OPERATING AND SITE DEVELOPMENT AGREEMENT

BETWEEN

THE SMITHSONIAN INSTITUTION
FOR ITS
SMITHSONIAN ASTROPHYSICAL OBSERVATORY

AND

THE UNIVERSITY OF HAWAII

CONCERNING THE
DESIGN, CONSTRUCTION AND OPERATION
OF THE
SMITHSONIAN SUBMILLIMETER ARRAY TELESCOPE
ON
MAUNA KEA, HAWAII

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OPERATING AND SITE DEVELOPMENT AGREEMENT

THIS AGREEMENT is made this 15th day of May, 1995, by and between the SMITHSONIAN INSTITUTION for its SMITHSONIAN ASTROPHYSICAL OBSERVATORY (hereinafter referred to jointly as "SAO") and the UNIVERSITY OF HAWAII (hereinafter referred to as "UH").

WHEREAS, the submillimeter region of the electromagnetic spectrum has shown great scientific potential for contributing to our understanding of the astronomical universe;

WHEREAS, the summit area of Mauna Kea is exceptionally well-endowed as a site for observations at these wavelengths;

WHEREAS, the SAO has initiated a program to construct and operate the Smithsonian Submillimeter Array Telescope (hereinafter referred to as "SMA"), and is desirous of locating the telescope and related facilities on Mauna Kea;

WHEREAS, SAO and UH believe that the best interests of both parties are to be served through a program of close scientific cooperation centered around this telescope and related facilities;

WHEREAS, the operation of the SMA on Mauna Kea will greatly benefit the academic and research programs at UH;

WHEREAS, SAO and UH have a common interest in insuring that the development of the Mauna Kea site will enhance the effective operation of this telescope;

WHEREAS, a Memorandum of Understanding was executed by SAO and UH on October 22, 1987, and subsequently revised by amendments, which provides that once SAO has identified funds for the construction and operation of the Submillimeter Array Telescope on Mauna Kea, an Operating and Site Development Agreement shall be negotiated between SAO and UH;

NOW. THEREFORE, in consideration of the mutual agreements herein contained, SAO and UH agree as follows:

I. DEFINITIONS

For purposes of construing the provisions of this Operating and Site Development Agreement, the following definitions apply:

"Base Support Facilities" refers to any possible headquarters in Hawaii for the operations of the SMA Telescope on Mauna Kea.

"BLNR" stands for the Board of Land and Natural Resources of the State of Hawaii.

"Demised Premises" refers to the land subleased to SAO by UH with the approval of the BLNR. The Demised Premises are a portion of that certain land area leased to UH by BLNR and described in General Lease S-4191, Exhibit A of Attachment A hereto, and more specifically identified in Exhibit C of Attachment A hereto; both Exhibits A and C are incorporated herein by reference.

"Easement" is that non-exclusive easement granted by UH to SAO under the terms of the Sublease.

"Facilities" include, but are not limited to, the Telescope; the Control Building (the space necessary to support scientific observers and technical personnel while at the summit); the Antenna Maintenance Building; together with receivers and other instruments, electrical conductors and cableways; driveways and parking lots; power, telephone and communications conduits and lines; and access roads within the border of the Demised Premises. "Facilities" does not include the Mid-Level Facilities, the Base Support Facilities, or any other facilities located outside the Mauna Kea Science Reserve.

"HELCO" stands for the Hawaii Electric Light Company, the public utility which provides electricity to the Mauna Kea Observatories.

"IfA" stands for the Institute for Astronomy and refers to that unit within UH which is responsible for conducting a research program in astronomy, and for representing the interests of UH on UH-leased land in the Mauna Kea Science Reserve.

"Information Station" is the building and associated infrastructure (access, parking, utilities) near the Mid-Level Facilities which is used as a public information building.

"Infrastructure Improvements" are any capital improvements made for the common good of the Mauna Kea Observatories including, but not limited to, roads, power, telephone and communications installations, and the Mid-Level Facilities.

"Instruments" include submillimeter radio receivers, and other special-purpose equipment used to detect and analyze radiation, together with computers, test equipment, and tools required to equip the Facilities.

"Major Astronomical Facilities" are: UH 88-inch Telescope, Canada-France-Hawaii Telescope (CFHT), NASA Infrared Telescope Facility (IRTF), United Kingdom Infrared Telescope (UKIRT), James Clerk Maxwell Telescope (JCMT), Caltech Submillimeter Observatory (CSO), Keck I, Keck II, VLBA Antenna, Japan National Large Telescope (Subaru), Gemini Mauna Kea, and the Smithsonian Submillimeter Array Telescope. Future telescope facilities forming a part of the Mauna Kea Observatories shall be considered "Major Astronomical Facilities" unless otherwise agreed in writing by UH.

"Mauna Kea Observatories" includes, but is not limited to, the Mauna Kea Science Reserve, the astronomical facilities and infrastructure improvements on Mauna Kea, and UH operations which support the astronomical facilities on Mauna Kea.

"Mauna Kea Science Reserve" is the land in the summit area of Mauna Kea consisting generally of that land above 12,000 feet altitude and specifically that which is leased by UH from the BLNR under General Lease S-4191.

"Mauna Kea Users' Committee" is the committee established by UH to serve as the official forum in which the Major Astronomical Facilities may discuss aspects of the management of the Mauna Kea Observatories. The committee is chaired by the Director of the IfA. Currently, each Major Astronomical Facility is entitled to two representatives on the Mauna Kea Users' Committee.

"Mid-Level Facilities" include, but are not limited to, the bedrooms, laboratories, common areas, and offices at Hale Pohaku on Mauna Kea.

"MKSS" stands for Mauna Kea Observatories Support Services, which is operated by UH through the IfA, and is responsible for providing services to support the Mauna Kea Observatories.

"MKSS Oversight Committee" is the committee established by UH to oversee the activities and management of MKSS and to recommend changes to the Director of the IfA. Currently each Major Astronomical Facility is entitled to one representative on the MKSS Oversight Committee.

"OSDA" stands for this "Operating and Site Development Agreement Between the Smithsonian Institution for its Smithsonian Astrophysical Observatory and the University of Hawaii Concerning the Design, Construction, and Operation of the Smithsonian Submillimeter Array Telescope on Mauna Kea, Hawaii," and to which is attached the Sublease and Non-Exclusive Easement. The rights and responsibilities of this OSDA shall not concern any other astronomical facilities on Mauna Kea which may involve SAO.

"Principal Parties" are SAO and UH, and refer to the Principal Parties to this OSDA.

"SAO" stands for the Smithsonian Astrophysical Observatory, which is the astronomical research unit of the Smithsonian Institution, a Trust Instrumentality of the United States of America; reference to SAO includes its parent organization, the Smithsonian Institution. The SAO is responsible for the construction and operation of the SMA.

"SMA" stands for the Smithsonian Submillimeter Array Telescope on Mauna Kea and the entire operation in Hawaii to support the Telescope including the Facilities, the SAO share of the Mid-Level Facilities, and any Base Support Facilities or other facilities that may be built or operated in Hawaii on behalf of SAO for this purpose.

"Sublease and Non-Exclusive Easement" is that agreement between SAO and UH, and approved by BLNR, attached hereto as Attachment A, including the exhibits thereto.

"Telescope" means the Smithsonian Submillimeter Array Telescope on Mauna Kea, to be located on the Demised Premises and used for astronomical observations.

II. LOCATION OF THE FACILITIES

The Sublease (Attachment A) specifies the location on Mauna Kea where the Facilities will be situated.

III. DESCRIPTION OF THE FACILITIES

The SMA shall include up to eight (8) antennas approximately six (6) meters in diameter and up to twenty-four (24) concrete observing pads approximately three (3) meters in diameter. The antennas will be positioned in various configurations on subsets of the observing pads and shall operate together as a radio interferometer. The Facilities will also include a Control Building, an Antenna Maintenance Building, service roads for transporting the antennas and underground utility and communications lines connecting the Control Building to the antenna pads.

Any Expansion of the SMA beyond eight (8) antennas shall require a new or amended OSDA and an additional infrastructure contribution as specified in Section VII.E.1.c.

IV. INTERACTION BETWEEN SAO AND UH

While the Principal Parties to this OSDA are SAO and UH, day-to-day interaction between them regarding design, construction and operation of the Facilities shall usually be carried out by specified representatives of SAO and UH or their designees. In the case of UH, the specified representative will normally be the Director of the IfA and, in the case of SAO, this will normally be the Director of the SAO.

V. SOLE RESPONSIBILITIES OF UH

A. Management of the Mauna Kea Observatories

UH shall provide a forum to allow the Major Astronomical Facilities which form a part of the Mauna Kea Observatories to discuss, on an equal footing, aspects of the management of the Mauna Kea Observatories. Such a forum currently exists and is referred to as the Mauna Kea Users' Committee. SAO, as representative of the SMA, shall be entitled to appoint two representatives to the Mauna Kea Users' Committee. Should this committee be replaced with another forum at some time in the future, SAO shall be entitled to participate on the same basis as the other agencies operating Major Astronomical Facilities. Since UH is the primary lessee with the State of Hawaii, it is recognized that final responsibility for management of the Mauna Kea Science Reserve resides with UH.

VI. SOLE RESPONSIBILITIES OF SAO

A. Design, Fabrication, Construction, Installation, and Operation of the Facilities

SAO shall be solely responsible for securing the funding for the design, fabrication, construction, installation, and operation of the Facilities. SAO commits to minimize any inconvenience which SMA construction activities may create for other telescope facilities.

B. Power and Communications Conduits and Lines

SAO shall fund and arrange for the installation of electric power and communications conduits from a handhole near the SMA site to the Facilities. These conduits shall conform to the standards for the existing summit power and communications distribution system. SAO shall also fund and arrange for connection of commercial power and telephone service via these conduits, both of which shall be individually metered. The relocation and upgrading of the summit power and communications loop in the vicinity of the SMA site is discussed in VII.E.1.c.

VII. RESPONSIBILITIES SHARED JOINTLY BY SAO AND UH

A. Research Environment

Under General Lease S-4191 between UH and BLNR (Exhibit A of Attachment A), UH is to use the Mauna Kea Science Reserve as a scientific complex and as a buffer zone to prevent the intrusion of activities inimical to said scientific complex. UH, in its role as custodian of the Mauna Kea Science Reserve, also carries the responsibility to protect the site from interference that may emanate from within or from outside the Mauna Kea Science Reserve.

1. UH:

a. UH shall continue to protect the interests of the astronomical facilities in the Mauna Kea Science Reserve from interference emanating from within the Mauna Kea Science Reserve which would affect the scientific integrity of the sites on which the astronomical facilities are located.

b. UH shall continue to pursue actively the initiation, improvement, and enforcement of such laws and ordinances as may be necessary to ensure that radio-frequency emissions from outside the Mauna Kea Science Reserve do not interfere with radio astronomy observations.

2. SAO:

SAO shall conduct its activities in the Mauna Kea Science Reserve in a manner compatible with and not inimical to the activities of other astronomical facilities located there and shall conform to applicable regulations established by UH, by the State of Hawaii, and by the United States of America for the preservation of the environmental quality and the scientific integrity of the Mauna Kea Science Reserve.

B. Permits

1. UH:

UH shall submit to the appropriate local authorities, and on behalf of SAO or its designee(s), such applications for permits connected with the Facilities, the Mid-Level Facilities and Base Support Facilities as are required and have been prepared by SAO for use of State of Hawaii land.

2. SAO:

SAO or its designee(s) shall prepare such applications for permits connected with the Facilities, the Mid-Level Facilities and Base Support Facilities as are required for use of State of Hawaii land.

C. Rights of Access

1. UH:

UH shall ensure SAO right of access to the Demised Premises and to such portions of the Facilities which may be located outside the Demised Premises. UH shall ensure right of access to a handhole or handholes for the commercial power, telephone, and data communications described in VI.B and VII.E.1.c, under the conditions described therein. UH shall grant to or use its best efforts to obtain for SAO such other rights of access as may be needed for utilities and cableways.

2. SAO:

SAO shall pay any costs, fees or other charges associated with the rights of access described in VII.C.1.

D. Access Roads to the Facilities

1. UH:

UH shall provide to SAO the use of existing roads for access to the Facilities. The existing roads in the vicinity of the Mauna Kea summit are shown in Attachment B. Improvement to existing roads is discussed in VII.E.1.c.

2. SAO:

SAO shall design, construct, and exclusively fund the paving of the approximately 90-foot section of the Pu'u Poliahu Road between the junction with the Mauna Kea Detour Road and the SMA parking lot, which design shall be subject to approval by UH and BLNR.

SAO shall ensure that neither the construction of the Facilities nor the above-mentioned road improvements result at any time in a blockage of vehicular access to other telescope facilities.

E. Infrastructure Improvements Shared in Common with Other Facilities at the Mauna Kea Observatories

UH has taken responsibility to fully or partially fund and arrange for infrastructure improvements to the Mauna Kea Observatories which are and will be of common benefit to all the astronomical facilities which operate there. All such infrastructure improvements are subject to State and County permits, approvals, and funding.

1. Commercial Power, Communications Conduits and Lines, Road Improvements, and Planning

a. Description of Improvements:

UH has completed the installation of commercial electric power to Hale Pohaku and to the Mauna Kea summit. At the summit, the power is distributed by means of a distribution loop (not yet complete), comprising two conduits containing the electrical cables, and conforming to HELCO standards, which passes near each of the existing astronomical facilities and also near some of the sites proposed for future facilities. Each facility accesses the commercial power by connecting to the distribution loop at a suitable handhole near its location. UH has also provided two communications conduits from Hale Pohaku to a central point at the summit, and from there to a distribution system comprising two or more conduits which generally follows the same path as that used for the power. UH has installed fiber-optic cable in one of these conduits. This cable is part of the Mauna Kea Observatories Communications Network, a high-bandwidth communications system which is intended to link the facilities of the Mauna Kea Observatories with each other, with base facilities, and with commercial carriers which can provide links to home institutions and other institutions around the world. UH has completed

improvement and paving of the upper section of the Mauna Kea Access Road (above elevation 11,800 feet) and of the connecting roads to the existing facilities at the summit.

b. Access to Existing Improvements by SAO:

For purposes of the SMA, SAO shall have access to the infrastructure improvements described in VII.E.1.a. as follows:

(i) Commercial power for the Facilities to a peak capacity of 750 kVA. The Facilities shall connect to the commercial power and telephone service and to the communications conduits as described in VI.B. and VII.E.1.c.

(ii) Use of the access roads within the Mauna Kea Science Reserve subject to the conditions given in VII.D.

(iii) The right to join the Mauna Kea Observatories Communications Network and to participate in the network on the same terms as other network members. The costs associated with connecting the Facilities to the network shall be borne by SAO.

c. Contribution to Future Infrastructure Improvements by SAO:

SAO shall contribute a total of ONE MILLION, NINETY-EIGHT THOUSAND, FOUR HUNDRED TWENTY-FIVE Dollars ($1,098,425) (in second-half 1994 dollars, with adjustment to current dollars following the most recently published State of Hawaii All Urban Consumers Price Index), toward the cost of continued development of the Mauna Kea Infrastructure. This infrastructure contribution shall first be used to fund seven specific improvements, to the extent that these funds allow, and in the following order of priority:

(i) Installation of new electrical switch units (expected to be two PME-9 units) near the SMA site and extension of the primary electrical feeders from the existing PME-9 switches to the new ones, together with the required HELCO fees to connect this circuit.

(ii) Any expansion or upgrading of the summit communications distribution system, including the associated utility connection fees, which is essential to provide minimum but adequate communications services to the SMA. This shall include extension of the communications conduits from their current termination at the Subaru site to a handhole near the SMA site.

(iii) Widening and paving of the approximately 350-foot section of the Mauna Kea Detour Road between the spur road into the James Clerk Maxwell Telescope and the junction with the Pu'u Poliahu Road (see Attachment B). The portion of the SAO infrastructure contribution used to fund this improvement shall be the actual cost or ONE HUNDRED THOUSAND DOLLARS ($100,000), whichever is less.

(iv) Extension of the electric power distribution system from its current termination at the Subaru site to a handhole near the SMA site. This will close the power distribution loop.

(v) Provision of a 480 V service to a mutually agreed location near the outer limits of the SMA to provide power for the testing of future telescope sites.

(vi) Improvement of the power and communications distribution system in the vicinity of the James Clerk Maxwell Telescope and the Caltech Submillimeter Observatory.

(vii) Preparation and implementation of an Historic Preservation Management Plan for the Mauna Kea Science Reserve, as required by the State Historic Preservation Division.

SAO shall arrange for the design of items (i) through (vi) above and for the construction of items (i) through (v). SAO shall also arrange for the construction of item (vi), provided that this can be accomplished in conjunction with items (i) through (v). The design shall conform to the standards for the existing summit power and communications distribution system, and for the existing improved access roads at the summit and shall be subject to approval by UH, by HELCO, by GTE Hawaiian Tel, and by the Hawaii State Department of Land and Natural Resources. All contractors involved with these improvements to the power, communications and road infrastructure shall be required to specify the associated costs separately from the costs for any other work, both in the initial bids and in the final invoices. Before any contracts for these improvements are let, SAO shall provide UH with a cost estimate for the improvements, which figure may include a contingency factor up to 10% and be subject to revision following the receipt of actual bids for the improvements. If UH approves this cost estimate, as revised, then UH shall authorize SAO to use a portion of its infrastructure contribution to pay for the actual cost of these improvements, as verifiable by contractors' invoices, up to a maximum amount equal to the above-mentioned cost estimate, as revised, or the entire contribution, whichever is less. Should the contractor(s) default or otherwise fail to complete these improvements necessitating additional contracts and/or expense, or should major change orders be required, then SAO shall provide UH with a new cost estimate. If UH approves this new cost estimate, SAO may continue to use a portion of its infrastructure contribution to pay for the actual cost of these improvements, as verifiable by contractors' invoices, up to a maximum amount equal to the new cost estimate or the entire contribution, whichever is less.

Should the SAO infrastructure contribution be insufficient to complete items (i), (ii), (iv), (v), and (vi) above, then UH shall use its best efforts to secure the necessary additional funds from the infrastructure contributions of other Major Astronomical Facilities. Should UH be unsuccessful in obtaining all of the necessary additional funds, then the available funds, including the entire SAO infrastructure contribution, shall be applied to items (i) through (vi) in order of priority with the limitation that only SAO infrastructure funds shall be applied to item (iii), to a maximum of the actual cost or ONE HUNDRED THOUSAND DOLLARS ($100,000), whichever is less. UH and SAO may mutually agree to alter the scope and relative priority of these items. In accordance with the above, should the SAO infrastructure contribution be insufficient to complete items (i) through (vi), SAO shall not be obligated to contribute any amount towards these improvements

beyond the total of its infrastructure contribution as specified above, and UH shall not be obligated to contribute any amount beyond that amount which it may, through its best efforts, be able to secure from the infrastructure contribution of other Major Astronomical Facilities.

Should the SAO infrastructure contribution exceed the amount needed to fund items (i) through (vii) above, then UH shall be free to use such excess funds for other infrastructure improvements which UH considers desirable.

SAO shall make this infrastructure contribution on or before THIRTY (30) days after the execution of this OSDA. UH agrees that SAO may withhold from the payment an amount equal to the approved cost estimate for any infrastructure improvements described in VII.E.1.c.(i) through (vi) above which SAO shall undertake. Should the approved cost estimate equal or exceed the SAO infrastructure contribution, then SAO may withhold the entire contribution. Following acceptance of the work and within NINETY (90) days of the receipt of final invoices, SAO shall provide UH with a final accounting of the cost of these infrastructure improvements, and shall remit to UH the amount, if any, by which the sum withheld exceeds the actual cost.

The Principal Parties may agree to have SAO arrange for other infrastructure improvements (in addition to items VII.E.1.c.(i) through (vi) above), in which case actual costs up to an agreed limit shall be reimbursed by UH.

Should SAO choose to install additional antennas so that the total number of antennas exceeds eight (8), then the new or amended OSDA (see III above) shall require an additional infrastructure contribution by SAO, which shall equal the contribution which would normally be assessed on the entire expanded facility less the contribution specified herein, with all amounts adjusted to current dollars at the time of expansion.

2. Mid-Level Facilities

The Principal Parties agree to negotiate in good faith in order to meet the requirements of the SMA for space at the Mid-Level Facilities. If necessary, UH shall use its best efforts to arrange for the expansion of the Mid-Level Facilities to accommodate additional dormitory space for the SMA. If the SMA elects to participate in the Mid-Level Facilities, this participation, including any possible expansion, shall be governed by the terms of a separate agreement negotiated between SAO and UH. The cost for SAO's space at the Mid-Level Facilities shall be borne by SAO.

3. Information Station

a. UH:

UH expects that it may be in the best interests of the astronomical facilities forming a part of the Mauna Kea Observatories to expand the Information Station at some future time. UH shall consider this possibility and pursue it if this becomes appropriate.

b. SAO:

(i) SAO shall fund the initial costs of the design and installation of an Information Station display for the SMA, which display is subject to the approval of UH.

(ii) SAO shall in good faith entertain proposals by UH for the expansion of the Information Station and for additional outreach activities associated with the SMA.

c. UH and SAO:

UH and SAO agree to each work toward funding, at an appropriate level, an Information Station and outreach program associated with the SMA.

4. Other Infrastructure Improvements to the Mauna Kea Observatories

It may become necessary or desirable for the greater benefit of the astronomical facilities that form a part of the Mauna Kea Observatories to construct infrastructure improvements beyond those described in VII.E.1. through VII.E.3. If such infrastructure improvements are funded entirely by contributions from new funding sources (e.g., new astronomical facilities which join the Mauna Kea Observatories) and/or UH, then the SAO shall enjoy access to such improvements on an equal footing with the other astronomical facilities. If such infrastructure improvements require contributions from some or all of the astronomical facilities for which there are signed Operating and Site Development Agreements with UH, then the SAO shall have access to such improvements, and SAO shall be liable to contribute to the cost of such improvements, only if and to the extent that SAO and UH have agreed in writing to such access and contributions. If SAO elects to participate in any such improvements, SAO and UH shall negotiate in good faith to determine the fair share of the cost of such improvements which SAO shall contribute. The amount of this fair share shall be set forth in separate written agreements and normally shall be based on the fractional utilization by SAO of any such improvements. In cases where utilization is not readily quantifiable, the share paid by SAO shall not exceed a fraction, the numerator of which is ONE (1), and the denominator of which is the number of subleases, including the SAO Sublease, which have been executed for land within the Science Reserve for separately identified telescope facilities.

F. Base Support Facilities

1. UH:

UH shall use its best efforts to secure Federal funding for a building in the University of Hawaii at Hilo University Park and to make suitable space (approximately 12,000 square feet) available on a rent-free basis in this building for a SMA base facility. The SMA shall be responsible for its share of operating expenses such as utilities, janitorial services, building and grounds maintenance, etc. Should UH be unsuccessful in securing the above-mentioned space, all other provisions of this OSDA shall remain unchanged. If UH is unsuccessful in obtaining the above-mentioned space or if SAO chooses not to accept such space, then at SAO's option, and

subject to the authorization of the UH Board of Regents, UH shall sublease to SAO, at a nominal cost of $1.00 per year, a site within the University Park for a SMA base facility. The description of the site and other particulars of this arrangement will be specified in the above-mentioned sublease agreement. SAO shall be under no obligation to accept either the above-mentioned space or the base facility site.

2. SAO

If SAO elects to site its Base Support Facilities in the University of Hawaii at Hilo University Park, it shall do so in a manner which fosters cooperation with the University of Hawaii at Hilo and with the other telescope projects located on the same premises.

G. Operations and Maintenance

1. UH:

a. UH shall provide services on a basis of no profit, no loss to SAO through Mauna Kea Observatories Support Services (MKSS). Such services may include, but shall not be limited to: food and lodging; library; fuel, water and utilities; data communications; road maintenance; snow removal; emergency services; public information services and access control; and general administration.

b. The cost of MKSS services shall be shared among the astronomical facilities operating or under construction at the time the costs are incurred. For some services the costs may be allocated to each facility as shares. For others a rate will be set and the charge to the facility will be based on actual utilization of that service. Each year, in its budget, MKSS will establish the shares and rates so that projected costs equal projected revenue for each service. MKSS will adjust said shares and rates if actual expenditures or revenues differ significantly from the projections.

c. SAO, or its designee, shall be represented on the MKSS Oversight Committee, which reviews MKSS activities, recommends changes to the activities, and reviews and makes recommendations on the MKSS budget.

2. SAO:

a. SAO shall provide the funds necessary to operate and maintain the Facilities.

b. SAO shall pay the SMA's share of the cost of MKSS services as described in VII.G.1. Said share shall include all MKSS services except as follows:

(i) public information services are not included until first light;

(ii) library is not included until the SMA becomes a participant in the Mid-Level Facilities;

(iii) data communications is not included until the SMA becomes a participant in the Mauna Kea Observatories Communications Network.

c. SAO shall fund the cost of operating and maintaining the power and communications lines from the handhole described in VI.B. to the Facilities.

H. Sublease and Non-Exclusive Easement

Immediately upon execution of this OSDA, and for so long as it shall remain in force, UH and SAO shall each fulfill all of their respective obligations as specified in Attachment A hereto.

VIII. DELEGATION OF RESPONSIBILITIES BY SAO

SAO may delegate certain of its obligations and responsibilities hereunder to other agents for the purpose of constructing or operating the Facilities. However, it is understood and agreed that SAO shall remain ultimately responsible for the obligations and responsibilities undertaken by it in this OSDA.

IX. ADDITION OF PARTNERS AND ASSIGNMENT OF RIGHTS BY SAO

In the event that SAO decides that it would be beneficial to involve a scientific partner or partners in the construction and/operation of the SMA through financial or in-kind contributions and/or entitlement to observing time, SAO shall inform the Director, IfA, in writing, of the identity of the partner(s) and of the terms and conditions of such partnership. Provided that: SAO continues to be the principal party with the ultimate responsibility for the project; that the SMA continues to comprise no more than eight (8) antennas; that the additional partners agree to be bound by the terms of the OSDA; and that the addition of the partners is not detrimental to the interests of UH; then UH shall agree to the addition of the partner(s) and UH and SAO shall negotiate in good faith any amendments to the OSDA which may be necessary to take account of such additional partners. UH and SAO agree that under the above-mentioned circumstances, the following sections of the OSDA shall not be amended unless there is mutual agreement to do so: III., VII.E.1.c., X.A., X.B., X.C., X.G. Nonetheless, anything herein to the contrary notwithstanding, any assignment of an interest in the SMA shall be bound by paragraph III.F. of the Sublease and Non-Exclusive Easement Agreement and shall require the prior written consent of the UH Board of Regents, the State of Hawaii Board of Land and Natural Resources and any other bodies whose consent is required under the terms of the General Lease, the Sublease or other agreements and documents.

X. SCIENTIFIC COOPERATION

In recognition of the potential for scientific interaction between SAO and UH which the Facilities offer, and of the contribution of UH in making the site available for the SMA, SAO and UH agree on the following matters with regard to the operational phase of the Facilities.

A. UH Use of the Facilities

1. UH-sponsored programs shall receive observing time on the Facilities as follows:

a. UH shall be entitled to a guaranteed fraction of the observing time according to whichever one of the following applies:

(i) should SAO, subject to the availability of funds, endow the Fellowships Program at the Institute for Astronomy, as specified in X.C.1 below, then henceforth the UH guaranteed fraction shall be 12.5%;

(ii) during a Fellowships Period, as specified in X.C.2.e below, the UH guaranteed fraction shall be 12.5%;

(iii) if neither (i) nor (ii) apply, then the UH guaranteed fraction shall be 15%.

b. UH observing time shall be equally distributed over the seasons of the year and over other observing conditions, such as, for example, precipitable water. For the purpose of determining the UH entitlement, observing time does not include engineering time, which is telescope time whose purpose is not astronomical research but is rather the testing, development or maintenance of the Telescope.

c. It is expected that most observing programs will not be assigned to specific time intervals far in advance of the observations. Rather, the programs will be assigned to one of several queues depending on the atmospheric conditions and array configuration required. Day-to-day scheduling of the SMA will entail selecting programs from the queues in accordance with the current configuration and with the current or expected atmospheric conditions.

d. Allocation of observing programs to the various queues shall take place at regular intervals of no more than six (6) months.

e. The allocation of programs to the queues and the day-to-day scheduling shall be performed so as to achieve an actual utilization of the SMA for UH programs which is in accordance with 1.a. and b. above. If, at the end of an interval, there should be a discrepancy between the actual UH observing time and the entitlement specified in 1.a. above, then said discrepancy shall be corrected as quickly as practicable by adjusting the allocation and scheduling of subsequent intervals.

f. In the event of a major failure of the Facilities, the resulting lost observing time shall be accommodated by reducing the UH entitlement and the entitlement of the SAO in the same proportion.

g. Only proposals having a UH-affiliated Principal Investigator, and forwarded by the IfA Director, shall be considered in allocating the UH share of observing time. UH shall be solely responsible for evaluation and selection of proposals to be included in the UH allocation of time. The selection shall be made on the basis of scientific merit. There shall be no restrictions on the eligibility of co-investigators to collaborate on observing programs utilizing the UH observing time.

h. Detailed scheduling of observing time is the responsibility of the SAO Director, who may designate another individual to be in charge of this process with regard to the UH share of observing time.

i. In the event that SAO and UH both forward proposals for the same time-critical observation, the SAO Director or individual scheduling the Facilities shall attempt to achieve a resolution satisfactory to SAO and UH. If this cannot be achieved, selection between the proposals shall be done by the SAO Director on the basis of scientific merit.

j. SAO and UH recognize that, in order to achieve the full scientific potential of the SMA, it may be necessary to adopt innovative and flexible approaches to the scheduling of the Facilities. Subject to operational constraints, both SAO and UH are entitled to re-allocate observing time between their own approved programs so as to maximize the scientific return. Any re-allocation which reschedules time allocated to UH and time allocated to SAO requires prior agreement of the directors of both the SAO and the IfA.

2. UH-sponsored observers shall receive technical and logistic support while using the Facilities and shall have access to the Facilities, all on the same basis as SAO-sponsored observers.

3. UH-sponsored personnel shall be subject to the authority of the SAO Director or his/her designee when using the Facilities.

4. Data obtained by UH observers during UH time on the SMA shall be proprietary to UH and subject to UH policy for eighteen (18) months after their collection. UH may request the SAO Director to extend this proprietary period for valid scientific reasons, said extension not to be unreasonably withheld. After the proprietary period, the data shall become available to any qualified researcher in accord with normal practice for complex astronomical observations.

5. Persons eligible for the UH time shall not compete as Principal Investigators for additional time on the SMA.

B. SAO Visiting Scientists at the IfA

UH shall accept up to two (2) SAO scientists at any one time as long-term visitors to the Institute for Astronomy (IfA), subject to approval of each visitor by the IfA Director. Such visitors shall have access to the Mauna Kea radio telescopes (those telescopes whose normal operations are at wavelengths of about 300 microns or greater) on the same basis as IfA faculty, and to other Mauna Kea telescopes in accordance with the IfA policy for long-term visitors. SAO shall be responsible for the costs associated with such visitors, which costs shall be those which are normally charged to a faculty member's research grant, except overhead.

C. Fellowships

UH shall establish a Fellowships Program at the Institute for Astronomy. SAO shall support this program either through an endowment or through annual contributions.

1. Endowment

If SAO elects to support the Fellowships Program by means of an endowment, then it shall do so by paying to UH the sum of ONE MILLION FIVE HUNDRED THOUSAND DOLLARS ($1,500,000). This sum is expressed in second-half 1994 dollars and shall be adjusted to current dollars at the time of payment using the most recently published State of Hawaii All Urban Consumer Price Index. SAO may endow the program at any time, provided that it has given UH at least six (6) months' notice of its intention to do so. UH may, at its discretion, reduce or waive this requirement for notice.

2. Annual Contributions

If SAO elects to support the Fellowships Program by means of annual contributions, then the following shall apply:

a. The contribution amount shall be ONE HUNDRED THOUSAND DOLLARS ($100,000). This sum is expressed in second-half 1994 dollars and shall be adjusted to current dollars at the time of payment using the most recently published State of Hawaii All Urban Consumer Price Index.

b. The contribution, unless suspended, shall be paid by SAO to UH on or before 20 September each year, unless another date is mutually agreed to by SAO and UH.

c. SAO and UH expect that the initial contribution will be made in 1997, coincident with the start of SMA operations. The foregoing notwithstanding, SAO shall be free to postpone the initial contribution to a later year consistent with the actual schedule of SMA operations and with the availability of funding. SAO shall give UH at least three (3) months' written notice of its intention to make the initial contribution. UH may, at its discretion, reduce or waive this requirement for notice.

d. SAO expects that, after the initial contribution, it will make contributions in each subsequent year. Nonetheless, SAO shall be entitled to suspend its ongoing contributions, provided that it gives UH written notice of its intention to do so at least ten (10) months in advance of the agreed payment date as specified in b. above, and provided further that SAO shall not suspend its contribution for the year immediately following the year of the initial contribution or for the year immediately following a year in which contributions are resumed after a suspension. Thus SAO guarantees to fund the program for at least two years at the start and at any resumption following a suspension. SAO shall give UH at least three (3) months' written notice of its intention to resume contributions following a suspension. UH may, at its discretion, reduce or waive this requirement for notice.

e. For each contribution of $100,000, SAO and UH shall specify a one (1)-year period of the SMA observing schedule which will be associated with this contribution. This period shall be called a Fellowships Period and shall begin at the start of the first scheduling interval following the date of the contribution, unless SAO and UH mutually agree that it shall begin on some other date.

D. UH Participation in SMA Committee Structure

UH shall be entitled to have either one representative, or representation in proportion to its guaranteed share of observing time, whichever is greater, on all scientific and policy-setting committees associated with the SMA.

E. Facilities Attribution

In all publications and news releases regarding results obtained from work performed at the Facilities, the SMA shall be given appropriate credit and shall be referred to as the "Smithsonian Astrophysical Observatory Submillimeter Array". Results obtained at the Facilities by IfA faculty shall have credit for these results also given to "the University of Hawaii, Institute for Astronomy" in any publications or news releases.

F. Interaction with News Media

Except for the publication of scientific results, institutional interactions with news media shall be coordinated between SAO and UH. UH and/or SAO may request one another to coordinate specific media events. Each party shall keep the other informed of press releases, filming and live television transmissions.

G. SAO Collaboration with other Major Astronomical Facilities

SAO may carry out scientific collaborations with other Major Astronomical Facilities, either in the form of cooperative observations or by the formation of a combined interferometer. UH may participate in the use of any combined interferometer within its allocation of time on the telescopes involved. SAO shall be permitted to install, at no expense to UH, underground communications conduits containing fiber-optics and other communications links between the

SMA and other Major Astronomical Facilities. These conduits and communications links must be separate from those of the Mauna Kea Observatories Communications Network. This permission is subject to UH approval of the detailed design, which approval shall not be unreasonably withheld. UH shall not require any fee or other consideration in return for the permission to install the above-mentioned conduits and communications links. This collaboration between SAO and other Major Astronomical Facilities shall not be construed as an expansion of the SMA in the context of Section III above.

XI. GENERAL LIABILITY AND INSURANCE

SAO shall, at all times, exercise due care for safety, and be liable for any loss, liability, claim, or demand for property damage, personal injury, or death arising out of any injury, death, or damage on the Demised Premises caused by or resulting from any negligent activities, operations, or omissions of SAO, its officers, employees, agents, or invitees, on or in connection with the Demised Premises subject to Federal law, including, the Federal Tort Claims Act, as amended, and where not inconsistent therewith, to applicable laws of the State of Hawaii governing liability.

Additionally, SAO shall maintain Commercial General Liability Insurance for personal injury or death and property damage in a minimum amount of FIVE MILLION DOLLARS/U.S. ($5,000,000/U.S.) per occurrence. Such insurance shall name UH and the State of Hawaii as additional insureds. UH shall retain the right at any time to review the coverage, form, and amount of the insurance required hereby. If, in the opinion of UH, after discussion with SAO, the insurance provisions in this Operating and Site Development Agreement do not provide adequate protection for UH, UH may require SAO to obtain insurance sufficient in coverage, form, and amount to provide adequate protection. The requirements of UH shall be reasonable but shall be designed to assure protection from and against the kind and extent of the risks which exist at the time a change in insurance is required. A Certificate of Insurance evidencing that said insurance is in full force and effect shall be deposited with the Director of Procurement and Property Management, University of Hawaii, 1400 Lower Campus Road, Room 15, Honolulu, Hawaii 96822, U.S.A.

XII. ATTORNEY'S FEES

SAO and UH shall each pay their own attorney's fees and any other legal expenses.

XIII. SERVICE OF PROCESS

The United States Attorney within the State of Hawaii is duly authorized to accept service of process on behalf of SAO.

XIV. GOVERNING LAW: SEVERABILITY

The validity, construction and performance of this OSDA and the legal relations among the parties to this OSDA shall be governed by and construed in accordance with the laws of the State of Hawaii, excluding that body of law applicable to choice of law. In the event any provision of this OSDA shall be held by a court of competent jurisdiction to be contrary to law, the remaining provisions of this OSDA shall remain in full force and effect.

XV. AMENDMENTS TO THIS OSDA

This OSDA may be amended in writing at any time by mutual agreement of SAO and UH.

XVI. TERM OF THIS OSDA

This OSDA shall become effective on the date first above written to execute this document or the effective date of the Sublease, whichever is later, and shall terminate as provided in XVIII.

XVII. RENEGOTIATION OR EXTENSION OF THIS OSDA

If UH and the BLNR either renegotiate or extend General Lease S-4191 beyond December 31, 2033, or if UH obtains a lease providing the same general terms and conditions as General Lease S-4191 for a period beyond December 31, 2033, UH shall extend this OSDA accordingly, except that SAO and UH agree to negotiate in good faith any revisions to this OSDA proposed at the time by either SAO or UH.

XVIII. TERMINATION

This OSDA shall be terminated upon the first of any of the following events to occur:

1. Mutual written agreement of SAO and UH.

2. Termination of the Sublease.

3. Termination of management or operation of the Facilities by SAO or its assignee, if any, as approved under Section VIII.

4. December 31, 2033, when General Lease No. S-4191 terminates if there are no extensions or a superseding General Lease as described in XVII.

5. The expiration date of any superseding General Lease or extension of General Lease S-4191 as contemplated in XVII.

XIX. DISPOSITION OF FACILITIES ON TERMINATION

Disposition of the Facilities on termination shall be conducted pursuant to the provisions of the Sublease.

IN WITNESS WHEREOF, the parties hereto have executed these presents on the day and year first above written.

FOR THE UNIVERSITY OF HAWAII:

By Donald N. B. Hall 5/15/95
Donald N. B. Hall — Date
Director, Institute for Astronomy

By Ralph T. Horii, Jr. 5/15/95
Ralph T. Horii, Jr. — Date
Senior Vice President for Administration

By Kenneth P. Mortimer 5/15/95
Kenneth P. Mortimer — Date
President

FOR THE SMITHSONIAN INSTITUTION:

By Irwin Shapiro 4/28/95
Irwin Shapiro — Date
Director, Smithsonian Astrophysical Observatory

By John G. Harris 4/28/95
John G. Harris — Date
Contracting Officer, Smithsonian Astrophysical Observatory

Approved as to form:

By Harriet Y. Lewis 4/18/95
Harriet Y. Lewis — Date
Deputy Attorney General
State of Hawaii

5. The expiration date of any superseding General Lease or extension of General Lease S-4191 as contemplated in XVII.

XIX. DISPOSITION OF FACILITIES ON TERMINATION

Disposition of the Facilities on termination shall be conducted pursuant to the provisions of the Sublease.