

**Panoramic Survey Telescope &  
Rapid Response System (Pan-STARRS)**

**TMK 4-4-15:09  
Summit of Mauna Kea, Island of Hawaiji**

**ENVIRONMENTAL IMPACT STATEMENT  
Preparation Notice**



**December 2006**

# Panoramic Survey Telescope & Rapid Response System (Pan-STARRS)

TMK 4-4-15:09  
Summit of Mauna Kea, Island of Hawai'i

## Environmental Impact Statement Preparation Notice

Applicant:



Institute for Astronomy  
University of Hawai'i at Mānoa

This environmental document is prepared pursuant to Hawai'i Revised Statutes, Chapter 343, Environmental Impact Statement Law and Chapter 200 of Title 11, Hawai'i Administrative Rules, Department of Health, Environmental Impact Statement Rules.



Architecture • Planning • Interior Design • Environmental Services  
Honolulu, Hawai'i

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Appendix B: DVD of 'Ōlelo Community Television Production "E Mau Ke Ea: Mālama Mauna Kea" October 2005

## LIST OF ACRONYMS AND ABBREVIATIONS

AΩ	etendue
AAQS	Ambient Air Quality Standards
ACHP	Advisory Council on Historic Preservation
AFRL	U.S. Air Force Research Laboratory
AIA	American Institute of Architecture
AICP	American Institute of Certified Planners
AIRFA	American Indian Religious Freedom Act
Arch.D.	Doctorate of Architecture
ARL	Applied Research Center
ATST	Advanced Technology Solar Telescope
AU	Astronomical Units
BAA	Broad Area Announcement
BLNR	Board of Land and Natural Resources
CCD	Coupled Charged Device
CDUA	Conservation District Use Application
CEQ	Council on Environmental Quality
CFHT	Canada France Hawaii Telescope
CFR	Code of Federal Regulations
CO	Carbon monoxide
CWA	Clean Water Act
DCRE	Division of Conservation and Resources Enforcement
Deg <sup>2</sup>	degrees squared
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
DVD	Digital Video Disk
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EISPN	Environmental Impact Statement Preparation Notice
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAIA	Fellow of the American Institute for Architecture
ft	Feet
FY	Fiscal Year
GB	Gigabyte
GEODSS	Ground Electro-Optical Deep Space Surveillance telescopes
HLRDP	Haleakalā Long Range Development Plan
HRS	Hawai'i Revised Statutes
IfA	Institute for Astronomy

KKM	Kahu Kū Mauna
km	Kilometer
LINEAR	Lincoln Near Earth Asteroid Research project (MIT Lincoln Laboratory)
LUPAG	Land Use Plan Allocation Guide
LURE	Lunar Ranging Experiment Observatory
m	Meter
M.A.	Masters in Arts
MB	Megabyte
MIT	Massachusetts Institute of Technology
MKMB	Mauna Kea Management Board
MKSR- MP	Mauna Kea Science Reserve Master Plan
MKSR	Mauna Kea Science Reserve
MKSS	Mauna Kea Observatories Support Services
MOID	Minimum Orbital Intersection Distance
NAGPRA	Native American Graves Protection and Repatriation Act
NARC	Natural Area Reserves Commission
NASA	National Aeronautics and Space Administration
NATV	Native TV, public community cable access channel on Oahu through 'Ōlelo Corporation
NEA	Near Earth Asteroid
NEAT	Near Earth Asteroid Tracking project
NEO	Near Earth Object
NEO-PO	Near Earth Object Program Office
NEPA	National Environmental Protection Act
NHPA	National Historic Preservation Act
NOI	Notice of Intent
NOMISS	New Opportunities through Minorities Initiatives in Space Science
NO <sub>x</sub>	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
OCCL	Office of Conservation and Coastal Lands
OEQC	Office of Environmental Quality Control
OMKM	Office of Mauna Kea Management
O <sub>3</sub>	Ozone
Pan-STARRS	Panoramic Survey Telescope & Rapid Response System
PC	Personal computer
Ph.D.	Doctorate
PHA	Potentially Hazardous Asteroid
PM10	10 microns
PM2.5	particulate matter smaller than 2.5 microns
PPA	Pollution Prevention Act
PS-1	Pan-STARRS prototype 1 located on Haleakala, Maui
RFP	Request For Proposal
RFQ	Request For Qualifications
SDT	Science Definition Team
SHPD	State Historic Preservation Division
SO <sub>x</sub>	sulfur oxides
STEM	Science, Technology, Engineering and Mathematics (education)
TMK	Tax Map Key
TNT	TriNitroToluene. Explosive consisting of a yellow crystalline compound, CH <sub>3</sub> C <sub>6</sub> H <sub>2</sub> (NO <sub>2</sub> ) <sub>3</sub> , that is flammable toxic derivative of toluene.

U.S.C.	United States Code
UARC	University Affiliated Research Center
UH	University of Hawai'i
UH-H	University of Hawai'i at Hilo
UH-M	University of Hawai'i at Mānoa
UKIRT	United Kingdom Infrared Telescope
ULTIMA	University-based Laser Technologies for Information and Materials Advancement
USAF	United States Air Force
USFWS	United State Fish and Wildlife Service
USGS	United States Geological Service
VC-RGE	Vice Chancellor for Research and Graduate Education
WMP	Waste Minimization Program

## LIST OF TERMS, PLACES AND PROJECTS

### **Astronomy – Science Related Terms**

Apophis (name of an asteroid)  
 Archeoastronomy  
 Asteroid belt  
 Asteroids  
 Centaurs  
 Dark matter  
 Extrasolar planetary systems  
 Inner solar system  
 Interplanetary dust  
 Interplanetary material  
 Jovian Trojans  
 Kinetic energy  
 Kuiper belt  
 Meteorites  
 Near Earth Astroids  
 Near earth Comets  
 Planetoids  
 Pluto, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune  
 Sun, moon, planets, solar system, Earth  
 Terrestrial planets, Gas planets  
 Thermonuclear warhead

### **Scientific Terms**

*Family Linyphiidae*     *sheetweb spider*  
*Meriola arcifera*     *clubinoid spider*  
*Nysius wekiuicola*     *Wekiu bug*  
*Vespula pensylvanica*     *yellow jackets*

### **Scientific Places and Projects**

Asiago DLR Asteroid Survey, Asiago-CimaEkar, Italy  
Barringer Meteor Crater  
Catalina Sky Surveys, Tucson, Arizona  
Flagstaff, Arizona  
‘Imiloa Astronomy Center – formerly the Mauna Kea Astronomy Education Center  
Japan Spaceguard Association, Bisei, Japan  
Lowell Observatory Near-Earth Object Search, Flagstaff, Arizona  
Maui Space Surveillance Site  
MIT Lincoln Laboratory  
NASA Jet Propulsion Laboratory  
Palomar Observatory in San Diego, California  
Siberian region of Tunguska  
Socorro, New Mexico  
Space watch, Kitt Peak, Arizona  
Spaceguard Survey  
StarLab Portable Planetarium  
Yucatan peninsula

## **GLOSSARY OF HAWAIIAN TERMS**

*‘Āina* – defined as land; literally translated to “that which feeds and devours”

*Akua* – God, goddess, spirit, divine, supernatural, godly

*Aloha* – love, affection, compassion, mercy, sympathy, pity, kindness, sentiment, grace, charity; greeting, salutation, regards; sweetheart, lover, loved one; beloved, loving, kind, compassionate, charitable, lovable; to love, be fond of; to show kindness, mercy, pity, charity, affection; to venerate; to remember with affection; to greet, hail

*E Mau Ke Ea* – Literally translated as “the essence, life, breath, or sovereignty is perpetuated.” Name for a community television series that focuses on Native Hawaiian issues and events.

*Hāloa* – second child born to Ho’ohokulani; identified as the first Hawaiian. Recognized as the younger sibling of the ancestor from which kalo is born

*Hāloanakalaukapalili* – name of the still born child born to Ho’ohokulani; it is from the burial site of this child that the first kalo is born

*Hānai* – To raise, rear, feed, nourish, sustain; provider, caretaker

*Haumia* – defilement

*He alo a he alo* – literally translated as “face to face”, represents the preference among many cultural groups in holding a conversation or meeting.

*Heiau* – traditional places of worship or spiritual invocation

*Ho’ohokulani* – first human offspring to Wākea and Papahānaumoku

*Hoku hō’ike* – royal stars

*Hoku kahuna* – guiding stars

*Hoku kilo* – observing stars

*Hoku no ke akua* – stars relating to the gods

*Hoku no ke mālama* – stars for the months

*Hoku ‘āina* – land stars

*Ho’olohe* – to hear, to obey

*Ho'olono* – to listen

*Ho'omalū* – To bring under the care and protection of, to protect; to keep quiet, still, as during taboos or (modern) for peaceful meditation during ho'oponopono family therapy; to restrict, confine, quarantine; to judge, rule over, govern, make peace between warring parties; to suspend, as a license; to preside, as at a meeting; to call to order; probation

*'Ike hana* – knowledge gained through experience

*'Ike kumu* – fundamental knowledge *Iwi kūpuna* – ancestral remains

*Kahaki'i* – defined as a “formed image”, it represents the connection between shared community concerns and responses from project planners to those concerns in the documentation of the EIS process

*Kahe ka waiola* – literally translated as the “flow of life-giving fresh water”, represents the cultural principle that for knowledge to become wisdom, it must be continuously shared and passed down through multiple and successive generations

*Kai 'ewalu* – poetic reference to the eight ocean currents or channels that connect the islands of Hawai'i.

*Kaikaina* – the younger siblings or generation

*Kalaninui'tamamao* – name of the ruling ali'i for which the Kumulipo was created

*Kama'ilio* – to talk, converse; conversational

*Kānaka* – humans

*Kānaka 'Ōiwi* – native son or daughter; literally translated as “those of the bone”, term used by Native Hawaiians to identify themselves

*Kanalu* – one oral tradition that provides a priestly genealogy that describes multiple early settlements in Hawai'i

*Kaona* – defined as hidden meaning, as in Hawaiian poetry. Alludes to veiled or concealed references that possess layers of meaning and significance.

*Kauoha* – Order, command, demand, testament, decree, precept, will, message, statement; to order, command, direct, send for, subscribe, dictate, assign, decree, entrust, bequest, commit into the hands of; to summon

*Ke alo o nā kilohoku* – Literally translated as, the way or manner of the star watchers- represents an ideal in pursuing knowledge through keen observation of one's surroundings.

*Kinolau* – physical manifestations or forms of an akua

*Kua* – Back, rear, burden, windward; to carry on the back, as a child

*Kuahiwī 'elima* – literally translated as the five mountains; poetic description of the mountains of Hawai'i Island and Haleakalā on Maui

*Kua'āina* – the backbone of the land referring to those individuals or families that have strong associative ties to a specific place

*Kua'ana* – the eldest sibling in the family unit

*Kūkākūkā* – formal discussion or negotiations

*Kūkulu* – Pillar, post, side, border, edge, horizon; to build, as a house; to construct, erect, establish, organize, set up; to put up, as a tent or as mast and sail; to heap up; to form, as a military unit; to found, as a society; to establish, as a name or dynasty; to lay, as an oven

*Kuleana* – define as right, privilege, concern, responsibility, title, business, property, estate, portion, jurisdiction, authority, liability, interest, claim, ownership, tenure, affair, province; reason, cause, function, justification; small piece of property, as within an ahupua'a; blood relative through whom a relationship to less close relatives is traced, as to in-laws. This term is highlighted in this document as meaning responsibilities and privilege that are derived by an association to one's ancestors or lands

*Kumu hula* – sources of oratorical knowledge as perpetuated through the practice of hula

*Kumulipo* – one of the creation traditions of Native Hawaiians; divides the beginning of life into 16 distinct time periods that provide a succession and order to the emergence of all life.

*Kūpuna* – grandparent; ancestor, relative, or close friend of the grandparent’s generation; an elder; a starting point; source; a beginning to one’s learning

*Loea* – skilled experts with technical knowledge of practice and place

*Māhele* – division, piece, or portion. Name used to describe the formal land apportionment events in Hawai’i that occurred in 1848

*Mai ka pilipuka, mai ka pawa, mai ka poni li’ulā, e pāne’ene’e i ke panepo’o* – From the depth of night, from the time before dawn, from the early glimmer of day’s first light, climb steadily and with purpose towards the summit. This is a ‘ōlelo no’eau that is used by the planning teaming as a guiding tool.

*Mālama Mauna Kea* – phrase defines in a cultural context the stewardship responsibilities attached to the management of resources, use, and access to Mauna Kea as a sacred site

*Mālama* – To take care of, tend, attend, care for, preserve, protect, beware, save, maintain; to keep or observe, as a taboo; to conduct, as a service; to serve, honor, as God; care, preservation, support, fidelity, loyalty; custodian, caretaker, keeper

*Māmane* – A native leguminous tree (*Sophora chrysophylla*), which thrives at high altitudes, up to the tree line, as on Mauna Kea and Mauna Loa. The leaves are narrow, compound, more or less downy, the flowers commonly yellow, the pods four-winged, yellow-seeded. Hawaiians formerly used the hard wood for spades and sled runners.

*Mana* – spiritual power; inherent talent and skills

*Mana’o* – Thought, idea, belief, opinion, theory, thesis, intention, meaning, suggestion, mind desire, want; to think, estimate, anticipate, expect

*Mo’okū’auhau* – genealogical lineage

*Nānā Pono ko kākou Honua* – Name of an educational program focused on observing our World

*Noho a akua* – process by which through spiritual invocation the associative spiritual element or deity dwells within part of the physical form for the function to be appropriately carried out and for knowledge to be attained

*No’ono’o* – reflective thoughts; meditation; concentrate; to think carefully

*‘Ohana* – family; relative; kin group; related

*‘Ōlelo no’eau* – Hawaiian proverb or wisdom

*Oli* – Chant that was not danced to

*Pae ‘āina* – Group of islands, archipelago

*Pāhiku - Ke Kapakea Pahiku o Mauna Kea* – Literally translated as “the seven-folded white kapa of Mauna Kea. This phrase is the poetic name for the culturally derived community dialogue process utilized in this project. The name honors the sacredness and revered nature of the summit. The process is defined in seven distinct elements that form the basis for foundation building, interaction, and guidance in each of the relationships that are attempted to be strengthened between the planning team and community interests

*Palila* – An endangered gray, yellow, and white Hawaiian honey creeper (*Psittirostra bailleui*, *P. kona*); endemic to the island of Hawai’i. Its bill is especially suited for opening māmane tree pods. Its only home is on Mauna Kea, Hawai’i

*Papahānaumoku* – Ancestral figure of Native Hawaiians, identified as Earth Mother

*Piko kolu* – guiding principal that defines three centers of cultural identity that represent the fontanel, the umbilical cord, and the genital organs; connotes attachment or relationship with one’s ancestors or lands.

*Pilipuka* – the period between midnight and dawn; represents the metaphorical depth of the ancestral past that has been preserved through the oral traditions that provides the necessary traditional knowledge, values, and principles that help to define and maintain cultural identity.

*Pule Ho’ola’a Ali’i* – the sanctifying prayer or a ruling chief

*Wā* – Period of time, epoch, era, time, occasion, season, age

*Wahi kanu* – place for the deceased in traditional and recent times to be planted or buried

*Wahi kupuna* – ancestral places

*Wahi pana* – sacred and legendary places

*Wākea* – Ancestral figure to Native Hawaiians, identified as Sky Father

*Walaʻau* – informal conversation

*Wao akua* – geographical realm of the gods; the highest physical realm on earth that is the dwelling place of spiritual sources

*Wekiu* – name of bug

## **Hawaiian Place Names**

*Hale Pōhaku* – meaning “rock house”, is the name of the mid-elevation facilities on Mauna Kea

*Haleakalā* – National park (established in 1961), volcano, peak, ranch, and visitor center, East Maui; homesteads, Kahului qd., Maui. *Lit.*, house [used] by the sun (the demigod Māui was believed to have lassoed the sun here in order to lengthen the day, and permit his mother, Hina, to dry her tape

*Hāmākua* – Quadrangle, district, ditch, ditch trail, golf course, forest reserve, and mill, northeast Hawaiʻi.

*Hilo* – land district on the east side of Hawaiʻi

*Hualālai* – Large volcano, Kailua qd., North Kona, Hawaiʻi; it last erupted in 1801

*Kaʻohe* – Quadrangle; land sections in Hāmākua, Humuʻula, Ka-ʻohe, and Wai-kiʻi qds.; homesteads, Kalapana qd.; tract and ranch, Hānaunau qd., Hawaiʻi

*Kilauea* – Active volcano on the flank of Mauna Loa, nearly continuously active 1823–1894 and 1907–1924; eruptions began again in 1952 and still continue

*Kohala* – District (famous for the ʻĀpaʻapaʻa wind), quadrangle, extinct volcano, land section, club, sugar plantation, elementary and high schools, ditch, trail, mill, mountains, forest reserve, post office, seminary, and village, all in northwest Hawaiʻi; point, Honomū qd., northeast Hawaiʻi.

*Kona* – leeward district on Hawaiʻi

*Kumukahi* – Easternmost cape, Hawaiʻi, named for a migratory hero from Kahiki who stopped here and who is represented by a red stone. Two of his wives, also in the form of stones, manipulated the seasons by pushing the sun back and forth between them. One of the wives was named Haʻehaʻe

*Lake Waiau* – translated as “swirling water”, a lake (13,020 feet elevation) near the summit of Mauna Kea, Hawaiʻi

*Mauna Kea or Mauna a Wākea* – The highest mountain on Hawaiʻi, translated as “snow mountain” and as the “mountain born of Wākea”

*Mauna Loa* – Active volcano, second highest mountain in Hawaiʻi, and probably the largest single mountain mass on earth, rising 13,677 feet above sea level and about 29,000 feet above its base on the ocean floor

*Puʻu Lilinoe* – Peak (12,956 feet), Mauna Kea qd., Hawaiʻi, also called Puʻu Lilinoe, named for a goddess of mists (Lilinoe), sister of the more famous Poliahu, goddess of snow

*Puʻu Kūkahauʻula* – Cinder mount on Mauna Kea with the highest peak (13,796), named for the Kū form whose kinolau is the red hewn rays that shimmer on the snow mantle of Poliahu

*Puʻu Poliahu* – Cinder mount on Mauna Kea, Hawaiʻi, named for the snow goddess. *Lit.*, garment [for the] bosom (referring to snow)

## PREFACE

Chapter 343 of the Hawai'i Revised Statutes establishes a system of environmental analysis to ensure that environmental and cultural concerns are given appropriate consideration along with economic and technical considerations in the decision making for a proposed project. Under HRS 343-1, the law stipulates that the analysis of environmental effects and the inclusion of public participation is desirable and beneficial to all interests because the "environmental consciousness is enhanced, cooperation and coordination are encouraged, and public participation during the review process benefits all parties involved and society as a whole." However, public participation is often included in the process after key decisions are made to project design and siting and occurs after some level of formal documentation has been prepared, such as an Environmental Impact Statement Preparation Notice (EISP/N).

Regarding the project that will be described below, the planning team believed that early public participation is crucial for any meaningful analysis of environmental affects to be completed. Listed below are key members of the overall planning team.

### **University of Hawai'i, Institute for Astronomy**

Rolf Peter Kudritzki, Ph.D.  
Robert McLaren, Ph.D.  
Michael Maberry, Ph.D.  
Nicholas Kaiser, Ph.D.  
Klaus-Werner Hodapp, Ph.D.  
Paul Coleman, Ph.D.  
William S. Burgett, Ph.D.  
Thomas Dombeck, Ph.D.  
Gale Yamada

### **University of Hawai'i at Hilo, Dept. of Physics and Astronomy**

Robert Fox, Ph.D.

### **Group 70 International, Inc.**

Francis Oda, FAIA, Arch.D., AICP  
Jeffrey H. Overton, AICP  
Kim Evans  
Kāwika McKeague

**Kumu Hula**

Victoria Holt-Takamine  
Wayne Kaho'onei Panoke

**Archaeology and Ethnography**

David Welch, Ph.D.  
Maria Orr, M.A.

**Socioeconomic Analysis**

John Knox, Ph.D.

**Natural Resources****Anthropod Survey**

Reginald E. David, Ph.D.  
Steven Lee Montgomery, Ph.D.

**Civil Engineering**

Richard E. Frey, AIA

In December 2004, a Request for Qualifications (RFQ131001) to assist in the preparation of an Environmental Impact Statement and a State Conservation District Use Application for the Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) was issued by the Research Corporation of the University of Hawai'i on behalf of the Institute for Astronomy (IfA). In February 2005, a Request for Proposal (RFP131008) was subsequently issued for Pan-STARRS. In both the RFQ and RFP, the IfA emphasized the importance of developing an approach that truly engaged in meaningful dialogue with members of the local island communities and specifically with the Native Hawaiian community. The IfA made this a critical and important criteria in the selection process and is committed to work towards the long-term goal of creating collaborative relationships within these communities.

In response to the RFP, members of the planning division of Group 70 International, Inc. held several internal meetings to discuss how its potential involvement could lead to a better outreach process and could facilitate meaningful and responsive discussions with the Native Hawaiian community. The answer was simple- the concerns and issues of the broader local island communities and those specific to Native Hawaiians would need to be articulated, integrated, and effectively addressed at the forefront and throughout the Environmental Impact Statement (EIS) planning process.

To accomplish this task, Group 70 International, Inc. asked two well-known and respected Kumu Hula to help bring in-depth experience and understanding for the team to think creatively and to respond honestly to the issues and the appropriate manner in which they would need to be addressed. These two Kumu Hula serve as strategic project advisors and their personal thoughts, experiences, and concerns as well as those shared with them by other members of the community are integral to the decision-making and planning of project scope and design. Through this mutual collaboration, new ideas and approaches were formed as to how to establish a true cultural foundation for project planning, environmental analysis, and community consultation while fulfilling the regulatory requirements of applicable environmental laws. The approach has been named Ke Kapakea Pāhiku o Mauna Kea (The Seven-folded White Kapa of Mauna Kea) alluding to the sacred essence and highly esteemed nature of the summit, the spiritual and ancestral associations of the summit to Native Hawaiians, and the purposeful manner in which the planning team would need to create and sustain working relationships with key community interests and advocates. The planning team has been meeting with individuals and groups since the onset of the process and continues to strive to meet with as many interested members of the community as possible prior to and during the course of submitting any formal documentation.

The concerns and voices of the community are reflected throughout the EISPN. The kahaki'i (formed image) that appears as a column in various places in the document and serves to highlight either applicable thoughts or concerns shared by the community or subject matter discussed in the main body of text. Information documented in the kahaki'i includes quotes taken directly from shared community concerns presented during our initial informal meetings with different community interests. Further, specific questions presented during these meetings has also been recorded to direct the reader as to what major issues are being shared by the community and what type of response has been provided by the planning team. Team responses should either appropriately address the concerns raised or testimonies provided within the main body of text or by a statement verifying that this concern will be addressed as more information becomes available via studies to be conducted and during the preparation of the Draft EIS.

The kahaki'i includes several layers of kaona (veiled or concealed references) that are illustrative of some of the cultural values and focus that guide this process. Some of the key concepts include:

- 
- The eight vertical gray lines illustrate the kai ‘ewalu (eight ocean currents) that poetically symbolize the pae ‘āina (the archipelago), representing that this is an issue that is important to many Native Hawaiians and local island residents across Hawai‘i.
  - The seven white lines are reflective of the kapakea pāhiku, representing that the culturally-based process of relationship-building for purposes of this EIS is constant throughout the environmental analysis.
  - The combination of lines illustrate kahe ka waiola (the flow of life giving fresh water), representing both the spiritual essence of life and both the ‘ike kumu (fundamental knowledge) and ‘ike hana (knowledge gained through experience) that needs to be respected, integrated, and perpetuated through all parts of the process.
  - The five triangles are the kuahiwi ‘elima (five mountains) that poetically describe the volcanic forms of Mauna Kea, Mauna Loa, Hualālai, Kohala, and Haleakalā, representing that this issue has bearing on the communities of Hawai‘i island and Maui.
  - The three points on the triangle represents the guiding principle of the piko kolu (three centers of cultural identity), which is utilized in the planning and decision-making of this process.
  - The combined form of triangles create the kua (backbone) representing the mo‘okū‘auhau (genealogical lineage) of ‘ohana that have an ancestral connection to Mauna Kea. Within this kua, the voices of the community are clearly presented and shared.
  - At the base of each page is a kūkulu (foundational pillars) representing the pooling of spiritual strength and commitment to the story that unfolds between the pages.

The kahaki‘i is a guide for the reader to ensure that the important and critical issues are being identified and interpreted correctly as important to the community by the planning team. This is a planning tool that will assist the team to conduct a planning process that is mindful, respectful, and inclusive of the multiple perspectives pertaining to the natural, cultural, and spiritual context and landscape of Mauna Kea. The questions and comments that are shared during this process have been and will continue to be forwarded to the consultants preparing the various technical studies for the Draft EIS. It is the intent of this study that the questions raised and comments shared will help guide the scope of work that will need to be completed for each technical study. It is the hope that this approach will help the planning team produce a document that is comprehensive in technical merit and community response.

# 1.0 INTRODUCTION

Section 1.0 provides an introduction for the proposed project, including a brief description on the project’s purpose, location, and existing land use. The purpose and contents of this Environmental Impact Statement Notice of Preparation (EISPN) are discussed in this section along with a description of the public consultation process.

## 1.1 PROJECT INFORMATION SUMMARY

**Project Name:** Panoramic Survey Telescope & Rapid Response System (Pan-STARRS)

**Applicant / Proposing Agency:** University of Hawai’i  
Institute for Astronomy (IfA)  
2680 Woodlawn Drive  
Honolulu, Hawai’i 96822  
Contact: Rolf Peter Kudritzki, Ph.D.  
IfA Director  
Phone: (808) 956-8566  
Fax: (808) 946-3467  
Project Website:  
<http://pan-starrs.ifa.hawaii.edu>

**Planning/  
Environmental Consultant:** Group 70 International, Inc.  
925 Bethel Street, 5th Floor  
Honolulu, Hawai’i 96813-4398  
Contact: Jeffrey H. Overton, AICP  
Phone: (808) 523-5866  
Fax: (808) 523-5874  
Email: PANSTARRS@group70int.com

**NEPA EIS Approval and  
Record of Decision:** Headquarters, US Air Force

**State EIS Accepting Authority:** Office of the Governor, State of Hawai’i

**Tax Map Key:** 4-4-15:09

*What is the name of this project?*

*Who is responsible for the management and operation of this proposed project?*

*Who is responsible for drafting the EIS?*

*What authorities are responsible to review and accept EIS?*

**Where is the preferred location for this proposed project?**

**Who are the current land stewards?**

**What type of activities are currently conducted and what is the proposed action?**

**What are the State and County land use designations?**

**Where on Mauna Kea will this project be located?**

**Can you quickly describe the Pan-STARRS project?**

<b>Preferred Project Location:</b>	Mauna Kea Science Reserve, UH 2.2 meter (m) site (88-inch) Ka’ohe Ahupua’a, Hāmākua District, Island of Hawai’i
<b>Land Stewards:</b>	Mauna a Wākea State of Hawai’i
<b>Existing Uses:</b>	Astronomy Research
<b>Proposed Action:</b>	Replace existing 2.2m telescope with new Pan-STARRS telescope
<b>State Land Use District:</b>	Conservation District
<b>County of Hawai’i LUPAG Designation:</b>	Conservation
<b>County of Hawai’i General Plan Designation:</b>	Conservation
<b>County of Hawai’i Zoning Designation:</b>	Not Applicable

## 1.2 PROJECT SITE

The preferred site for Pan-STARRS is the Island of Hawai’i at the summit of Mauna Kea (Figure 1-1) and within the Science Reserve (Figure 1-2 and 1-3). The plan is to replace the existing UH 2.2m observatory located at the summit and situated between the UKIRT (United Kingdom Infrared Telescope) and Gemini facilities along the northeast ridge. The alternate site for consideration would be within the University’s Haleakalā High Altitude Observatory on the island of Maui (Figure 1-4 and 1-5).

## 1.3 PROPOSED ACTION

The proposed action is to place the Pan-STARRS technology, which consists of four optical segments each with its own digital camera, within a rebuilt facility at the UH 2.2m site. Most large astronomical telescopes are designed to study a small patch of sky in fine detail. Pan-STARRS is different from these telescopes in that its purpose is to survey large sections of the sky quickly and often. A major goal of Pan-STARRS is to discover and characterize Earth-approaching objects, known as Near Earth Objects (NEOs). NEOs include both

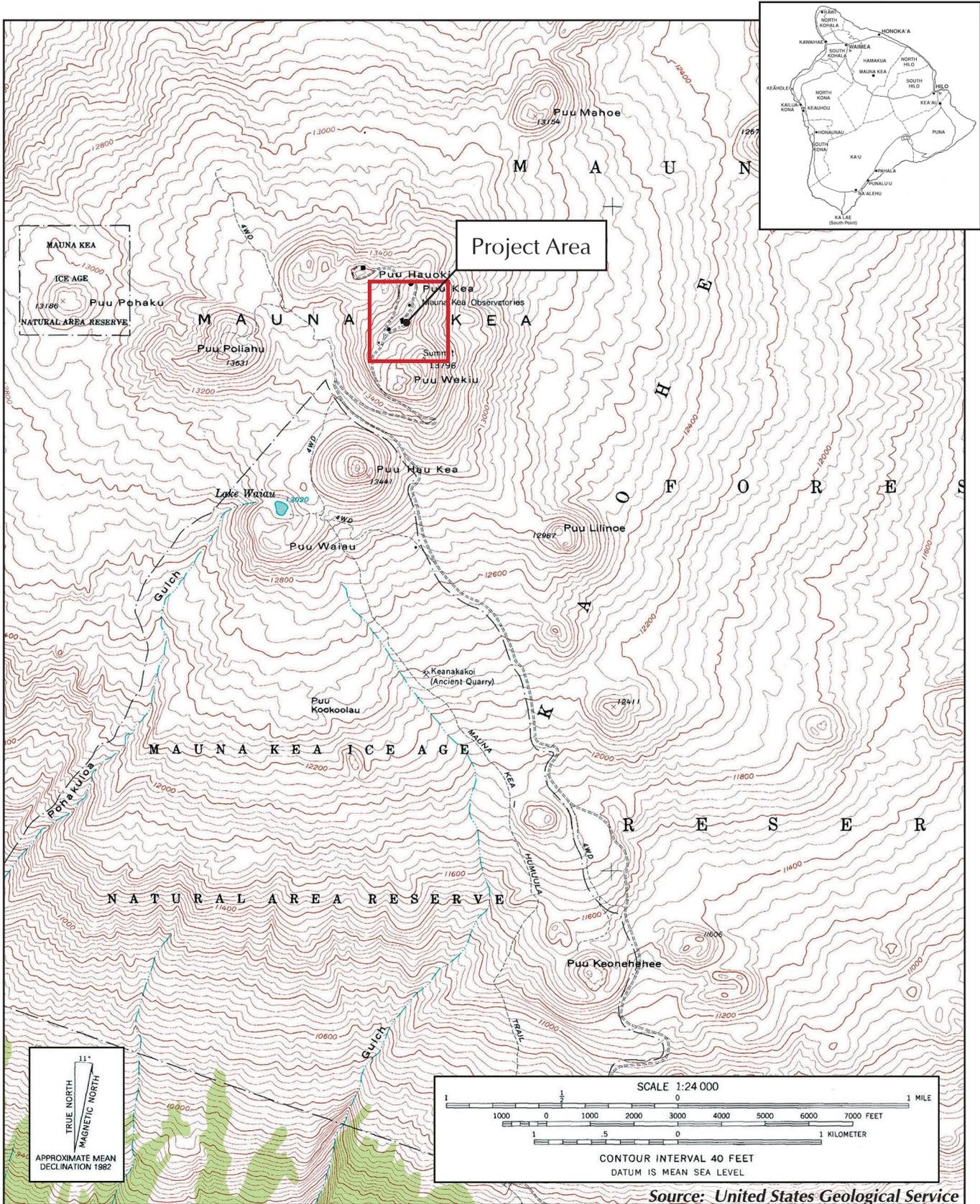


Figure 1-1 Mauna Kea Summit Location Map, USGS Quad

asteroids and comets that might pose a danger to our planet. It is also the ideal system for mapping the large-scale structure of the Universe, as well as searching for astronomical objects that move or change, such as exploding stars, variable stars, and planets around other stars. Pan-STARRS is to complete a survey of all 1 kilometer objects and to detect approximately 90% of NEOs down to 300 meters (1,000 feet) in diameter.

Although funding for project development for has been provided through a cooperative agreement provided by the United States Department of Defense, Air Force Research Laboratory, the Pan-STARRS project will be owned, operated, and maintained by the IfA. Further, the university will be responsible for processing the imagery and data. The primary team for Pan-STARRS construction includes the IfA, the University of Hawai'i at Hilo Department of Physics and Astronomy, the Air Force's Maui High-Performance Computing Center, MIT Lincoln Laboratory, and Science Applications International Corporation.

#### 1.4 CONTENTS OF THE EISPN

This Environmental Impact Statement Notice of Preparation (EISPN) is being filed with the State of Hawai'i's Office of Environmental Quality Control (OEQC). This EISPN and the subsequent Draft EIS and Final EIS will evaluate the potential impacts of the proposed Pan-STARRS project on the human environment, including its natural, cultural and socioeconomic aspects.

*What is the purpose of the EISPN?*

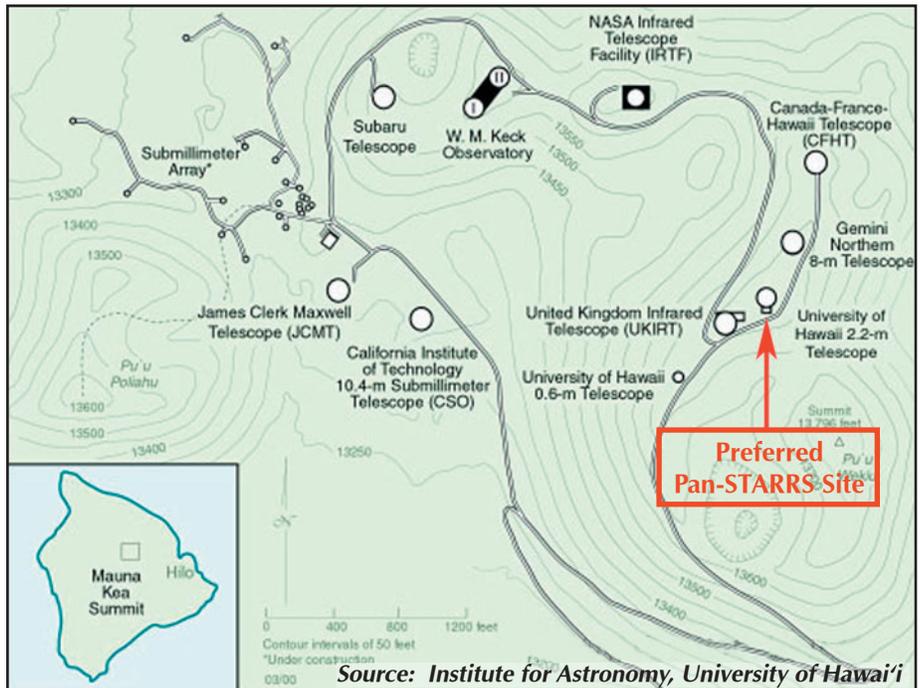


Figure 1-2 Mauna Kea Summit Map

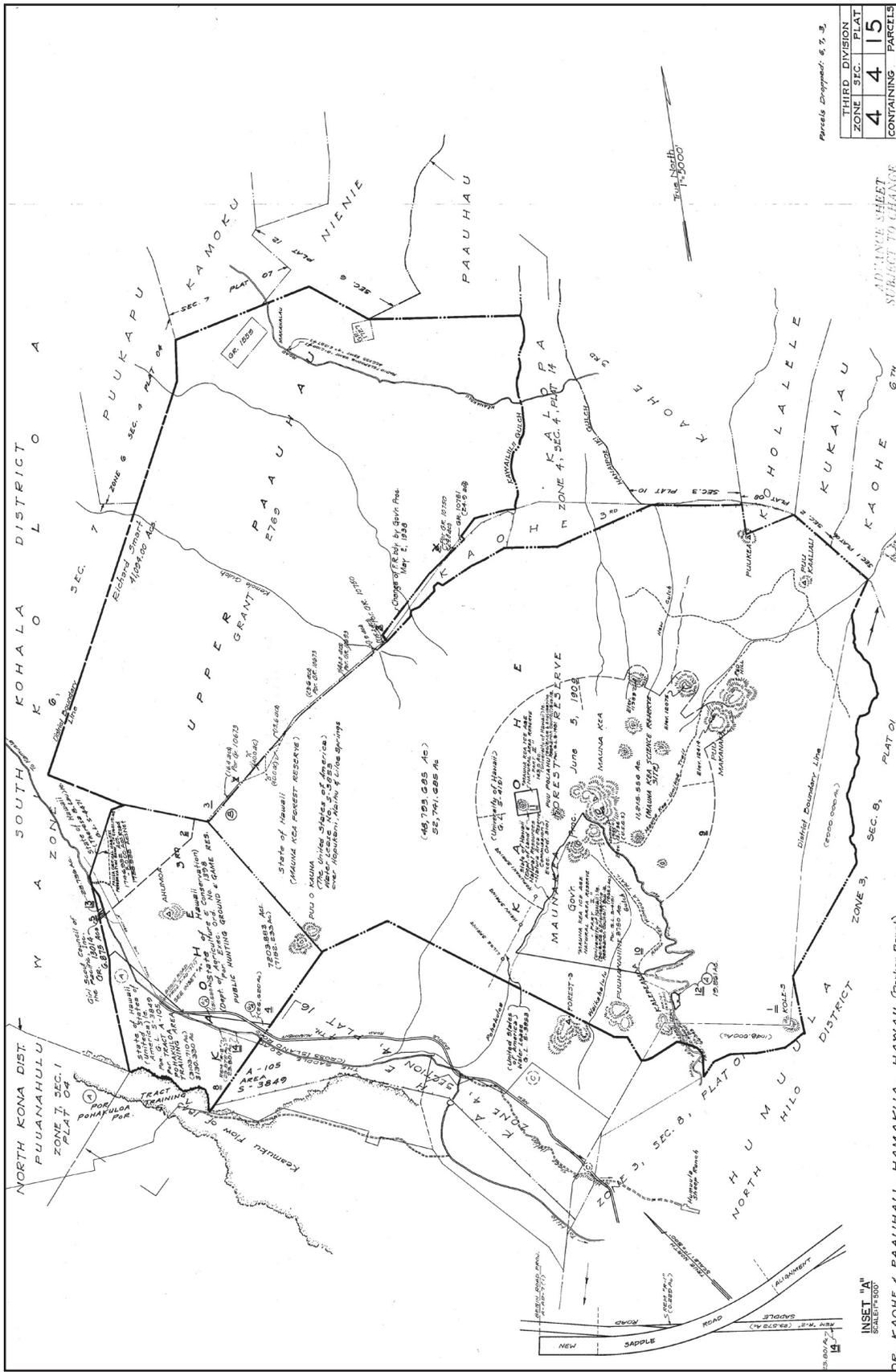


Figure 1-3 TMK 4-4-15, por. 9 (Mauna Kea)

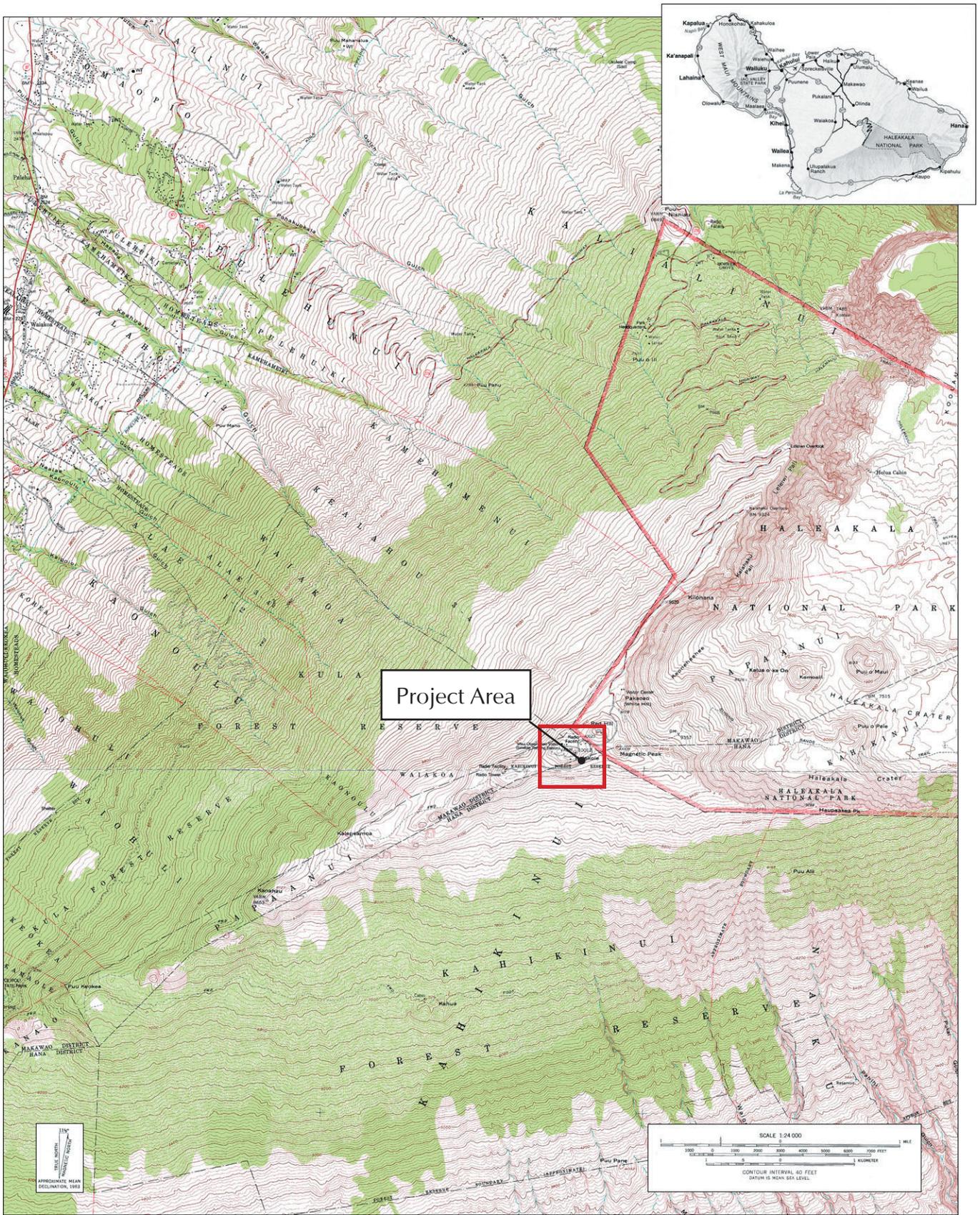


Figure 1-4 Haleakalā Summit Map

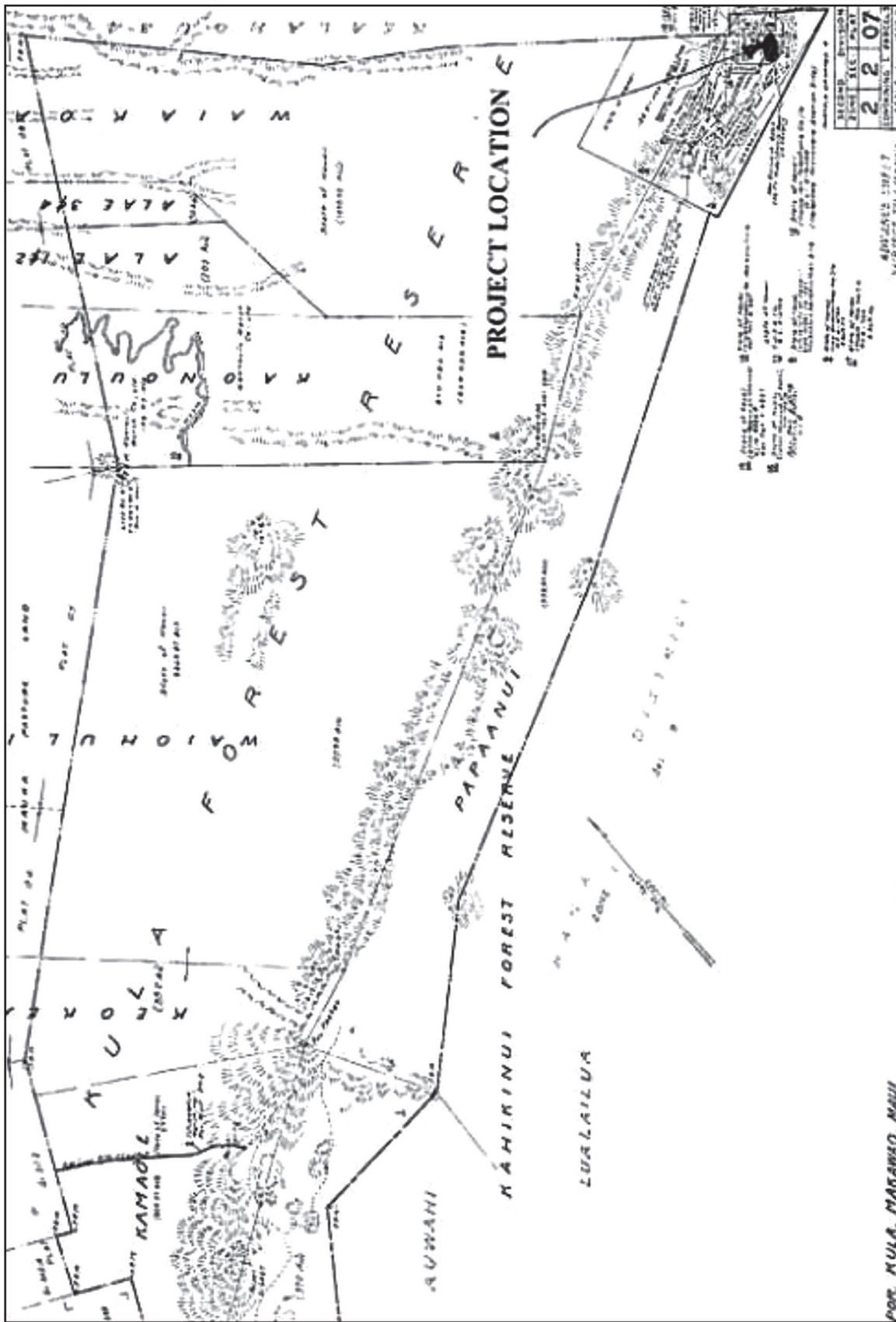


Figure 1-5 TMK 2-2-7:08 (Haleakalā)

***What is included in the EISPN? What will be discussed? How can we be sure that our thoughts and concerns will be appreciated and actually make a difference this time around?***

As discussed in the Preface Section of this EISPN, an important element in conducting this environmental review was the inclusion of the Native Hawaiian and local island communities from the onset of this process. To accomplish this task, the planning team worked together to design an approach that is proactive in meeting with community members and is responsive to the questions and comments presented during these informal stages of dialogue. Thus, the EISPN is designed to be inclusive of the thoughts and concerns that have been and will continue to be shared by participating community interests. These community dialogues will not be treated as a check box agenda item in this EIS process. Rather, the planning team intends to integrate, to the best of its ability, the values and concerns in the discussions of project design, facility programmatic planning and operations, and overall project decision-making.

This EISPN has been formatted to highlight key questions, comments, or ideas that were expressed during informal discussions with various community groups and individuals. The “voices” of the community are reflected throughout the kahaki’i contained on the pages of this document (see Preface for further details). It is the intent that the questions raised by the community are either immediately addressed in this document or it is noted that the concern raised will be included in the discussion presented in the Draft EIS. The EISPN is presented in ten sections:

- Section 1.0 contains an introduction including an overview of the proposed project.
- Section 2.0 provides a discussion on the sacredness of space as related to the preferred site of the proposed action on the summit of Mauna Kea.
- Section 3.0 details the purpose and need of the project and concepts of project design.
- Section 4.0 discusses the policies and processes utilized in evaluating the potential impacts of the project.
- Section 5.0 discusses probable impacts and significance criteria.
- Section 6.0 identifies the alternatives to the proposed project to be evaluated including the no-action alternative, alternatives to project design and location.
- Section 7.0 reviews the determination and findings of this report.
- Section 8.0 identifies those parties consulted during preparation of the EISPN and to be consulted during the Draft EIS.

- Section 9.0 identifies the participants involved in the preparation of the Draft EIS.
- Section 10.0 identifies the references used in preparing this report.

## 1.5 ENVIRONMENTAL ANALYSIS PROCESS

The environmental analysis process for this project is being conducted to fulfill the requirements of both Federal and State Environmental Impact Statement rules, specifically the National Environmental Policy Act of 1969, 42 US Code 4322, Title 40 Code of Federal Regulations (CFR) 1500-1508, and Air Force supplemental rules at Title 32 CFR 989, and the Hawai'i Revised Statutes (HRS), Chapter 343 and Chapter 200 of Title 11 Administrative Rules, Department of Health, "Environmental Impact Statement Rules." Section 4.0 of this document provides details as to the applicable legal and procedural requirements for these reviews.

### 1.5.1 Hawai'i Revised Statutes, Chapter 343 Review

Under HRS, Chapter 343, an environmental analysis is required for any project or program that proposes one or more of the following nine land uses or administrative acts:

- Use of State or County lands or funds
- Use of any lands classified as Conservation District
- Use within the Shoreline Setback Area
- Use within any historic site or district
- Use within the Waikiki Special district
- Any amendment to County General Plans
- Reclassification of State Conservation District lands
- Construction or modification of helicopter facilities
- Proposes any wastewater facility with specified exceptions, waste-to-energy facility; landfill; oil refinery; or power-generating facility.

The proposed action would require the use of State lands on Mauna Kea, which are classified as Conservation under State Land Use law. The accepting authority for this review is the Office of the Governor.

HRS, Chapter 343 requires the publication of this document to initiate the environmental review. After this document is published, there is a 30-day public comment period for the EISPN. Upon completion of the comment period, the Draft EIS will be prepared

***What are the legal statutes for conducting a Federal or State EIS?***

***What types of projects trigger the need to conduct a State EIS?***

***What are the basic requirements for complying with NEPA?***

***What is a major Federal action? Is Pan-STARRS a major Federal action? What is the relationship of the University to the Air Force? Why is the Air Force the lead Federal agency? Is the involvement of the Air Force make Pan-STARRS a military project?***

***How does the NEPA EIS start? What is the Notice of Intent for?***

***When will the scoping meetings be held?***

***Where will the scoping meetings be held?***

in two to three months thereafter. Questions, comments, and concerns derived during the informal discussion and the formal public review period of the EISPN will be answered or addressed to the fullest extent possible within the Draft EIS.

### **1.5.2 National Environmental Policy Act Environmental Review**

Under the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) is the federal administrative authority regulations responsible for ensuring that the various programs and activities of the Federal government are reviewed and appraised as to their environmental impact. The procedural provisions of NEPA are outlined in 40 Code of Federal Regulations (CFR Parts 1500-1508). The Federal EIS requirements will be satisfied in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code SS 4321-4374), the CEQ regulations, and Air Force Instruction 32-7061, The Environmental Impact Analysis Process (EIAP), as promulgated in 32 CFR Part 989.

Under Part 1508.18, a major Federal action is defined as either new or continuing activity subject to Federal control and responsibility. These activities include projects or programs entirely or partially financed, assisted, conducted, regulated, or approved by a Federal agency. Although Pan-STARRS is a University of Hawai'i project, it has been funded by a series of annual grants through the U.S. Air Force. As of FY 2006, funding is disbursed through a Cooperative Agreement. It is important to note that the project is not affiliated with any military or classified research project. This is discussed in further detail in Section 3.2.1 of this document.

To initiate the NEPA process, a Notice of Intent (NOI) will be prepared and published in the Federal Register. The NOI notifies the general public that an EIS will be prepared. The contents of the NOI includes a description of the proposed action and alternatives, the scoping process, and provides a point of contact if the general public has any questions.

Upon publication of the NOI, the public scoping process will begin. As part of the public scoping process, five meetings are planned for Hawai'i Island (3), Maui (1), and O'ahu (1). The purpose of these meetings is to engage the community to help identify the critical issues that need to be addressed in the EIS. Questions, comments, and concerns derived from these formal public scoping meetings will help finalize the scope of work for the necessary technical studies that will be prepared to complete Draft EIS.

Where appropriate, information available from past studies for Mauna Kea and Haleakalā will be utilized to define the baseline of certain environmental aspects. New technical studies will be conducted for certain issues that have been identified as a significant concern. Such issues include, but are not limited to, assessing and evaluating the project's impact on endangered and threatened species; archaeological, historical, and cultural resources; visual impacts (aesthetic and cultural); socioeconomics; and wastewater treatment and disposal concerns.

## 1.6 KŪKĀKŪKĀ AND CONSULTATION

In addition to the environmental analysis described in Section 1.5, the project planning team is hoping to improve the means by which discussions and formal consultation are held as part of the EIS. Of importance to this project is an emphasis on early and meaningful community input that includes meeting and speaking with families, organizations, and individuals from the Native Hawaiian community that have demonstrated a past commitment to speak to the issues of stewardship and management for the summit.

Based upon past project experiences involving Mauna Kea, the University of Hawai'i administration and the Institute for Astronomy recognizes that a renewed process of engaging in meaningful and responsive community dialogue is the only true way of ensuring that expressed interests and concerns are adequately addressed in the planning process. The selection of planning team members, including the technical consultants, will hopefully create a collaborative working environment that addresses specific concerns about the natural, cultural, or socioeconomic environment. Section 9.0 of this EISPN provides a complete listing of the EIS planning team for Pan-STARRS.

As the environmental consultant, Group 70 International, Inc., has formally requested the assistance of Kumu Hula Victoria Holt-Takamine and Kumu Hula Wayne Kaho'onei Panoke, two recognized Native Hawaiian leaders that have advocated on behalf of the interests of Native Hawaiian community. These Kumu Hula have taken on issues that have challenged the rights and interests of Native Hawaiians, particularly those threatening to diminish or regulate traditional and cultural practices; cultural access and resources; land and ocean management and subsistence areas; intellectual property rights; and the protection of cultural landscapes.

***How does the IfA propose to “do things differently” in terms of community involvement in this EIS process?***

***Why are two well-known Kumu Hula involved in this project?***

***Is the inclusion of these respected Kumu Hula an attempt to convince the community that Pan-STARRS is a good project?***

***What benefit is it to the community to have these Kumu Hula involved in the EIS process for Pan-STARRS?***

***Who will the Pan-STARRS team talk to during the EIS process?***

***Are these initial dialogues with community groups considered as “formal consultation” with community groups by the Pan-STARRS team?***

***“Do not take our participation in this informal meeting as meaning that we have or will participate in formal consultation.”***

The role of these two Kumu Hula is definitely not to try to convince concerned Native Hawaiian community members as to the merits of the Pan-STARRS project. Rather, their role is to facilitate interactions with interested Native Hawaiians and environmental advocacy groups and individuals that have concerns related to the overall management and use of Mauna Kea or Haleakalā for astronomy or specifically to the fundamental elements of Pan-STARRS itself.

The participation of these two Kumu Hula is to ensure that the concerns of the Native Hawaiian community are being proactively addressed by all members of the project planning team. More fundamentally, it is the intent that their voice in the decision-making and planning of this project is a true extension of the community that is heard and integrated early in the EIS process. Their shared voice of community concerns becomes proactive rather than reactive to discussions and decisions made regarding project design, operation, management, and implementation.

Different culturally-based methods of informal and formal dialogue such as wala’au and kūkākūkā will be utilized to meet with recognized kūpuna (recognized elders), Kumu Hula (sources of oratorical knowledge as perpetuated through the practice of hula), loea (skilled experts with technical knowledge of practice and place), kua’āina (literally translated as “the backbone of the land”, referring to those ‘ohana or individuals that have strong associative ties to a specific place), environmental interest groups, and others that would be able and willing to share ‘ike (knowledge) or mana’o (thoughts) related to Mauna Kea or Haleakalā. Several members of the planning team, including representation of astronomers, planners, technical consultants, and Kumu Hula will participate in these community dialogues, as appropriate and requested.

These initial informal dialogues should not be construed as part of the formal EIS inquiry or consultation, as defined under the law. Rather, it is the intent that these dialogues will build new or renew working and respectful relationships between the University and the community by bringing critical and key community issues to the forefront of the planning process and finding solutions to those issues. Unresolved issues are an unknown possibility but in the spirit of true community planning, a shared commitment and mutual purpose to the appropriate stewardship of both summits can be fostered in this setting to find a means for possible resolution.

Based on previously conducted studies and concerns expressed thus far, two fundamental questions emerge from as the baseline from which the EIS will need to proceed:

- Why must this project occur on Mauna Kea?
- What good or benefit will come of this project, especially for Native Hawaiians and for Mauna Kea?

These two basic questions have and will continue to challenge team members to draft adequate and committed responses within the context of the EIS. Section 8.0 identifies individuals, agencies and organizations that will be receiving a copy of this EISPN requesting their formal input in developing the Draft EIS.

## 1.7 PROJECT SETTING AND PAST STUDIES

Any current or proposed future project associated with Mauna Kea or Haleakalā inherits the responsibility to meet the community's demand for respect and proper management of these sacred mountains. The intent of this planning process is to ensure that the Pan-STARRS project from its inception to completion is sensitive and responsive to these concerns. As a first step to accomplish this task, several studies, court decisions, and media sources will be reviewed to chronicle and identify common themes, concerns, and unresolved issues that may need to be addressed in the Pan-STARRS EIS process. These sources of information include, but are not limited to the following:

- Memorandum of Decision Re: Civil No. 04-1-397, Circuit Court of the Third Judicial Circuit, State of Hawai'i, August 2006
- Follow-up Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve. A Report to the Governor and the Legislature of the State of Hawai'i. Report No. 05-13. The Auditor, State of Hawai'i. December 2005.
- Final Environmental Impact Statement for the Outrigger Telescopes Project, NASA, February 2005
- Haleakalā High Altitude Observatory Site Long Range Development Plan, January 2005
- Environmental Assessment for the University of Hawai'i at Hilo 24-inch Telescope Observatory Renovation, August 2006
- Draft Environmental Impact Statement for the Advanced Technology Solar Telescope (ATST), September 2006
- Mauna Kea Science Reserve Master Plan, March 2000
- Final Environmental Impact Statement for the Mauna Kea Science Reserve Master Plan, December 1999

***What are the critical questions being expressed by the community?***

***Will the Pan-STARRS team be considering the scope of its project as per the recent Judge Hara decision? Will Pan-STARRS address issues in the follow-up audit conducted in 2005?***

***Will you use existing information in previously conducted studies? If so, we recommend that you consider updates and/or a more comprehensive approach in the analysis to warrant a better evaluation.***

- 
- “Haleakalā: House of the Sun, A Sense of Place Cultural Overview”, Maui Economic Development Board with support from the University of Hawai’i, Institute for Astronomy, 2004
  - “Mauna Kea: Temple Under Siege”, Nā Maka O Ka ‘Āina Media production, 2005
  - “First Light”, Public Broadcast System, 2004
  - “E Mau Ke Ea: Mālama Mauna Kea,” ‘Ōlelo Media Production, October 2005

## 2.0 SACRED PLACES AND SENSE OF PLACE ON MAUNA KEA

Some of the core issues arising from the proposed action cannot be addressed under the standard process of an environmental review. The planning team is committed to understanding the complexities of these issues within the framework of spiritual understanding of those within the Native Hawaiian community that by their ancestral inheritance and association have the kuleana (associative responsibilities) to care for what is respected as a kupuna (an elder, a beginning to one's learning). It is the objective of the planning team that the elements of project design, the environmental analysis, and considerations to the overall management and stewardship of the proposed action will be guided from this objective.

The IfA seeks to have a dialogue with the Native Hawaiian and local island communities that reaches beyond its current form and context to foster mutual understanding and respect - recognition that fortifying a relationship between Mauna Kea, the community, and the University is one plausible scenario for the long-term stewardship of the mountain. The ability to find an adequate threshold of resolution for all major issues related to the management of Mauna Kea is a lofty objective for the scope of this one project. However, it is the position of the planning team that any possible consideration or advancement of astronomy on Mauna Kea can not be warranted without an integration of a much deeper understanding of and respect for the beliefs and values of the Native Hawaiian community in the planning process. The desired outcome of this process is developing a relationship that leads to the spiritual healing of Mauna Kea and its people. The first step to developing a better relationship for IfA with the community is to understand the intimate nature and character of the relationship held by Native Hawaiians with Mauna Kea.

### 2.1 MAI KA PILIPUKA, MAI KA PAWA, MAI KA PONI LI'ULĀ

- ‘O hānau o mauna a Wākea  
Born of Wākea was the mountain
- ‘Ōpu‘u a‘e ka mauna a Kea  
Budding forth was the mountain of Kea
- ‘O Wākea ke kupunakāne ali‘i  
Wakea is the male ancestral chief

***“This is Mauna a Wākea, which means this mountain belongs to Wakea and not to either you or I. Our responsibility and thoughts should be first and foremost to the mountain and to Wākea.”***

***“Mauna Kea is sacred. It is our ancestor. It is our life force. It is the elemental beginning, the mole, the taproot, of who we are as a people.”***

***Our island begins at Mauna Kea. The first rains fall at the summit. The first rays of the morning sun fall upon the summit. It is first to receive everything that brings life.”***

***“Every aspect of life on Mauna Kea is sacred and has been invariably impacted for the last 30 years. How can this hewa be made pono? How can future plans for Mauna Kea reverse or restore that which has been impacted?”***

***“The Hawai’i State Constitution ensures and protects the traditional and customary rights of Native Hawaiians, including their right to gather and access, conduct ceremonies, and invoke protocols to ho’omana. How does the astronomy community comply with these rights currently? What can this project and its process lend to implement changes in existing summit policies and procedures that need to occur to ensure that Native Hawaiian cultural practitioners have unfettered access to their temple on the summit? “***

‘O Papawalinu‘u ke kupunawahine  
Papawalinu‘u was the woman  
Hānau kēlā lani koa lau a Hāloa  
The spreading branch of Hāloa was born  
Hānau o Kawekiu he ohi no ka moku  
Kawekiu is born, a sprout for the island  
Hānau ka mauna, he keiki mauna na Kea  
Born was the mountain, a child for Kea  
Kuamū ‘ia e Kāne, kuawa ‘ia e Lono  
Rained upon by Kāne, grooved by Lono  
Ho‘i mai ‘o Wākea a loko o Lanimoemoe  
Wākea returns from Lanimoemoe  
Moe Wākea moe iā Papa  
Wākea sleeps with Papa  
Hānau ka mauna he keiki kapu na Kea  
Born is the mountain, a sacred child for Kea  
‘Ae, ka mauna, hānau ka mauna  
Indeed, the mountain, the mountain is born

The Kumulipo is one of the creation traditions of Native Hawaiians. In this tradition, the natural elements of the sea are born first, establishing the first order of ancestral identity. The Kumulipo is classified as a Pule Ho’ola’a Ali’i (the sanctifying prayer of a ruling chief) and was first chanted at the birth of Kalaninui‘iamamao as a prayer that consecrated the chief through the recital of his genealogical line.

Over two thousand lines in length, the Kumulipo divides the beginnings of the world in sixteen wā (distinct time periods) that unfold the creation of all natural elements through a specific genealogical order. The elements of light and darkness, salt water and freshwater are characterized as primordial and are the essential life-givers to all that have been born since the beginning of time. The stratification of elements and creatures being born into these periods illustrate that kānaka (humans) are the youngest of all creations. Therefore, all natural elements that were created prior to the first kānaka is understood as an elder sibling.

In the twelfth and thirteenth wā, the Kumulipo acknowledges the genealogical lineages of Wākea and Papahānaumoku. The emergence of these two lineages comes from a time of antiquity that these ancestors are understood and identified as Sky Father and Earth Mother, respectively. The union of these two ancestors resulted in the birth of the first human offspring, a daughter who was named Ho’ohokukalani, who then gave birth to a stillborn named Hāloanakalaukapalili.



**Kalo (*Colocasia esculenta*)- the Ancestral Embodiment of Hāloa**

From the burial site of this child, oral tradition states that the first kalo plant is born. It is understood by Native Hawaiians that kalo is the staple food source that is the kua'ana (older sibling). It should be noted that a second child named Hāloa in honor of his elder brother was born to Ho'ohokukalani and is considered the progenitor of all Kanaka 'Ōiwi (literally translated as "those of the bone" and is a name by which Native Hawaiians identify themselves).

The primary lesson derived from these accounts of ancestral genealogy is that in the Hawaiian understanding of the universe, the world is defined through a social order established by a set of associated responsibilities and duties among all natural elements. This social order is derived from an indivisible genealogical line. Thus, the 'āina (often defined as "land" but in its literal translation means "that which feeds and devours") is characterized as an ancestral and familial member, fulfilling the role as the kua'ana, the eldest sibling in the family unit.

The responsibilities of the elder sibling in the traditional 'ohana structure, the distinctive social and familial unit of Native Hawaiians, was to ho'omalu (protect), hānai (nurture and feed), and to kauoha (give instruction). Conversely, those in the present and subsequent generations are given the responsibilities of the kaikaina (younger siblings) to mālama (care for and attend), aloha (extend love to), ho'olono (listen), and ho'oloha (obey) our elders. Therefore, as applicable to traditional land tenure "management", the Native Hawaiian values of mālama 'āina and aloha 'āina are derived from this established relationship or engagement that defines specific responsibilities between the individual, the 'āina, and from a Hawaiian understanding, the akua, the spiritual interpretation and actualization of the natural environment.

As recounted in the cited oli (chant), Mauna Kea is ascribed the namesake of Wākea. Thus, there is a body of ancestral knowledge that is inherited by the people that have the responsibility of stewardship by their shared genealogy to this place. As such, it is necessary to highlight that from a Native Hawaiian understanding it is the pilipuka, the metaphorical depth of their ancestral past that has been meticulously preserved through the oral traditions that is the source of the traditional knowledge, values, beliefs, practices, and principles that help to define and maintain their cultural identity. It is this traditional base of knowledge that should guide contemporary planning and decision-making in establishing and maintaining adequate stewardship practices for the natural and cultural environment.

*Mai ka pilipuka, mai ka pawa, mai ka poni li'ulā, e pāne'ene'e i ke panepo'o* - From the depth of night, from the time before dawn, from the early glimmer of day's first light, climb steadily and with purpose towards the summit. This 'ōlelo no'eau depicts the cyclic process of renewal and rebirth; a literal descriptive transition from night to day but a figurative allusion to the following: unconscious incompetence to unconscious competence; ignorance to enlightenment; ancestral to contemporary; ethereal to physical; intangible to tangible. It also signifies a commitment to learning and knowing when to engage the process, whose approach is defined as Ke Kapakea Pāhiku o Mauna Kea (The Seven-folded White Kapa of Mauna Kea), which is described in Section 4.0 of this document. It is from this 'ōlelo no'eau that the issues centered on the proposed actions of this project with Mauna Kea will be addressed.



**Pu'u Kūkahau'ula, Mauna Kea**

## 2.2 KE ALO O NĀ KILOHOKU - A PURSUIT OF KNOWLEDGE

As evidenced in the oral traditions of kilohoku (astronomers) and within the techniques of traditional long-voyaging navigation, seasonal planting, and fishing, Native Hawaiians in traditional and contemporary times possess an acute sense of their environment and understood the relationships of the position of the moon, the rising and setting of certain fixed stars and constellations, and the sun. As with the understanding of their association with the land and the ocean, it can be inferred that ancestral connections to the heavens are equally revered.

As described in the fourteenth wā of the Kumulipo, the relationship between the stars, the heavens, the earth, and the chiefly line are clearly defined. Throughout its description of genealogical procession, each line that identifies and names the celestial bodies begins with the term “lewa”, which can be translated as “swings” or more poetically, as belonging to the firmament or afloat with an emphasis that there is an ancestral connection to these elements.

According to the Kanalu tradition, another genealogical and oratorical account that discusses a view of Native Hawaiian understanding of the celestial bodies, the stars were categorized into eight classes: hoku ali’i (royal stars), hoku maka’āinana (commoner stars), hoku hō’ike (prophetic stars), hoku kahuna (guiding stars), hoku ‘āina (land stars), hoku no ke akua (stars relating to the gods), hoku no ke mālama (stars for the months), and hoku kilo (observing stars).

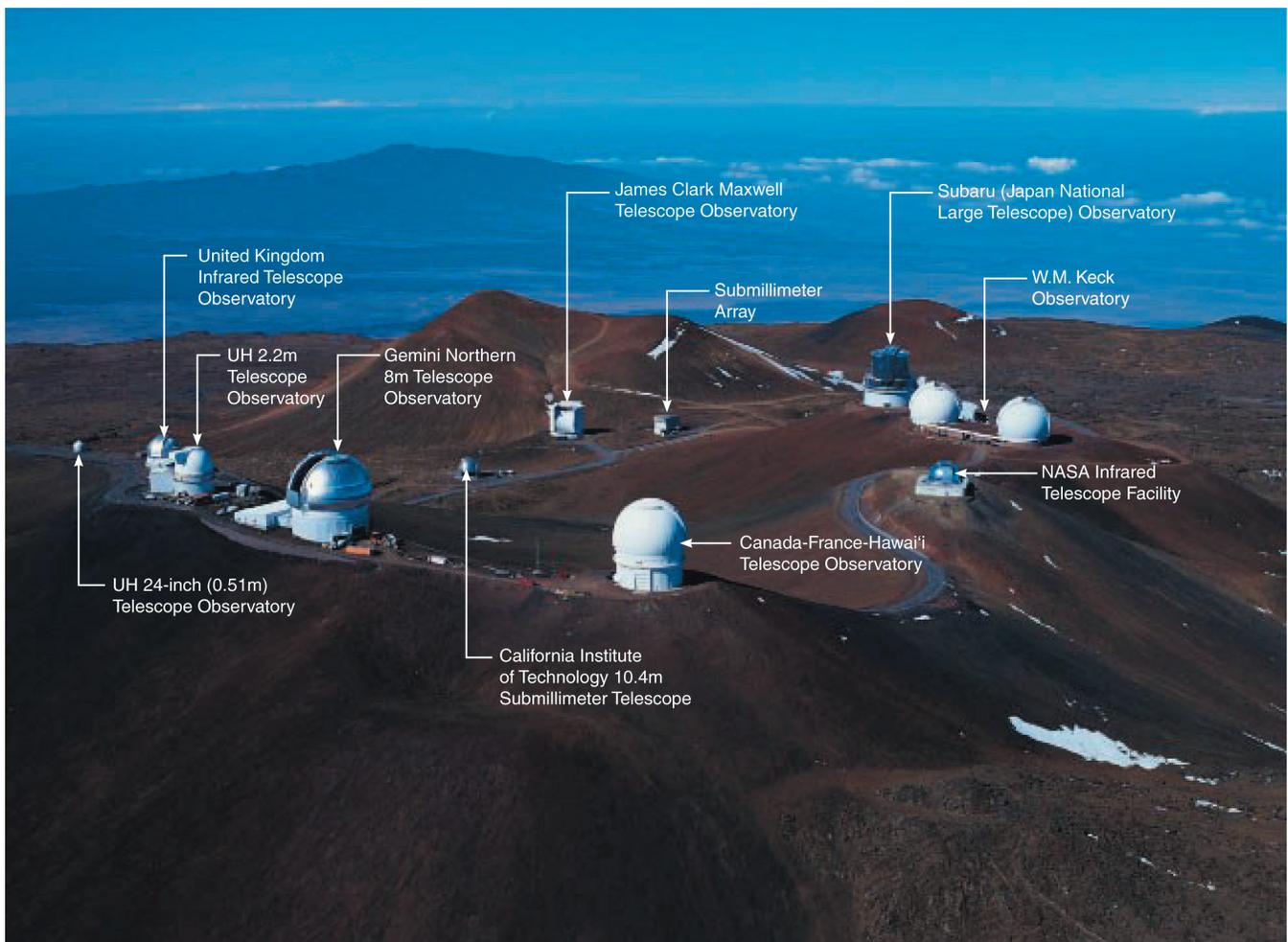
It is interesting to note that in known Native Hawaiian oratorical traditions, there is no documentation that traditional built structures such as heiau were ever built on the summit proper of Mauna Kea. As understood by kūpuna, heiau and other physical tangible features were built by necessity based upon addressing a specific spiritual need, whereupon specific protocols and understood principles governed the development of the physical form in which a specific function would then be invoked. Physical and tangible cultural features such as heiau were built for a specific function such as healing centers, agricultural and aquacultural centers, political power and governmental affairs, and training centers. The completion of these structures would often require a spiritual invocation known as “noho a akua”, the understood associative spiritual element or deity to dwell within part of the physical form for the function or task to be appropriately carried out and for knowledge to be attained.

***“Respect the ways and understandings of our ancestors. Mauna Kea is a natural temple, provided by the Gods. It is where the Gods take on their kinolau, or bodily form to dwell among us.”***

***“Mauna Kea is the wao akua, the last earthly realm that touches the beginning ranks of the heavens.”***

The summits of Mauna Kea and Haleakalā are known as the wao akua, the realms on earth that are the dwelling place of spiritual sources. In essence, the summits are spiritual realms that were and continue to be accessed by those individuals connected through successive genealogical ties to each respective summit for the purpose of inspiring, healing, guiding, teaching, and nurturing the needs of the people. Given their extensive knowledge of star alignments and celestial events, it was the traditional kilohoku that were viewed as key sources to adequately plan for daily life activities, the timing for handling governmental affairs, and for travel and navigation across the vast ocean. These acute skills of observation continue to be perpetuated in contemporary expressions of traditional cultural practices. As an approach to this planning process, any planned and desired activity at either summit has to be viewed and framed in this spiritual context and understanding.

Comparatively, according to the Merriam Webster dictionary, the term “science” has its derived roots in the Latin term *scientia* which means as “having knowledge” and is ascribed as being in the state of knowing. Astronomy is defined as the systematic accumulation of knowledge related to the study of objects and matter outside the earth’s atmosphere and of their physical and chemical properties. Some of the key questions that astronomers seek answers in the pursuit and quest for knowledge include some fundamental inquiries to understand the beginnings of our origins and to assess the future potential of our continued existence.



Southwest Facing View of Wao Akua o Mauna Kea



**Kūkahau'ula Building, Institute for Astronomy, Hilo**

Although it can be argued that there may exist a distinct difference in the cosmology (the theory or philosophy of the nature and principles of the universe) between university astronomers and Native Hawaiian practitioners and stewards, it is this difference that needs to be recognized, respected, and valued to begin to appreciate some of the finer threads of mutual and shared values in understanding the essence of our existence and the responsibilities associated with that understanding. One of these threads is having the appreciation and understanding of the lessons and experiences of the past in order to identify and fulfill the kuleana in the present, and how the decisions made to carry out the kuleana in present times will have an unforeseen influence on the sustainability of resources but more importantly on maintaining the linkages of identity for those generations yet unborn.

It is a goal of the IfA that astronomy, as a science, is a catalyst to foster healthy working relationships with interested members of the local and global community with the aim of knowing and understanding some principal truths of our human origins. Further, the IfA further believes that the scientific achievements of astronomy conducted in Hawai'i can significantly contribute to the diversification of the local economy by attracting high-tech businesses in electronics, optics, precision mechanics, and information technology. Currently, the contribution of astronomy-based

science to the island economy has been quantified as providing over 600 jobs dedicated to the education, research, or support of astronomy at an economic level of approximately \$150 million per year, as of the 2000 Mauna Kea Master Plan. The discussion that needs to be had is how to translate these types of jobs into opportunities that direct benefit local residents and students.

***“The Institute for Astronomy, as a representative of our local university, needs to assert a firm commitment to provide opportunities of education to our local students.”***

***“The University should be the example of supporting the education and career development of local students.”***

As an educational focus, the IfA believes that astronomy can be a major learning discipline that helps fuel the interests of current and future students in Hawai‘i to consider pursuits in science, engineering, and technology. IfA leadership is committed to developing the role of the institution as a contributing repository of knowledge and a home for teachers to train future technical experts with local ties and commitments to the islands. One measurement of success in the quality of work produced by an academic institution is defined by how that work is perceived and utilized by its academic peers. The IfA is second only to Princeton University in the total number of referenced astronomy journal citations that are made by academic institutions across the U.S. to the project work of the IfA on an annual basis. These citations affirm within the academic and scientific community that the academic work of the IfA is a major contributor to the body of knowledge within the core disciplines of astronomy, physics, and mathematics.

It is vital that the University of Hawai‘i, as the primary center for higher education in Hawai‘i, provide the means and incentives for local students to pursue their interest and desires in education, whether formally at a college campus or through community and family-based learning. It is also vital that the University assist in creating and sustaining an appropriately-scaled job market that supports the economic needs of individuals for the tenure of their career. A part of the Pan-STARRS EIS process will seek to identify a project-share contribution to provide and sustain opportunities of higher learning for local students.

### **2.2.1 Kuleana to Mālama Mauna Kea**

Mālama ‘āina is literally translated as “to take care of, attend, care for preserve, protect, maintain that which feeds and devours” and can be characterized as a systematic and consistent engagement with the natural elements and an acknowledgement that the ancestral conscience of the landscape continues to transcend throughout the generations. For the natural and cultural resources to be sustained within the islands, the cultural values of mālama ‘āina and aloha ‘āina need to be perpetuated, practiced, and invoked by those with the kuleana (associated responsibilities) to the land.

Part of the EIS process for Pan-STARRS needs to identify how the kuleana of stewardship to Mauna Kea would or should be addressed in relation to identified tasks or actions associated to project management, design, operation, or programmatic development. This EIS process is attempting to create a new interaction between the University and the community that is predicated upon the acceptance of kuleana to the overall welfare and management of activities that occur on Mauna Kea. It is also the intent that this environmental analysis process and the planned design for the proposed action to articulate, respect, integrate, and reflect the traditional principles and values of the Hawaiian community.

As a first step of carrying out its kuleana within the process, the IfA intends to purposefully seek dialogues within the community. The IfA acknowledges the value of knowledge retained within and shared by the community. The preferred course of action includes facilitating open forums of communication and cooperation among interested stakeholder and community member interests for the mutual benefit of improving and creating enduring relationships that are vital to sustain the stewardship of Mauna Kea.

Although there may be specific points during the process where there may be difference of perspectives in the process or the project itself, attempts to resolve these differences in a respectful manner will be utilized to the fullest extent possible. The intent of the process is to instill a sense among all participants that solutions are always available. The IfA believes that fostering mutual respect and collaborative outcomes is important for invoking its share of responsibilities towards proper stewardship. Further, the IfA does not wish to contribute to an outcome that results in an entrenchment of positions with no feasible or agreeable actions of resolution put forth for consideration or implementation. It is the intent of this process that the IfA and the community come to a fuller understanding regarding the responsibilities of stewardship and that viable solutions to ensure the proper care of the summit are fully supported and implemented.

### **2.2.2 Transcendence of Ancestral and Universal Knowledge**

Several astronomers share a philosophy that the pursuit of knowledge is fueled by an innate desire to understand the beginnings of our human existence and the past events that have contributed to the formation of the universe. However, a clear distinction must be made that this sense of universal belonging does not immediately

***“The University should not view itself as a leasee; as long as the lease is in place, they are stewards to the land and need to act accordingly.”***

***How is the value of differing perspectives included in the EIS process?***

translate as meaning the same thing in the belief system of Native Hawaiians. One focus of this EIS process is to create a working atmosphere that respects the viewpoints and perspectives of all interested parties and recognizes the value within those viewpoints that may present a varying, minority, or dissenting opinion. The decisions that are made in the present should be guided by the lessons and values gained from these experiences. Further, the EIS will be framed within the context of identifying the potential implications of impacts of those decisions made to an unknown future generation.

One desired outcome from this EIS process is that the knowledge gained through the experiences and relationships shared between the astronomy and Native Hawaiian community becomes a learning tool that can be passed down to future generations as a guide to plan for the sustainability of their communities. Therefore, to begin to understand the potential contribution of Pan-STARRS, the story of astronomy beginnings and current presence on the summit needs to be told.

### **2.3 THE BEGINNING OF ASTRONOMY AND UNIVERSITY LAND MANAGEMENT ON MAUNA KEA**

In 1964, a team led by Gerard Kuiper from the University of Arizona conducted tests of the skies at Mauna Kea. Subsequent studies were carried out by the University of Hawai'i (UH) under the leadership of Dr. John Jefferies. The two universities, along with Harvard University, applied to



**Satellite Aerial View of Mauna Kea Summit**

NASA for funding of the first research telescope on Mauna Kea. In 1965, NASA accepted the proposal submitted by UH and agreed to fund the design and construction of the first research telescope. In the fall of 1967, construction of the UH 2.2-meter (also known as the UH 88-inch) telescope began. The University of Hawai'i Institute for Astronomy (IfA) was founded in 1967 and is responsible for carrying out research in astrophysics and planetary science and for the development of astronomy within a portion of the Mauna Kea Science Reserve. It is the mission of the IfA to produce the highest quality of astronomy research in the world. In June 1968, the Board of Land and Natural Resources approved a 65-year lease (General Lease No S-4191) for lands at the summit with the University of Hawai'i. The leased lands consist of over 11,288 acres and are part of the Conservation District under the State Land Use Classification System and are known as the Mauna Kea Science Reserve (MKSR).

### **2.3.1 Existing Management Structure for Mauna Kea**

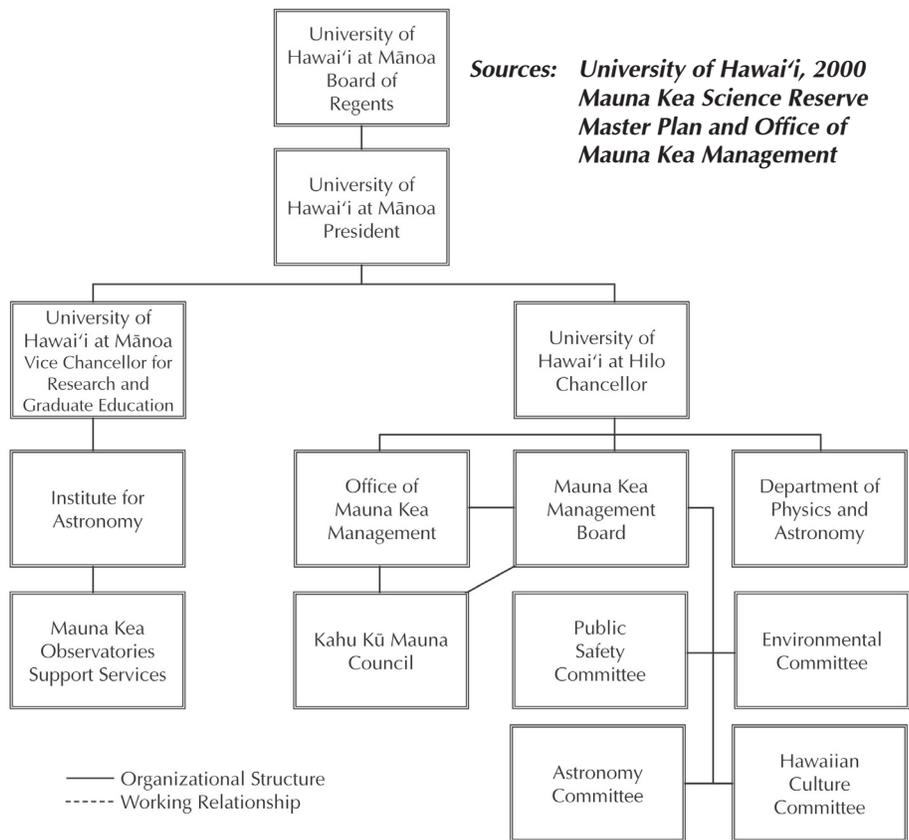
Several management plans have been created and subsequently revised or replaced during the first 33 years of the lease. In 1998, the State Auditor's Office conducted an audit of the management of Mauna Kea and the Mauna Kea Science Reserve. The 1998 audit recommended that the University carry out the following responsibilities: a) begin the next iteration of the master plan process; b) ensure that the new master plan and environmental impact statement identify areas for suitable development, areas of critical habitats, and no-build zones; c) establish controls for better management practices including the hiring of rangers, periodic inspections, visitor registration, and rules for development and public access; d) remove remnants of old equipment on the summit; and e) develop a forum for continuous community input. Further, the Auditor recommended that IfA develop a new method for measuring the impact of future development on Mauna Kea.

In 2000, the University of Hawai'i adopted the Mauna Kea Science Reserve Master Plan (MKSR-MP) that recommended a new management structure for the Reserve, which consists of the Office of Mauna Kea Management (OMKM), the Mauna Kea Management Board (MKMB), and Kahu Kū Mauna (KKM). Management of the summit is the responsibility of the University of Hawai'i at Hilo (UH-H) (Figure 2-1).

Under the authority of UH-H, the MKMB is comprised of seven community members that serve in an advisory capacity to the UH-H Chancellor regarding the management of the Science Reserve.

***What is the current management and decision-making structure as to operations and stewardship of Mauna Kea?***

***What is the role of the Mauna Kea Management Board?***



**Figure 2-1 Organizational Chart of University Affiliations and Mauna Kea Management**

The MKMB has several community-based committees that address specific concerns related to environmental, cultural, educational, and public safety concerns. In its advisory role, the MKMB helps guide the daily operations of OMKM.

Under the auspices of the UH-H, the OMKM is charged with the daily management duties as prescribed in the Master Plan and works closely with MKMB to establish and enforce current management policies, as well coordinate the Ranger Program, and provide oversight of activities on the mountain.

Kahu Kū Mauna (KKM) is an advisory council comprised of nine Hawai'i Island residents, representing each of the major moku (land districts). The role of KKM is to advise MKMB and OMKM on cultural matters that relate to the proper management and stewardship of Mauna Kea. Members of KKM are recognized in the community as leaders in cultural practices, traditions, and significant landforms as applied to traditional and customary use of Mauna Kea and for their sensitivity to the sacredness of Mauna Kea.

**What is the role of the Office of Mauna Kea Management?**

**What is the role of Kahu Kū Mauna?**

The IfA is responsible for all science and research related activities on Mauna Kea. Further, the Mauna Kea Observatories Support Services (MKSS) is a service organization within the Mauna Kea Division of the IfA. The MKSS reports directly to the IfA on all matters related to astronomy operations and reports to the OMKM on all environmental and cultural issues. The MKSS is responsible for operating the Hale Pohaku mid-elevation facilities; providing road maintenance, snow removal, and water delivery; and for operating the visitor information station and tour program.

In December 2005, the Auditor's Office completed a follow-up audit on the management of Mauna Kea. The Auditor's Office has recommended that the University should: a) obtain the authority to promulgate administrative rules for the Reserve to authorize OMKM to protect cultural and natural resources; b) revise and update planning documents, including the master plan to clearly assign roles and responsibilities for managing Mauna Kea and reflect stewardship matters resolved with DLNR; c) develop, implement, and monitor a comprehensive management plan for natural, cultural, and historic resources of the summit and Hale Pohaku area; and d) implement and enforce a permit and sublease monitoring system for the astronomy precinct observatories to promote responsible stewardship and prevent damage to the environment. The Auditor affirms that the University is taking positive steps in its management role but must be continuously vigilant in its stewardship responsibilities.

### **2.3.2 Departmental Oversight and Future Stewardship**

Over the last 30 years, Mauna Kea has become a premier, world-class astronomy site. However, the hard and emotional question that is often expressed by kūpuna, 'ohana, and kumu that have taken on the kuleana to care for Mauna Kea is at what cost to the cultural integrity and sanctity of Mauna Kea did all this development occur. Many community members feel that the existing facilities on the summit are indicators as to the level of compromise that has been imposed upon the Native Hawaiian community by preceding university leaders and state agency authorizations in the historical development of astronomy activities and public lands management on the summit. To understand the State's role in managing public lands on Mauna Kea, a brief synopsis of land use history and the current responsible State departments and divisions of public lands is provided below.

***What is the role of the IfA in the management of Mauna Kea?***

***What did the 2005 follow-up audit recommend to the University? Are any of these recommendations being pursued?***

***"Native Hawaiians have compromised for decades as to the use of Mauna Kea. How do all the telescopes on Mauna Kea and Haleakalā benefit Native Hawaiians?"***

The lands of Mauna Kea are part of the ceded lands trust. During the 1898 Annexation, the Republic of Hawai'i ceded all taken and confiscated lands designated as Government and Crown Lands (defined under the 1848 Māhele) to the United States. Under the 1959 Admissions Act, aside from those lands set aside for federal use, these lands were transferred as public lands to the State of Hawai'i, who assumed the role of land trustee. Under Section 5 (f) of the Admissions Act, the lands, revenue, and income generated from these lands are held in a public trust, which are to be used for five purposes, including the provision of public education and for the betterment of Native Hawaiians (as defined under the Hawaiian Homes Commission Act of 1920, as amended). Currently, the Department of Land and Natural Resources (DLNR) manages all public lands of the State.

***What State agencies are responsible for the management of Mauna Kea?***

The office and divisions of DLNR that are involved with the management of Mauna Kea are the Office of Conservation and Coastal Lands (OCCL), the Division of Conservation and Resources Enforcement (DCRE), the Division of Forestry and Wildlife (DOFAW), the Land Division, the State Historic Preservation Division (SHPD), and the Natural Area Reserves Commission (NARC).

***What specific actions have been implemented that have led to better management of the summit?***

The 1998 Auditor's Report concluded that DLNR needed to strengthen its regulatory oversight and role by tightening the conditions under which permits are approved. In the 2005 follow-up audit, the report stated that although DLNR had made improvements in protecting Mauna Kea's natural resources, the Auditor recommended that DLNR should take additional steps to ensure plans and permits are revised and updated to resolve stewardship issues.

***How does IfA, OMKM, and DLNR plan to address the management plan issue? How do they plan to address the need for restoring balance to the responsibilities of stewardship and being able to consider astronomy as a future activity on the summit?***

Further with the recent August 2006 Memorandum of Decision by the Circuit Court of the Third Judicial Circuit, current IfA leadership OMKM, and DLNR recognize and acknowledge that there has been an imposition upon the natural and cultural landscape of Mauna Kea. As the current university entities and State authority entrusted to bear the kuleana of proper stewardship and management, the these three entities are committed to creating a comprehensive management plan that will address issues of natural and cultural resource management, as well as to address the issue of future desires of astronomy on the summit. The management plan process is a separate but leading process to the Pan-STARRS environmental review. The planning team recognizes that Pan-STARRS should or could not move forward until an approved management plan is in place.

In recognition of past processes that resulted in frustration among parties involved and perhaps walls of mistrust or miscommunication to be built, the IfA is hopeful that the EIS process developed for Pan-STARRS will be a continuing stepping stone to demonstrate the commitment to its stewardship responsibilities and to move forward for the duration of its tenure in a manner that is respectful and responsive to community concerns. Part of this demonstration has already occurred with the actions taken in response to the recommendations and guidelines of the Master Plan and its management strategies.

A key component of the university taking a greater role in its responsibilities is the creation of the MKMB and Kahu Kū Mauna as a means for community input to be provided on all activities and development on the summit. Further, the existing Ranger Program has been a critical component in improvements to resource protection within the Science Reserve. The focus of the Ranger Program is to establish a presence on the summit to ensure the safety of visitors and to educate visitors as to appropriate and proper conduct in order to protect the summit's natural and cultural resources.

However, it is recognized that much more work, as detailed in the Master Plan, needs to be done. In 2005, a Collection of Native Traditions, Historical Accounts, and Oral History Interviews for Mauna Kea was completed by Mr. Kepa Maly on behalf of OMKM. Ongoing archaeological studies are being conducted to complete the inventory survey for the MKSR. In November 2006, a Request for Qualifications (RFQ) was issued by OMKM to hire a consultant to complete a natural resource management plan.

Further, on the part of the IfA developing the proposal for this EIS, which represents the first major planned action of summit development by the University itself since the Master Plan, a major criterion that the IfA sought to emphasize in its selection and desire was the importance of working with local communities, and specifically Native Hawaiian communities from the onset.

As a premier academic institution, the IfA has the desire and commitment to maintain its level of contribution to the body of knowledge in the multiple disciplines of astronomy. As the entity that is currently engaged in activities on Mauna Kea, the university with the IfA and OMKM does have an equal desire and commitment to continue to develop its role as a steward. In its responsibilities, the IfA seeks to be the leader among its academic peers to be

***How does the university view its role in the stewardship and care of Mauna Kea?***

***What types of studies are being done to fulfill the management plan requirements?***

***Does the IfA understand its stewardship role and responsibilities?***



**What role can Pan-STARRS have in strengthening the management of the summit?**

appreciative of the resources availed to its activities but also to contribute in a reciprocal manner back to the community and to the summit, ensuring the proper protection of these resources. Among the planning team, a discussion that continues to be fostered in the informal and formal dialogues with community groups includes identifying procedural steps and implementing actions to develop and rebuild community trust. Further, it is anticipated that strategies can be derived from these discussions to outline how commitments to the stewardship of the summit can be secured and perpetuated at an institutionally maintained at all levels of the university administration.

The IfA realizes that there are unresolved issues, related specifically to the ongoing dialogue and planning process of the management plan that extend outside the scope of this environmental review. However, these issues cannot be neglected and at some level must be addressed during this review. Recognizing that some of these concerns may need to be addressed prior to any consideration of moving Pan-STARRS forward, the IfA will seek to define what contributions can be made and commitments secured on a project-specific level. From a project management perspective, the EIS will evaluate what an appropriate project-share contribution should and would be made to the overall protection and management of the summit and what applicable means through the development of mitigation measures could be utilized to implement such actions.

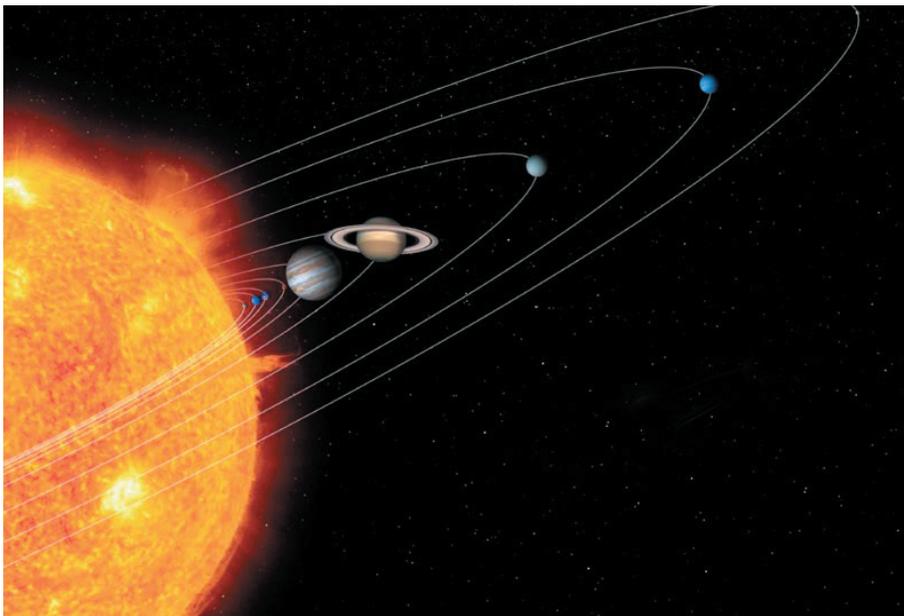
## 3.0 PURPOSE, NEED AND OVERVIEW OF PAN-STARRS

The principal purpose of the Pan-STARRS project is to detect asteroids which may intersect with the Earth's orbit and pose a threat. This section highlights the potential threat and man's approach through science to fully assess the future risk from these objects.

### 3.1 PURPOSE AND NEED FOR PAN-STARRS

Our solar system consists of nine planets orbiting the Sun and about 200 moons accompanying those planets. In addition to these major planets, the solar system also contains numerous smaller bodies, ranging in size from about the size of Pluto down to the small particles that make up interplanetary dust.

The Earth is located in the inner solar system, together with the other terrestrial planets Mercury, Venus, and Mars. Beyond the orbit of Mars, there is a concentration of small rocky bodies called asteroids, forming what is called the main asteroid belt. Outside of this asteroid belt, the giant gas planets Jupiter, Saturn, Uranus, and Neptune are located, each surrounded by a large system of moons. The outer realm of the solar system is the Kuiper belt, discovered in 1992 by UH astronomers, that consists of small bodies composed of mixtures of ices, dust, and rocks.



Rendering of the Sun and Planets in the Solar System

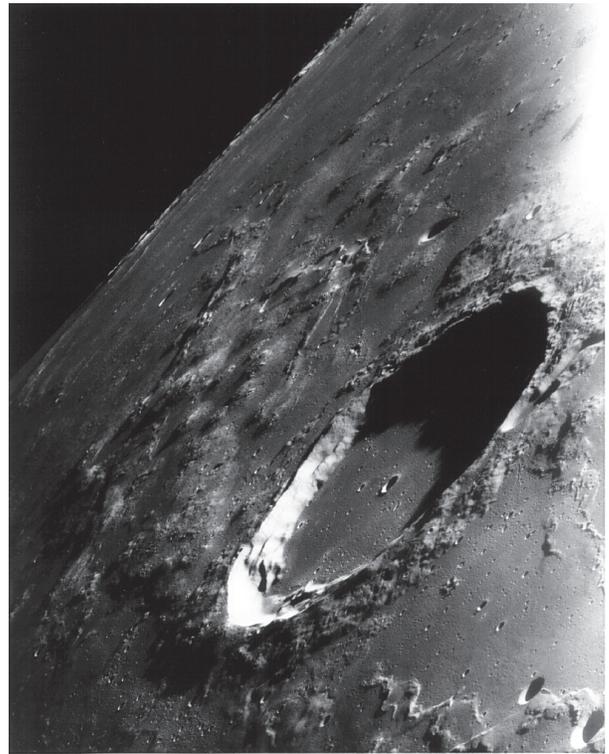
*How big is the Solar System?*

*Where do asteroids come from?*

***How do asteroids move within our solar system?***

***Has the Earth been hit by meteors or asteroids in the past? If so, what was the impact?***

Pluto (whose designation as a planet is under debate) is one of the larger of these Kuiper belt objects, which are the frozen leftovers from the time when the solar system formed out of a large disk of gas and dust. When Kuiper belt objects get perturbed from their original orbits into new orbits that bring them closer to the Sun, their frozen gasses begin to evaporate, forming the typical phenomena associated with comets.



**Unnamed Crater on the Far Side of the Moon**

The asteroid belt is not sharply defined, and even though the Earth's orbit is not in the densest parts of the asteroid belt, many asteroid orbits come close enough to the orbit of the Earth to make collisions possible. Similarly, meteorites, ranging in size from small rocks down to dust particles, constantly collide with the Earth. These small rocks get slowed down by the atmosphere, the larger ones burn up and become visible in the night sky as "shooting stars". Each day, the Earth accumulates about 100 tons of interplanetary material, from interplanetary dust and burned-up meteorites. This material drifts down through the atmosphere and usually reaches the ground mixed with rain.

While small meteorites lose most of their energy on their way through the atmosphere and usually burn up completely, larger rocks above the size of about 100 feet (ft) in diameter will remain intact and retain most of their kinetic energy on their way through the atmosphere. These larger bodies therefore will either explode in the dense lower atmosphere or impact the ground.

Due to geological forces and weathering, a record of asteroid impacts on Earth has not been preserved as well as the craters on the



### **Barringer Meteor Crater in Flagstaff, Arizona**

Moon. Nevertheless, clear evidence of destructive impacts on Earth has been found. Maybe the best example of the destructive force of these impacts is the Barringer Meteor Crater near Flagstaff, Arizona. This crater was formed about 50,000 years ago by the impact of an iron body approximately 150 ft in diameter, striking the ground with an energy of about 20 megaton TNT equivalent, roughly the explosive yield of a very large thermonuclear warhead.

More recently, in 1908, the Earth was hit by a similarly sized small asteroid, but one made of lighter and more brittle material. This impact resulted in the breakup and explosion of the asteroid a few miles above ground, leading to an airburst over the remote Siberian region of Tunguska, destroying thousands of square miles of forest, but not killing any human being.

Strong evidence has been accumulated over the past 25 years that the impact of an asteroid of about 10 miles in diameter near today's Yucatan peninsula led to a global environmental disaster that ultimately caused the extinction of the dinosaurs 65 million years ago.

According to the National Aeronautics and Space Administration (NASA), Near-Earth Objects (NEOs) are defined as periodic comets and asteroids whose orbits bring them within a 1.3 Astronomical Units (AU) of Earth's orbit. One AU is the average distance between the Earth and the Sun, which is approximately 150 million kilometers (km) or 93 million miles.

The vast majority of NEOs are asteroids, largely composed of rocks and dust. Comets are a second and rarer type of NEO. Comets are composed mostly of frozen gases, water, ice, dust, and larger

***What are Near-Earth Objects (NEOs)? How close do these objects come to Earth?***

***How many NEOs have been identified?***

rocks frozen together. According to discovery data published by the Minor Planet Center, there are 3,533 identified NEOs at the time of this writing, with more being discovered nearly every night. Of these NEOs, approximately 98% (3,476) are classified as Near-Earth Asteroids (NEAs). The remaining 2% (57) of NEOs are identified Near-Earth Comets.

***What are Potentially Hazardous Asteroids?***

The minimum distance between any object's orbit and the Earth's orbit is known as the Minimum Orbital Intersection Distance (MOID). Potentially Hazardous Asteroids (PHAs) are defined as all NEAs whose MOID is 0.05 AU or less (within 4.6 million miles of the earth) and have a diameter greater than 150 meters (500 feet). Approximately 840 currently known asteroids are identified as PHAs.

***What is the known history of asteroid impacts on the Earth?***

The threat posed by asteroid impacts was not recognized until quite recently. Up until the Apollo lunar landings and the study of lunar rocks, there was even debate on whether the numerous craters visible on the Moon were volcanic in nature or the result of impacts. The effect of asteroid impacts on the evolution of life on the Earth became clear when the extinction of the dinosaurs, the dominant species on Earth until about 65 million years ago, was linked to a large asteroid impact. Finally, in 1994, astronomers witnessed the impact of about 2 dozen comet fragments into Jupiter within one week, resulting in explosions vastly stronger than any nuclear warhead.

***What U.S. departments or agencies are responsible to address this threat?***

In response to this new understanding of the potential threat of asteroid impacts, initial hearings on NEOs were held before the Subcommittee on Space and Aeronautics, House Committee on Science in May 1998. During these hearings, leading scientists presented their findings from both the 1992 and 1995 Spaceguard reports. These two reports indicated that although the annual probability of the Earth being struck by a large asteroid is small, the projected outcomes of an asteroid impact would range from local devastation to a global environmental disaster.

***How powerful can an asteroid impact be?***

For a 40 meter (131 ft) asteroid, the impact energy generated is estimated at 3 megatons. As a comparison, the blast at Hiroshima generated a TNT equivalent of 15 kilotons. The impact of a 40-meter asteroid would generate two hundred times more energy than the nuclear bomb that destroyed Hiroshima.

For larger asteroids, the energy goes up with the mass of the body, proportional to the cube of the diameter. For a 1 to 2 kilometer (0.6 to 1.2 miles) asteroid, the impact energy is estimated at one million megatons, far exceeding the explosive power of all nuclear arsenals on Earth. In assessing the impact that could be generated from a NEO striking the earth, three components are typically assessed:

- 1) The potential regional damage caused by impacts on land or air bursts over land. Depending on the size of the impacting asteroids, the effects range from the equivalent of a single large nuclear weapon with thousands or millions of casualties for small impacts to the complete destruction of a typical country in case of the larger impacts, with casualties of tens of millions.
- 2) Tsunami damage caused by NEO impacts into the oceans. Computer model calculations indicate that large asteroid impacts (500 m - 2 km) into the oceans can generate extremely large waves with global destructive power similar to or exceeding strong tsunamis. These impact-generated waves put all coastal cities in direct risk, and threaten the global economy by the possible destruction of most seaports on Earth.
- 3) Global climatic catastrophes from large NEO impacts, independent of where impacts occur. The climatic effects of large asteroid impacts (1 km or larger) are similar to those predicted and calculated for the “nuclear winter” scenarios from a global, all-out nuclear war. The dust deposited into the atmosphere will lower the temperature on Earth and may lead to several consecutive years of crop failure, with dire consequences for most of humankind.

Any estimates of the consequences of an asteroid impact are very uncertain. While the frequency of such events and the energies released by the impact can be stated with some certainty, there is no experience base (fortunately) for the reaction of society to catastrophes of this scale, therefore all estimates are very uncertain. While acknowledging these uncertainties, it is still possible to state that according to probability theory, the chances of dying from an airplane crash and from an asteroid impact in a person’s lifetime are comparable. As a result of these preliminary findings and to reduce the risks with this hazard, U.S. government officials made it a priority to identify those NEOS with the potential to impact the earth.

***What are the odds of an asteroid impact in a person’s lifetime?***

***How real is the threat of an asteroid hitting the earth?***

***Have we had any near misses in recent history?***

It should be noted that the majority of approximately 200,000 known asteroids are not on a direct collision course with Earth at this time. However, the most dangerous object, the asteroid Apophis, which was discovered in 2004 by a UH astronomer, will make an extremely close pass near Earth on April 13, 2029, passing below the orbits of the common TV broadcast satellites. This asteroid has the potential of getting its orbit slightly perturbed and of becoming a direct threat in the foreseeable future.

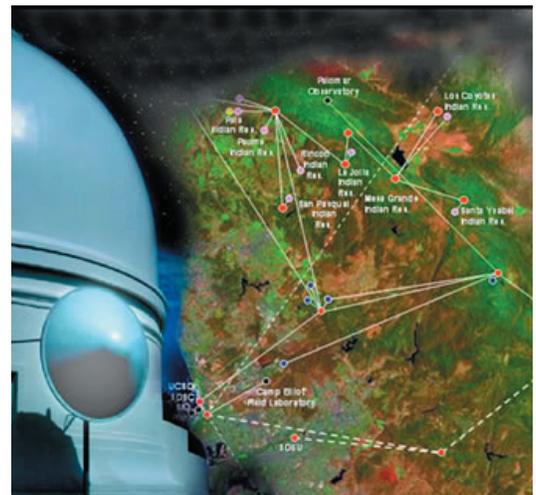
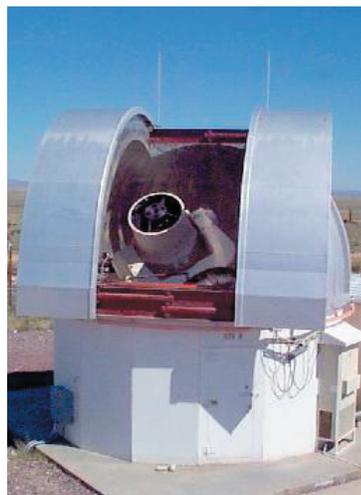
The problem is the thousands of other possibly dangerous asteroids that astronomers currently do not know. At this time, their knowledge is so incomplete that an undetected threat could be an unknown reality.

### **3.1.2 Near-Earth Object Program**

The result of the 1998 hearing was the formation of the Near-Earth Object Program Office (NEO-PO) within the NASA Jet Propulsion Laboratory. The primary objective of the NEO-PO is to find 90% of the estimated unknown 2,000 NEAs that are larger than a kilometer by 2008. The NEO-PO determined that a comprehensive search would reduce the uncertainty of knowing if an asteroid were on a collision course with the Earth by a factor of ten and would provide ample time to address the threat situation. In 1999, NASA collaborated with the United States Air Force to meet the objectives set forth in the Spaceguard Survey. The result of this collaboration was the creation of two major asteroid search projects.

The first search project involved a partnership with the Massachusetts Institute of Technology Lincoln Laboratory in developing the Lincoln Near Earth Asteroid Research (LINEAR) project, which was funded

***Are there other telescope projects beside Pan-STARRS that are doing this kind of research?***



**LINEAR and NEAT Asteroid Search Systems**

by NASA. The LINEAR project utilizes detector systems known as Ground Electro-Optical Deep Space Surveillance (GEODSS) telescopes, which were developed for the U. S. Air Force in Socorro, New Mexico. The LINEAR telescopes consists of two 1.0 meter (3.2 ft) telescopes and one 0.5-meter (1.6 ft) telescope which survey the night sky five times in one evening. Since 1999, the LINEAR system is the primary vehicle for identifying NEOs. As of October 2004, the LINEAR system has detected over three million asteroids and confirmed 1,622 NEOs and 142 comets.

The second asteroid search project was the Near Earth Asteroid Tracking (NEAT) project that was originally developed with a GEODSS telescope located on Haleakalā, Maui. The NEAT system is comprised of two autonomous observing systems at the Maui Space Surveillance Site and one at the Palomar Observatory located in northern San Diego, California. Since February 2000, the three separated systems survey the same part of the sky three times during an interval of one hour. The automatic data system searches for moving objects by comparing three images. The NEAT system has observed the night sky 18 nights a month since 2000 and has detected 18,344 asteroids and has discovered eight NEOS greater than 1 km. In addition to the LINEAR and NEAT projects, five other NEO search programs are contributing to the science and data of identifying NEOs including Spacewatch (Kitt Peak, Arizona), the Lowell Observatory Near-Earth Object Search (Flagstaff, Arizona), the recently upgraded Catalina Sky Surveys (Tucson, Arizona), the Japan Spaceguard Association (Bisei, Japan), and the Asiago DLR Asteroid Survey (Asiago-CimaEkar, Italy).

### **3.1.3 Extending the Search for Near-Earth Objects**

In 2002, NASA contracted a Science Definition Team (SDT) to study the feasibility of extending the search to smaller NEOs. The SDT reported that a search system to produce a catalog that identified at least 90% of potentially hazardous objects larger than 140 meters (460 ft) should be constructed. The SDT concluded that for the next generation of NEO surveys, any available funding should be spent on finding and cataloguing threatening NEAs or short-period comets.

Several options for executing an expanding search project were evaluated ranging from a series of specific ground-based, space-based, and mixed-based systems that could be utilized to conduct this next phase of NEO searches. In the feasibility study, the SDT made three specific recommendations to NASA:

***How many NEOs have been discovered by this searching systems?***

***Where are these other asteroid searching systems located?***

***What are the guidelines and recommendations to develop better technology to detect asteroids?***

**Recommendation #1:** Future goals related to the search for potential Earth-impacting objects should be stated explicitly in terms of the statistical risk eliminated and should be firmly based on cost/benefit analysis.

**Recommendation #2:** Develop and operate a NEO search program with the goal of discovering and cataloging the potentially hazardous population sufficiently enough to eliminate 90% of the risk due to sub-kilometer objects.

**Recommendation #3:** Release a NASA Announcement of Opportunity to allow system implementers to recommend a specific approach to achieve Recommendation #2.

In October 2002, another round of hearings was held before the Subcommittee on Space and Aeronautics, House Committee on Science to focus on steps to be taken beyond the then-current Spaceguard Survey of NEAs with diameters larger than 1 km. With the wealth of data being generated by the LINEAR, NEAT, and the other searching systems, new information regarding the potential threat from smaller asteroids between 200 to 500 meters wide was reported to the Committee.

During these hearings, astronomers had estimated that there were possibly 900 to 1,300 asteroids that were larger than 1 km. It was further estimated that the number of asteroids smaller than 1 km could range between 40,000 to 50,000. Since 1995, the existing systems have collectively identified 3,438 NEAs, of which 794 are greater than 1 km. These studies also suggested that the number of identified NEAs could drastically increase with new advances in technology for optics and data processing.

In an August 2003 report submitted by the NEO SDT, their findings concluded that large area surveys of the sky were essential for reducing NEO threats and reducing the smaller threat from long-period comets as well as to catalog the main-belt asteroid population. Further, the identification of future NEOs and their distinctive paths of motion are dependent upon an adequate survey of the asteroid main belt. The report stated that future search surveys would demand a higher level of accuracy and precision in identifying NEOs and their projected paths.

The report also evaluated ground-based telescope systems as compared to space-based systems. Although space-based designs do offer a significant coverage advantage over ground-based designs due to 24-hour availability, the overall costs of operation,

***What is the estimated number of unidentified yet potentially dangerous asteroids?***

***Can Pan-STARRS be conducted in outer space? Can you use technology like the Hubble Telescope? What are the advantages or disadvantages of using telescopes in space versus on Earth?***

maintenance, and data transfer makes space-based designs less cost effective than their ground-based counterpart. The report identified Mauna Kea as the premier ground-based site in the United States and perhaps in the entire world. Although the majority of existing asteroid searching systems are situated within the desert regions of the Southwestern United States, Mauna Kea provides more nights of clear visibility at its altitude and overall better weather conditions year-round compared to the Southwest. Also, Mauna Kea offers much better atmospheric stability, leading to better image quality, which in turn translates into fainter asteroids being found and their orbits determined with better precision.

The subsequent question is once the identification and survey is completed, what are we, as a global society, to do about any asteroids identified as a serious threat? Contrary to what some movies might suggest, scientists currently do not have any means of deflecting an asteroid that might be on collision course with Earth. At this time, we do not even know how an asteroid might best be deflected. The favorite method of science fiction movies to send a crew of astronauts to blow up the asteroid with nuclear weapons is completely impractical. This action would actually make things worse by breaking the asteroid up into hundreds of smaller fragments that would still hit Earth.

Most serious plans involve nudging the asteroid rather gently off course. For this to work and for this technology to be developed, decades of warning time are required ahead of a potential impact. Therefore, a complete census of all potentially hazardous asteroid is required if we want to have any chance of defending the Earth against this threat.

It is worth noting that with enough warning time, even conventional emergency responses will save millions of lives. With years or even only months of warning, cities could be evacuated, emergency supplies could be prepared and other measures taken to minimize the death toll, even if the impact itself cannot be prevented.

#### **3.1.4 Genesis of Pan-STARRS**

In February 2002, the IFA submitted a white paper on its Panoramic Survey Telescope & Rapid Response System (Pan-STARRS) to the U.S. Air Force Research Laboratory (AFRL) in response to a Broad Area Announcement (BAA), Solicitation Number BAA 02-DE-01 (12/21/01), which requested proposals for University-based Laser Technologies for Information and Materials Advancement

***What happens if astronomers detect a dangerous asteroid? Is there anything we can really do to protect the Earth?***

***How did the IFA get the funding to build Pan-STARRS?***

***Why is the Air Force involved in Pan-STARRS?***

(ULTIMA). Part of the ULTIMA program supports developing ideas about new instrumentation for general telescope facilities, whether it be for technology demonstration, observatory control, science measurements, or data analysis.

The AFRL subsequently accepted the proposal to develop Pan-STARRS and made the first funding award to UH IfA with a government fiscal year 2002 appropriation. Since then, the Air Force has continued to sponsor and fund UH-IfA's development of Pan-STARRS.

This formal relationship was executed under a grant through government fiscal year 2005 and is now being executed under a cooperative agreement. A cooperative agreement is a legal instrument used by a federal agency to enter into a relationship whose principal purpose is assistance. It is important to note that although the Air Force is involved in the associated program for Pan-STARRS under this agreement, the IfA maintains substantial flexibility in the development of the technology in establishing the scientific goals.

## 3.2 DESCRIPTIVE OVERVIEW OF PAN-STARRS PROJECT

### 3.2.1 Non-Classified Research and No Affiliation to UARC

Although funding for project development is provided by the USAF, the Pan-STARRS observatory will be owned, operated, and maintained by the University of Hawai'i Institute for Astronomy (IfA). As the IfA and its partners will utilize the data that will be generated by Pan-STARRS, **none of the research to be conducted at Pan-STARRS will be classified.**

Another critical concern presented by many community members during informal discussions was the University of Hawai'i at Mānoa (UH-M) considering to become a University Affiliated Research Center (UARC). This concern was further compounded when the UH-M, Applied Research Laboratory (ARL) submitted its February 2005 proposal to the U.S. Navy. In the proposal, the UH-M ARL highlighted astronomy research as one of its four competencies and underscored the Pan-STARRS program as an example of the excellence and achievements of the IfA.

Unfortunately, this inclusion in the February 2005 proposal created some apprehension by community members, which was shared

***Will the Pan-STARRS project be associated with any military use?***

with the Pan-STARRS planning team. To rectify this inaccuracy, the planning team communicated these concerns to the UH-M Vice Chancellor for Research and Graduate Education (VC-RGE), who is the responsible university administrator for the research enterprise of UH-M. In November 2005, the VC-RGE issued a letter that clarified that **Pan-STARRS will not be a part of any proposed UARC.** Further, the Director of the Institute for Astronomy, Rolf Kudritzki, has stated that Pan-STARRS, as a facility that will be owned and operated by the IfA, will not be a part of any proposed UARC. A copy of this letter is provided in Appendix A of this EISPN.

### 3.2.2 Design Elements of Pan-STARRS Telescope

Most large astronomical telescopes are designed to study a small patch of sky in detail. Pan-STARRS is different in that its purpose is to survey large sections of the sky quickly and often. The immediate goal of Pan-STARRS is to discover and characterize Earth-approaching objects, both asteroids and comets that might pose a danger to our planet. It is also the ideal system for mapping the large-scale structure of the Universe, as well as searching for astronomical objects that move or change, such as exploding stars, variable stars, and planets around other stars.

Although the primary purpose of Pan-STARRS is to detect threatening NEAs, the unique design and survey process of Pan-STARRS will contribute to new expanded source of data attained through a uniform census of small bodies throughout the Solar System. This data will be utilized in the study of astronomy within the University of Hawai'i system, including the curriculum at both the Mānoa and Hilo campuses. It is anticipated that new data will emerge relevant but not limited to the study of comets and asteroids in the Kuiper Belt; Jovian Trojans (a group of asteroids that revolve about the sun in the same orbit as Jupiter) and other planet Trojan systems; Centaurs (small icy planetoids that orbit the Sun between Jupiter and Neptune); comets; planetary satellites; the birth, evolution and death of stars; the nature of dark matter; extrasolar planetary systems (other systems of planets outside our own Solar System); and other clues to understanding the formation and expansion of the Universe.

Instead of using one large mirror, the conceptual model of Pan-STARRS is a composition of four individual 1.8 meter diameter concave mirrors with a three-degree field of view (comparable to the view in a pair of binoculars). This wide field of view is the main feature that allows Pan-STARRS to survey the entire sky so quickly.

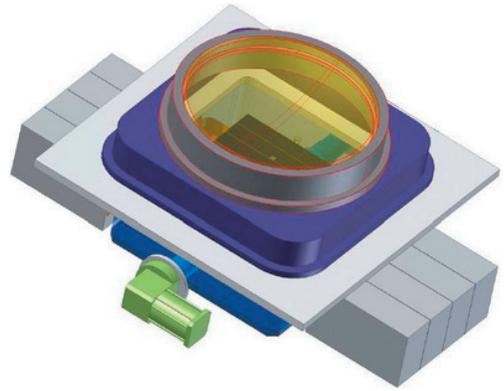
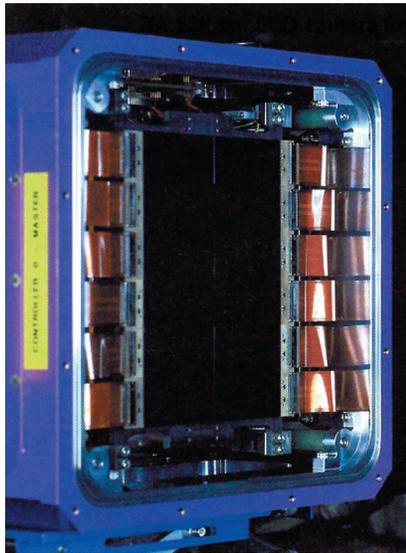
***Is Pan-STARRS associated with the Navy's proposed University Affiliated Research Center (UARC)?***

***What is unique about the Pan-STARRS system?***

***What kind of new information is anticipated to be generated by Pan-STARRS?***

***How far in the universe will Pan-STARRS be able to see?***

***What is the basic design concept of Pan-STARRS?***



**Coupled Charged Device (CCD) & Rendering of Gigapixel Camera**

Light from the primary mirror will be reflected off a secondary convex mirror and passed through three corrector lenses before reaching the camera at the focus.

The system will use four digital cameras composed of electronic detectors known as a Charged Coupled Device (CCD), a light sensitive computer chip used to gather images with a resolution of 1.4 billion ( $10^9$ ) pixels spread over an area about 40 centimeters square. These cameras will be the largest digital cameras ever built. The four cameras will point at a selected portion of the sky for about 30 seconds and then download the exposed images to a databank for processing and analysis. The innovative technology of Pan-STARRS comes not from its optics but from its use of very large electronic cameras and very powerful computers to analyze approximately 3,000 gigabytes (GB) of data that will be collected every night.

Approximately three-quarters of the total sky can be observed from Hawai'i, equating to approximately 30,000 degrees squared ( $\text{deg}^2$ ). Pan-STARRS will observe about  $7 \text{ deg}^2$  in each 30 second exposure. In roughly one eight-hour cycle, Pan-STARRS will record approximately  $6,000 \text{ deg}^2$  of the sky. Taking into account unknown variables such as inclement weather, it is anticipated that Pan-STARRS will be able to survey the entire sky once a week. Given the conditions on Mauna Kea, it is anticipated that the entire survey could be completed in ten years.

***How much information will be produced on a nightly basis?***

***How much of the sky will Pan-STARRS cover on a nightly basis? How long will Pan-STARRS take to survey the entire sky?***

Specific areas of the sky with a high probability of risk due to the concentration of known NEOs in orbit will be observed on a more frequent basis. Given its high precision in determining positions, Pan-STARRS will also provide invaluable information about the motion of nearby stars.

As for its ability to detect distant and faint objects, Pan-STARRS will reach 24th magnitude in approximately 30 seconds allowing it to detect asteroids as small as 300 meters (1,000 ft) in diameter. For comparison, the human eye can barely discern a star whose brightness measurement is 6th magnitude, which is about 15 million times brighter than a 24th magnitude star.

The best survey instruments currently used are located at the Subaru and CFHT telescopes on the summit of Mauna Kea. The rate at which objects can be detected, known as the etendue ( $A\Omega$ ) of the telescope, is demonstrative of a telescope's viewing power and depends on the collecting area of the telescope times the field of view. Both Subaru and CFHT have a combined  $A\Omega$  of  $14 \text{ m}^2 \text{ deg}^2$ . Pan-STARRS will have an  $A\Omega$  of  $54 \text{ m}^2 \text{ deg}^2$ , approximately three times greater than the combined power of Subaru and CFHT. In comparison, the existing LINEAR system that is currently the most active asteroid tracking system has an  $A\Omega$  of  $1.5 \text{ m}^2 \text{ deg}^2$ . Pan-STARRS will provide almost 10 times the collecting capability of the LINEAR search system. Additionally, Pan-STARRS will have a much faster read-out and processing time than existing programs, which is essential to rapidly cover the sky.

The use of the Pan-STARRS four-camera system will provide advantages in terms of cost, time of construction, diversity of operations and uses, simplicity in optical design, and low impact to the surrounding environment. However, the use of the telescope will require the completion of four camera systems and creates a need for greater computing power to analyze the data generated by four cameras working together.

The reason that Pan-STARRS will require the use of four cameras is to eliminate the possibility of misidentifying faint objects that are really defects in the image. These defects could be attributable to physical flaws on the camera pixels or gaps between the detector chips. Further, cosmic rays, which are any particles that bombard the Earth beyond its atmosphere, can also be recorded by a camera and result in a distorted image.

***How powerful will Pan-STARRS be?***

***Why does Pan-STARRS require the use of four cameras? Can the same science be done with only one camera thus making the project scope and land needs smaller?***



**Existing UH 2.2 meter (88-inch) Telescope Facility, Mauna Kea**

***How much data will Pan-STARRS generate?***

With its state-of-the-art field of view and resolution, Pan-STARRS will be able to detect many more faint objects than currently possible. It is anticipated that Pan-STARRS will fulfill and expand the current Spaceguard goal by detecting 90% of NEAs greater than 300 meters.

**3.2.3 Survey and Data Processing**

Pan-STARRS will generate raw images from each camera that are approximately two gigabytes (GB) or 2096 megabytes (MB). In full survey mode, the typical exposure will be last approximately 30 seconds. It is estimated that this will generate 10 terabytes or 10,240 GB of data per night. Comparatively most standard home PCs currently have a disk storage capacity of 120 GB, approximately 1% of data quantity generated in one night of Pan-STARRS observations.

Additionally, real time processing will require additional computing capacity. Due to the high volume of raw data being generated, the four images will need to be calibrated and combined into one composite image. Each composite image will be part of a master database and contribute to the formation of a single master image of

the sky. The positions and magnitudes of all objects above a certain threshold of brightness will be measured and analyzed. Some of these objects will be previously known objects while others will become part of a new archival record of data. Given the rate that Pan-STARRS will produce new images, all of the data computations and archival tasks for each exposure must be completed in one minute.

Although there are no plans to publish the individual raw images, the composite images and ultra-deep surveys, as well as the catalogs of moving, variable, and transient objects, will be accessible to the public.

Under the Data Rights section of the Cooperative Agreement, “All rights and title to data, as defined in 48 CFR 27.401, generated under this agreement shall vest in the recipient.” Therefore, UH-IfA will be the sole owner of the data produced by Pan-STARRS. As the owner of the data, UH-IfA will be responsible for collecting, reducing, processing, transferring, archiving, and publishing/sharing the data at its discretion. The data will not be classified but will be accessible to all interested research institutions, including the Air Force.

### **3.2.4 Mounting Platform Options for Pan-STARRS**

The Pan-STARRS design team is studying several options for mounting the four optical systems. There are three design alternatives initially considered and being evaluated: a) a common mount for all four cameras housed in one single protective dome; b) individual mounts for each camera in one single protective dome; and c) independent mounts for each camera with individual domes.

The analysis of using one alternative versus another involves assessing the technical and engineering feasibility of one design versus another; the comparative costs; the aesthetic and cultural visual impacts; and the preference of minimizing environmental impacts in reusing an existing 36-year old dome versus new construction. Engineering studies will be conducted in the coming months and prior to the publication of the Draft EIS to assess the best design alternative.

***How will these cameras be mounted?***

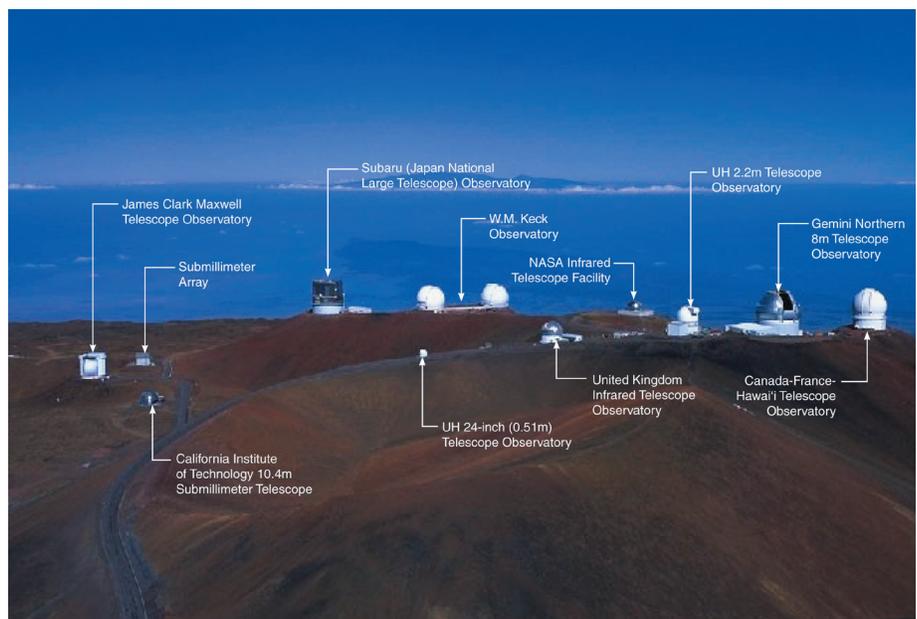
### 3.2.5 Preferred Site and Design Scheme for Pan-STARRS Telescope

**Why is Mauna Kea the preferred site for developing Pan-STARRS?**

**Was selecting a new construction site on the summit ever considered as option for developing Pan-STARRS?**

Mauna Kea is considered by the astronomy community as one of the finest locations in the world for ground-based astronomical observations. Because of its isolated character and location high on an island in the Pacific, the sky above the mountain is generally cloud free, thereby providing one of the highest proportions of clear nights in the world. The summit is above the tropical inversion layer, which provides summit skies that are pure, dry and free from atmospheric pollutants. As this is a University of Hawai'i project, the science and equipment belongs to the university. As such, Mauna Kea is the preferred summit locale to site Pan-STARRS.

The design team initially had an engineering preference to utilize an undeveloped area on Mauna Kea for Pan-STARRS. However, in applying the physical plan management scheme under the existing Mauna Kea Science Reserve Master Plan (MKSR-MP), the potential reuse of the UH 2.2m site and the replacement of the existing telescope facility is currently the preferred approach. In the MKSR-MP, and specific to the interest of redeveloping the UH 2.2m site, the IfA identified five different categories of facility development projects. The first and most common type of considered facility projects were characterized as the "redevelopment of existing observatory sites on the summit ridge" which includes the UH 2.2m facility.



**West Facing View Corridor of Mauna Kea Summit**

One of the critical design elements originally considered but recently dismissed as a feasible option was the complete reuse of the existing foundation, base structure and enclosure of the UH 2.2m facility. The reuse of the existing facility and enclosure would have potentially been no more of an environmental or visual impact than currently existing at the site since it would require minimal structure modification and refitting the interior with new optics, cameras, and technology. However, given the known engineering design requirements and liability issues, there are concerns that the existing infrastructure would not be able to support the high torque of four telescopes rapidly surveying the sky. Further the existing facility is considered to be visually intrusive. IfA evaluated the potential of creating a new facility that could be designed with less of a visual impact than currently experienced on the summit. As engineering studies to the different design options are completed, the participation of community interests and concerns in the critical elements of project development and implementation will be solicited in the ongoing informal and formal dialogue processes of consultation.

A second design option that is currently the preferred option for project design is the complete redevelopment of the site, which may involve a partial or full removal of the foundation, base structure, and enclosure. In April 2006, the Pan-STARRS Science Design Committee issued a Request for Proposal (RFP) for studies to be conducted for the preferred design option of a “common enclosure” for the four-optical system array on Mauna Kea. These studies were intended to address the engineering feasibility at a conceptual design level, as well as to develop a cost estimate for construction. Several parameters were stated in the requirements for conceptual design, one of which included the requirement that these designs must stay within the two-dimensional footprint of the existing UH 88” telescope. It was also desirable that proposed design options consider staying below the height of the current enclosure and to limit the depth of excavation for the enclosure’s foundation to the depth of the current pier. Currently, three conceptual design options are being evaluated.

The existing UH 2.2m facility is the first large optical/infrared telescope ever built on the summit of Mauna Kea (1970). The UH 2.2m facility is utilized in a wide range of observing programs and continues to be an essential component in the graduate teaching and research program of the IfA. Principal researchers associated with the University of Hawai’i typically conduct the observations

***What other design options were first considered and are no longer being evaluated for future designs?***

***What is the preferred design option for Pan-STARRS?***

***What exists now at the UH 2.2m site?***



**PS-1 Prototype Dome, Haleakalā (December 2006)**

at the UH 2.2m site. The facility is part of the existing Astronomy Precinct established in the MKSR-MP and is situated in close proximity to sacred space of Pu'u Kūkahau'ula.

As the existing UH 2.2m site is within the summit region, it resides in an area considered the most sacred in the cultural knowledge and understanding of Native Hawaiians. In recognition of the cultural and spiritual importance of Mauna Kea, the environmental analysis process for Pan-STARRS must consider that if astronomy were to continue as an “engagement” or “relationship” with Mauna Kea, the IfA and its partners must integrate the shared knowledge and values into the planning, design, construction, operations and maintenance of the facility. A secondary but essential objective of Pan-STARRS then is to achieve a mutual learned approach between astronomers and Native Hawaiians to the kuleana of stewardship in restoring, protecting, and maintaining the sanctity of the summit.

Although the UH 2.2m facility is an IfA-owned and operated facility that is over 30 years old, research performed at the facility is still producing new data and findings. However, as Pan-STARRS would be the most technologically advanced system, the contribution that would be made to other sciences by replacing the existing facility and its technology would be immense thereby further enhancing and promoting the IfA as a premier academic institution.

***What kind of research is being done at the UH 2.2m facility?***

Any new structure would need to comply with design guidelines provided in the Mauna Kea Science Reserve Master Plan. Other feasible design options developed during the informal community dialogues and EIS process will be considered in the planning of the site. However, in either scenario, there would be some extended level of construction-related impacts anticipated in both the removal and rebuilding stages of the facility.

Other key and critical areas of concern for evaluation and study during the environmental review process are further discussed in Section 4.0 of this document.

### **3.2.6 Test of Pan-STARRS Design with PS-1 Prototype**

In June 2005, the IfA began construction on a prototype (PS-1) of Pan-STARRS on the summit of Haleakalā on the island of Maui. The site selected for the prototype is the former Lunar Ranging Experiment Observatory (LURE) that was closed in June 2004. Construction of the prototype includes the removal and replacement of one of the existing domes and the installation of the camera and equipment that is the prelude to Pan-STARRS technology. The telescope design, cameras, and data processing software for the PS-1 system will be comprised of only one camera but will have the capacity to be integrated as 1/4 of the overall version of Pan-STARRS. The telescope is anticipated to be online in mid-2006.

As discussed in Section 6.0 of this document, the Haleakalā High Altitude Observatory Site is the alternative site considered for Pan-STARRS. One of the disadvantages of Haleakalā as the Pan-STARRS site is that given the less favorable atmospheric conditions, it would take twice as long to complete the project than if done on Mauna Kea, meaning that the survey would be completed in 20 years. If the project were to proceed at the preferred location of Mauna Kea, then the optics, camera, and equipment would be removed from the LURE facility and integrated into the location and design for the Mauna Kea site.

### **3.2.7 Potential Integration Into Existing Outreach and Education Programs**

Existing outreach programs at both UH campuses are expected to be enriched by the new data that stems from Pan-STARRS. Recent outreach activities at the UH-Hilo campus have resulted in expanded learning opportunities both for the general public and for minority students interested in astronomy or other sciences.

***What are the design guideline standards for the proposed facility?***

***Why is a prototype being built on Haleakalā?***

***If already building PS-1 on Haleakalā, why not finish the design on this mountain instead of Mauna Kea?***

***What types of community and education outreach related to summit activities and astronomy have been done in the past?***



***Are there existing or potential partnerships for community and educational outreach with Pan-STARRS?***

Under a recently-completed New Opportunities through Minorities Initiatives in Space Science (NOMISS) grant from NASA, the campus, in partnership with the Hawai'i Department of Education and Kamehameha Schools, has bridged concepts of space science, history of Hawaiian navigation, and the traditions of the land. University faculty, working with undergraduate students from UH-Hilo who were current or potential astronomy majors, provided both professional development and curriculum development for K-12 teachers from public, private, and charter schools and their students, most of which were of Native Hawaiian ancestry.

One of the fundamental outcomes of the NOMISS program was the idea of transformational learning which builds, develops, maintains, and nurtures a community of learners over time. It is grounded in specific places, people and time and always includes the invocation of proper protocol. The primary outcome of transformational learning is that it creates and supports relationships of reciprocal giving through the provision of service and education to real communities.

“Hawaiian Values, Science and Technology: Advancing a New Paradigm for STEM Education,” is a National Science Foundation program at UH-Hilo which provides support for Native Hawaiian students who are underrepresented in the science professions. Through this program, UH-Hilo faculty members, several of whom are also members of the Pan-STARRS team, have developed a number of educational and community outreach programs, including Nānā Pono Ko Kākou Honua – Observing our World, a four week intensive summer course for entering college students, a traveling StarLab Portable Planetarium which is used both for undergraduate instruction and public outreach, a new course in Archeoastronomy which includes Polynesian navigation and field trips to sacred sites such as Cape Kumukahi, Ahu a Umi, Mauna Kea, etc.

The Mauna Kea Observatories Outreach Committee, whose members include the Institute for Astronomy, the UH-Hilo Department of Physics and Astronomy, and representatives from the centers currently conducting research on Mauna Kea, sponsors frequent public talks and opportunities for the public to learn more about astronomy and to experience hands-on exhibits in the fields of science.

AstroDay in Hilo, which is part of a global grassroots initiative to share in the knowledge of astronomy with the general population, was created to inspire children to become interested in science and

to consider pursuing higher education in the fields of science. The annual event has become so popular that it fills the current venue to capacity.

Findings from Pan-STARRS may find an appropriate public venue for educational outreach with the opening of the 'Imiloa Astronomy Center (formerly the Mauna Kea Astronomy Education Center) in the UH-Hilo Technology Park. Opened in February 2006, the concept of 'Imiloa was developed in the mid-1990s by a team of educators, scientists, and community leaders who understood the need for a comprehensive educational facility that would showcase the traditions of Hawaiian culture and the science of astronomy that is conducted on Mauna Kea. Fitted with technologically advanced interactive programs, the 'Imiloa Center contains 42,000 square feet of exhibition and planetarium space. Exhibits, which are showcased bilingually in Hawaiian and English, focus on two themes - origins and voyages. It is envisioned that Pan-STARRS will lend to the future support and continuance of these and other community and educational outreach programs.

### **3.3 PRELIMINARY PROJECT SCHEDULE AND CONSTRUCTION COSTS**

The research and proposed construction of Pan-STARRS technology involves a partnership between the IfA, the University of Hawai'i at Hilo Department of Physics and Astronomy, the Maui High-Performance Computing Center, MIT Lincoln Laboratory, and the Science Applications International Corporation.

Project development and implementation is planned to begin immediately following approvals of environmental reviews, land use applications, ministerial permits and the disbursement of available funding. Currently, Pan-STARRS has an approved construction budget of \$60 million. If approved, construction could start in 2007. Further details regarding development phasing and costs will be presented in the Draft EIS.

***Will Pan-STARRS be linked to community and educational outreach?***

***Who are IfA's partners in the construction of the Pan-STARRS project?***

***What are the known estimated construction costs of this project?***

## 4.0 PROCESSES AND POLICY REQUIREMENTS

### 4.1 PĀHIKU PROCESS - DESIGNING A NEW APPROACH TO CONDUCTING ENVIRONMENTAL ANALYSIS IN HAWAII

An increasing understanding of the sacred relationship of the Hawaiian community with Mauna Kea needs to be elevated throughout the various stages of the planned design and environmental analysis process. This understanding is essential to adequately recognize and evaluate the complexity and breadth of environmental, cultural, and social issues associated with activities on Mauna Kea.

The approach that is utilized in this EIS process is culturally derived and defined as Ke Kapakea Pāhiku o Mauna Kea (“Pāhiku”), which translates as “the Seven-folded White Kapa of Mauna Kea.” The name of this process has several layers of kaona (contextualized layers of meaning and significance). Success of the process is predicated upon the idea that the cultural relationship that Native Hawaiians have with the summit must be the focal point of any planning process. With this focal point as a guide, the subsequent steps of the environmental analysis is to consider whether or not the potential implementation of Pan-STARRS is an appropriate relationship with the summit. To conduct this analysis, seven elements of community building, which are guided by Native Hawaiian cultural protocols and behaviors, are being utilized with the intent to build meaningful and responsive relationships within the local island and Native Hawaiian communities.

In its simplest form, the application of the process is based upon a purposeful emphasis on building and maintaining working relationships with community leaders and government agency officials at the Federal, State and County levels. This relationship relies upon the guidance and counsel from recognized cultural advocates within the Native Hawaiian community. Some of these cultural voices were initially included through personnel involved on the planning team and through direct family or personal friendships, organizational links, and on-going professional connections such as existing or former clients and consultants. It is intended that this process will avoid the limitation and constraints of following a standardized procedural “checklist” of required meetings and

***What is the Pāhiku Process?***

***Why is this process being utilized in this EIS study?***

***What does IfA hope to accomplish by utilizing such a community-oriented process?***

***Do all members of the Pan-STARRS planning team understand the cultural values and principles that are shared in the Pāhiku process? If not, how is such cultural information shared with the community?***

consultations, which has led to challenging and litigious outcomes in past EIS processes that involved Mauna Kea.

The formal environmental analysis will be conducted in a manner that integrates the community planning elements of the Pāhiku process while complying with the regulatory requirements for consultation. It is critical to highlight that identified areas of concern, including environmental and cultural issues, will not be treated as check box agenda items in any stage of project development. Rather, with input from the community and a timely response from the planning team, it is the intent that the critical issues relevant to the values and beliefs of the Native Hawaiian community will be integrated in the discussions of project concepts, community dialogue, facility planning, and decision-making.

As stated, the foundational roots of the Pāhiku process has been and continues to be focused on purposeful dialogue and relationship-building with key interests of the Hawaiian and local island communities as well as from the onset to identify past issues and potential future partnerships into the planning and assessment phase. However, it must be acknowledged that the integration of multiple perspectives and voices is one of the most difficult challenges in designing and facilitating any community planning process.

The primary short-term goal of developing the Pāhiku process is to create a course of action that shifts away from classical adversarial positions of gridlock between active participants with uncompromising beliefs and positions. The objective of this process is to achieve a mutually acceptable level of cooperative understanding and recognition between all interested participants. Further, in the spirit of having a mutual purpose that focuses on the principles of proper stewardship and engagement with Mauna Kea, it is the intent that discussions that are derived in the Pāhiku process address the critical issues in a respectful manner and derive viable solutions that are amenable to all participants involved.

## **4.2 JOINT NEPA AND HRS, CHAPTER 343 ENVIRONMENTAL ANALYSIS PROCESSES**

The proposed action will require completion of an Environmental Impact Statement under both federal and state laws. A joint Federal/State Environmental Impact Statement (EIS) is the approach being employed for the Pan-STARRS project. Federal funding of the project is provided through the United States Air Force (USAF),

***Who officially reviews  
and accepts this  
document?***

***Why is the Air Force  
involved?***

and the project is planned for lands within the State of Hawai'i Conservation District. The approval authority and lead agency for EIS preparation under NEPA is the US Air Force while the accepting authority and lead agency under the state process is the Office of the Governor.

The Federal EIS requirements will be satisfied in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code SS 4321-4374), and the Council on Environmental Quality regulations implementing the procedural provisions of NEPA 40 Code of Federal Regulations (CFR Parts 1500-1508). The State of Hawai'i EIS requirement will also be satisfied in compliance with State Environmental Review Law (as amended Chapter 343 Hawai'i Revised Statutes), and The Environmental Review System (Chapter 11-200, Hawai'i Administrative Rules). Under both Federal and State systems, a EIS document is prepared for projects, decisions, or actions which can reasonably be expected to have a significant impact upon the environment.

The EIS will provide a detailed description of the Pan-STARRS project and viable alternatives of project design and location. Further, the document will identify the potential disturbances; the preferred action and alternatives would have on the natural, cultural, or socioeconomic environment; and determine whether any of the disturbances would create a significant impact on specific elements within these environments. In addition, the EIS will describe the following:

- detail mitigation measures that can be taken to minimize the impacts of the Pan-STARRS project on these environments;
- identify adverse environmental effects that can not be avoided even with mitigation measures if the action is implemented;
- present cumulative impacts of the action upon the environment in combination with other actions;
- evaluate the relationship between short-term uses and long-term productivity of the environment;
- and describe irreversible or irretrievable commitment of resources that would occur.

**NEPA Environmental Analysis.** The NEPA EIS process is initiated by a federal agency's publication of a 'Notice of Intent' (NOI) in the Federal Register. The NOI will be provided to newspapers and other media, specifically on Hawai'i Island, as well as general statewide coverage. Further, a copy of the NOI will be provided to the State Office of Environmental Quality and Control (OEQC),

***What Federal laws apply to the completion of the EIS?***

***What State environmental laws apply?***

***What are the standard elements of an EIS document?***

***How does the Federal process for EIS review work?***

***What is a Notice of Intent?***

**What are the next steps for the NEPA process?**

the Office of the Governor, and will be distributed to requesting agencies, organizations, and individuals.

As outlined in the Council on Environmental Quality (CEQ) regulations, scoping meetings will be conducted on the islands of Hawai'i, Maui, and O'ahu to identify the issues, actions, alternatives, impacts, and mitigation measures to be addressed in the EIS. Although the format of the scoping meetings will adhere to the applicable CEQ regulations, different options will be explored as to how to conduct these meetings in a more efficient and community-focused effort. Comments made during the scoping meetings and review period thereafter will be addressed and included in the formal record of the EIS. The issues that are highlighted during the meeting and review period will be included in the informal consultation of the Pāhiku process for further discussion and evaluation.

**How does the State EIS process work? What is a EISPN?**

**HRS, Chapter 343 Environmental Review.** For the State-level environmental review process, the purpose of this Environmental Impact Statement Preparation Notice (EISPN) is to define the scope of analysis that will be addressed in a subsequent environmental impact statement (EIS). It should be noted that the preparation of this EISPN complied with the regulatory requirements of Hawai'i Revised Statutes, Chapter 343; and Hawai'i Administrative Rules, Title 11, Chapter 200. Guidance provisions that are outlined in The Environmental Guidebook (1997), which is published by OEQC, were utilized in the preparation and execution of the EISPN process.

**What are the next steps of the State environmental process after the EISPN is finished?**

This EISPN will undergo a 30-day public review period from the date of its first notice of publication in the Environmental Notice. As provided in Section 8.0 of this document, this EISPN has been circulated among several Federal, State, and County agencies; citizen groups and community organizations; and concerned citizens that have expressed an interest in the proposed action. Comment letters received during the review period will be addressed and become part of the formal record that will be appended to the EIS.

After the public review period deadline has passed, comment letters received in the review of the EISPN will be addressed and included as a formal record that is appended to the Draft EIS. Further, the questions, comments, and issues highlighted by the community will be forwarded to the consultants preparing the technical studies to help finalize their scope of work.

### 4.3 ELEMENTS OF THE NATURAL ENVIRONMENT

The EIS will examine several features of the physical environment. Environmental studies will be required to address potential impacts in several disciplines. IN past studies and environmental reviews of projects identified with Mauna Kea, several issues have been identified as warranting critical review and analysis as to the potential impacts to these resources, features, or habitats. For this study, the following environmental studies will be addressed: geology and soils; the ecological habitat of the Wēkiu (*Nysius wēkiuicola*); botanical resources; terrestrial and avian fauna; water resources; and air quality.

The proposed scope of work for the arthropod (Wēkiu) study currently includes a review of previously conducted arthropod studies for other environmental studies on Mauna Kea and Haleakalā. The analysis includes a review of possible construction scenarios and will assess the relative impact to the arthropod habitat and resident arthropod communities within or adjacent to the UH 2.2m facility with focus on identifying endemic or native species.

The scope of work would also involve site reconnaissance and sampling for Wēkiu bugs and other athropods in habitats within and near the site with attention given to specific areas that serve as a habitat to some of these species. It is expected that non-native species that pose a threat to native species will also be reported, such as the clubinoid spider (*Meriola arcifera*), the sheetweb spider (*Family Linyphiidae*), yellow jackets (*Vespula pensylvanica*), and species of predaceous wasps and introduced ants.

To conduct these surveys, access was granted by the Office of Mauna Kea Management, the State Department of Land and Natural Resources for Mauna Kea, and will be, if needed by the IfA for Haleakalā. The final report of the arthropod survey will include the following synopsis: a review of specimen collections and literature relevant to the arthropod resources; a listing of all arthropods identified; notation and discussion of significant species; and to identify potential impacts and measures to mitigate said impact on any significant species.

As the preferred project site for Pan-STARRS is situated at the Mauna Kea summit, it is out of the habitat range of the Palila (*finch-billed Honeycreeper*), the last of endemic and endangered honeycreepers to exist within the main Hawaiian Islands. On Mauna Kea, the Palila has a unique relationship with the māmane tree as part of

***What types of studies will be conducted for plant or animal habitats or species of concern?***

***Is there a general scope of work already outlined for studying the wēkiu?***

***Are there any concerns to Palila habitats?***

its critical habitat in the subalpine forested woodlands region from the 2,800 foot to the 6,000 foot elevation level. However, an evaluation will be conducted for short-term construction related impacts and disturbances that could be anticipated if construction staging occurs at Hale Pohaku as well as the potential impact of vehicles transporting construction materials and personnel through the habitat area along Mauna Kea Access Road. If staging at the mid-elevation is a possibility, then possible concerns attributable to increased traffic flow of construction equipment, vehicles, and personnel, particularly during the breeding months of the Palila that occurs from March through September will be taken into consideration.

#### **4.4 OTHER ELEMENTS OF THE HUMAN ENVIRONMENT**

The scope of the Draft EIS will include a discussion of subjects covering issues pertaining to archaeological and historic resources, cultural resources, visual impacts (both aesthetic and cultural perspectives), public access, hazardous materials storage and disposal, noise, traffic conditions; and socioeconomic conditions.

**Socioeconomic Conditions.** Socioeconomic conditions and trends will be examined including an analysis of island-wide conditions and trends of demographic, economic, and social data. Potential economic and fiscal impacts that could be generated by the project during construction and operational phases will be assessed as well as the cost-revenue ratio for both Maui and Hawai'i Counties. The study will also include a review of issues, controversies, and perceived social impacts of past telescope development including those integrated under the NEPA requirements for assessing cumulative impacts and compliance with Environmental Justice regulations.

**Archaeological, Cultural, and Historical Resources Analysis and Approach.** A major criticism of past studies related to any activity on Mauna Kea is that these studies have never assessed the cumulative cultural impacts to several identified areas viewed by many within the Hawaiian community as wahi pana, or sacred areas or landscapes that include both tangible and intangible features. These areas are identified but not limited to the following: a) the summit region from approximately the 6,000 foot level to Kūkahau'ula; b) the pu'u on and along the summit; c) the view plane; d) Lake Waiau; and e) the numerous trails systems.

***What types of economic studies will be conducted? What kind of short-term or long-term contributions will be made to the local economy with project implementation?***

***What types of archaeological and cultural resource studies will be conducted?***

In a preliminary compilation generated by the cultural consultant retained for this study, eight categories of previously documented cultural resource information highlight that Mauna Kea is an important cultural landscape, resource, and ancestral presence due to:

- the connection provided in its landscape as a wao akua (geographical realm of the gods) to the spiritual interpretation of that realm by Native Hawaiians;
- the understanding that Mauna Kea is a wahi kanu, a place for the deceased in traditional and recent times to be “planted or buried” and the significance of that “planting” in cyclic processes of life, mana, and ancestral identity as understood by Native Hawaiians, to continue.
- extensive traditional practices that were once invoked and/or continue to be perpetuated in contemporary times.
- numerous native and foreign accounts that document the relationships and association with historically and culturally significant people.
- existing tangible (sites, features) and intangible (visual landscapes and spiritual planes) cultural resources.
- existing traditional gathering practices and resources that are invoked by contemporary cultural practitioners to maintain and perpetuate said practices.
- identified wahi pana (sacred places) and place names that have an attached genealogy and cultural legacy to Native Hawaiians.

Some of the key concerns expressed in the informal levels of discussion with agency and community groups pertaining to impacts to Mauna Kea as a sacred site and to its cultural resources include identifying the potential existing, cumulative, and anticipated impacts: a) to cultural view-planes from the views to, from, and within the summit from the perspective of a cultural practitioner; b) to the kinolau (physical manifestation) of the understood spiritual presences and residences of Kūkahau‘ūla, Poliahu, Lilinoe, and other akua; c) of wastewater treatment, disposal, and discharge that in its current form of on-site treatment is viewed as an act of haumia (defilement). The community continues to voice concern that these actions have not been accounted for in previous cumulative analysis studies.

As the Pan-STARRS review process is intended to approach its impact with a key level of sensitivity to cultural concerns, the typical past response would be inappropriate as a means to define its impact.

***What types of key information will be drawn up in deriving an assessment of potential impacts to cultural sites, resources, practices, and beliefs on both summits?***

***“There are existing cultural impacts on the summit that have never been adequately addressed- cultural view planes, sanctity of space, and access to available resources are a concern that can not be neglected.”***

With the best intent of design and appropriate scale, it needs to be stated that placing Pan-STARRS on Mauna Kea or Haleakalā will have its own measure of cultural impact and will contribute to an overall cumulative impact to the cultural landscape. The issue that needs to be addressed in the process is not whether or not there is an impact. Rather, it is knowing that if there is some level of impact to the cultural landscape, the process needs to identify how best to define and implement any mitigation measures taking into full consideration the cultural understanding and relationship that Native Hawaiians possess with Mauna Kea.

One level of mitigation that this review will evaluate is the no-build scenario suggesting that the general consensus from the Hawaiian community would suggest that there is no culturally appropriate means to rectify any alteration or transformation of what is deemed as sacred, including altered sites where existing facilities reside.

Another level of consideration is that if the project were to be considered and implemented, there are elements to the project's design, construction, operation, maintenance, and programmatic development that would need to be addressed. From a cultural perspective, some key issues to be evaluated include: a) assessing the impacts to visual quality and scale that result in a reuse approach or a reconstruction of a new facility on the existing footprint; b) ensuring means to access by Native Hawaiian cultural practitioners; c) evaluating and requiring a project-share contribution to the management and protection of the summit; and d) developing programs, initiatives, and educational incentives that derive a direct benefit to the local and Native Hawaiian communities.

Finally, one of the major criticisms of past activities and studies conducted on Mauna Kea has been the development and completion of a comprehensive Archaeological Inventory Survey and a subsequent Cultural Resource Management Plan, with Burial Treatment Plan for the summit. Under Hawai'i Administrative Rules, Title 13, Subtitle 13, Chapter 300 (Rules of Practice and Procedure Relating to Burial Sites and Human Remains), the burial treatment plan is a document that serves as a guide to the appropriate treatment and care for previously identified burials. Regardless of the varying legal interpretation, a burial treatment plan can be a proactive tool that if engaged early in the planning process can be utilized to minimize any potential impacts to known ancestral remains within or near a general area in question and to minimize the level of cultural interference and desecration that could result in the event of an unanticipated find by having a strategy in-place that is inclusive of concerned descendants to those burials.

***How will historic and cultural resources be evaluated?***

***Will the protection of ancestral burial sites be considered? What will determine the Area of Potential Effect?***

Although the preferred action includes the reuse of an existing site and will stay within the footprint, a proactive approach will be taken by the Pan-STARRS team to ask for guidance from ‘ohana and appropriate cultural groups in outlining a culturally appropriate process that could be applied to help identify culturally sensitive areas where it would be necessary to mālama (to tend and care for) known wahi kanu (burials) and iwi kūpuna (ancestral remains). If it is determined that the proposed action could have an impact to known burials or areas of potential unknown burials, a burial treatment plan would be developed during the early stages of project evaluation.

Overall, potential impacts to elements of the cultural landscape, including resources, access, and visual planes, will be identified in the EIS and will comply with the identification, evaluation, determination of significance, mitigation, and consultation requirements of Section 106 of the National Historic Preservation Act and State Historic Preservation laws. Further, any proposed measures to be considered in minimizing or eliminating any identified and known impacts must respect and integrate the cultural perceptions, values and principles in proper stewardship and care of the summit.

#### **4.5 INFRASTRUCTURE AND UTILITIES CONDITIONS AND REQUIREMENTS TO BE STUDIED**

Currently, infrastructure maintenance on the summit is an ongoing requirement, as provided for in the Mauna Kea Science Reserve Master Plan. The Master Plan provided recommendations for improvements to roadways, communications and power supply, water supply, wastewater management, and drainage. On-going and near-future improvements will be identified as well as the necessary future infrastructure needs and utility support for the Pan-STARRS project will be assessed and evaluated.

#### **4.6 INTEGRATION OF PAN-STARRS WITHIN THE MAUNA KEA MANAGEMENT PLAN AND THE HALEAKALĀ LONG RANGE DEVELOPMENT PLAN**

In the Mauna Kea Science Reserve Master Plan (2000), there are five different categories of facility development projects that are part of the applied program for astronomy development on the summit. The first type is characterized as the replacement or upgrading of facilities as existing sites along the summit ridge, as a first preference.

***Will viable and environmentally sensitive wastewater treatment options, including removal or capping of existing septic systems be included in the infrastructure study?***

***How does the project fit into the management and development plans developed for both Mauna Kea and Haleakalā summits?***

***What will the Pan-STARRS design need to include to fulfill the requirements of the Mauna Kea Master Plan?***

The first priority of siting these facilities will be the recycling of existing facilities with aging technology, which includes the UH 2.2m facility.

As stated in the plan, any proposed redevelopment along the summit limits future facilities to a maximum height and diameter of approximately 130 feet to limit the then-understood visual impact along the ridge. As stated in the Master Plan, all redeveloped and proposed new facilities need to undergo individual project reviews, including an environmental analysis. Further all project applications and designs are to be reviewed by the Office of Mauna Kea Management, the Mauna Kea Management Board, and the Kahu Kū Mauna Council.

Some of the critical questions posed in the Master Plan that each facility will be required to address include but are not limited to the following:

- Why is this facility needed?
- Why is Mauna Kea the best site for the facility?
- What other location options are available?
- What are the expected benefits: research and education, employment and economic activity, and potential revenues?
- What is the expected facility lifetime and term on the sublease agreement?

***What are the guiding elements of project design on Haleakalā?***

Likewise, the consideration of Haleakalā as the alternative site would require the project to comply with the management component of the Haleakalā Long Range Development Plan (HLRDP) that was completed in January 2005.

The HLRDP describes the general environmental, cultural, and historic conditions and the site characteristics to guide the future use of the mountain. The HLRDP also provided the principles that define the scientific programs to be maintained and development at Haleakalā. Within the HLRDP physical plan, one of the new potential facilities discussed is the Pan-STARRS project.

Design of project specifications of the proposed Pan-STARRS facility would need to be in compliance with elements of the physical and management plan of both the Mauna Kea Reserve Master Plan and the Haleakalā LRDP.

## 4.7 FEDERAL LAWS AND REGULATORY CONTROLS

The requirements of applicable Federal regulations regarding specific issues that must be addressed in the evaluation of potential impacts of the project on the natural and human environment will be included in the EIS.

### 4.7.1 National Environmental Policy Act of 1969

The National Environmental Policy Act (NEPA) was enacted in 1969 and requires that consideration be made of any potentially adverse environmental effects that could result from proposed federal developments. Perhaps the most significant result of the promulgation of NEPA is that it provides a statutory basis upon which environmental concerns must be evaluated. In enacting NEPA, the United States Congress recognized that nearly all federal activities affect the environment in some way. As such, it mandated that before federal agencies make decisions for a potential project or action, they must consider the effects of these actions on the quality of the human environment. NEPA assigns the Council of Environmental Quality with the task of ensuring that federal agencies meet their obligations under NEPA.

Regulations for implementing NEPA are located in Title 40 (Protection of the Environment), Chapter V, Parts 1500 to 1508 of the Code of Federal Regulations. The Pan-STARRS EIS will be prepared in accordance with these regulations.

### 4.7.2 National Historic Preservation Act of 1966

The National Historic Preservation Act (NHPA) establishes a general policy for supporting and encouraging the preservation of prehistoric and historic resources for present and future generations, by directing Federal agencies to assume responsibility for considering such resources in their activities. The statute sets forth a multi-faceted preservation scheme to accomplish these policies and mandates at the State and Federal levels.

Under NHPA, the Section 106 process requires the USAF to take into account the effect of proposed activities on historic properties. Section 106 of NHPA simply states that for federal agencies with jurisdiction over a proposed federal action or federally assisted undertaking, they must do two things: a) take into account the effects of their actions on historic properties and b) afford the ACHP a reasonable opportunity to comment on the proposed federal

***What Federal environmental laws apply to this study?***

***What Federal laws apply for the protection and care of historic and cultural resources?***

***What is the Section 106 process? What is the outcome or benefit to Native Hawaiian practitioners to rely on this Federal law to protect the lands of our ancestors?***

***Are there laws that protect the religious freedoms of Native Hawaiian practitioners?***

actions. As part of the NEPA EIS, the USAF must determine if Pan-STARRS will have an adverse effect, which is defined as whether the action “may alter directly or indirectly, on any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association.”

The Section 106 process requires the USAF to consult with agency and community interests. Under Section 101(d)(6)(B) of NHPA specifically, the USAF is to consult with Native Hawaiian organizations that attach religious and cultural significance to Mauna Kea. If the proposed action may have an adverse effect to any identified historic properties, then all interested parties must be consulted to resolve the adverse effect by means of developing and evaluating alternatives to avoid, minimize, or mitigate the said effects.

Through an informal dialogue of the Pāhiku process and in accordance with the formal consultation process of Section 106 in the National Historic Preservation Act, an evaluation of identified historical and cultural resources will be conducted for the Pan-STARRS EIS.

Informal and formal levels of dialogue will be initiated with, but not limited to, the State Historic Preservation Division, the Office of Hawaiian Affairs, the Royal Order of Kamehameha I (including both incorporated and non-incorporated entities), Mauna Kea ‘Āinana Hou, Hawaiian Civic Clubs, Kahu Kū Mauna, and other interested and critical community/cultural interests.

These discussions will identify possible historical and cultural properties within an area of potential effect, evaluate the historical significance of these properties using established criteria, and assess potential project impacts and derive appropriate mitigation measures.

#### **4.7.3 American Indian Religious Freedom Act of 1978 & Executive Order 13007 (Indian Sacred Sites) 1996**

The passage of the American Indian Religious Freedom Act of 1978 (AIRFA) (42 U.S.C. § 1996, Pub. L. No. 95-341, amended in 1994 as Pub. L. No. 103-344) establishes legislative precedent designed to protect the rights of Native Americans, whose definition does include Native Hawaiians, in their inherent right of freedom to

“believe, express, and exercise” their traditional religion. This exercise of traditional religion includes but is not limited to access to sites, the use and possession of sacred objects, and the freedom to engage in ceremonial and traditional rites.

The passage of Executive Order 13007 in 1996 mandates that Federal agencies accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid affecting the physical integrity of such sacred sites. However, the law’s definition currently does not include Native Hawaiians in the definition of “Indian.”

As related to the Pan-STARRS study, the inclusion and provision for the adequate protection and maintenance of traditional and cultural practices will be formally document in the Cultural Impact Assessment being conducted for the EIS. Any recommendations defined in this study will be discussed with participating interests to detail possible courses of action to improve the existing management and education programs currently implemented for the summit.

#### **4.7.4 Native American Graves Protection and Repatriations Act of 1990**

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) provides for the protection, inventory, and the proper treatment, and where applicable, the repatriation of Native human remains, funerary objects, and sacred and cultural objects.

The law requires that consultation and potential repatriation efforts should occur with identified lineal descendants or cultural affiliated groups, specifically federally recognized Native American tribes and Native Hawaiian Organizations. The law applies to those ancestral remains and cultural resources that were either excavated and removed from Federal lands or retained by institutions receiving federal funding. The Secretary of the Interior is charged with the responsibility for overseeing national NAGPRA compliance, while a designated staff member of the U.S. Department of the Interior oversees its implementation.

For the Pan-STARRS EIS, both informal and formal levels of consultations on the matter of protecting any identified and known ancestral burial sites that could be affected by the project will be held with known interests within the Hawaiian community. Findings from these discussions will be reported within the Section 106 documentation upon consent from those participating interests.

***Mauna Kea is home to Native Hawaiian ancestral burials. What federal laws apply to the protection of these burials and cultural resources?***

***What types of effects to air quality will be considered in the EIS?***

#### **4.7.5 Clean Air Act Amendments of 1990**

The Clean Air Act Amendments of 1990 established an air conformity requirement for federal agencies and, therefore, a conformity applicability analysis and, if appropriate, a conformity determination will be made a part of the EIS. This Act directs the U.S. Environmental Protection Agency (EPA) to set limits as to how much of a pollutant can be in the air at any time within the United States. Although it is a Federal law, the implementation of the act is usually carried out at the State level.

As required by the Clean Air Act, National Ambient Air Quality Standards (AAQS) are established by the EPA for seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), ozone (O<sub>3</sub>), particulate matter smaller than 10 microns (PM<sub>10</sub>), PM<sub>2.5</sub> (particulate matter smaller than 2.5 microns), sulfur oxides (SO<sub>x</sub>), and lead. The AAQS is defined as the limit in quantity and exposure to pollutants dispersed or suspended in the general outdoor atmosphere to which the general public has access.

Under Section 309 of the Clean Air Act, the EPA is required to review and publicly comment on the environmental impacts of major federal actions including actions which are the subject of EISs. If the EPA determines that the action is environmentally unsatisfactory, it is required by Section 309 to refer the matter to Council of Environmental Quality. Air quality effects and compliance with the Act will be addressed in the EIS.

#### **4.7.6 Pollution Prevention Act (PPA) of 1990**

The Pollution Protection Act (PPA) of 1990 requires federal agencies to attempt to reduce or eliminate pollution at its source. The Act seeks to prevent and reduce pollution that emanates from a hazardous substance, pollutant, or contaminant. Administered by the U.S. Environmental Protection Agency, the policy of the PPA states that:

- pollution should be prevented or reduced at the source whenever feasible;
- pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible;
- pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and
- the disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

***Will the project create any pollution or hazardous waste? If so, what Federal laws will apply in this study? How will water that is used to clean telescope mirrors be disposed?***

The State of Hawai'i is under the jurisdiction of the EPA Region 9. In Hawai'i, the Waste Minimization Program (WMP) was established by the State Department of Health, Solid and Hazardous Waste Branch. The waste minimization and pollution prevention practices in the WMP include: a) the development of better operating procedures to effectively utilized materials; b) the substitution of nonhazardous or less hazardous materials; c) redesign of the product to avoid hazardous materials that generate waste; d) recycle and reuse of hazardous and other wastes. Hazardous materials considerations will be addressed in the EIS.

#### 4.7.7 Endangered Species Act (ESA) of 1973

The Endangered Species Act (ESA) of 1973 provides a legal means by which identified ecosystems that are determined to be essential to the sustainability of an endangered or threatened species can be conserved. Under this Act, the U.S. Fish and Wildlife Service (USFWS) in the Department of the Interior is responsible for all terrestrial and freshwater species, as well as migratory birds, while the U.S. Department of Commerce, National Marine Fisheries Service is responsible for the protection of marine, estuarine, and anadromous species.

Several biological surveys have been conducted in recent years as part of other environmental reviews. As stated in Section 4.3 of this EISPN, of particular concern within the summit of Mauna Kea is the protection of the Wēkiu bug (*Nysius wēkiuicola*), which is a candidate for listing under the Endangered Species Act.

On Haleakalā, the silversword (*Argyroxiphium sandwicense subsp. macrocephalum*) is Federally listed as a "threatened" species. Further, the 'ua'u (Hawaiian dark-rumped petrel, *pterodroma phaeopygia sandwichensis*) is the a seabird federally listed. Approximately 85% of the world's known population of 'ua'u nests are on the summit of Haleakalā. Other species of interest on Haleakalā that are on the Federal list of Endangered Species include the Nēnē goose (*branta sandwicensis*) and the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). These species have been known to occasionally fly over or near the Haleakalā observatory area.

For the Pan-STARRS EIS and as per the requirements of ESA, Section 7, a cooperative effort through informal consultation will initially occur with the USFWS to adequately assess if the proposed action may have an effect on either listed species or habitats. The first step in this process will be for IfA and the Air Force to request USFWS to

**What Federal laws apply to the protection of plant and animal species and habitats?**

**Will the EIS take into account endangered or threatened species on both Mauna Kea and Haleakalā?**

***How will the project deal with non-point source pollution issues?***

***Will issues related to social justice and equality to all citizens be considered in this study?***

***What are the requirements and procedures of the Air Force in this NEPA environmental review? What is the role and scope of their participation in the process?***

prepare a species list for both summits. If it is determined that the proposed action may affect species or critical habitats and that these effects are adverse, then formal consultation will be administered and documented in preparation of the EIS.

#### **4.7.8 Clean Water Act (CWA)**

Under Section 402 of the CWA, discharge requirements are established under the National Pollutant Discharge Elimination System (NPDES). As such, effective in March 2003, all construction sites over one acre is to be considered Section 402 point source discharge. The State Department of Health administers the NPDES permit program for the U.S. Environmental Protection Agency. The EIS will discuss project requirements to comply with the CWA.

#### **4.7.9 Executive Order 12898 - Environmental Justice**

Issued in 1994, Executive Order 12898 underscores certain provisions of existing laws such as NEPA and the Clean Water Act to help ensure that all communities and persons within the United States live in a safe and healthful environment. The term “environmental justice” is defined as the fair treatment of people of all races and incomes with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

The Executive Order is designed to focus Federal attention on the environmental and human health conditions in minority communities and low-income communities with the goal of achieving environmental justice. It is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide both minority and low-income communities access to public information on, and an opportunity for public participation in matters relating to human health or the environment. The EIS will address Environmental Justice concerns as relevant to the Pan-STARRS project.

#### **4.7.10 Environmental Impact Analysis Process, 32 CFR 989**

NEPA requires federal agencies to develop their own procedural supplement to the NEPA regulations at 40 CFR 1500-1508. The Air Force supplement is called the “Environmental Impact Analysis Process” (EIAP) and it is coded into federal regulations at 32 CFR 989. In analyzing the impacts of its proposed actions, the Air Force must comply with both sets of regulations.

NEPA requires that federal agencies which have even a modest level of control over non-federal proposals must consider the environmental impacts as if the proposal were its own. To date the Air Force has funded four years of Pan-STARRS research and prototype development. However, all of that developmental work has been covered by NEPA Categorical Exclusions. Categorical Exclusions are categories of actions that have been determined to have no significant adverse impacts on the human environment, either individually or cumulatively with other actions past, present and future.

With Pan-STARRS approaching the construction phase, the Air Force is now required to analyze the impacts of the proposed action and all reasonable alternatives before making decisions on construction funding and siting. Both the anticipation of potentially significant adverse impacts and the likelihood of substantial environmental controversy dictate that the level of analysis be an EIS.

The NEPA EIS process is initiated with the publication of a Notice of Intent in the Federal Register. It concludes with the signing of a Record of Decision. One of the first steps in the process will be to hold public scoping meetings to obtain input into issues, alternatives, impacts and mitigation.

#### **4.8 STATE AND COUNTY LAND USE PLANS, CODES, AND REGULATORY CONTROLS**

On the State level, the EIS will include a review of the project's compliance with the Hawai'i State Plan, applicable functional plans, State land use designations, Conservation District use laws, historic preservation law, the environmental review process, and hazardous waste regulations will be conducted. Further, the County of Hawai'i General Plan, zoning, and land use regulations will be reviewed and evaluated for the EIS.

***What State laws and County regulations and plans will the EIS address?***

## 4.9 NECESSARY PERMITS AND APPROVALS

Upon preliminary review, the following permits and approvals will be necessary prior to the implementation of the project:

Permit or Approval	Authority
NEPA EIS Approval and Record of Decision	U.S. Air Force
Acceptance of EIS pursuant to HRS, Chapter 343	Office of the Governor
Completion of National Historic Preservation Act, Section 106 Consultation	State of Hawai'i, Department of Land and Natural Resources, Historic Preservation Division & State Historic Preservation Officer
Approval of Conservation District Use Permit	State of Hawai'i, Department of Land and Natural Resources, Board of Land and Natural Resource (BLNR)
Public Lands Disposition	State of Hawai'i, DLNR-Land Management Division
Ministerial Permits (for actions outside State Conservation District)	County of Hawai'i, Department of Planning

## 5.0 PROBABLE IMPACTS AND MITIGATIVE MEASURES

The proposed action is the construction and installation of the University of Hawai'i Institute for Astronomy, Pan-STARRS project. Operations of the Pan-STARRS project will be funded and controlled by the University of Hawai'i Institute for Astronomy.

The EIS will discuss probable impacts, short-term and long-term, and propose mitigative measures to minimize adverse affects related to the proposed Pan-STARRS project. Short-term impacts are generally associated with construction, and prevail only for the duration of the construction period.

Long-term effects generally follow completion of the improvements, and are permanent. The EIS will also discuss the extent of which short-term or long-term effects are adverse and unavoidable. The EIS will also discuss cumulative impacts. Impacts will be described for all alternatives discussed in Chapter 6 of this EISPN.

There are several Environmental Impact Statement reports related to activities at Mauna Kea. These include the Final EIS for the Outrigger Telescopes Project (February 2005), the Final EIS for the Mauna Kea Science Reserve Master Plan, (December 1999), and the Final EA for renovation of the UH-Hilo 0.6 (24-inch) telescope (August 2006). Readers familiar with these reports recognize the volume of existing information describing the environmental setting as well as the social, cultural and community conditions relating to Mauna Kea.

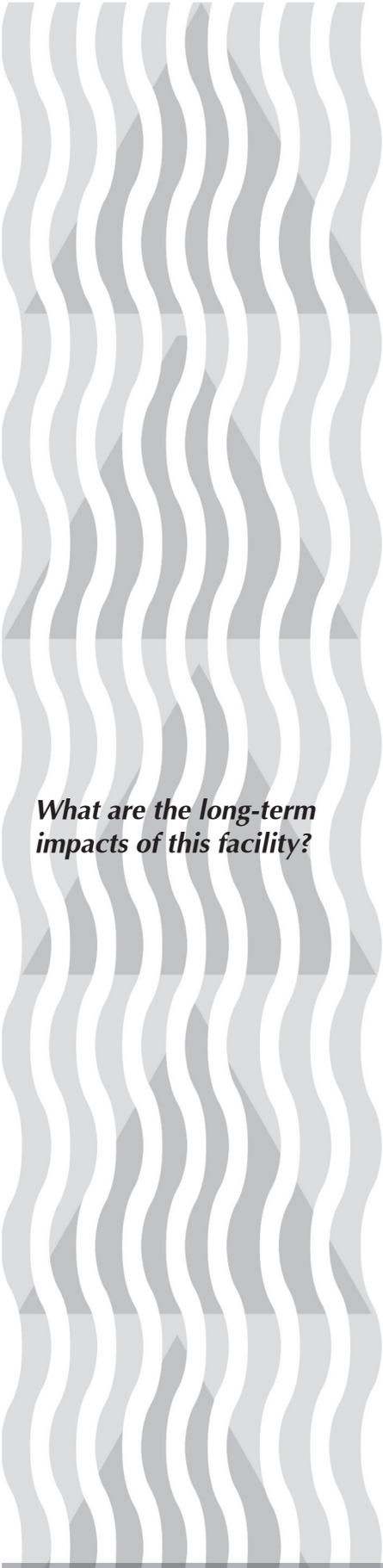
### 5.1 SHORT-TERM IMPACTS

Installation of the proposed Pan-STARRS project will create some local short-term construction related impacts on the environment. Potential short-term impacts to be evaluated in the EIS will include: soil disturbance, dust and erosion due to clearing and grading; traffic in the project's vicinity due to construction equipment and trucks; increased noise due to construction related operations. Potential drainage and runoff issues will also be evaluated. Mitigative measures will be proposed and implemented, as feasible, to minimize short-term construction impacts.

There will be short-term impacts related to the re-use of the existing site of the UH 2.2m observatory at Mauna Kea for the

***What are some of the short-term construction impacts that will be evaluated?***

***What are the impacts of redeveloping at this site?***



***What are the long-term impacts of this facility?***

Pan-STARRS project. Short-term impacts related to the removal of existing equipment and installation of new equipment will create some local short-term related impacts to the environment. Potential impacts of on-site construction and installation of Pan-STARRS as it relates to archaeological sites, traditional cultural practices and properties will also be discussed in the EIS.

Short-term impacts for all alternatives described in Section 6.0 will be discussed in the EIS.

The short-term beneficial impacts related to installation are expected to include expenditures and employment, as well as the purchase of services and materials to design and construct the telescope. It is expected that education of the contractors, supervisors and construction workers involved in the construction and installation of the Pan-STARRS project will be a proposed on-site mitigative measure for probable short-term construction related impacts.

## **5.2 LONG-TERM IMPACTS**

Implementation of the Pan-STARRS project will generate some long-term impacts to the natural and human environment. Potential long-term impacts that will be examined in the EIS include: soils, water quality, drainage and runoff effects, natural hazards, vegetation and wildlife, archaeology, cultural and historic resources, roadways and traffic, noise, air quality, visual resources, social and economic considerations, public infrastructure and public services. Material and economic resources will be irretrievably committed to the facility and programs implemented.

Long-term impacts on surrounding areas include continued impacts on the cultural significance of Mauna Kea and the continuing need for management of resources at Mauna Kea. The physical design of the proposed Pan-STARRS four camera system will be designed to minimize the environmental, visual and cultural impacts to the greatest extent possible. Further discussion of anticipated long-term impacts and benefits of the project on the natural and human environment will be presented in the EIS.

## **5.3 SIGNIFICANCE CRITERIA**

The EIS will assess the overall impact on the environment based on criteria established in Title 11 Administrative Rules, Chapter 200 Environmental Impact Statement Rules, Section 12. These criteria include evaluating the following:

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.* All efforts will be made to minimize any significant loss of natural or cultural resources related to the implementation of the Pan-STARRS project. Archaeological, ethnographical, biological, geological and cultural research studies are being conducted to better understand the potential impacts that may be caused by this project upon the natural and cultural resources at Mauna Kea or at Haleakalā. Consultation with regulatory agencies such as the US Fish and Wildlife Services and the DLNR State Historic Preservation Division are also ongoing as the planning team works together to collectively discuss appropriate mitigative measures to minimize any impacts upon the natural and cultural resources. Meetings with individuals and organizations whom may be impacted are being scheduled to discuss these concerns.

It is expected that this project will impact the sacredness of Mauna Kea and Haleakalā, which is held by Native Hawaiians. It is not clear at this time as to what mitigative measures are available to minimize the impact upon the sacredness of Mauna Kea. This will remain a significant issue relevant to any project proposed at both summits

2. *Curtails the range of beneficial uses of the environment.* The proposed project site is currently being utilized for scientific astronomical observation purposes. The proposed project is similar in general function and use but with a different program emphasis that requires new equipment in a renovated design. The EIS will discuss the extent to which the range of beneficial uses of the environment will or will not be curtailed by the proposed Pan-STARRS project.
3. *Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344 (State Environmental Policy), HRS, and thereto, court decisions, or executive orders.* The purpose of Chapter 344, HRS, is "to establish a state policy which will encourage productive and enjoyable harmony between man and his environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, and enrich the understanding of the economical systems and natural resources important to the people of Hawai'i". The project is proposed to be located within the State conservation designated lands. A State Conservation District Use Application (CDUA) will be required. The EIS will address issues also raised by the CDUA permit.

***What are the criteria used to evaluate an EIS?***

- 
4. *Substantially affects the economic or social welfare of the community or State.* It is expected that the implementation of the Pan-STARRS project will affect the social welfare not only of the community and State, but the nation and the world. The scientific goal of the project is to provide information regarding potential asteroids that may hit the Earth. Such information will affect the economic and social welfare of the world.

The impacts on the local economy and social welfare caused by the implementation of the project at Mauna Kea or Haleakalā will also be discussed in the EIS. Consultant studies are underway to discuss specifically the economic and social impacts of the Pan-STARRS project to the community and the State. Findings of these studies will be printed as appendices in the EIS for further discussion and review by the community.

In September 2002, funds were provided to support the development of the design thereby contributing an increase in manpower in management and engineering required to support this project.

5. *Substantially affect public health.* The implementation of the Pan-STARRS project is not expected to substantially affect public health. The EIS will discuss potential impacts related to appropriate State Department of Health guidelines concerning hazardous materials use and storage, water, air, and noise quality. The location of the Pan-STARRS project at Mauna Kea or Haleakalā will have short-term impacts on individuals health related to the physical conditions of the high altitude.
6. *Involves substantial secondary impacts, such as population changes or effects on public facilities.* The implementation of the Pan-STARRS project is expected to have a minor secondary impact on population in the area. There will be a nominal increase in population in the immediate area because of the limited range of job opportunities related to the project. The EIS will discuss the potential impacts and mitigative measures the project may have on public facilities such as power, telecommunications, water, and wastewater treatment systems.
7. *Involves a substantial degradation of environmental quality.* The intent of the implementation of the project is to minimize the potential for degradation of the environmental quality. The EIS will discuss the extent to which the proposed project involves a substantial degradation of environmental quality. The project

is a replacement of existing technology within the existing footprint, substantial degradation of the environmental quality is not expected.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.* All developments have incremental and cumulative impacts. However, the nature of the plans and programs related to the Pan-STARRS project will ensure that the impacts to the environment will be minimized and positive in many respects. The proposed project is not a precursor to future actions and the full scope of the project will be addressed in the EIS.
9. *Substantially affects a rare, threatened or endangered species, or its habitat.* Previous faunal and botanical investigations were conducted for the Mauna Kea Science Reserve area and at Pu'u Kolekole on Haleakalā. The EIS will review the results of these surveys and address any potential impact to an identified rare, threatened, or endangered species. Additional studies to invertebrates are being conducted as part of this EIS. Appropriate mitigative measures will be discussed should such resources be discovered.
10. *Detrimentially affects air or water quality or ambient noise levels.* Detailed discussions on ground water quality including drainage and potential run-off issues will be presented in the EIS. These studies will take into account both short- and long-term impacts, during construction, as well as proposing mitigative measures as appropriate. Preliminary issues of siltation and sedimentation associated with existing erosion activity will also be addressed in the EIS. Possible impacts of noise upon the Palila will also be assessed.
11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.* The proposed sites for the Pan-STARRS project are located at the summits of Mauna Kea and Haleakalā. Geologically hazardous lands will be considered in the modifications plan. These factors will be addressed in the EIS.
12. *Substantially affects scenic vistas and view planes identified in County or State plans or studies.* The Pan-STARRS project has a significant potential to affect scenic vistas and cultural view



planes identified in previously conducted plans and studies and from the community. Efforts are being made so that the Pan-STARRS project can be designed and located to minimize the visual impact. Specific view impacts and proposals will be addressed in the EIS.

13. *Requires substantial energy consumption.* The EIS will discuss the extent to which the proposed Pan-STARRS project will require substantial energy consumption. In the short-term, energy will be consumed for construction. The project will demand utilities including roadways, electricity and water as well as a sewage system. The Pan-STARRS project will depend on a reliable source of energy to operate the proposed facilities and maintain communications between the information gained at Mauna Kea and the information transferred to Hilo, Honolulu and Maui.

## 6.0 ALTERNATIVES TO THE PROPOSED PROJECT TO BE CONSIDERED

This section addresses the alternatives to the proposed project that will be evaluated in the EIS. Alternatives currently being discussed include sites and designs, as well as a no-action alternative for the proposed project. Alternatives which have been eliminated from further consideration are also identified and discussed.

The EIS will include a rigorous evaluation of each alternative design and location considerations. A comparative evaluation of the environmental benefits and costs of the proposed action and alternatives will also be presented. Criteria for the evaluation will be described, along with analysis leading to the final selection of a preferred alternative.

### 6.1 SITE ALTERNATIVES FOR FURTHER CONSIDERATION

#### 6.1.1 No-Action Alternative

The no-action alternative is the baseline against which all other alternatives are measured. This analysis essentially presents the projections of the future site and program conditions that will most likely result should the proposed Pan-STARRS project not proceed.

For the Pan-STARRS project, the evaluation of the no-action alternative will apply to examining the future outcomes of not redeveloping the existing UH 2.2m facility. This scenario will allow for the continued future use of the existing 30-year old facility, and not preclude the potential for a future redevelopment proposal at this location. **The no-action alternative means killer asteroids will not be detected and impacts will result, including those to humans and the environment.**

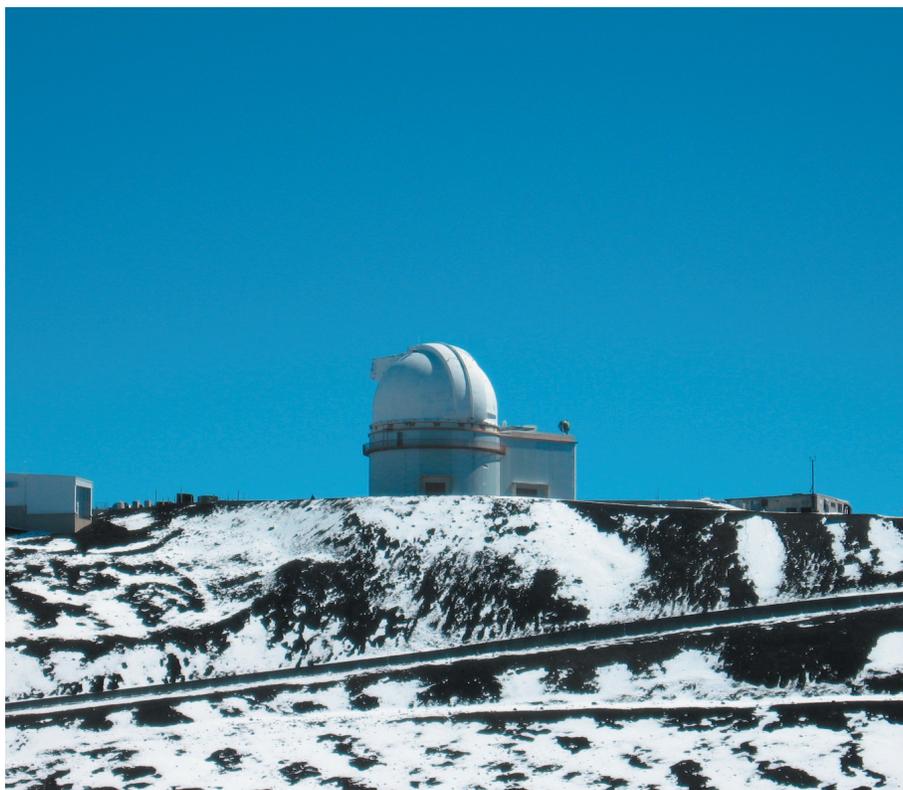
The no-action alternative will be fully explored in detail in the EIS.

***What is the no-action alternative?***

***If Pan-STARRS is not built, then what is the potential future of the existing facility?***

*“There should be no development on Mauna Kea. We prefer that Pan-STARRS be built somewhere else”.*

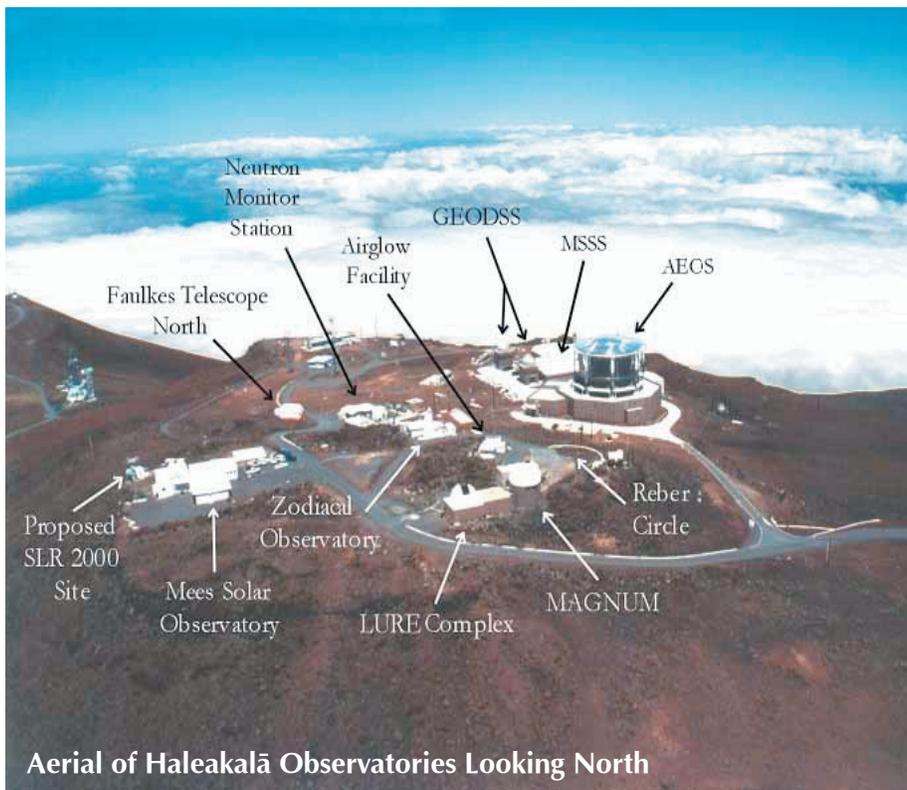
*Why is Mauna Kea the preferred site?*



### **6.1.2 Mauna Kea Science Reserve: UH 2.2m Facility**

The summit of Mauna Kea, on the Island of Hawai‘i as described in Section 3.2.5, is widely recognized by the science community to provide the best conditions in the world for ground-based astronomical observations. The preferred site for the Pan-STARRS project is at the existing University of Hawai‘i 2.2m telescope at the Mauna Kea Science Reserve, primarily due to the superior observation conditions and UH control over the site. The Pan-STARRS project is a survey project which, if conducted from the summit of Mauna Kea, could be completed in a survey period of approximately 10 years.

IfA is proposing to replace the existing UH 2.2m telescope on Mauna Kea with Pan-STARRS in a four-mirror, one-telescope configuration that would stay within the footprint of the existing facility. For the existing UH 2.2m site, specific facility design and configurations for the Pan-STARRS project enclosure and instruments have yet to be developed. The EIS will include details about the facility design, including the extent of construction disturbance, elevation views, and perspective views from on-mountain and off-mountain locations.



Aerial of Haleakalā Observatories Looking North

### 6.1.3 Haleakalā High Altitude Observatory

The only viable alternative site for the Pan-STARRS project which is currently being considered is the Haleakalā High Altitude Observatory Site, on the Island of Maui. Aside from the summit of Mauna Kea, this is the only other location where the University of Hawai‘i has a site for ground-based observatories.

At 10,000 feet elevation, Haleakalā is above one third of the earth’s atmosphere. While the typical “seeing” conditions for ground-based observations on Haleakalā are not as good as those experienced on Mauna Kea, the Maui site is among the premier locations in the northern hemisphere and the world. Though it is technically possible to conduct the Pan-STARRS project survey at Haleakalā, it is expected to take nearly 20 years to complete because astronomical conditions are not as good as Mauna Kea.

Specifically, the Pan-STARRS project alternative site is proposed for the area including the existing PS-1 facility and the previously developed Reber Circle. The Haleakalā site requires a configuration which adds three new instrument enclosures in the area near the Pan-STARRS prototype PS-1 facility, as described in the Haleakalā High Altitude Observatory Site Long Range Development Plan (2005).

***“Can Pan-STARRS be done from Haleakalā? “***

***Why is Haleakalā being considered as a secondary site for Pan-STARRS?***

## 6.2 SITE ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

There are a number of potential alternative locations that could be considered for siting the Pan-STARRS project. In the preparation of this document, several other potential sites were initially considered, such as other sites in Hawai'i, other known astronomy locations in the world, as well as a space-based option. Each of these potential alternative sites have since been dismissed from further consideration at the outset due to fatal flaws.

- **Development at a new site on Mauna Kea.** The development of a new site on Mauna Kea would be ideal for the Pan-STARRS Project from a design perspective. However, this alternative was rejected early as a response from the community was a demand to not expand the impact to the summit of Mauna Kea by proposing new observatories beyond the scope of the 2000 Master Plan.
- **Reuse of other existing telescope sites at Mauna Kea.** The IfA consider reusing the site of its existing 24-in telescope at Mauna Kea. This alternative was rejected since IfA has agreed that this site should be used by UH-Hilo as the instructional telescope of UH-H's Department of Physics and Astronomy. In this way, no new telescope site would be needed to support the UH-H Astronomy undergraduate program. UH does not control other facility sites in the Mauna Kea Science Reserve that could potentially be redeveloped.
- **Location outside of Hawai'i or space-based observation.** Members of the community suggested locating the project in distant areas, such as another country, Chile, or in satellite orbit in space. These two alternatives were rejected early in the process. Technologically, these options are not feasible. The cost in time and distance of locating the project in Chile when the primary user is the University of Hawai'i is not desirable. Further, UH has no control over an astronomy site at this location.

*“What about locating the project elsewhere, such as Chile?”*

Although space-based designs do offer significant coverage advantage over ground-based designs due to 24-hour availability, the overall costs of operation, maintenance, and data transfer makes space-based designs less cost effective than their ground-based counterpart. There is a requirement for data

transmission involving the Maui High Performance Computing Center, which cannot be accommodated using either of these alternative locations.

The EIS will focus on the siting of the Pan-STARRS project at the existing UH 2.2m site at Mauna Kea or Haleakalā. Efforts in regards to technical studies and consultation with community are being employed both for Mauna Kea and for Haleakalā.

### 6.3 DESIGN ALTERNATIVES FOR FURTHER CONSIDERATION

The reuse of the existing UH 2.2m telescope facility is being pursued as the preferred option at this time.

Concerns regarding the visual impact created by the existing telescopes at Mauna Kea are recognized. Efforts to find design solutions which will minimize the visual impact while maintaining scientific integrity of the instruments are being made.

**Design Options** include evaluating varying degrees of colors, size of the facility and materials used in outer construction. These options will be evaluated under the established Project and Design Review process outline in the Implementation Plan of the MKSR Master Plan. Details of the design alternatives will be presented and examined in the EIS.

**Mounting Alternatives.** Initially, the design team reviewed three options to determine how the four optical systems would be mounted within the specification of remaining within the existing footprint of the UH 2.2m facility on Mauna Kea. The three alternative mount designs initially considered included:

- Mounting Design Alternative A: a common mount for all four optical systems housed in one single protective dome;
- Mounting Design Alternative B: individual mounts for each optical system in one single protective dome; and
- Mounting Design Alternative C: independent mounts for each optical system with individual domes.

Preliminary design analysis has suggested that Alternative A would not be feasible. Final findings of this alternative will be presented in the EIS. Alternative C is not being considered for the UH 2.2m site as the preferred and committed approach is the reuse of this site and not expand into undeveloped areas.

*“The challenge is to stay within the footprint and that footprint is 3-D; it includes length, width, height, and depth.”*

*“If another structure is being put in its place, then the new facility must minimize the visual impact it will create.”*

*“The footprint is 3-D. If you have to go below the foundation....expect your journey through this process to be a little less smooth.”*



**Complete redevelopment of 2.2m Site.** Another design option under consideration is the complete redevelopment of the existing UH 2.2m site. This involves the removal of the foundation, base structure, and enclosure. This alternative is being further examined as alterations may be necessary to support the system. Any new structure would need to comply with design guidelines provided in the Mauna Kea Science Reserve Master Plan.

**Other feasible design options** developed during the informal community dialogues and EIS process will be considered in the planning of the site.

#### **6.4 DESIGN ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION**

**Initial Design for the Pan-STARRS system.** The initial design system for the Pan-STARRS project involved the four individual optical systems situated on new individual foundations. This design alternative was rejected because of community concerns over development of new sites at Mauna Kea. The decision to reuse the existing UH 2.2m site and stay within the footprint of the site places a design restriction to develop Pan-STARRS within a existing footprint.

#### **6.5 WASTEWATER SYSTEM ALTERNATIVES**

The EIS will discuss issues regarding wastewater collection, treatment and disposal relating to the Pan-STARRS project. Engineering studies are being commissioned to explore the range of potential alternative wastewater systems, in comparison to the existing septic tank system at the UH 2.2m facility.



PS-1, Haleakalā, Maui (December 2006)

## 6.6 PS-1 PROTOTYPE

There is a prototype being developed and tested on Haleakalā, known as PS-1. PS-1 is being installed within the existing Lunar Range Experiment (LURE) Observatory facility at the Haleakalā High Altitude Observatory Site, Maui. Installation of the prototype included the replacement of the 30-year old south dome, the installation of the telescope, camera and equipment that constitutes one of the four optical systems that make-up Pan-STARRS. The telescope is anticipated to be online in 2006.

PS-1 will test all the technology that is being developed for Pan-STARRS, including the telescope design, the cameras and the data reduction software. PS-1 will be used to make a full-sky survey that will provide astrometric and photometric calibration data that will be used in the full Pan-STARRS survey. The PS-1 facility is essentially one-quarter of Pan-STARRS, and will be completed ahead of the full observatory. It will have the same optics design and camera design as anticipated for the full version of Pan-STARRS.

More information about the PS-1 prototype is available on the Pan-STARRS Project website: <http://pan-starrs.ifa.hawaii.edu/public/design-features/ps1-prototype.html>

The EIS will present a complete description of the PS-1 prototype.

## 7.0 DETERMINATION AND FINDINGS

The Office of the Governor and the University of Hawai'i, Institute for Astronomy have reviewed the proposed project action and have determined that the project may have significant cumulative impacts and finds that an Environmental Impact Statement will be required.

The EIS is being prepared under the triggers of using State land and use within the Conservation District. Specifically, according to Chapter 343, Hawai'i Revised Statutes, this environmental analysis is being conducted because the Pan-STARRS project proposes the following land uses:

- Use of state or county lands or the use of State or County funds, other than funds to be used for feasibility or planning studies or the purchase of raw land;
- Use of any land classified as Conservation District by State law;

The Pan-STARRS project proposes to use State lands at the Mauna Kea Science Reserve, which is under the jurisdiction of the State Department of Land and Natural Resources. This property has been classified as part of the State Conservation District and requires a Conservation District Use Application (CDUA). These applications are reviewed and approved by the Board of Land and Natural Resources and includes the participation of those of the general public interested in the permit process. It is important to note that a CDUA will not be formally submitted to the State Office of Conservation and Coastal Lands until a Final EIS/Record of Decision has been issued.

The Pan-STARRS construction is funded under a cooperative agreement between the University and the United State Air Force. As the project is utilizing Federal issued monies and there are identified concerns related to the significance or nature of the environmental impacts of this project, it is defined as a Federal action. As such, a Joint Environmental Impact Statement will be prepared and distributed for review in accordance with the Federal requirements of the National Environmental Policy Act, 40 CFR 1500-1508 and the regulations set forth in Chapter 343, Hawai'i Revised Statutes.

## 8.0 AGENCIES AND PARTIES CONTACTED

A list of the agencies, community organizations and individuals contacted prior to the publication of this Environmental Impact Statement Notice of Preparation (EISPN).

### 8.1 AGENCIES, COMMUNITY ORGANIZATIONS, AND INDIVIDUALS CONTACTED PRIOR TO THE PUBLICATION OF THE EISPN

A conscious effort was made to speak face to face with individuals, organizations and agencies about the project and the process prior to the publication of a formal EIS Preparation Notice (EISPN).

Section 4.0 of this document describes the fundamental approach of the Pāhiku process which calls for early engagement of the community into the issues and concerns of the proposed action that will need to be formally addressed within the EIS process.

Section 8.3 lists the individuals and agencies whom were contacted either by the applicant and or by members of the environmental consulting team, which consists of Francis Oda, Jeff Overton, Kāwika McKeague, and Kim Evans of Group 70 International, Inc. in partnership with Kumu Hula Victoria Holt-Takamine and Kumu Hula Wayne Kaho'onei Panoke. Some individuals are not included on this list out of respect that their participation in the informal dialogue is limited to this level of discussion and not part of formal process of consultation.

### 8.2 INITIAL CONCERNS EXPRESSED

Several points of concern have been expressed through these dialogues prior to the writing of this EISPN and can be categorized as follows:

- Remarks regarding the Pāhiku Process.
- Remarks regarding management of Mauna Kea.
- Remarks regarding the Pan-STARRS project.

The EIS will focus primarily on concerns regarding the Pan-STARRS project. However, where relevant, the need to discuss management issues as it relates to the Pan-STARRS project, will also be discussed in the EIS.

***“We only want to talk if Vicky is present.”***

***“You need to respect the mana’o of those that feel connected or are interested in protecting the summit.”***

*“The Pāhiku process is maika’i.”*

### **Remarks on the Pāhiku Process**

As described in Section 4.0, the Pāhiku process is unique to this EIS project as the planning team attempts to develop and apply a derived methodology that encourages and requires early and greater input from the community into the subsequent steps of a more formal EIS process.

Community members and agency representatives that have been engaged have expressed a positive and supportive outlook for what is characterized by some as a proactive process.

The majority of those that have participated in meetings and small discussions have expressed appreciation for the sensitivity to provide early notification and to have meetings held in small groups and issues discussed he alo a he alo (face to face) rather than solely depending upon classical means of “public input” through scoping meetings and public hearings.

Although it is characterized as a good start, there is still concern that not everyone truly understands the depth and meaning of all the aspects of the Hawaiian values expressed in the Pāhiku process. Further, a point of clarity provided by many community members is that a “good” process does not necessarily make the project right.

### **Remarks about Mauna Kea Management**

Concerns expressed regarding general management issues relating to Mauna Kea often made reference to a legislative Auditor’s report which was released in 2005, “Follow Up Audit on the Management of Mauna Kea and the Mauna Kea Science Reserve, A report to the Governor and the Lieutenant Governor of the State of Hawai’i”, December 2005. Concerns revolved around the overall management of cultural and natural resources of Mauna Kea.

### **Remarks about the Pan-STARRS project**

In all of the meetings and discussions held thus far with community interests, when the topic of Pan-STARRS was discussed, common themes began to emerge in the form of questions raised and concerns shared about the project.

A key component of these meetings was assigning an individual from the planning team to make note of the questions being asked,

as it is considered that these will need to be addressed in either/or the project scopes for the environmental studies being initiated and the EIS document itself.

Assurances were made to those participating in the meetings that answers to their questions would be provided in the EIS.

The following represents the general or common questions and concerns expressed in these discussions. The questions and issues are presented as they were shared with the planning team. However, clarification to the question raised is highlighted in [brackets] below.

### **Location Concerns**

- Do it [construction of Pan-STARRS] somewhere else.
- Can you do it somewhere else?
- Can you do it from Haleakalā?
- No development on Mauna Kea.
- What about Chile [as a option for site development]?
- Can you put cameras somewhere else?
- Why there (Mauna Kea)?
- What alternative sites are being considered?

### **Design Concerns**

- How is this new one [Pan-STARRS] better than old one [existing UH 2.2m facility]?
- What is the [design and size] of the instrument?
- No one can do this now [are other telescope facilities currently doing this type of research]?
- What is new about this project? What is unique?

### **Process Concerns**

- Can we stop it [Pan-STARRS] from coming [being built on Mauna Kea]?
- Any hearings in the community planned? Any meetings with the public?
- No negotiation when it comes to [development on] the mountain.
- Who is going to give the NEPA EIS Record of Decision?
- Does IfA need to go to the Office of Mauna Kea Management (OMKM) [for approval of the EIS as part of the review process]?
- So what difference will this process [Pāhiku] make in the end?
- What's the possibility of change [in the management of Mauna Kea]?



### **Costs**

- Who is funding this [Pan-STARRS project]?
- How much will be spent [what is the budget for operation and maintenance]?
- What is the expected Operating Budget Projections?
- What is the Operating Funds Source?
- Is there a time limit on Air Force grant funding? Does it [the grant] lapse [if fund are not spent]?

### **Military Concerns**

- Is the IfA able to tell the military “no” if they want to use the [Pan-STARRS] site after its built?
- Any association [in the operations of Pan-STARRS] for the planned UARC?
- What is its association to the military?
- Any planned military objectives?

### **Impacts**

- What would be the impact on the ‘āina during construction?
- Who is going up there [to conduct research involving Pan-STARRS]?
- Don’t wait on this process to close the other cesspools [with other facilities on Mauna Kea].
- There may be more than the Wēkiu bug endangered on Mauna Kea.
- If an asteroid comes, what can be done about it?
- What will we do to affect an asteroid [what are options for changing or interrupting the path of an asteroid identifying as a potential threat]?
- Is there anything which exists right now to give it a nudge?
- Will this project lead to [the development of] the next generation of telescopes, such as the 30m Telescope?

### **Benefit Concerns**

- Who is going to benefit from this [the Pan-STARRS project]?
- Any projects at Mauna Kea, what money is coming for use of sacred mountain, for the education of our students?
- What’s in it for us [benefits for Native Hawaiians and local communities]?
- Do appreciate using what is there now [IfA and OMKM should appreciate the opportunity they have now to conduct astronomy on Mauna Kea].

- What is good [about Pan-STARRS] for the Hawaiian people?
- What does this project do for the Hawaiians?
- IfA should be the example to others [astronomy facilities] in developing benefits for the community.
- What do we [local community] get for education[al benefit]?
- What monies [available] for the use of the sacred mountain? How much [is enough to justify the use of the sacred mountain]? Yet no amount of money is going to relieve the desecration of the use of this mountain. However, monies should be used to improve management of the summit.
- What money will come out of this [economic benefits to Native Hawaiians and local communities]?
- [Can there be a project allocation for] Free scholarships for Hawaiians?

### **8.3 AGENCIES AND INDIVIDUALS TO BE CONSULTED IN PREPARATION OF THE EIS**

The following list identifies agencies, community organizations and individuals whom we will be asking to meet with and request input from for this project during the formal EIS documentation and analysis. The list includes those required by law, as well as those who have participated in past EIS processes for other projects on Mauna Kea and Haleakalā such as the Keck Outrigger EIS, the Haleakalā LRDP, and the Mauna Kea Master Plan EIS or are recognized for their commitment as community and/or cultural advocates. The list currently includes, but is not limited, to the following:

#### **U.S. Federal Agencies**

- U.S. Air Force Materiel Command (Wright Patterson AFB)
- U.S. Air Force Research Laboratory (Kirtland AFB)
- U.S. Air Force Research Laboratory, Detachment 15 (Kīhei)
- U.S. Army Corps of Engineers, Pacific Ocean Division
- U.S. Department of Interior
  - Fish and Wildlife Service
  - U.S. Geological Service
  - Advisory Council on Historic Preservation
  - Office of Environmental Policy and Compliance
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Environmental Protection Agency, Pacific Islands Contact Office



## **State of Hawai'i Agencies**

Office of the Governor

Office of the Lieutenant Governor

Office of Environmental Quality Control

Department of Accounting and General Services

Department of Hawaiian Home Lands

Department of Business and Economic Tourism

Energy, Resources and Technology Division

Office of Planning

Strategic Industries Division

Department of Defense

Department of Health (DOH)

Clean Water Branch

Clean Water Branch, Environmental Management Division

Council on Development Disabilities

Disabilities and Communication Access Board

Environmental Management Division

Environmental Planning Office

Department of Land and Natural Resources (DLNR)

Historic Preservation Division

Hawai'i Island Burial Council

Maui Island Burial Council

Land Management Division

Division on Forestry and Wildlife (DOFAW)

DOFAW, Natural Area Reserves System

Office of Conservation and Coastal Lands

Department of Transportation

Hawai'i Tourism Authority

Kaho'olawe Island Reserve Commission

Office of Hawaiian Affairs

Hilo Office

Kona Office

Main Office (O'ahu)

Native Rights, Land and Culture Division

University of Hawai'i at Hilo (UH-H)

Department of Physics and Astronomy

Office of Mauna Kea Management

Kahu Kū Mauna Council

Mauna Kea Management Board

Hawaiian Culture Committee

Hawaiian Studies Program

Pūko'a Council

University of Hawai'i at Mānoa (UH-M)

Chancellor

Board of Regents

Water Resources Research Center  
Kuali'i Council  
Environmental Center  
Institute for Astronomy  
Mauna Kea Support Services  
Center of Hawaiian Studies  
Federal and State Legislative Senators and Representatives

**County of Hawai'i**

Office of the Mayor  
County of Hawai'i, Council Chairman  
Department of Civil Defense  
Department of Public Works  
Department of Research and Development  
Department of Water Supply  
Planning Department  
Police Department  
County Council Members

**County of Maui**

Cultural Resources Commission  
Department of Civil Defense  
Department of Parks and Recreation  
Department of Planning  
Department of Public Works  
Department of Research and Development  
Department of Water Supply  
Police Department  
County Council Members

**Libraries and Media**

Bond Memorial Public Library  
Garden Island Newspaper  
Hana Public & School Library  
Hawai'i Kai Regional Library  
Hawai'i State Library  
Hawai'i Tribune Herald  
Hilo Regional Public Library  
Hōlualoa Public Library  
Honoka'a Public Library  
Honolulu Advertiser  
Honolulu Star Bulletin  
Kahului Regional Public Library  
Kailua-Kona Public Library  
Kaimuki Regional Library





Kāneʻohe Regional Library  
Kealakekua Public Library  
Keaʻau Public & School Library  
Kīhei Public Library  
Lahaina Public Library  
Laupāhoehoe Public & School Library  
Lihue Regional Library  
Makawao Public Library  
Maui Community College Library  
Maui News  
Molokaʻi Dispatch  
Mountain View Public & School Library  
Nāʻālehu Public Library  
Pāhala Public & School Library  
Pāhoa Public & School Library  
Pearl City Regional Library  
Thelma Parker Memorial Public & School Library  
University of Hawaiʻi at Hilo  
University of Hawaiʻi Hamilton Library  
Wailuku Public Library  
West Hawaiʻi Today

#### **Organizations and Individuals**

ʻAha Kahuna Nui, Hilo  
ʻAhahui Kaʻahumanu  
ʻAhahui Kū Mauna  
ʻAhahui Mālama I Ka Lōkahi  
Ahupuaʻa Action Alliance  
American Friends Service Committee  
Association of Hawaiian Civic Clubs  
Gordeen Bailey  
Conservation Council for Hawaiʻi  
Kumu Hula Moses Crabbe  
Daniel Pōmaikaʻi Kaniaupiʻo-Crozier  
Ekela Kaniaupiʻo-Crozier  
Leimana DaMante  
Earthjustice  
Edith Kanakaʻole Foundation, Hilo  
Friends of Mokuʻula  
Hālau O Kekuhi  
Hale Mua  
Hale o Nā Aliʻi o Hawaiʻi  
Haleakalā National Park Service  
Dana Hall  
Issac Hall

***“Thank you for coming to talk to us. We ask that you continue to talk to the people...in their districts. Go to each district throughout Hawaiʻi Island. Hold your meeting on a week night. Bring food. Acknowledge that those who attend the meeting, represent many people in their area.”***

Hamakua Civic Club  
Hawai'i Ko Aloha  
Hawai'i Laieikawai Association  
Hawai'i Thousand Friends  
Mikahala Helm  
Hilo Civic Club  
Nelson Ho  
Ho'opūloa Civic Club  
Hui Mālama I Na Kupuna o Hawai'i Nei  
ʻĪlio'ulaokalani Coalition  
Island Community Lending  
Ka Lāhui Hawai'i, Honolulu  
Kahanamoku Estate Foundation  
KAHEA, The Hawaiian Environmental Alliance  
Kahikinui 'Ohana  
Kaleikoa Ka'eo  
Kamehameha Schools  
Kau Civic Club  
Kawaihae Homestead Association  
Ke'eaumoku Kapu  
Kingdom of Hawai'i  
Colin Kippen  
Kohala Civic Club  
Kona Civic Club  
Kulana Huli Honua  
Les Kuloloio  
Kumu Pono Associates, LLC  
Laupāhoehoe Civic Club  
Life of the Land  
Living Indigenous Forest Ecosystems  
Ali'i Hugh Lovell  
Mālama O Puna  
Ali'i Aurthur Mahi  
Charlie Maxwell  
Maui Arts and Cultural Center  
Maui Civic Club  
Maui Community College Po'okela Project  
Maui Sierra Club  
Mauna Kea Anaina Hou  
Bill Medeiros  
Moku O Hawai'i  
Kumu Hula Kaponō'ai Molitau  
Nā Kalai Wa'a Moku O Hawai'i  
Nā Koa O Pu'ukoholā  
Nā Kūpuna Moku O Keawe





Clifford Nae'ole  
Nation of Hawai'i  
Native Hawaiian Legal Corporation  
Bernice Pauahi Bishop Museum  
Polynesian Voyaging Society  
Prince David Kawanakoa Civic Club  
Protect Keōpuka 'Ohana  
Protect Kohanaiki 'Ohana, Kailua-Kona  
Queen Liliuokalani Children's Center, Kailua-Kona  
Kiope Raymond  
Kumu Hula Keali'i Reichel  
Barbara Robertson  
Royal Order of Kamehameha  
Royal Order of Kamehameha, Inc.  
Sierra Club, Hawai'i Chapter  
South Kohala Civic Club  
Ulalia Woodside  
Ululani Sherlock  
Waimea Civic Club  
Waimea Hawaiian Homestead Association, Kamuela

#### **8.4 PUBLIC OUTREACH DURING THE EIS PROCESS**

Hard copies of this EISPN will be mailed out to the agencies, community organizations and individuals listed in Section 8.3. As part of our concerted effort to deepen and broaden our reach into the local community, additional outreach tools are being employed in this process. These outreach initiatives include:

- **Public Access Television production.** A 28-minute television show titled "E Mau Ke Ea: Mālama Mauna Kea" was produced through 'Ōlelo Community Television in October 2005 for the purpose of bringing this issue and our discussions further into the community. The show was produced and hosted by Kumu Hula Victoria Holt-Takamine and discusses the Pāhiku process being used for the EIS for the Pan-STARRS project. The show was initially aired on O'ahu in December 2005 and January 2006 on NATV, channel 53 and continues to be shown as a repeat episode. A copy of this show is included with this EISPN in the form of a DVD.

Two subsequent shows are being planned, one prior to the scoping meetings in early 2007 to provide the community an update to the EIS process. Another show is planned after all the scoping meetings are held as to provide a concise summary

of the key issues and concerns shared by those participating in these meetings.

We will be distributing these shows for further broadcasting to the neighbor island public access cable services: Akakū on Maui; Hō'ike on Kaua'i; and Nā Leo o Hawai'i on Hawai'i Island. We are grateful to these organizations for providing access to the public about issues important to our community.

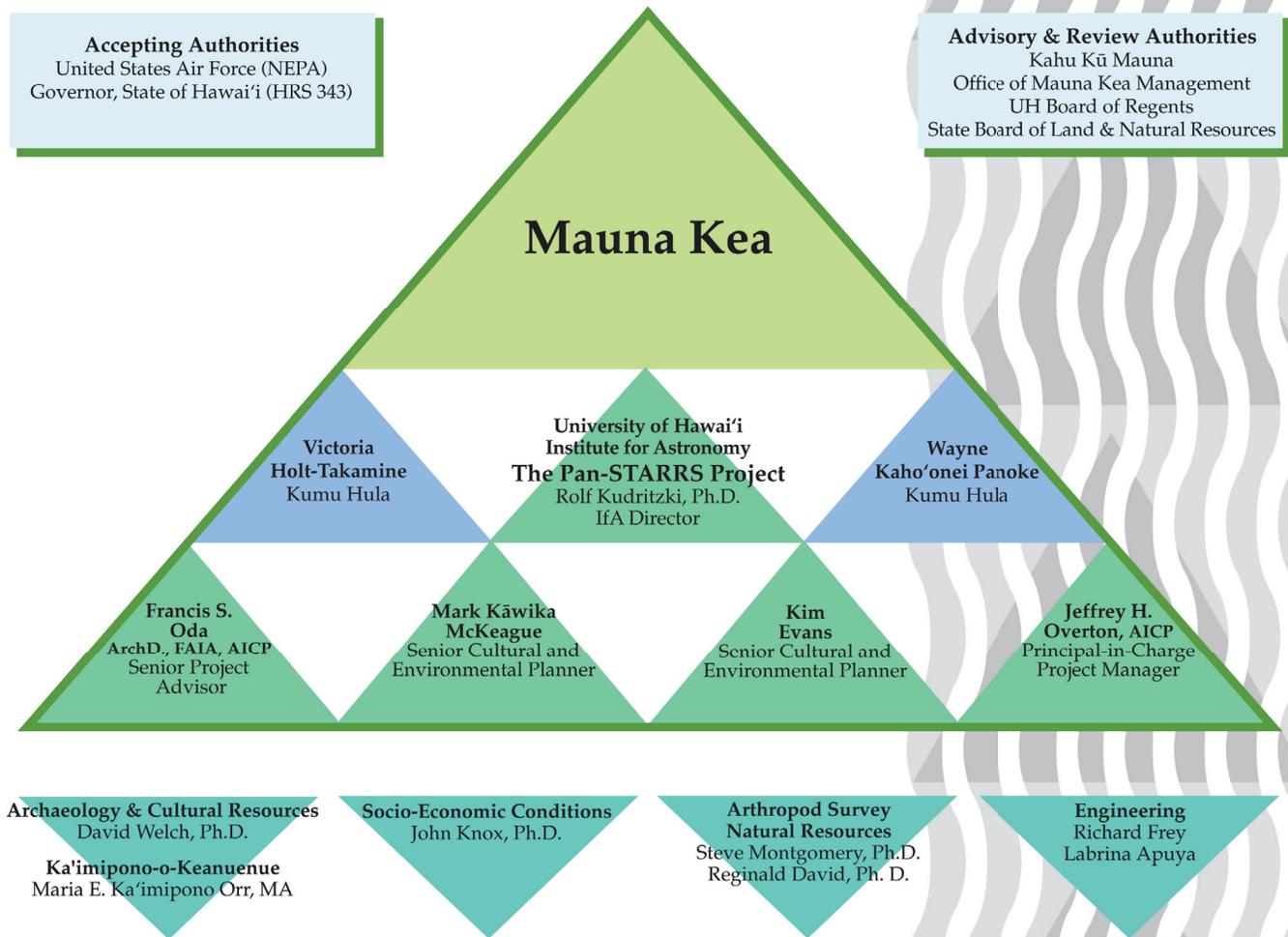
- **Continued dialogue** in the informal Pāhiku process that includes personal phone calls and coordinating face to face small group meetings.
- **Presentations.** A formal presentation was given before the Annual Convention of the Association of the Hawaiian Civic Clubs, Kona on October 26-27, 2005. Other group presentations can be conducted upon request and availability.
- **Formal EIS Scoping Meetings** will be held on the islands of Hawai'i, Maui, and O'ahu, as requested by Kahu Kū Mauna and other community interests.
- **Electronic Access.** Posting of information and provisions of updates on project website with email access. An electronic copy of this EISPN is available on the web through the IfA Pan-STARRS website: <http://pan-starrs.ifa.hawaii.edu>

## 8.5 PUBLIC COMMENTS

The planning team responsible for the EIS process will be responsive to comments shared in writing, via email, facsimile, telephone, and personal conversations. Community members and agency representatives are encouraged to contact the planning team with the information provided below:

Group 70 International, Inc.  
925 Bethel Street, 5th Floor  
Honolulu, Hawai'i, 96817  
**phone:** 808-523-5866 x104, x149, or x134  
**fax:** 808-523-5874  
**email:** PanSTARRS@group70int.com

## 9.0 LIST OF PREPARERS / PLANNING TEAM



The Project Organization Diagram above illustrates the relationship of Pan-STARRS Project and Planning Team in relation to Mauna Kea. The organizational concept, emphasizes the creation of a strong relationship foundation, within which each professional and organization contributes essential skills to this EIS/CDUA process. The diagram also shows the relationship of supporting technical consultants and the primary review and accepting authorities. Detailed description of the Pāhiku process is provided in Section 4.0 of this EISPN.

The EIS for the Pan-STARRS project is being prepared for the University of Hawai'i Institute for Astronomy. The following organizations and individuals are contributing to the overall effort in the preparation of the EIS document.

### **University of Hawai'i, Institute for Astronomy**

Rolf Peter Kudritzki, Ph.D.	Astronomer, Director
Robert McLaren, Ph.D.	Astronomer, Associate Director
Michael Maberry	Assistant Director
Nicholas Kaiser, Ph.D.	Astronomer, Principal Investigator Pan-STARRS
Klaus-Werner Hodapp, Ph.D.	Astronomer, Associate Director, Hawai'i Division
Paul Coleman, Ph.D.	Associate Astronomer
William S. Burgett, Ph.D.	Pan-STARRS Interim Project Manager
Thomas Dombeck, Ph.D.	Pan-STARRS Specialist
Gale Yamada	Administrative Officer

### **University of Hawai'i at Hilo, Department of Physics and Astronomy**

Robert Fox, Ph.D.	Professor, Chairman
-------------------	---------------------

### **Group 70 International, Inc.**

Francis Oda, FAIA, Arch.D., AICP	Project Advisor
Jeffrey Overton, AICP	Principal in Charge, Project Manager
Kimberly Evans	Senior Planner
Kāwika McKeague	Senior Planner

### **Kumu Hula**

Victoria Holt-Takamine	Pua Ali'i 'Ilima
Wayne Kaho'onei Panoke	Hālau Ha'a o Kaho'onei

### **Archaeology and Ethnography**

David Welch, Ph.D.	International Archaeological Research Institute, Inc.
Maria Orr, M.A.	Ka'imipono-o-Keanuenu

### **Socioeconomic Analysis**

John Knox, Ph.D.	John M. Knox & Associates, Inc.
------------------	---------------------------------

### **Anthropod and Natural Resources**

Reginald E. David, Ph.D.	RANA Productions, Ltd.
Steven Lee Montgomery, Ph.D.	Consulting Biologist

### **Civil Engineering**

Richard E. Frey, AIA	Engineering Solutions, Inc.
----------------------	-----------------------------

## 10.0 REFERENCES

Kanahele, Pualani Kanaka'ole & Edward L.H. Kanahele. (August 1997). Social Impact Assessment Saddle Road Realignment and Improvements- Appendix B: Indigenous Hawaiian Cultural Values. Hilo: HI.

Kumu Pono Associates LLC. (March 2005). Mauna Kea- Ka Piko Kaulana o Ka 'Āina: A Collection of Native Traditions, Historical Accounts, and Oral History Interviews for Mauna Kea, the Lands of Ka'ōhe, Humu'ula and the 'Āina Mauna on the Island of Hawai'i. Prepared for the Office of Mauna Kea Management (University of Hawai'i at Hilo).

National Aeronautics and Space Administration, Universe Division (February 2005). Final Environmental Impact Statement for the Outrigger Telescopes Project, Mauna Kea Science Reserve, Island of Hawai'i. 2 v. Washington D.C.

National Science Foundation (September 2006). Draft Environmental Impact Statement for the Advanced Technology Solar Telescope, Haleakalā, Maui, HI.

Pukui, Mary Kawena; Elbert, Samuel. (1986). Hawaiian Dictionary. University of Hawai'i Press: Honolulu, HI.

State of Hawai'i, Department of Land and Natural Resources. (2000). Mauna Kea Historic Preservation Plan Management Components. Prepared for the Institute for Astronomy, University of Hawai'i. Honolulu, HI.

State of Hawai'i, Department of Land and Natural Resources and the Institute for Astronomy, University of Hawai'i. (1995). Revised Management Plan for the UH Management Areas on Mauna Kea. Honolulu, HI.

State of Hawai'i, Department of Land and Natural Resources. General Lease No. S-4191. Honolulu, HI.

State of Hawai'i, Office of the Auditor (2005). Follow-up Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve. Report No. 05-13. Honolulu, HI.



State of Hawai'i, Office of the Auditor (1998). Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve. Report No. 98-6. Honolulu, HI.

State of Hawai'i, Office of Environmental Quality Control (2004). A Guidebook for the Hawai'i State Environmental Review Process. Honolulu, HI.

United States Air Force. Part 989 Environmental Impact Analysis Process (EIAP). National Technical Information Service, U.S. Department of Commerce: Springfield, VA

United States Department of the Interior, National Park Service, Cultural Resources, Interagency Resources Division (1992). National Register Bulletin No. 41. Guidelines for Evaluating and Registering Cemeteries and Burial Places. Prepared by Elisabeth Walton Potter and Beth M. Boland.

United States Department of the Interior, National Park Service, Cultural Resources, Interagency Resources Division (1994). National Register Bulletin No. 38. Guidelines for Evaluating and Documenting Traditional Cultural Properties. Prepared by Patricia L. Parker and Thomas F. King.

University of Hawai'i. (1999). Mauna Kea Science Reserve Master Plan Final Environmental Impact Statement. 2 v. Prepared by Group 70 International, Inc. Honolulu, HI.

University of Hawai'i Institute for Astronomy (January 2005) Haleakalā High Altitude Observatory Site Long Range Development Plan. Prepared by KC Environmental, Inc.

University of Hawai'i, Institute for Astronomy. (April 2006). Pan-STARRS Project Management System, NOTICE TO BIDDERS/OFFERORS, RFP131013: A Design Study of a Common Enclosure on Mauna, Kea to House the Four-Telescope Array Comprising the Panoramic Survey Telescope and Rapid Response System (Pan-STARRS). Pan-STARRS Project Management Office, Jeff Morgan, Tom Dombeck, and William Burgett, Pan-STARRS Technical Personnel, PSDC-310-024-05

University of Hawai'i at Hilo (August 2006). Final Environmental Assessment, University of Hawai'i, 24-Inch Telescope Observatory Renovation, Mauna Kea Science Reserve, Hāmākua, Hawai'i. Helbert, Hastert, and Fee: Honolulu, HI.

**APPENDIX A:  
Letter Clarifying Relationship of  
Pan-STARRS Project to UARC**





RECEIVED  
NOV 21 2005

DIRECTOR  
INSTITUTE FOR ASTRONOMY

UNIVERSITY OF HAWAII AT MĀNOA

GARY K. OSTRANDER, Ph.D.  
VICE CHANCELLOR FOR RESEARCH  
AND GRADUATE EDUCATION  
E-Mail: gko@hawaii.edu

November 17, 2005

Dr. Rolf-Peter Kudritzki, Director  
Institute for Astronomy  
2680 Woodlawn Drive  
Honolulu, HI 96822

RE: Panoramic Survey Telescope and Rapid Response System (Pan-STARRS)

Dear Dr. Kudritzki:

I write this letter with the intent that it be included in the Environmental Impact Statement for the PanSTARRS project so as to state publicly that PanSTARRS is NOT part of the proposed University Affiliated Research Center (UARC) nor will the project undertake any form of classified research.

In February 2005, the University of Hawai'i at Manoa, Applied Research Laboratory (UHM/ARL) submitted a proposal to the U.S. Naval Seas Systems Command (NAVSEA) in response to NAVSEA RFP N0024-05-R-6234 (S) for consideration to establish the University as a University Affiliated Research Center (UARC) under the authority of this Office. In its proposal, the UHM/ARL highlighted four core competencies to emphasize the technical achievements and programs of the University and to demonstrate its ability to conduct fundamental and applied research; engineering design and development; and to provide technical support to NAVSEA. One of the four core competencies outlined in the proposal was in the academic discipline of astronomical research.

To demonstrate the University's excellence and achievement in astronomical research, the proposal underscored the importance of the Pan-STARRS program, which is a primary research initiative of the Institute for Astronomy (IfA) and whose focal purpose is to detect and characterize Earth-approach objects, asteroids, and comets that pose a danger to the Earth. The proposal further iterated the goals, objectives, and intent of Pan-STARRS and cited that one of the task elements that could be achieved in astronomical research as a UARC included "monitoring near-Earth objects and exploiting the Pan-STARRS data product."

However, based upon the counsel and communication that transpired between this Office and yours on October 26, 2005, this letter acknowledges and affirms that the research objectives of Pan-STARRS are **not** affiliated with any type of classified research nor intended by the IfA to be associated with any other military or UARC initiative. Any previous citation or publication as to the role and intent of Pan-STARRS that is contrary to this announcement is inaccurate.

Dr. Rolf-Peter Kudritzki  
November 18, 2005  
Page 2

Sincerely,



Gary K. Ostrander, Ph.D.

- c: David McClain, Interim President
- Denise Eby Konan, Interim Chancellor
- Kathy Cutshaw, Acting Vice Chancellor for Administration, Finance, and Operations
- James R. Gaines, Vice President for Research
- Sam Callejo, Vice President for Administration
- Nainoa Thompson, Special Advisor to the President on Hawaiian Affairs
- Carolyn Tanaka, Associate Vice President for External Affairs and University Relations

**APPENDIX B:  
DVD of 'Ōlelo Community Television Production  
"E Mau Ke Ea: Mālama Mauna Kea"  
October 2005**

