Galaxy Forum 2010 Europe – Prague

International Lunar Observatory Association (ILOA)

Saturday 2 October 2010, 10am – 12pm

Stefanik Observatory, Prague, Czech Republic
International Lunar Observatory Association (ILOA) October 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
- Silicon Valley, California, USA
- Kansas, USA
- Vancouver, Canada
- Beijing, China
- Bangalore, India
- Prague, Czech Republic (Saturday 2 October 2010 at Stefanik Observatory)
- Tokyo, Japan (4 December 2010)
ILOA – 3 Missions

- ILO-1 Polar Mission (NET 2012-2013)
- ILO-X 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
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

Mons Malapert

Shackleton Crater

© JAXA/NHK
Lunar South Pole – Chang’e-1
Lunar South Pole – Chandrayaan-1

Malapert

TMC Image

MIP Image
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
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

The Milky Way: Spitzer Infrared Space Telescope
Galaxy First Light Imaging Program – Average Color of the Galactic Plane

- 1 million pixel visible imager, 2.5° 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

   - 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
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 Garden / Jon Lomberg
Kona, Hawai`i Island
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

100,000 light years
100 feet

1 foot = 1000 light years
1 inch = 83 light years
Barbara Morgan
1st Teacher in Space
You are Here
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

<table>
<thead>
<tr>
<th>Pre-sold Bandwidth</th>
<th>Bandwidth Available Upon Emplacement (May be pre-sold when launch date set)</th>
<th>Future Need</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Calendar Broadcast</strong>&lt;br&gt;This Space Calendar will be transmitted from the Moon. Advertisers will pay a premium rate for transmission of their ads from the lunar surface.</td>
<td><strong>Internet Search Engine Giants</strong>&lt;br&gt;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.</td>
<td><strong>Specialty Advertising Opportunities</strong>&lt;br&gt;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.</td>
</tr>
<tr>
<td><strong>In Situ Communications and Monitoring Capabilities for Robotic Project Operators</strong>&lt;br&gt;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.</td>
<td></td>
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International Lunar Observatory Association
Space Age Publishing Company

‘The First, Best Space Calendar in the Business’
www.spacecalendar.com

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Space Generation Council 2010 to be Held in Prague

The Space Generation Advisory Council (SGAC) will hold the 9th Space Generation Congress (SGC) in Prague, Czech Republic on September 23-25. Approximately 100 selected young space professionals from over 30 countries will converge at Charles University to focus on key space issues. This year’s themes will center around industry, agency, climate, exploration and outreach. Attendees will discuss the new role of commercial space, collaborative space systems between countries, Earth observation data, human space exploration and developing science and technology education / careers for the new generation of space explorers. Invited SGC speakers include NASA Administrator Charles Bolden (BL), ESA International Relations Head Chris De Cock, International Astronautical Federation President Berndt Feuerbacher (BR), ArianeSpace President Clayton Momy, Space Frontier Foundation Executive Director Wil Watson (IC) and International Space Services President Jim Zimmerman. The Czech Republic has gradually developed its own infrastructure for Space exploration, becoming the 18th member of the European Space Agency in 2008. Also held in conjunction with SGC 2010 is the 61st International Astronomical Congress on Sep 27-Oct 1. (Credit: SGAC, NASA, Virgin Galactic, Investor.com)

USGS Helping to Advance Planetary GIS Research with 2 Workshops

Researchers from the planetary mapping community will meet at the US Geological Survey (USGS) in Flagstaff, Arizona on September 20-21 for the GIS for Planetary Mappers 2 workshop. Participants will receive hands-on training in the uses of the innovative GIS systems such as SIS3, EMI and Quantum GIS. The goal of the workshop will be to demonstrate how to initiate, organize and implement best practices for a digital planetary mapping project. Registration for the...
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
ILO-X ‘Moon Express’
Rapid Development Program

• 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

ILOA: Hawai`i

ILO: Malapert Mountain
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
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
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 21\textsuperscript{st} Century architecture

- Open to: Space and government agencies, Aerospace and NewSpace companies, private individuals, science and astronomy institutes, universities
- Enterprise: establish 21\textsuperscript{st} Century permanent lunar presence
ALOHA!

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