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Research Report

A Sixty-Year Timeline of the Air Force Maui Optical and Supercomputing Site

Megan Clifford, Dave Baiocchi, William Welser IV

RAND Project AIR FORCE

Prepared for the United States Air Force
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Preface

For over 60 years, the present-day Air Force Maui Optical and Supercomputing Site (AMOS) has provided the U.S. Department of Defense (DoD) with space situational awareness capabilities from the island of Maui, Hawaii. AMOS is comprised of two separate facilities: the Maui Space Surveillance Complex (MSSC) and the Maui High Performance Computing Center (MHPCC). The MSSC is located on the top of the Haleakala volcano and is operated by the Air Force Research Laboratory (AFRL). MSSC has three large (meter-class) optical telescopes that were designed to provide situational awareness for missile tests and orbiting man-made objects. Together, these telescopes provide the Air Force with a unique capability to support space situational awareness missions. MHPCC is located in Kihei and is one of the five DoD Supercomputing Resource Centers. MHPCC provides computational resources, high-speed communications infrastructure, and support services to MSSC. Although they are separate facilities, MHPCC and MSSC are often referred to together as AMOS, due to a strong collaboration that exists between them.[1]

Since its inception, AMOS has evolved to meet emerging challenges and new missions. It is important for present-day decisionmakers to understand how AMOS has changed over time as they assess its role for future missions. To this end, this document contains an annotated timeline of AMOS from its origin in 1951 to the present day (2012). It is presented here to provide background for future researchers and strategic planners who need to understand the context and background of the site's history.

This timeline was created as part of a larger fiscal year 2012 study, "Assessing Current/Future Customers for the Maui Space Surveillance Site," which was designed to assess AMOS's long-term sustainability. In support of the main research objectives, RAND compiled a thorough listing of key events that helped shape the modern-day manifestation of AMOS, and these events are listed in the timeline contained in this document.

This research was sponsored by Dr. David Hardy, Director, Directed Energy Directorate, Air Force Research Laboratory (AFRL/RD). The study was performed within the Force Modernization and Employment Program of RAND Project AIR

[1] According to discussions with ARFL Det 15 staff, the AMOS acronym has changed several times over the course of its history. The site opened in 1966 as the ARPA Midcourse Observation Station (AMOS) but was also referred to as the ARPA Midcourse Optical Station (AMOS) interchangeably from its inception until 1977 when the Air Force Strategic Air Command (SAC) took over the site and renamed it the Air Force Maui Optical Station (AMOS). In 1993, when MHPCC opened, the "S" changed from "Station" to "Supercomputing Site," making AMOS the Air Force Maui Optical and Supercomputing Site. Notably, with this change, the site no longer referred only to the optical station atop Haleakala but more broadly to both MSSC and MHPCC.

FORCE. It should be of interest to policymakers and researchers working in space control, space situational awareness, and national DoD optical facilities.

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Summary

This document contains a timeline of key events in the history of the Air Force Maui Optical and Supercomputing Site (AMOS). AMOS is located on the island of Maui, Hawaii, and is comprised of two physically separate facilities: the Maui Space Surveillance Complex (MSSC) located on the top of the Haleakala volcano and the Maui High Performance Computing Center (MHPCC) located in Kihei. The events contained in this document focus primarily on the MSSC, but MHPCC has always maintained a strong collaboration with the MSSC, so we have included several events associated with MHPCC.

The MSSC[1] is operated by the Air Force Research Laboratory (AFRL) on land leased from the University of Hawaii. MSSC provides electro-optical imagery for space situational awareness on man-made objects in low Earth and geosynchronous orbits. The complex has three large optical telescopes—a dual 1.2-meter diameter refractive telescope, a single 1.6-meter diameter reflective telescope, and a 3.67-meter telescope that is the largest optical aperture in the Department of Defense (DoD). Together, these three telescopes provide the Air Force with a unique capability for high-resolution, visible and infrared wavelength imagery of space objects over the Pacific Ocean.

MSSC was first imagined as an optical research observatory in the early 1950s. Since then, the site's mission, management structure, and operational partners have changed several times to accommodate the contemporary challenges and research tools. This timeline is an attempt to document these historical changes. This history was originally researched for a RAND project on MSSC that was sponsored by AFRL/RD. In the process of performing this project, we found that there was no definitive source that provided a complete history of the site.

The purpose of this document is not to be a definitive history, but to provide a source more thorough than what is currently available to the public. We are publishing this timeline with the hope that it will be helpful to researchers and policymakers who can use this information to inform future decisions about the U.S. space surveillance architecture.

The research for this timeline was based on open source articles, historical documents, references within the scientific literature, and discussions with current and former site personnel. All of the timeline's entries have a supporting bibliographic entry that details the source for each entry.

[1] In this document, we make a distinction between the Maui Space Surveillance Site (MSSS) and the MSSC. MSSS refers to a specific building within the observatory that houses the 1.2-meter, the 1.6-meter, and the Ground-Based Electro-Optical Deep Space Surveillance (GEODSS) telescopes. MSSC refers to AFRL's entire facility on the mountaintop. The MSSC also includes the 3.6-meter Advanced Electro-Optical System (AEOS), which is housed in a separate building from the MSSS. Because of this distinction, the term MSSC did not exist prior to the construction of AEOS in the 1990s.

The timeline is provided in both tabular and wall chart formats. The tabular form will likely be the most convenient for viewing the data using conventional display formats, such as letter-sized paper or computer screens. However, we chose to also include the full-size wall chart for readers who have access to large-format printing capabilities. Readers can also view the wall chart on a large computer screen, using the scroll bar to move from one section of the timeline to the next. The wall chart can be found at the end of this document.

Acknowledgments

We are very grateful for our U.S. Air Force sponsors, Dr. David Hardy and Col Scott Maethner (AFRL/RD), who were supportive of this work from the beginning.

This research would not have been as successful without the enthusiastic help and guidance that we received from a number of people who have a connection to the site: Maj Gen (ret) Curt Bedke, Lt Col Michael Harvey, Mr. Paul Kervin, Dr. Keith Knox, Dr. Chuck Matson, Dr. Earl Spillar, Dr. Robert L. Johnson, Ms. Mo Monsalve, Dr. Tony Pensa, Dr. Bob Peterkin, Maj James Phillips, Col Joe Romero, Ms. Sandy Ryan, Maj James Slear, Mr. Dan Theil, Ms. Lisa Thompson, Ms. Virginia Wright, Dr. Darryl Greenwood, Dr. Kelly Hammett, Mr. Stan Czyzak, Mr. Mark Bolden, and Mr. Scott Hunt.

Ms. Laura Ulibarri graciously offered to make a number of her staff available to us in this endeavor, and we are thankful that she was so supportive of our research. Ms. Lori Bragg helped coordinate and distribute several early versions of the timeline to solicit comments and suggestions from existing MSSC personnel, in addition to providing her own expertise on the site's history. Dr. Bob Duffner provided us with several useful references and contacts, and his book *The Adaptive Optics Revolution: A History* was an important starting point for this research.

Don Forrester and Gary Mcleod provided careful reviews of an early draft, and their comments helped make this timeline more complete and easier to read. Finally, Dr. Joseph Janni provided detailed feedback on several iterations of the timeline, and we are very grateful for all of the time and effort that he was willing to contribute to this project.

Abbreviations

AEOS	Advanced Electro-Optical System
ACE	Atmospheric Compensation Experiment
ADCOM	Air Defense Command
ADONIS	AMOS Daytime Optical Near-Infrared Imaging System
AERL	Avco Everett Research Lab
AFB	Air Force Base
AFMC	Air Force Materiel Command
AFOSR	Air Force Office of Scientific Research
AFRL	Air Force Research Laboratory
AFRL/DE	Air Force Research Laboratory/Directed Energy (historical)
AFRL/RD	Air Force Research Laboratory/Directed Energy (current)
AFSC	Air Force Systems Command
AFSPC	Air Force Space Command
AFWL	Air Force Weapons Laboratory
AMOS	Air Force Maui Optical and Supercomputing Site (1993–present)
AMTA	Advanced Multicolor Tracker for AMOS
ARPA	Advanced Research Projects Agency
ASRC	Atmospheric Sciences Research Center
CCD	charge-coupled device
CIC	Combined Intelligence Center
CIS	compensated imaging system
CMCM	critical measurements and countermeasures
DARPA	Defense Advanced Research Projects Agency
DEBI	Directed Energy Beam Improvement
DIAL	differential absorption light detection and ranging
DMSP	Defense Meteorological Satellite Program
DoD	Department of Defense
DSRC	DoD Supercomputing Resource Center
GBFELTIE	Ground-Based Free Electron Laser Technology Integration Experiment
GEOS-C	Geodetic Earth Orbiting Satellite-C
GEODSS	Ground-Based Electro-Optical Deep Space Surveillance
GRB	gamma ray burst
HANDS	high accuracy network determination system
HI-CLASS	High Performance CO2 Laser Radar Surveillance Sensor
HiVIS	High-Resolution Visible and Infrared Spectrograph
HYSWAC	hybrid small waterplane area craft

HTTA	Hawaii Technology Trade Association
ICBM	intercontinental ballistic missile
IfA	Institute for Astronomy
IMAGE	Imager for Magnetopause-to-Aurora Global Exploration
IOC	initial operational capability
JPL	Jet Propulsion Laboratory
JSpOC	Joint Space Operations Center
LBD	laser beam detector
LIDAR	light detection and ranging
LLTV	low-light level television
LURE	Lunar Ranging Experiment
LWIR	long-wave infrared
MauiMALT	Maui Mesosphere and Lower Thermosphere
MCAT	Meter-Class Acquisition Telescope
MDA	Missile Defense Agency
MFBD	multi-frame blind deconvolution
MHPCC	Maui High Performance Computing Center
MIT/LL	Massachusetts Institute of Technology / Lincoln Laboratory
MOTIF	Maui Optical Tracking and Identification Facility
MSSC	Maui Space Surveillance Complex
MSSS	Maui Space Surveillance Site
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NEAT	Near-Earth Asteroid Tracking
NSF	National Science Foundation
NRC	National Research Council
O&M	operations and maintenance
OCS	Observatory Control System
Pan-STARRS	Panoramic Survey Telescope and Rapid Response System
PCID	Physically Constrained Iterative Deconvolution
PHIAT	Propulsion High Impact Avionics Technology
PL	Phillips Laboratory
R&D	research and development
RADC	Rome Air Development Center
RAILE	Retro-Assisted Imaging Laser Experiment
RV	reentry vehicle
SAC	Strategic Air Command
SATKA	Surveillance, Acquisition, Targeting and Kill Assessment
SBIR	Small Business Innovation Research
SDIO	Strategic Defense Initiative Organization
SECAF	Secretary of the Air Force
SOI	space object identification

SOR	Starfire Optical Range
SSA	space situational awareness
SSN	Space Surveillance Network
SWAT	Short-Wavelength Adaptive Techniques
TAOS	Technology for Autonomous Operational Survivability
UH	University of Hawaii
UM	University of Michigan
UNM	University of New Mexico
USAF	U.S. Air Force
USSPACECOM	U.S. Space Command
USSTRATCOM	U.S. Strategic Command

A Sixty-Year Timeline of the Air Force Maui Optical and Supercomputing Site (AMOS)

Start	End	Event	Category	Source
1951		Grote Reber recognizes the scientific merit and practicality of Haleakala as an optical site.	Programs and Technology	Institute for Astronomy, 2013a
Apr 1955		Dr. Walter R. Steiger from the University of Hawaii (UH) Department of Physics conducts a site survey study near the summit of Haleakala to determine the suitability of the location for a solar observatory.	Construction/Hardware Updates	Institute for Astronomy, 2013a
1956		Dr. Whipple from the Smithsonian Astrophysical Observatory selects Haleakala as one of the twelve sites for its global network of twelve Baker-Nunn telescope/camera systems dedicated to tracking the *Vanguard* satellite. At his request, Dr. Mees, former vice president for research at the Eastman Kodak Company, provides financial support to UH to build a satellite tracking station atop Haleakala.	Construction/Hardware Updates	Potter, 1998
Jul 11 1956		Prior to the establishment of the optical station, the U.S. Army begins six-month star tracking project at Haleakala.	Programs and Technology	Ainsworth, 2012
Jun 22 1957		Haleakala takes on important International Geophysical Year role with satellite tracking.	Programs and Technology	Ainsworth, 2012
Jul 01 1957		UH's satellite tracking facility is ready. It uses a meteor-tracking Schmidt camera until the Baker-Nunn telescope arrives.	Construction/Hardware Updates	Institute for Astronomy, 2013b
Oct 04 1957		*Sputnik* launch provides motivation for the establishment of a satellite tracking system in Hawaii.	Political	Institute for Astronomy, 2013a
1958		The Baker-Nunn telescope arrives and is installed. These large telescopic cameras, based on the Schmidt telescope, are designed specifically to provide space object tracking information on satellites.	Construction/Hardware Updates	Africano et al., 2001
May 07 1958		Tracking camera photographs *Sputnik II*.	Programs and Technology	Ainsworth, 2012
Apr 20 1960		Tracking camera photographs *Tiros I* weather satellite.	Programs and Technology	Ainsworth, 2012
Jun 25 1960		Prior to the establishment of the optical station, the Army launches Project Betty satellite tracking project at Puunene.	Programs and Technology	Ainsworth, 2012
Aug 17 1960		Tracking camera photographs *Echo I*.	Programs and Technology	Ainsworth, 2012

Start	End	Event	Category	Source
Aug 20 1960		Haleakala observers are first to obtain photo of *Discoverer XIV* beacon.	Programs and Technology	Ainsworth, 2012
1961		An Executive Order by Governor William Quinn establishes the "Haleakala High Altitude Observatory Site," sometimes referred to as Science City, on the summit of Haleakala.	Construction/Hardware Updates	Institute for Astronomy, 2013a
1961		R. Zirkind of the Advanced Research Projects Agency (ARPA) proposes the ARPA Midcourse Observation Station (AMOS) as an astronomical-quality observatory for obtaining precise measurements and images of reentry bodies and decoys, satellites, and other space objects in the infrared and visible spectrum. During its early years, it was interchangeably referred to as the ARPA Midcourse Optical Station.	Construction/Hardware Updates	Reed et al., 1990
1961		Dr. J. Ruina, ARPA Director at the time, gives his approval for the project, on the condition that the astronomical community agreed it was a good idea, and would actually do research with AMOS.	Construction/Hardware Updates	Reed et al., 1990
1961		Several prominent astronomers meet at Harvard's Smithsonian Optical Observatory and agree that AMOS's planned infrared observing capabilities and its proposed location farther south of the existing U.S. observatories would be beneficial to the astronomical community.	Construction/Hardware Updates	Reed et al., 1990
June 1961		ARPA Order 236 is set up with the University of Michigan (UM). Amendment No. 2 to this order would formally begin the AMOS effort by allocating $8.3 million to UM for telescope design, construction, and eventual operation of the observatory. The ARPA order amendment stated the objectives of AMOS as follows: identification and signature of space objects, establishment of an active program to advance the state of the art of infrared technology and high-resolution imagery, and establishment of a research program in geophysical and astrophysics including the astronomical community.	Construction/Hardware Updates	Reed et al., 1990
1963		UM completes the design of the 1.2-m twin telescopes, one mainly for tracking and the other for special observations, and a 1.6-m telescope to be used predominately for work in the visible spectrum.	Construction/Hardware Updates	Reed et al., 1990
1963		The Army Corps of Engineers begins Phase I of the construction of AMOS atop Haleakala, using land leased from UH at no cost. The Corps constructs all the facilities except for the telescopes and domes.	Construction/Hardware Updates	Reed et al., 1990; Ulibarri and Harvey, 2012

Start	End	Event	Category	Source
Feb 05 1964		UM begins $5 million observatory.	Construction/Hardware Updates	Ainsworth, 2012
Feb 08 1964		Groundbreaking set for UM project.	Construction/Hardware Updates	Ainsworth, 2012
1965		AMOS satellite tracking facility achieves first light.	Programs and Technology	“Haleakala to Hubble?” 2000
Jan 27 1965		*The Maui News* recognizes AMOS as a first-class institution.	Programs and Technology	Ainsworth, 2012
Aug 1966		AMOS opens as ARPA’s Midcourse Optical Observatory Station to collect optical measurements on intercontinental ballistic missiles (ICBMs) launched from Vandenberg Air Force Base (AFB), California, to the Kwajalein Atoll in the Pacific. At the time, its 1.6-m telescope is one of the world’s ten largest astronomical telescopes.	Programs and Technology	Duffner, 2009
Nov 02 1966		UM observatory head office moves from Kahului to Wailuku.	Construction/Hardware Updates	Ainsworth, 2012
1967		ARPA designates AMOS site for Western Test Range midcourse observations, with UM conducting operations and maintenance (O&M). About 40 scientists, engineers, and technicians work for UM, about half traveling to the summit on any given day.	Site Management	National Science Foundation, 2009
1967		UH establishes the Institute for Astronomy (IfA). Its faculty and staff are involved in astronomy education and in the development and management of the observatories on Haleakala.	Programs and Technology	Institute for Astronomy, 2013a
1969		1.2-m twin telescopes become operational for missile launches and space surveillance.	Construction/Hardware Updates	Duffner, undated
1969		1.6-m telescope becomes operational for missile launches and space surveillance.	Construction/Hardware Updates	Duffner, undated
1969		ARPA begins to allow use of facility to outside visiting customers.	Support	Duffner, undated
1969		Avco Everett Research Lab (AERL) takes over the technical direction and Lockheed Martin is awarded the O&M contract.	Site Management	Reed et al., 1990
1969		Mission eventually evolves into strategic missile observations and space surveillance.	Programs and Technology	Duffner, undated
1969	1974	AMOS Phase II, during which time the stated goal is to provide a more space-oriented role for AMOS’s capabilities.	Construction/Hardware Updates	Hartogensis, 1978
May 21 1969		UM relinquishes O&M management of AMOS.	Site Management	Ainsworth, 2012
Jun 21 1969		Lockheed Corporation takes over O&M management of AMOS.	Site Management	Ainsworth, 2012

Start	End	Event	Category	Source
Jun 28 1969		Lockheed Corporation runs AMOS with AERL from Wailuku office.	Site Management	Ainsworth, 2012
Jan 06 1972		Lockheed Corporation moves offices to Puunene Hospital.	Site Management	Ainsworth, 2012
1974		UH builds the Lunar Ranging Experiment (LURE) Observatory atop Haleakala. LURE utilizes a high-powered pulsed laser to obtain distance measurements to five reflector arrays left on the Moon by three Apollo missions and two Russian Federation robot spacecraft.	Construction/Hardware Updates	University of Hawaii, 2013
Nov 01 1974	Dec 31 1977	The Defense Advanced Research Projects Agency (DARPA), through executive agents in the Air Force Systems Command (AFSC) Space and Missile Systems Organization (SAMSO), contracts with the AERL to conduct Phase III operations at AMOS. This phase concentrates heavily on refinement and optimization of existing systems in addition to installation of new and/or modified hardware and software.	Programs and Technology	Hartogensis, 1978
1975		0.6-m Laser Beam Director (LBD) telescope is installed.	Construction/Hardware Updates	Duffner, undated
1975		AERL takes over all contracts (two of three site facilities), while AMOS is controlled by DARPA, but Rome Air Development Center (RADC) is the “Executive Agent” for DARPA.	Site Management	Duffner, 2002
1975		Visiting Experimenter Program formalized and initiated.	Support	Duffner, undated
Jan 1975	1977	AMOS Phase III.	Construction/Hardware Updates	Hartogensis, 1978
1977		AMOS hosts operational adaptive optics silicon-on-insulator imaging system (AF/RADC).	Programs and Technology	Ulibarri, 2011
1977		Strategic Air Command (SAC) takes operational control of the twin 1.2-m telescopes and the site is renamed the Air Force Maui Optical Station (AMOS).	Site Management	Ulibarri and Harvey, 2012
1977		Transition of 1.2-m telescope to SAC and Air Defense Command (ADCOM).	Site Management	Duffner, undated
1977		Transition of the 1.2-m mount to operational space object identification (SOI) data collection.	Programs and Technology	Duffner, undated
1978		AMOS begins routine adaptive optics imaging for space situational awareness (SSA), resulting from the DARPA program for the compensated imaging system (CIS) on the 1.6-m telescope.	Programs and Technology	Ulibarri, 2011
1978		Real-time handoff of ballistic targets to an over-the-horizon sensor using precision range and angles measurements.	Programs and Technology	Marek, 2001

Start	End	Event	Category	Source
Jun 1979		AMOS's twin infrared 1.2-m telescopes and associated systems become part of the Air Force Space Track Network, which is renamed the Maui Optical Tracking and Identification Facility (MOTIF).	Site Management	Reed et al., 1990
Oct 1979		MOTIF's paired 1.2-m telescopes become dedicated Space Surveillance Network (SSN) sensors, providing satellite imaging, tracking, and infrared signature data down to +19th magnitude.	Programs and Technology	Jane's, 2007
1980		Construction begins on Ground-Based Electro-Optical Deep Space Surveillance System (GEODSS). Three new domes and approximately 10,000 square feet of office and laboratory space on the south side are built.	Construction/Hardware Updates	National Science Foundation, 2009
1981		SAC runs MOTIF while RADC is DARPA's agent for all AMOS activities/facilities.	Site Management	Duffner, 2002
1982		Atmospheric Compensation Experiment (ACE) Phase I experiments conducted at AMOS demonstrate atmospheric compensation for a beam propagating along a 150-m horizontal path (with integrated turbulence equal to that for vertical propagation through the entire atmosphere). These experiments serve as a predecessor to modern adaptive optics.	Programs and Technology	Greenwood, 1992; AFRL Det 15, 2012f
1982		GEODSS system achieves initial operational capability (IOC), making it one of three operational sites in the world performing ground-based optical tracking of space objects. It employs about 15 O&M personnel.	Construction/Hardware Updates	Duffner, undated
1982		Installation of CIS on the 1.6-m telescope, the first operational application of adaptive optics.	Construction/Hardware Updates	Duffner, undated
1982		World's first adaptive optics CIS on line at AMOS and operational for over ten years. It provides ongoing support to National Technical Means, National Air and Space Intelligence Center (NASIC), and Joint Space Operations Center (JSpOC).	Programs and Technology	Ulibarri, 2011
Sep 1982		Air Force Space Command (AFSPC), headquartered at Peterson, is established. Advanced Electro-Optical System (AEOS) telescope would later provide near-real-time imaging to support this operational unit.	Site Management	Duffner, 2009
1983		In Phase II ACE experiments, Maui site personnel perform atmospheric compensation of a laser beam propagating to a small aircraft flying above the site.	Programs and Technology	Greenwood, 1992; AFRL Det 15, 2012f
Dec 1983		Development of RADC document for the acquisition of AMOS.	Site Management	Duffner, 2002
1984		The site transitions from DARPA to the U.S. Air Force (USAF) and is assigned to RADC.	Site Management	Reed et al., 1990

Start	End	Event	Category	Source
Jun 10 1984		After test failures with the first three flight tests, the fourth and final test of the Homing Overlay Experiment is successful, intercepting the Minuteman reentry vehicle (RV) with a closing speed of about 6.1 km/s at an altitude of more than 160 km. AMOS supported the Homing Overlay Experiment through acquisition and tracking with the 1.2-m Advanced Multicolor Tracker for AMOS (AMTA) system.	Programs and Technology	Marek, 2001
1985		AMOS images shuttle to look for missing tiles. This is the first ever anomaly resolution using resolved imagery.	Public Good/Discoveries	AFRL Det 15, 2012b
1985		AMOS signatures used to diagnose problems on Defense Meteorological Satellite Program (DMSP) with anomaly resolution using SOI photometry.	Support	AFRL Det 15, 2012b
1985		First daylight image of a satellite by AMOS using a low-light level television (LLTV) sensor on the 1.6-m telescope. This leads to a specialized camera on the 1.2-m telescope built by DFM Engineering.	Programs and Technology	AFRL Det 15, 2012b
1985		World's first outgoing beam compensation to space targets conducted at AMOS (Massachusetts Institute of Technology/Lincoln Laboratory [MIT/LL] tests to Space Shuttle 51G, Sandia sounding rockets to 600 km).	Programs and Technology	Ulibarri, 2011
Sep 23 1985		U.S. Space Command (USSPACECOM), for which AEOS later provides near-real-time imaging support, is established.	Site Management	Duffner, 2009
Apr 1986		RADC decides to upgrade telescopes at AMOS.	Construction/Hardware Updates	Duffner, 2009
Sep 1986		RADC makes a proposal for a world-class 4-m telescope at Maui, to be called the AMOS Large Optical Facility Test bed.	Construction/Hardware Updates	Duffner, 2009
Oct 1986		Strategic Defense Initiative Organization (SDIO) rejects RADC's proposal for a new telescope at Maui mainly because of its projected costs.	Construction/Hardware Updates	Duffner, 2009
1987	1988	AMOS participates in Surveillance, Acquisition, Targeting, and Kill Assessment (SATKA) Integrated Experiments, using the 1.2-m telescope and long-wave infrared (LWIR) AMTA sensor.	Programs and Technology	Marek, 2001
1988		0.8-m Beam Director Tracker installed to support SDIO's Relay Mirror Experiment.	Construction/Hardware Updates	Duffner, undated
1988		AFSPC becomes host organization of AMOS and AFSC becomes a tenant operating its own R&D resources.	Site Management	Ulibarri and Harvey, 2012
1988	1991	Short-Wavelength Adaptive Techniques (SWAT) experiments performed with the 50-cm laser beam director.	Programs and Technology	Greenwood, 1992

Start	End	Event	Category	Source
Aug 1988		World's first synthetic beacon adaptive optics image compensated at AMOS by MIT/LL with Air Force/RADC/AMOS under SDIO sponsorship (using sodium layer).	Public Good/Discoveries	Ulibarri, 2011
Jul 1989		RADC proposes a less costly plan for an $18 million telescope, AEOS, with lightweight optics and other cost-saving technologies. It also proposes that the cost of AEOS be shared by SDIO, AFSPC, and the Air Force's antisatellite planning group.	Construction/Hardware Updates	Duffner, 2009
1990		A congressional delegation led by Hawaiian-elected officials travels to Maui to review the AEOS proposal and to inspect the Haleakala site.	Political	Duffner, 2009
1990		Discussions begin on consolidating all AFSC optical sites under Phillips Laboratory (PL).	Site Management	Phillips Research Site, undated
1990		John Stanley of National Aeronautics and Space Administration (NASA) provides funding in the early 90s to AMOS in support of orbital debris observations.	Programs and Technology	AFRL Det 15, 2012g
1990		The Relay Mirror Experiment is conducted; it is the first successful relay of a laser from a ground station to an orbiting relay mirror and back.	Programs and Technology	Duffner, undated
Jan 1990		RADC briefs its headquarters, the Electronic Systems Division at Hanscom AFB near Boston, which supports its July 1989 proposal for a less costly AEOS telescope as well as its cost-sharing plan.	Political	Duffner, 2009
Feb 1990		Joint funding backed by AFSPC, SDIO, and an antisatellite planning group falls through due to changing priorities and budgetary constraints.	Political	Duffner, 2009
Feb 1990		Senator Daniel K. Inouye of Hawaii revives AEOS program by gathering support for the program in the Senate.	Political	Duffner, 2009
Mar 1990		AMOS contractors AERL and Textron Defense Systems outline advantages of AEOS in a paper addressing costs, requirements, missions, and users.	Political	Duffner, 2009
Jun 1990		Management of the Maui site shifts from RADC to the Air Force Weapons Laboratory (AFWL) at Kirtland AFB.	Site Management	Duffner, 2009
Oct 1990		Rockwell Power Systems begin five-year contract to operate MOTIF and AMOS.	Site Management	AFRL Det 15, 2012b; AFRL Det 15, 2012d
Nov 1990		Col John Otten, Commander of AFWL, forms a small advisory team to prepare specifications for the AEOS telescope, spelling out pre-contractual work to be completed before money is committed for contracts to design and build the telescope.	Site Management	Duffner, 2009
Dec 13 1990		PL at Kirtland AFB is established as one of the four new labs in the Air Force.	Programs and Technology	Duffner, 2009

Start	End	Event	Category	Source
1991		Department of Defense (DoD) Appropriations Act of 1991 allocated $14.95 million over two years to start the acquisition of a 4-m telescope, moving AEOS from the debate phase to the action phase.	Political	Duffner, 2009
1991		DFM Engineering builds specialized camera on 1.2-m telescope, which is financed entirely by AFSPC. This is the first charge-coupled device (CCD) camera at AMOS. It replaces film camera for uncompensated imaging.	Construction/Hardware Updates	AFRL Det 15, 2012b
1991		The AEOS review committee learns about a 25,000-pound Zerodur mirror blank manufactured for the Army's Ground-Based Free Electron Laser Technology Integration Experiment (GBFELTIE) but never put into use, and considers its use for AEOS.	Construction/Hardware Updates	Duffner, 2009; Janni, 2012
Jan 01 1991		Technical direction of the AMOS site transferred from Rome Laboratories (formerly RADC) to PL.	Site Management	Phillips Research Site, 1994
Jan 1991		The AEOS advisory team headed by Capt Rich Miller decides that AEOS would support the Air Force's space surveillance missions and might conduct research into a laser antisatellite weapon but would not carry it through to operational use.	Programs and Technology	Duffner, 2009; Janni, 2012
Mar 1991		Lt Rich Elder replaces Miller as head of the AEOS review team.	Site Management	Duffner, 2009
Mar 1991		The Retro-Assisted Imaging Laser Experiment (RAILE) successfully produces resolved imagery of the four corner cubes on the Relay Mirror Experiment satellite, employing an atmospheric-cancelling three laser beam synthetic aperture technique.	Programs and Technology	AFRL Det 15, 2012e
May 1991		AMOS site designated as the Air Force's Center of Excellence for Imaging Research.	Programs and Technology	Phillips Research Site, 1994
May 1991		Lt Rich Elder and Mr. Jim Mayo visit Schott Glass Works representatives in Germany to examine its 25,000-pound Zerodur mirror and determine the necessary modifications that would have to be made in order for it to fit the AEOS.	Construction/Hardware Updates	Duffner, 2009
May 1991		USAF transfers operational control of the AMOS facility from RADC to PL via the Program Action Directive for Strategic Optical Imaging Technology.	Site Management	Phillips Research Site, undated
Aug 1991		Phillips Laboratory hosts a pre-proposal conference at Kirtland AFB to inform contract bidders about the AEOS program and status. Fifteen prospective vendors attend.	Programs and Technology	Duffner, 2009
Oct 1991		Approval is granted for a foundation and pier to support an 8-m telescope base. The rest of the facility (azimuth base and mounting ring, azimuth yoke base, inner gimbal, dome roof, and walls) was built for a 3.67-m telescope.	Construction/Hardware Updates	Duffner, 2009

Start	End	Event	Category	Source
Dec 1991		Plans under way to ship the cut mirror blank from Germany to the United States.	Construction/Hardware Updates	Duffner, 2009
Dec 13 1991		The Air Force awards a $19.3 million dollar contract to Contraves USA to build the AEOS 3.67-m telescope.	Site Management	Duffner, 2009
May 1992		The Air Force approves Contraves's telescope design during a preliminary design review.	Programs and Technology	Duffner, 2009
May 07 1992		Senator Inouye writes a letter to Secretary of the Air Force (SECAF) recommending a larger facility to house the original 3.67-m telescope.	Political	Phillips Research Site, undated
Jun 11 1992		AEOS cost estimate is $63.9 million for an 8-m base and $58.9 million for a 3.67-m base.	Programs and Technology	Air Force Research Laboratory, AEOS Telescope, cost estimates, undated
Nov 1992		Installation of Propulsion High Impact Avionics Technology (PHIAT), the first operational SSA imaging system that improved performance based on post-detection image processing, is complete.	Construction/Hardware Updates	AFRL Det 15, 2012g
1993		AMOS develops an automated video object detection system using a Datacube MaxVideo20 image processing system and a SPARCstation10 workstation for statistical post-processing for the Air Force Orbital Debris Measurements Program.	Programs and Technology	Africano et al., 2001
1993		Maui High Performance Computing Center (MHPCC) is established to provide high-performance computing capabilities to the observatory site as a distributed center.	Programs and Technology	Ulibarri and Harvey, 2012
1993		Preliminary MHPCC costs estimated at $21 million.	Programs and Technology	Phillips Research Site, 1994
Jan 21 1993		Workshop held to develop an instrumentation plan for atmospheric science research at AEOS.	Programs and Technology	Phillips Research Site, 1994
Jun 1993		The Air Force approves Contraves's telescope design during a critical design review.	Programs and Technology	Duffner, 2009
Jun 1993		Work begins on manufacturing hardware components for the AEOS telescope.	Programs and Technology	Duffner, 2009
Sep 1993		DoD awards the University of New Mexico (UNM) a $10 million per year "cooperative agreement" to operate the MHPCC through fiscal year 2000.	Site Management	Duffner, undated
Dec 1993		Dr. John R. Kenemuth, an optics expert from PL, becomes the technical director of AEOS.	Site Management	AFRL Det 15, 2012j
1994		1.6-m dome is automated.	Construction/Hardware Updates	AFRL Det 15, 2012b
1994		AMOS (Africano, Medrano, Nishimoto) captures the only 3-6 micron images of Comet Shoemaker-Levy impacting Jupiter.	Public Good/Discoveries	AFRL Det 15, 2012b

Start	End	Event	Category	Source
1994		Funds dedicated to support High Performance CO2 Laser Radar Surveillance Sensor (HI-CLASS) field tests at AMOS and upgrade sensors to include rapid wavelength tunability.	Programs and Technology	Duffner, Robert, undated
1994		Lt Col Jim McNally, from PL, becomes AEOS program manager.	Site Management	Duffner, 2009
1994		MHPCC office opens.	Construction/Hardware Updates	AFRL Det 15, 2012b
1994		Researchers make a major technical breakthrough at Maui with the design, development, and deployment of the AMOS Daytime Optical Near-Infrared Imaging System (ADONIS), which allows the site to provide Air Force customers with high-resolution post-processed images in minutes instead of hours.	Construction/Hardware Updates	Duffner, 2009
Jan 1994		Completion of Phase 0 of HI-CLASS, the initial system development and check out. This includes a mission analysis and the establishment of performance requirements.	Programs and Technology	Mosley et al., 1998
Jul 1994		The LBD at AMOS undergoes upgrades in support of HI-CLASS.	Construction/Hardware Updates	Duffner, undated
Jul 1994		Two 20-gigaFLOPS machines are added to MHPCC.	Construction/Hardware Updates	Phillips Research Site, 1994
Aug 1994		HI-CLASS Phase I tests are completed, revealing that the system exceeded all specifications.	Programs and Technology	Duffner, undated
Aug 22 1994		PL awards a $15 million, three-year contract to Hughes Danbury Optical Systems to design and build the adaptive optics system.	Site Management	Duffner, 2009
Aug 26 1994		The Hawaii Department of Land and Natural Resources authorizes additional construction at the top of Haleakala.	Political	Duffner, 2009
Aug 29 1994		The Army Corps of Engineers issues a contract for $19 million to Kiewit Pacific Inc. of Honolulu to construct the 41,000 square feet AEOS facility.	Site Management	Duffner, 2009
Sep 1994		HI-CLASS Phase I system is installed at the Maui site.	Construction/Hardware Updates	Duffner, undated
Dec 1994		First Observatory Control System (OCS) compliant sensor implemented on the 1.6-m telescope.	Construction/Hardware Updates	Oder, undated
1995		AEOS retains its R&D mission for Air Force Materiel Command (AFMC), while its AFSPC mission evolves into three main areas: space intelligence, space tracking, and space control.	Programs and Technology	AFRL Det 15, 2012b
1995		Image data protection system is delivered and installed at USSPACECOM Combined Intelligence Center (CIC).	Construction/Hardware Updates	AFRL Det 15, 2012b
1995		Transition of all telescopes to AFSPC.	Site Management	Duffner, undated

Start	End	Event	Category	Source
1995		AMOS and MOTIF are collectively renamed Maui Space Surveillance Site (MSSS).	Site Management	Duffner, undated
Jan 1995		Construction begins on the facility foundation and walls to the Coudé room at AEOS facility.	Construction/Hardware Updates	Oder, undated
Jan 1995		Prototype mount control system implemented on the 1.6-m telescope.	Construction/Hardware Updates	Duffner, undated
Feb 1995		AEOS tracker implemented on the 1.6-m telescope.	Construction/Hardware Updates	Oder, undated
Apr 15 1995		Senator Inouye presides over the AEOS groundbreaking ceremony that officially signifies the start of the construction.	Political	Duffner, 2009
May 1995		Data from LURE allows scientists to determine the distance between the Earth and the moon to an accuracy of less than 2.0 centimeters.	Public Good/Discoveries	Institute for Astronomy, 2013a
May 1995		Experiments conducted using the HI-CLASS CO2 from AMOS (10,000 ft. mean sea level) to sea level over a slant range of 21.3 km to emulate the airborne Differential Absorption Light Detection and Ranging (DIAL) configuration eventually flown on the Argus C-135 aircraft for the Laser Airborne Remote Sensing (LARS) program.	Public Good/Discoveries	AFRL Det 15, 2012e
Jul 11 1995		A 12-hour concrete pour occurs for the first section of the AEOS telescope pedestal.	Construction/Hardware Updates	Duffner, undated
Aug 1995		LI-COR Biosciences awarded the radiometer/photometer contract to Mission Research Corporation for one of the three mission sensors for AEOS with delivery set for March 1997.	Site Management	Duffner, undated
Sep 1995		Hughes Aircraft Company awarded LWIR imager contract for one of three AEOS mission sensors with delivery set for December 1997.	Site Management	Duffner, undated
Nov 1995	1998	NASA/Jet Propulsion Laboratory (JPL) Near-Earth Asteroid Tracking (NEAT) system in operation at GEODSS.	Programs and Technology	AFRL Det 15, 2012f
1996		AEOS requests funding of $17.5 million.	Political	Oder, undated
1996		ADONIS is operational at the site, extending imaging capabilities to 24 hours daily.	Construction/Hardware Updates	Headquarters Air Force Materiel Command, 1995; AFRL Det 15, 2012e
1996		AMOS participates in Technology for Autonomous Operational Survivability (TAOS) satellite experiment.	Programs and Technology	Air Force Research Laboratory, 1995
Feb 1996		HI-CLASS Phase II, the system oscillator and receiver-process, installed at MSSS.	Construction/Hardware Updates	AFRL Det 15, 2012e
Feb 27 1996		$1 million is withheld from original funding amount AEOS requests.	Political	Oder, undated

Start	End	Event	Category	Source
Apr 06 1996		First returns from a cooperative satellite, the Geodetic Earth Orbiting Satellite-C (GEOS-C), are collected.	Programs and Technology	Mosley, 1998
Sep 03 1996		Lt Col Peter D. Keish becomes AEOS program manager.	Programs and Technology	Oder, undated
Oct 1996		Approximately 95 percent of the work on AEOS is complete.	Construction/Hardware Updates	Oder, undated
Nov 1996		Small Business Innovation Research (SBIR) contract to develop ground weather prediction system.	Site Management	Oder, undated
Dec 18 1996		Contraves completes factory testing of AEOS telescope at its plant in Pennsylvania.	Construction/Hardware Updates	Duffner, 2009
1997		Maj Chris Washer becomes new AEOS Program Manager.	Site Management	Oder, undated
1997		Maj Dave Richards appointed Branch Chief.	Site Management	AFRL Det 15, 2012j
1997		The Raven small telescope team, led by Paul Kervin, submits a Raven proposal to the Air Force Space Battle lab.	Site Management	Duffner, undated
Jan 1997		Integration of Phase III of HI-CLASS at MSSS complete.	Programs and Technology	Mosley et al., 1998
Feb 03 1997		The AEOS mirror receives its reflective coating, a 100-nanometer layer of aluminum weighing only 3 grams, at Kitt Peak.	Construction/Hardware Updates	Duffner, 2009
Feb 07 1997		AEOS mirror ships to Vancouver, Washington.	Construction/Hardware Updates	Duffner, 2009
Mar 1997		AEOS telescope arrives in Maui.	Construction/Hardware Updates	Duffner, 2009
Apr 1997		Kenemuth moves from Albuquerque, NM, to Maui to work with Hughes Danbury on integrating the adaptive optics system with the telescope.	Site Management	Duffner, 2009
Apr 01 1997	Mar 31 2000	Maj Gen Richard R. Paul serves as Air Force Research Laboratory (AFRL) Commander.	Site Management	Wikipedia, 2011
Apr 07 1997		AEOS's base put in place inside its dome.	Construction/Hardware Updates	Duffner, 2009
Apr 16 1997		AEOS's primary mirror put in place inside its dome.	Construction/Hardware Updates	Duffner, 2009
Apr 22 1997		AEOS's truss and gimbal put in place inside its dome.	Construction/Hardware Updates	Duffner, 2009
Apr 22 1997		Fourth heavy lift brings the trunnion, truss, and head ring to the new facility into AEOS.	Construction/Hardware Updates	Oder, undated
Apr 22 1997		Installation of the AEOS telescope is complete.	Construction/Hardware Updates	Duffner, 2009
May 1997		COMSAT RSI, the dome contractor, finds the cause of problems in raising and lowering the dome and provides the actuator replacement parts needed to complete the fix.	Construction/Hardware Updates	Oder, undated

Start	End	Event	Category	Source
Jun 30 1997		AEOS site is complete.	Construction/Hardware Updates	Oder, undated
Jul 1997		AEOS surpasses the Starfire telescope as DoD's largest telescope.	Programs and Technology	Duffner, 2009
Jul 05 1997		AEOS dedication held.	Political	Duffner, 2009
Sep 26 1997		AEOS attains its first light image of a space object, the Ring Nebula, demonstrating its high-quality imaging capability.	Public Good/Discoveries	Oder, undated
Oct 16 1997		Oceanit Laboratories, an AEOS contractor, awarded Tibbets Award for excellence in small business at White House ceremony.	Site Management	Oder, undated
Oct 31 1997	Apr 03 2003	Dr. R. Earl Good serves as the Air Force Research Laboratory/Directed Energy (AFRL/DE) Director.	Site Management	AFRL Det 15, 2012c
1998		A fiber optic link is put in place between the Maui Space Surveillance Complex (MSSC) and MHPCC to enable fast data transfer between the imaging sensors at the MSSC and the high-speed computers at MHPCC.	Construction/Hardware Updates	Duffner, 2009
1998		AMOS operational support for the John Glenn STS-95 mission shuttle damage assessment.	Public Good/Discoveries	Ulibarri, 2011
1998		Experiments confirm that AEOS's five dead actuators minimally impact its performance.	Construction/Hardware Updates	Duffner, 2009
1998		MHPCC ranked among the top 100 most powerful supercomputer sites in the world.	Programs and Technology	Dongarra, 1998
1998		The Director of Defense Research and Engineering selects MHPCC as one of four distributed centers to receive approximately $16 million in funding over two years.	Site Management	"US Expands its High-Performance Computing," 1998
1998		Transition of MHPCC from Atmospheric Sciences Research Center (ASRC) to DoD Supercomputing Resource Center (DSRC).	Site Management	AFRL Det 15, 2012b
Apr 1998		AEOS is fully operational.	Construction/Hardware Updates	Air Force Research Laboratory, AMOS Overview, undated
May 1998		AEOS team anticipated the completion and delivery of the LWIR system.	Construction/Hardware Updates	Oder, undated
Oct 1998		Air Force watchers from AFRL Det 5 in Maui track and photograph images of the Space Shuttle *Discovery* after receiving readings that an exterior door had either opened or fallen off.	Support	Greeley, 2001
Oct 1998		NASA/AFSPC Near-Earth Object Working Group recommends NASA/JPL NEAT program be moved to 1.2-m B37 telescope.	Programs and Technology	AFRL Det 15, 2012f

Start	End	Event	Category	Source
1999		Air Force Office of Scientific Research (AFOSR) announces $2.5 million in funding for civilian researchers for use of the Air Force's most advanced telescopes on Haleakala.	Public Good/Discoveries	High Tech Maui, 1999
1999		First Annual AMOS Technologies Conference with 254 attendees, including the Honorable Daniel Inouye.	Public Good/Discoveries	AFRL Det 15, 2012b
1999		GEODSS telescopes under control of AFSPC Det. 15.	Site Management	Duffner, undated
1999		MHPCC installs IBM's "Deep Blue" RS/6000 SP.	Construction/Hardware Updates	High Tech Maui, 1999
1999		Seven telescopes and their associated hardware/facilities, which makes up MSSC, belong to Det 15.	Site Management	Duffner, undated
1999		USAF contributes up to $2 million for joint National Science Foundation (NSF) and MSSC project.	Programs and Technology	Tanjl, 1999
Feb 1999		Raytheon completes factory acceptance testing of AEOS optics system.	Construction/Hardware Updates	Duffner, 2009
Feb 12 1999		Textron uses expertise developed on Maui to develop new sensors for the U.S. Navy.	Support	Missile Defence, 1999
Mar 1999		AEOS adaptive optics system delivered to Maui.	Programs and Technology	Duffner, 2009
Jun 1999		First light achieved on the LWIR imager, permitting good images of the Hubble Space Telescope.	Public Good/Discoveries	"Funds Coming for Civilian Projects at Maui," 1999
Jun 25 1999		MHPCC initiates efforts to procure and implement upgrades for 40–50 percent of its current hardware.	Construction/Hardware Updates	Maui Space Surveillance System Team, email discussion regarding timeline comments, May, 2012
Jul 29 1999		Due to joint efforts of Raytheon and the AEOS team, the AEOS telescope and adaptive optics systems work together to change the settings on the deformable mirror to generate a high-resolution image for the first time.	Programs and Technology	Duffner, 2009; AFRL Det 15, 2012c
Aug 1999		AMOS assists UH in capturing infrared images of the moon during an eclipse.	Public Good/Discoveries	Tanjl, 1999
Aug 03 1999		AEOS contributes to collection and investigation of data from the NASA's Lunar Prospective satellite mission.	Support	Stimson, 1999
Sep 1999		Hawaii Technology Trade Association (HTTA) is launched to serve the state's growing technology industry.	Public Good/Discoveries	High Tech Maui, 1999
Sep 1999	Sep 2000	Maj Joseph Bishop serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Sep 13 1999		1,100 to 1,200 customers throughout the United States, Pacific, and Asia use the supercomputer since its start of operation in 1994.	Public Good/Discoveries	Tanjl, 1999

Start	End	Event	Category	Source
Sep 13 1999		MSSC takes on new role of helping non-military scientists learn about space and objects such as the moon, asteroids, and nearby planets. MSSC also shares information on which space objects it sees and how well it is able to see them with these scientists.	Political	Tanjl, 1999
Sep 13 1999		Students at Maui Community College work with scientists to analyze data from Haleakala processed through the supercomputer.	Public Good/Discoveries	Tanjl, 1999
2000		AFOSR and NSF establish a basic research partnership to allow astronomers access to telescope site.	Public Good/Discoveries	Air Force Research Laboratory, AMOS Overview, undated
2000		AEOS adaptive optics system dedicated to SSA and the system at Starfire Optical Range (SOR) used to support beam control research as opposed to imaging research.	Programs and Technology	Ulibarri, 2011; AFRL Det 15, 2012i
2000		AEOS becomes fully operational for satellite imaging.	Construction/Hardware Updates	Duffner, 2009
2000		Collaboration between AFRL and NASA's JPL results in transfer of NEAT camera from GEODSS to 1.2-m telescope.	Programs and Technology	AFRL Det 15, 2012b
2000		Decision made to "resurrect" original Baker-Nunn telescope and retrofit it with a state-of-the-art CCD.	Programs and Technology	Africano et al., 2001
2000		Management and operation of AEOS made responsibility of AFRL/DE.	Site Management	Duffner, 2009
2000		Raven telescope becomes fully operational at the Maui site.	Construction/Hardware Updates	Duffner, undated
2000		The AEOS adaptive optics system is identified as one of the most advanced imaging systems in the world for tracking and producing high-resolution images of objects in space.	Programs and Technology	Duffner, 2009
2000		Transition of all telescopes to AFMC with exception of GEODSS.	Site Management	Duffner, undated
2000		Raven and GEODSS transferred to AFSPC.	Site Management	Nelson, 2003
2000		UH receives contract to run MHPCC.	Site Management	Duffner, undated
Feb 2000		First light achieved on 1.4 x 1.4 deg. field of view NEAT system.	Programs and Technology	AFRL Det 15, 2012f
Feb 2000		Contractors who assembled and tested the AEOS system and trained Maui employees on its operation are no longer resident on the island.	Site Management	Duffner, 2009
Apr 01 2000	May 31 2004	Maj Gen Paul G. Nielsen, PhD, serves as AFRL Commander.	Site Management	Wikipedia, 2011
Jul 01 2000		Transition of MHPCC from UNM to UH began, with 90 percent of UNM Maui employees transferring to work under the new UH contract.	Site Management	Duffner, undated
Sep 2000		Second Annual AMOS Technologies Conference, with 265 registered participants.	Support	Maui Economic Development Board, Inc., 2012

Start	End	Event	Category	Source
Sep 2000	Jul 2002	Maj Raley Marek serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Oct 2000		Site transferred from AFSPC purview to AFRL.	Site Management	"USAF Space Control Needs Cause Ops Tempo Surge at Maui Site," 2003
Oct 01 2000		Roles of Det 15 and Det 3 are reversed. Det 15 Directed Energy Beam Improvement (DEBI) became host organization for running entire Maui site. As the new tenant unit, Det 3 is only responsible for operating the three GEODSS telescopes it owns atop the mountain.	Site Management	Duffner, undated
2001		A new camera with a wider field of view mounted on the 1.6-m telescope significantly improves the chances of finding a satellite during its single pass over Maui.	Construction/Hardware Updates	Duffner, undated
2001		AFOSR leadership helps to allocate funding to AMOS in Fiscal Year 2001 and provides guidance on implementation of a basic research program at AMOS.	Site Management	Duffner, undated
2001		AFRL Det 15 initiates a project to develop and integrate a suite of wide field of view (WFOV) sensor systems.	Construction/Hardware Updates	Africano et al., 2001
2001		AFSPC certifies Raven as a contributing sensor to the integrated Threat Warning/Attack Assessment network.	Programs and Technology	Duffner, undated
2001		AMOS collects data on ten missile flights, the most ever in a one-year period in the history of the Maui site.	Public Good/Discoveries	Duffner, undated
2001		Det 3 converts the third GEODSS telescope (and its supporting hardware) into a better-performing telescope.	Construction/Hardware Updates	Duffner, undated
2001		MHPCC develops new imaging algorithms and software designed to enhance clarity of optical images provided by the telescopes at MSSC.	Construction/Hardware Updates	Duffner, undated
2001		MHPCC makes substantial progress developing and testing cutting-edge parallel computing software and hardware used for advancing modeling and simulation work to support the warfighter.	Programs and Technology	Duffner, undated
2001		MHPCC ranked as 12th largest supercomputer in the world.	Programs and Technology	Duffner, undated
2001		MHPPC devotes over three million hours of high-speed computing time to modeling and simulation studies supporting nine Air Force and Navy priority programs.	Support	Duffner, undated
2001		MHPPC hosts the first IBM Linux Supercluster in the DoD inventory.	Construction/Hardware Updates	Duffner, undated
2001		JPL pays for time on the 1.2-m telescopes.	Programs and Technology	Duffner, undated
2001		NSF provides an additional $250,000 for outside scientists to participate in the Maui basic research program.	Public Good/Discoveries	Duffner, undated

Start	End	Event	Category	Source
2001		Number of approved government and non-government researcher accounts that permit individuals the right to use MHPCC total 910 during the first quarter of Fiscal Year 2001.	Public Good/Discoveries	Duffner, undated
2001		Progress on the OCS upgrade program allows the operation of any telescope from consoles located at a number of locations at the MSSC. This allows the system to operate without downtime in the event that the AEOS facility fails.	Construction/Hardware Updates	Duffner, undated
2001		Project Phoenix, an effort to bring the Baker-Nunn camera back to operational status, begins.	Construction/Hardware Updates	Law, 2002
2001		The Raven small telescope team, led by Paul Kervin, technical director for AMOS, receives the prestigious Air Force Science and Engineering Award in the category of Engineering Achievement. The Raven consistently provides more accurate data to AFSPC than any of the three GEODSS telescopes.	Programs and Technology	Duffner, undated
2001		Visiting group of astronomers use the AMOS facilities to study the atmosphere around Titan.	Public Good/Discoveries	Duffner, undated
Jan 16 2001		The Air Force praises Raytheon for its success in the design, fabrication, installation, and test of the AEOS adaptive optics system and Visible Imager.	Site Management	Duffner, 2009
Feb 2001		Trex, a subcontractor to Boeing, is given full responsibility to operate and maintain the AEOS adaptive optics system.	Site Management	Duffner, 2009
Mar 2001		AMOS AFRL collaborates with NASA's JPL on the NEAT program.	Site Management	Africano et al., 2001
Mar 2001		AMOS uses spectrographs for debris observation research.	Programs and Technology	Africano et al., 2001
Jun 2001		Renovated Baker-Nunn Telescope scheduled to be made available for viewing.	Programs and Technology	Africano et al., 2001
Aug 2001		Telescope time at AMOS costs an estimated $2,000/hour.	Programs and Technology	Greeley, 2001
2002		AFRL/DE supports construction of a mirror coating facility at Maui.	Construction/Hardware Updates	Phillips Research Site, 2005
2002		First SSA conference held in conjunction with AMOS Conference.	Support	AFRL Det 15, 2012b
2002	2012	Collaboration with the NASA Orbital Debris Program Office located in Houston. The purpose is to build the Meter-Class Acquisition Telescope (MCAT) on Roi-Namur, Kwajalein Atoll, Marshall Islands.	Programs and Technology	AFRL Det 15, 2012g

Start	End	Event	Category	Source
Jan 2002	Mar 2005	Maui Mesosphere and Lower Thermosphere (MauiMALT) consortium measures sodium abundance over Haleakala using University of Illinois light detection and ranging (LIDAR) (35 nights of data).	Public Good/Discoveries	AFRL Det 15, 2012f
Jul 2002	Jan 2004	Lt Col Jeffrey McCann serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Sep 2002		Third Annual AMOS Technologies Conference brings together approximately 320 people.	Support	Nelson, 2003
Oct 2002		Responsibilities of USSPACECOM, for which AEOS provides real time imaging, transferred to U.S. Strategic Command (USSTRATCOM).	Site Management	Duffner, 2009
Dec 2002		AEOS Burst Camera installed for observing gamma ray burst (GRB) optical afterglows.	Construction/Hardware Updates	AFRL Det 15, 2012f
2003		AEOS images Aegis Ballistic Missile Defense System missile intercept.	Programs and Technology	AFRL Det 15, 2012b
Jan 28 2003		AMOS takes images of the Space Shuttle *Columbia* in orbit four days before its reentry.	Public Good/Discoveries	National Aeronautics and Space Administration, 2003
2003		MHPCC serves as a testing site for hybrid small waterplane area craft (HYSWAC).	Public Good/Discoveries	Jane's, 2003
2003		AMOS team provides operational support for the *Columbia* accident investigation (STS-107).	Public Good/Discoveries	Ulibarri, 2011
Apr 04 2003	Jun 28 2003	Col Mark D. Stephen serves as AFRL/DE Director.	Site Management	AFRL Det 15, 2012c
Jun 02 2003		10–15 percent of AMOS's telescope time is allocated for non-defense research.	Support	Nelson, 2003
Jun 02 2003		Lt Col Jeffrey McCann reports that the MHPCC is managed by AFRL.	Site Management	Nelson, 2003
Jun 02 2003		Some of MSSC's basic research money is applied to look at novel ways to perform adaptive optics, one of which is the development of non-mechanical actuators. Some of the basic research dollars would be spent looking for new adaptive optics techniques for use five to ten years from now.	Construction/Hardware Updates	Nelson, 2003
Jun 29 2003	Sep 22 2006	Dr. L. Bruce Simpson serves as AFRL/DE Director.	Site Management	AFRL Det 15, 2012c
Sep 2003		Maui HiBrite laser demonstrates repeatable success in hitting retro-reflector satellites, including *Lageos*, *Explorer*, and *Geos*.	Programs and Technology	AFRL Det 15, 2012e
Sep 2003		Fourth Annual AMOS Technologies Conference, with 415 registered participants.	Support	Maui Economic Development Board, Inc., 2012
Oct 2003		Risk assessments and studies of the hazards associated with moving the 3.67-m telescope shows the best solution is to re-coat AEOS mirror at the top of Haleakala.	Programs and Technology	Phillips Research Site, 2005

Start	End	Event	Category	Source
Oct 10 2003		Senate allocates an additional $2.6 million to install medium-wave infrared adaptive optics on AEOS.	Political	"Maui's Defense Sector to Profit from FY 2003 Department of Defense Appropriations," Winter 2002–2003
2004		House and Senate authorizers recommend a $10 million increase beyond the $6.3 million DoD request for MSSC to fund the high accuracy network determination system (HANDS).	Political	"USAF Space Control Needs Cause Ops Tempo Surge at Maui Site," 2003
2004		NASA collaborates with AMOS in three main observation programs.	Support	Africano et al., 2004
2004		The High-Performance Software Applications Institute for Space Situation Awareness is established at the MHPCC.	Programs and Technology	Air Force Research Laboratory, AMOS Overview, undated
2004	2008	AEOS observes 21 GRB notifications with ten detected afterglows.	Public Good/Discoveries	Flewelling, 2009
Jan 2004	Jul 2004	Maj Kelly Hammett serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Mar 06 2004		Identification of J002E3 as an artificial satellite is placed within the research interests of AMOS.	Programs and Technology	Lambert, 2004
Mar 24 2004		Researchers use results from observations of large rocket bodies and satellites in both lower and geosynchronous Earth orbits at AMOS to study physical properties of orbital debris.	Support	Jorgensen, 2004
May 28 2004	Jun 04 2004	National Research Council (NRC) reviews the effectiveness of the Maui Astronomy Research Program, a program jointly funded and managed by AFOSR and NSF, in encouraging competitive research.	Study	Kahn, 2004
Jun 01 2004	Nov 30 2005	Maj Gen Perry L. Lamy serves as AFRL Commander.	Site Management	Wikipedia, 2011
Jun 15 2004	Jun 30 2006	Dr. Jim F. Riker serves as AMOS Branch Chief.	Site Management	AFRL Det 15, 2012f
Jul 2004		Football, a Maui-to-SOR handover experiment, demonstrates precision satellite handover.	Programs and Technology	AFRL Det 15, 2012e
Jul 2004	Jul 2005	Lt Col Brent Richert serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Aug 16 2004		AMOS provides assistance with development of *Cosmos 1*, the world's first solar sail craft..	Support	"Cosmos 1 Solar Sail Passes New Milestone," 2004
Sep 2004		Fifth Annual AMOS Technologies Conference, with 485 registered participants.	Support	Maui Economic Development Board, Inc., 2012
Nov 20 2004		Active Track program begins, which supports timely characterization, dim object detection, and exquisite characterizations of objects in space.	Programs and Technology	Phillips Research Site, 2006
2005		Significant increase in the cost of using the large AMOS telescope makes it impossible for the Maui Astronomy Research Program to continue.	Programs and Technology	Kahn, 2004

Start	End	Event	Category	Source
2005		The Senate Appropriations Committee, led by Daniel Inouye of Hawaii, mandates a study to assess whether the AFRL Maui site may be more effectively managed by the AFRL Space Vehicles Directorate rather than by AFRL/DE. The study concludes that MSSC should remain under AFRL/RD management.	Study	Vansuch, 2005
Mar 05 2005		Northrop Grumman awarded $201,000 to provide technical support to AMOS.	Site Management	Domenici, 2005
Jun 2005		Beam Director Telescope (BDT) roll-away enclosure completed, allowing low elevation projection for Critical Measurements and Counter-Measures (CMCM) 1 & 2 support. The roll-away replaces the original clamshell dome.	Construction/Hardware Updates	AFRL Det 15, 2012f
Jul 2005		AEOS High-resolution Visible and Infrared Spectrograph (HiVIS) spectropolarimeter operated by UH observes impact of Comet Tempel 1 as part of worldwide support for the NASA Deep Impact mission.	Public Good/Discoveries	AFRL Det 15, 2012f
Jul 2005	Jun 2007	Lt Col Janet Augustine serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Aug 2005		First two of four launches of the CMCM program conducted in collaboration with Missile Defense Agency (MDA) at AMOS. These long-range interactions and missile complexes provide invaluable data collection and analysis.	Programs and Technology	AFRL Det 15, 2012e
Sep 2005		Sixth Annual AMOS Technologies Conference, with 540 registered participants.	Support	Maui Economic Development Board, Inc., 2012
Oct 13 2005		AMOS 3.6-m telescope acquires some limited temporal photometry of the *Galaxy 15* satellite in its post-launch period, establishing a baseline photometric record. *Galaxy 15* is later discovered to have an anomaly.	Support	Larose, May 23, 2012
2006		Collaboration with NASA to assist in anomaly resolution of their Imager for Magnetopause-to-Aurora Global Exploration (*IMAGE*) satellite, which had stopped responding.	Support	AFRL Det 15, 2012g
2006		Congress appropriates $45.9 million to MSSC.	Political	George C. Marshall Institute, 2007
2006		MHPCC increases computational capability to over 60 teraFLOPS.	Construction/Hardware Updates	Ulibarri and Harvey, 2012
Jan 01 2006	Oct 31 2007	Maj Gen Ted F. Bowlds serves as AFRL Commander.	Site Management	Wikipedia, 2011
Apr 2006		Third and fourth launches of the CMCM program conducted in collaboration with MDA at AMOS. These interactions and missile complexes provide invaluable data collection and analysis.	Programs and Technology	AFRL Det 15, 2012e

Start	End	Event	Category	Source
Jun 02 2006		Manpower and money is allocated to improve MSSC technology, such as actuators, mechanical piston-like devices that continually reshape the deformable mirror to make adaptive optics possible, and the system's cameras, especially the CCD components in the cameras.	Construction/Hardware Updates	Nelson, 2003
Jun 02 2006		MSSC reports working on new algorithms to sharpen images of space objects, improving post-image processing.	Public Good/Discoveries	Nelson, 2003
Jul 01 2006	Jul 31 2008	Dr. Kip Kendrick serves as AMOS Branch Chief.	Site Management	AFRL Det 15, 2012f
Sep 10 2006	Sep 14 2006	Seventh Annual AMOS Technologies Conference brings together over 400 scientists, engineers, and technical managers from academia, industry, government, and the military.	Support	Maui Economic Development Board, Inc., 2012
Sep 22 2006	Jan 08 2007	Col Kirk M. Kloeppel (acting) serves as AFRL/DE Director.	Site Management	AFRL Det 15, 2012c
2007		AMOS engages in multiple methods to overcome atmospheric blurring.	Programs and Technology	Matson, 2007
2007		Congress appropriates $50.4 million to MSSC.	Political	George C. Marshall Institute, 2007
2007		With the financial support of AMOS, a multi-frame blind deconvolution (MFBD) algorithm called Physically-Constrained Iterative Deconvolution (PCID) is efficiently parallelized and is able to produce image restorations in only a few seconds.	Construction/Hardware Updates	Matson, 2007
Jan 08 2007	Oct 23 2010	Ms. Susan J. Thornton serves as AFRL/DE Director.	Site Management	AFRL Det 15, 2012c
Jun 2007	Jun 2009	Lt Col Mark Leonard serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Sep 12 2007	Sep 15 2007	Eighth Annual AMOS Technologies Conference brings together over 550 participants and included representation from across the United States, Australia, Bulgaria, Canada, France, Japan, Russia, Switzerland, and Taiwan.	Support	Maui Economic Development Board, Inc., 2012
Sep 18 2007		Senator Inouye requests $24 million in earmarks for MSSC.	Political	Needham, 2011
Nov 2007		Chinese antisatellite weapons test highlights the importance of national security space programs, resulting in Congressional appropriations $100 million above the President's budget request for programs aimed at improving U.S. SSA capabilities.	Political	George C. Marshall Institute, 2007
Nov 01 2007	Jan 31 2010	Maj Gen Curtis M. Bedke serves as AFRL Commander.	Site Management	Wikipedia, 2011
2008		Congress appropriates $41.4 million to MSSC.	Political	Mazol, 2010
2008		President's budget requests $5.2 million for MSSC, a significant decrease.	Political	George C. Marshall Institute, 2007

Start	End	Event	Category	Source
Jun 2008	Jun 15 2008	Given the possibility that Congress might reduce or eliminate add-ons in a political environment increasingly averse to congressional earmarks, as well as the eventual retirement of Senator Inouye, Major General Bedke forms a Task Force to determine the best way for the Maui site to end its dependency on congressional add-on funding.	Study	Crawford et al., 2008
Aug 01 2008	Apr 24 2012	Ms. Laura J. Ulibarri serves as AMOS Branch Chief.	Site Management	AFRL Det 15, 2012f
Aug 21 2008		Mirror recoat facility ribbon cutting ceremony.	Construction/Hardware Updates	Air Force Research Laboratory, 2008
Sep 16 2008	Sep 19 2008	Ninth Annual AMOS Technologies Conference brings together over 580 scientists, engineers, and technical managers from across the nation to listen and discuss the latest in SSA, military space capabilities, and related technologies.	Support	Maui Economic Development Board, Inc., 2012
Dec 2008		General Bedke (then AFRL/CC) charges Col Gary Hopper to plan for the financial and contractual changes necessary to make the Maui site solvent without congressional earmarks. Many of these changes support recommendations of the Maui Task Force and are given to the AFRL/RD to implement.	Study	Hopper et al., 2010
Dec 06 2008		The first Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) telescope, PS1, goes online.	Construction/Hardware Updates	Wikipedia, 2012
2009		AMOS operational support for the Astronaut Safety for Hubble Repair Mission.	Public Good/Discoveries	Ulibarri, 2011
2009		Congress appropriates $36.4 million to MSSC.	Political	Mazol, 2009
2009		Research paper uses Cray XD1 supercomputer located at MHPCC to explore the scalability of PCID as a function of the number of worker processors used in a worker process.	Programs and Technology	Matson, 2009
2009		Researchers conduct tests on turbulence compensation approach using AEOS telescope.	Programs and Technology	Vorontsov et al., 2009
Jul 2009	Oct 2010	Lt Col James Greer serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Sep 01 2009	Sep 04 2009	Tenth Annual AMOS Technologies Conference brings together more than 630 scientists, engineers, and technical managers from ten countries, including China, Japan, Italy, and Russia.	Support	Schumacher, 2009; Maui Economic Development Board, Inc., 2012
Sep 29 2009		Senator Inouye criticized for adding $208 million of earmarks, including a $20 million for Boeing's operation of MSSC.	Political	Smith, 2009
Feb 01 2010	Apr 30 2011	Maj Gen Dr. Ellen M. Pawlikowski serves as AFRL Commander.	Site Management	Wikipedia, 2011

Start	End	Event	Category	Source
Feb 04 2010		End of Active Track program.	Programs and Technology	AFRL Det 15, 2012e
Mar 11 2010		Control of the mount is lost and the AEOS telescope rotates in azimuth until it reaches the end of travel. The azimuth drive motor is the source of the failure. Over the next six months, the problem is explored and a method for removing the motor is developed.	Construction/Hardware Updates	AFRL Det 15, 2012h
May 13 2010		The first PAN-STARRS telescope, PS1, begins full-time science observations.	Construction/Hardware Updates	Wikipedia, 2012
May 19 2010	Jun 19 2010	AFRL/RD response to General Bedke's requests to implement some of the financial and contractual changes study and produce a modernization plan for the Maui site. This modernization plan intends to make the Maui site attractive to defense and intelligence community customers, making it more of an operational, rather than research, facility and eliminating its dependence on congressional add-on funding by (Fiscal Year) 2017.	Study	Thornton, May 19, 2010; Thornton, June 18, 2010
Aug 12 2010		The Optical Society of America selects Venkata S.R. Gudimetla, a senior research physicist at MSSC, as a senior member.	Site Management	Dailey, 2010
Sep 14 2010	Sep 17 2010	Eleventh Annual AMOS Technologies Conference brings together over 620 experts in the fields of space surveillance and optical systems development from all over the world.	Support	Maui Economic Development Board, Inc., 2012
Oct 01 2010	Apr 24 2012	Lt Col Michael Harvey serves as AFRL Det 15 Commander.	Site Management	AFRL Det 15, 2012f
Oct 24 2010		Dr. David Hardy serves as AFRL/DE Director.	Site Management	United States Air Force, 2011
Feb 2011		DoD awards UH cost reimbursement contract for research, development, operations, and management of the Maui Supercomputing Center.	Site Management	University of Hawaii, 2011
Feb 02 2011		Senator Inouye accepts two-year ban on earmark requests.	Political	Needham, 2011
May 13 2011	Jul 29 2012	Maj Gen Dr. William McCasland serves as AFRL Commander.	Site Management	Wikipedia, 2011
Jul 16 2011		First instance of photographed glow from atmospheric pressure disturbances generated by tsunami observed, raising hopes that the technique could be used to predict the arrival of future waves.	Public Good/Discoveries	Borg, 2011
Aug 2011		Nine months after the removal of the AEOS broken azimuth drive motor, a new motor for AEOS is delivered and reinstalled over the course of several weeks.	Construction/Hardware Updates	AFRL Det 15, 2012f
Sep 13 2011	Sep 16 2011	Twelfth Annual AMOS Technologies Conference, with 632 registered participants.	Support	Schumacher, 2011; Maui Economic Development Board, Inc., 2012

Start	End	Event	Category	Source
Sep 13 2011		Senator Inouye reaffirms his support for AMOS.	Political	Schumacher, 2011
Jan 19 2012		Hardy Modernization Plan seeks to engage defense customers. Under the plan, the Maui site proposes to offer two primary products for defense customers: a Wide Eye optical “space fence” and Narrow Eye for local search and characterization of deep space and dim objects.	Study	Hardy, 2012

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