and Global demo**

References to Stanford University are for discussion purposes only

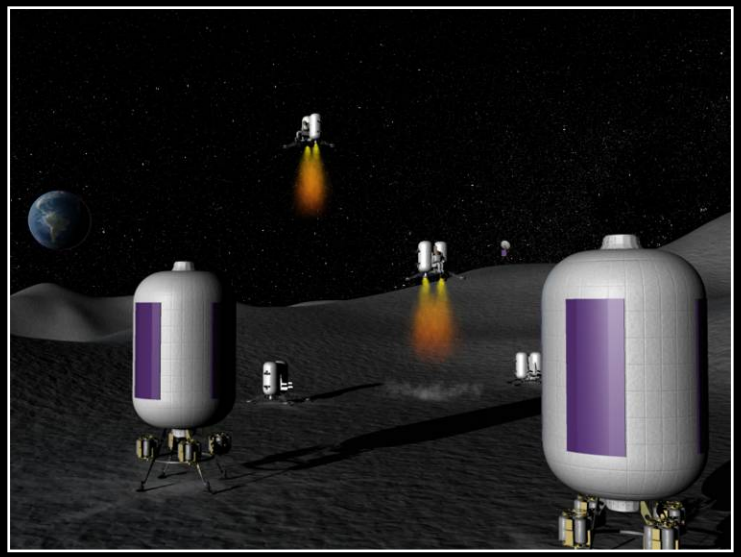
Instrumentation

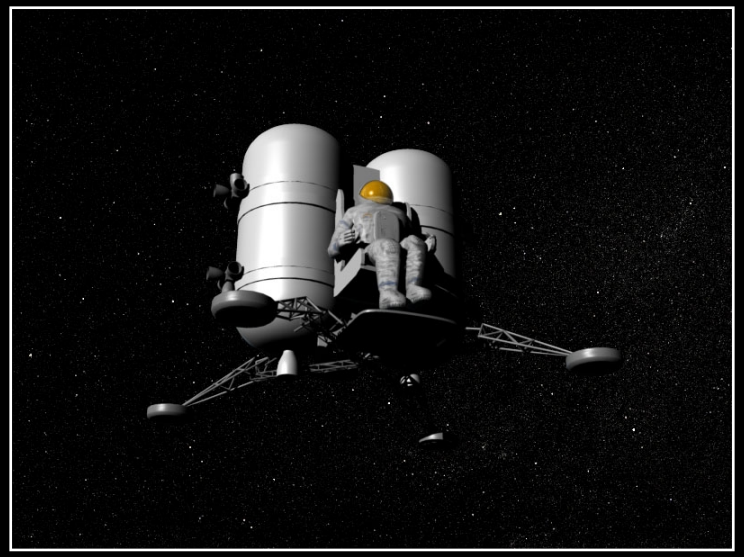
- Candidate Instrument – AMIE Camera
- UV / Vis / NIR CCD Imaging Array of 1024 x 1024 pixels
- Field of View – 5.3° x 5.3° = 738 parsecs on a side (0.72 pc / pixel)
- Mass = 2 kg





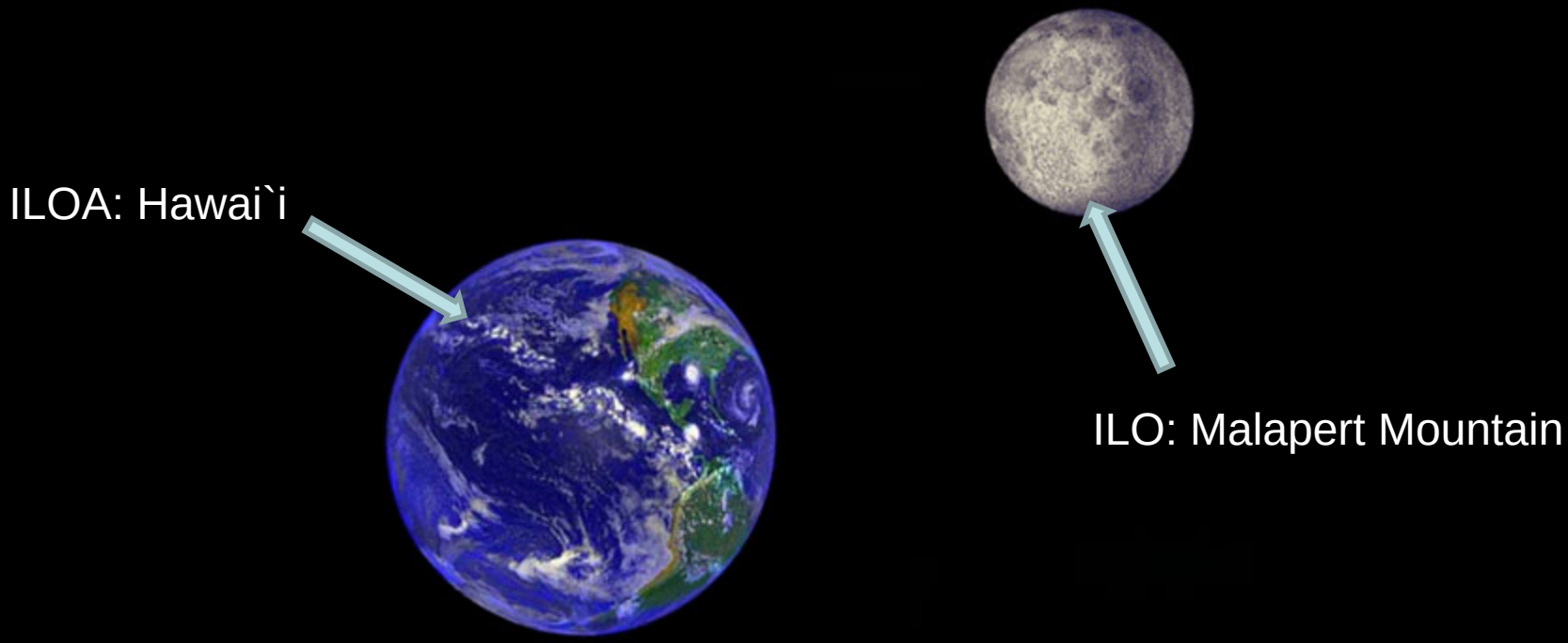
Human Service Mission



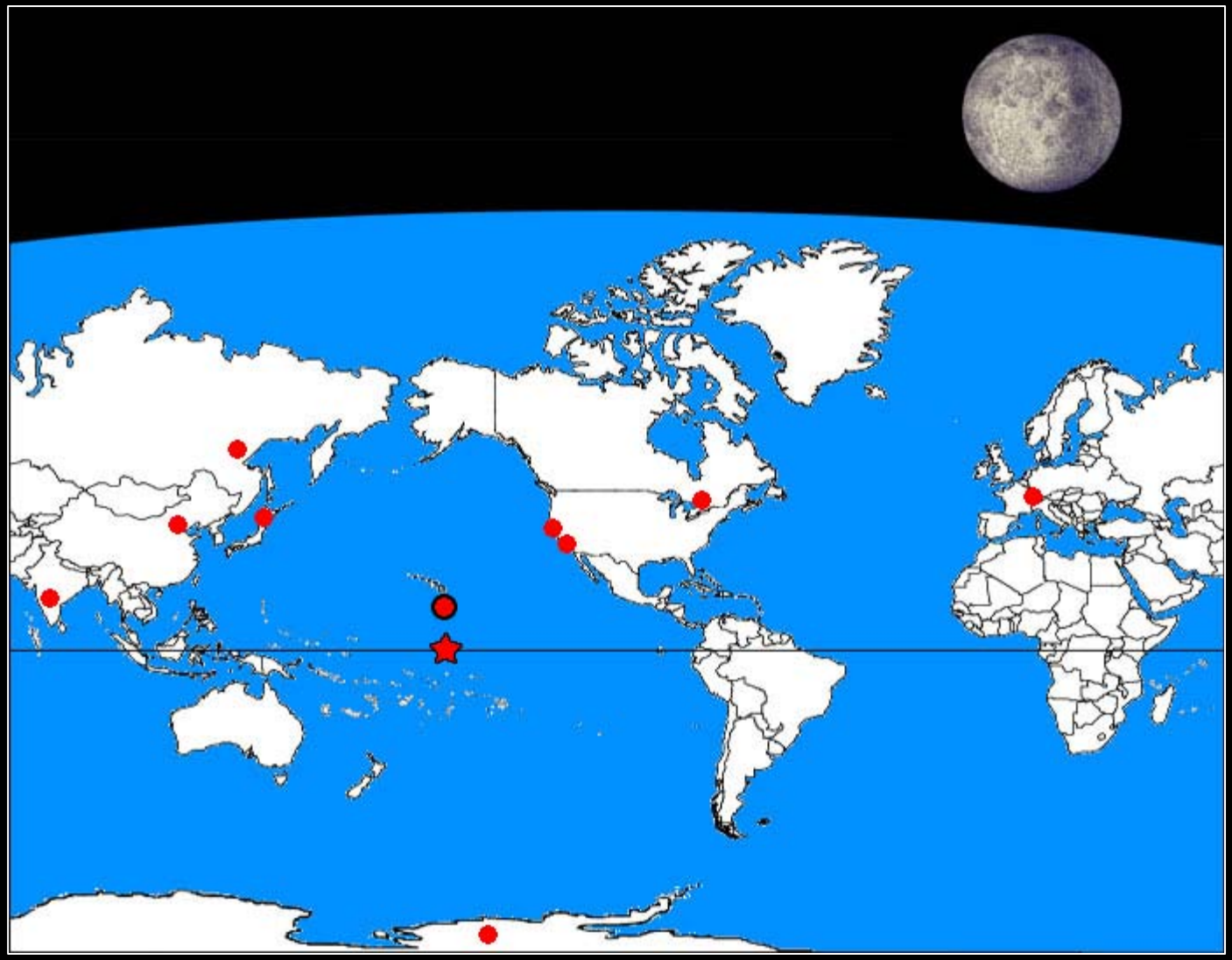


SpaceDev Inc – Dream Chaser, ALOHA Chair

Inter-Global / Cislunar System



A Global / Interglobal Mission



A Global / Interglobal Mission

- **Canada –** Canada France Hawai`i Telescope Corporation, MDA, University of British Columbia Astronomy Department, CASCA, National Research Council, Canada Space Agency
- **China –** National Astronomical Observatory of China, Beijing Planetarium, Chinese Academy of Sciences, Shanghai Astronomical Observatory, Chinese Society of Astronautics, CNSA
- **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, American Astronautical Society, SpaceDev, NASA

ILOA Affiliates

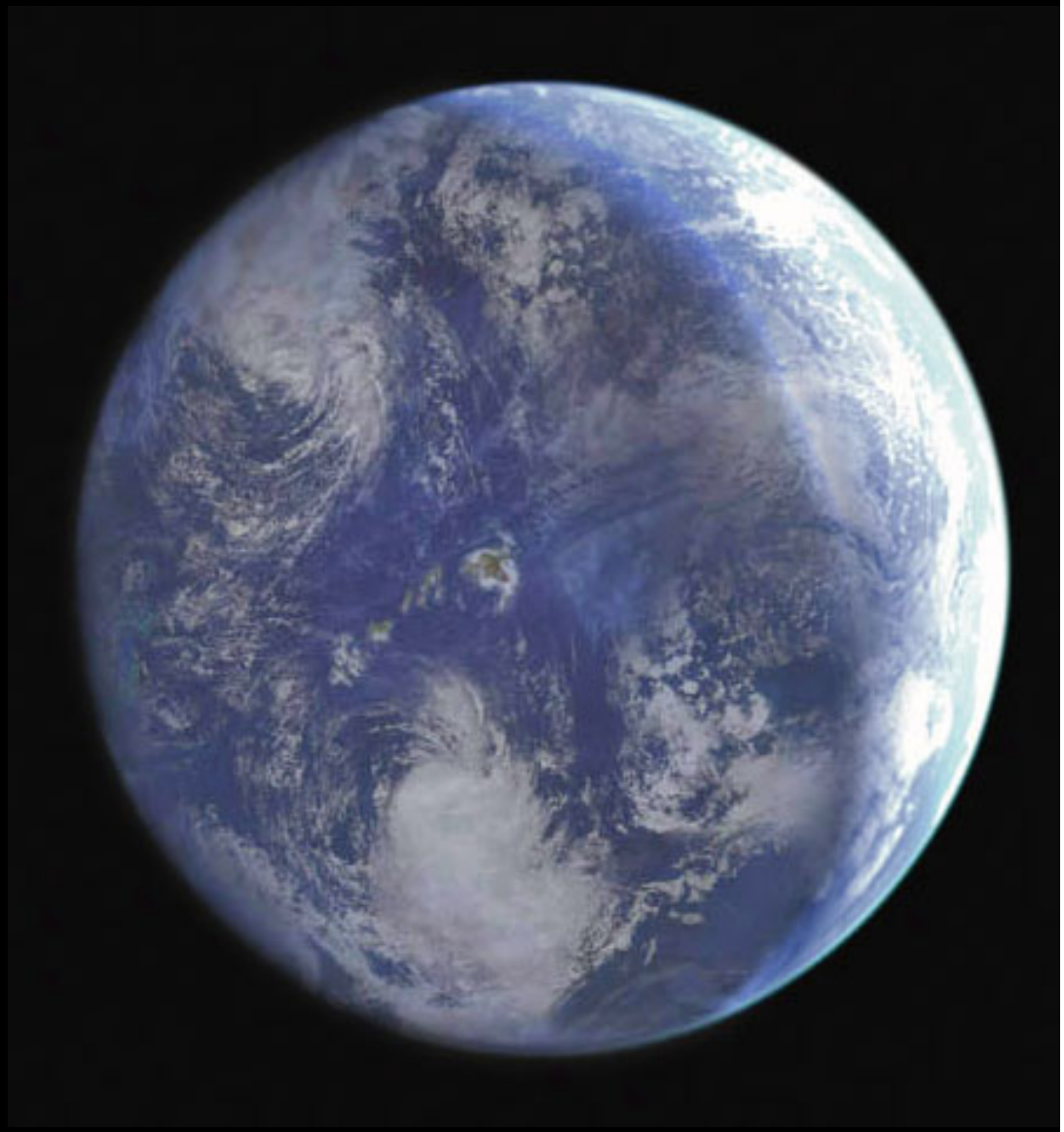
International Lunar Observatory Association

ILOA / ILO Asset:

- 2 MDA studies (2009-2010)
- 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

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



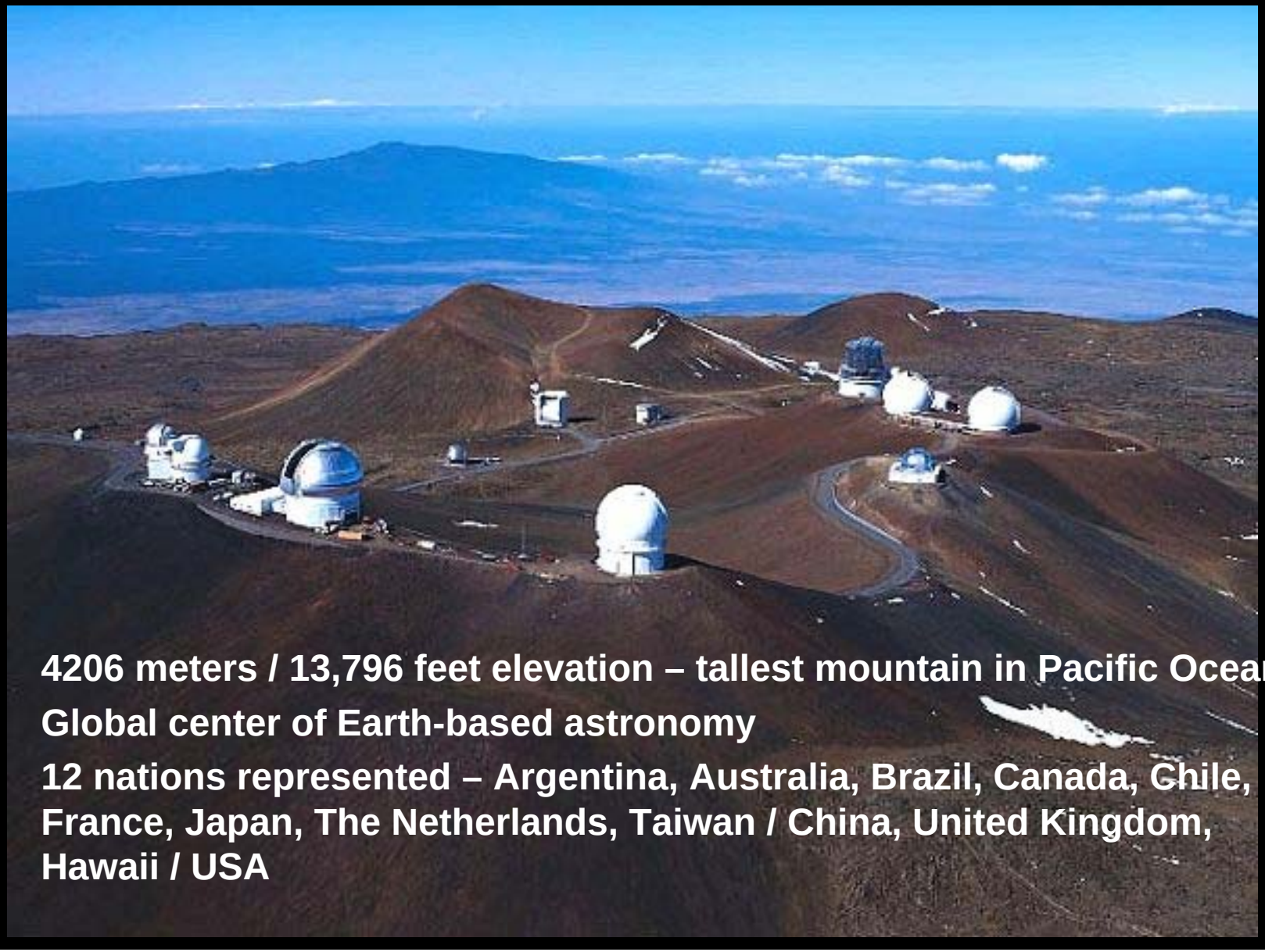
Why Is Hawai`i Important to Space Exploration?

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 Associates / 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: Space and government agencies, Aerospace and NewSpace companies, private individuals, science and astronomy institutes, universities
- Enterprise: establish 21st Century permanent lunar presence

ALOHA!

For more information about the ILO / ILOA, contact:

Space Age Publishing Company
65-1230 Mamalahoa Highway, D-20
Kamuela, HI 96743
Phone 808-885-3473
Fax 808-885-3475
Email news@spaceagepub.com
Web http://www.spaceagepub.com

ILO Association
65-1230 Mamalahoa Highway, D-20
Kamuela, HI 96743
Phone 808-885-3474
Fax 808-885-3475
Email info@iloa.org
Web http://www.iloa.org

SPACE AGE PUBLISHING COMPANY
www.spaceagepub.com
Hawaii and California, USA