Atacama Large Millimeter Array

Joint ALMA Office

Quarterly Report

for the period ending

30 September 2002

Contents

1. Activities of the Joint ALMA Office

As this is the first written report from the JAO, we include all significant activities since the establishment of the Office on June 1, 2002, although there is an emphasis on the activities of the last quarter.

1.2 Project Organization and Management

1.2.1 Meetings, Reporting, and ALMAEDM

The JAO has established two routine teleconferences. First, the Office itself meets every Thursday at 1300UT. Second, the Office and all IPT leaders and deputy leaders meet every other Monday at 1430UT.

Formal reporting is monthly. Reports from the European and North American teams are combined with a report from the JAO into a Monthly Report submitted to the ALMA (Coordinating Committee) Board at the middle of the month or seven days before an (ACC) Board meeting, which ever is first.

All official ALMA documents can be found in the ALMA Electronic Document Manager (ALMAEDM), a software system for entering, controlling, and archiving documents. It is the mechanism for implementing configuration control in ALMA. Access to ALMAEDM is limited to ALMA personnel and others requiring access. Password requests should be submitted to Stacey Oliver [soliver@nrao.edu]. ALMAEDM can be accessed at http://almaedm.tuc.nrao.edu.

1.2.2 Project Plan

A major activity of the JAO has been the completion of the Project Plan. This is the defining document for the Project. On September 17, 2002, the ACC approved the draft dated "September 9" subject to the revision of Figure 3.1 according to instructions the ACC gave. It was also understood that at the October 29, 2002, meeting of the ACC a new draft of the Project Plan with a budget and more detailed schedules would be submitted for ACC approval.

The JAO has been working with the IPTs to produce Level-2 Milestones and with the Executives to produce a combined Project budget. We have also called for comments and suggestions on the text of the Project Plan from members of the ACC who have now had a opportunity to study the September 9 draft more carefully. The new version of the Project Plan will be submitted to the ACC membership on or before October 22.

The preparation of Level-2 Milestones and the Project Budget has required considerable work on the part of the Executives teams. The entire project has been re-costed, with attention to schedule and risk.

1.2.3 Visits to Work Sites

Since June 1, 2002, the JAO has made visits to nearly all sites of major ALMA work packages. In North America, the three NRAO sites, Charlottesville, Socorro, and Tucson, have received multiple visits, either specifically for the purpose of reviewing the status of the work, or in connection with meeting for other purposes. The sole North American site that remains to be visited is the Herzberg Institute of Astrophysics, Victoria, BC, Canada.
In Europe, multiple visits have been made to locations of antenna prototype construction. In addition, a tour was made of institutes doing development work that are candidates for production contracts. These include: SRON in Groningen, The Netherlands; RAL in Oxford, United Kingdom; Bordeaux Observatory in Bordeaux, France; and IRAM in Grenoble, France. Sites remaining to be visited include: OSO in Onsala, Sweden; . . .

The purpose of all these visits was to communicate the change in the nature of the Project as it moves from design and development to construction. The plans of each of groups for meeting the challenge of production were discussed. The result of this assessment for the JAO is the conviction that the Project can be successful if properly managed. The most critical actions to be taken in this regard are: the strengthening of the Systems Engineering IPT, a re-orienting of the Front End IPT toward production, and the development of an antenna procurement strategy.

1.1.4 Safety Team

As construction begins and activities on the high site increase, it is necessary to have an ALMA Safety Plan with well-defined policies. Contractors must be provided with these policies and the ALMA team must be educated and trained to follow these policies. To that end an ALMA Safety Working Group has been appointed, as part of the project management function. The membership of the Working Group is: M. Boecker, J. Eschwey, and U. Varas, from ESO; J. Bolyard, W. Porter, and S. Radford from NRAO. M. Boecker will chair the group.

1.2 Chile/Site Related Activities

1.2.1 Negotiations with the Republic of Chile

The ACC delegated the responsibility of negotiating access to the ALMA site to a Chile Negotiating Team. The membership is C. Cesarsky, I. Corbett, R. Dickman, P. Donahoe, A. Freytag, and R. Giacconi, with the ALMA Director ex officio and serving as the single point of contact to the Chilean side. Since negotiations began, the organization of the Chilean side has evolved, with C. Barros, Under Secretary in the Ministry of Foreign Affairs, taking charge and serving as the single point of contact for their side.

Following a series of meetings and substantial effort by D. Hofstadt and E. Hardy, representing ESO and AUI in Chile, respectively, we have arrived at the following state. There is mutually agreed language for a document granting a 50 year concession on the ALMA site and access route from Bienes Nationales, the ministry that holds title to the land, to a Chilean corporation to be established by ESO and AUI. The value of the rent

to be paid annually for the concession is to be established soon. The document will state the amount of rent and refer to annual funding from ALMA for the development of astronomy in Chile and for educational and other purposes in Region II and the local communities. Until agreement on the amount of such funding has been reached, Bienes Nationales will not issue the concession.

Barros has received the requested amount of support for the development of astronomy in Chile from CONICYT. He is waiting for the request from Region II. On October 21 he is expected to present the Chilean position in a meeting with P. Vanden Bout. It is hoped that final agreement can be reached by the time of the October 29 ACC meeting.

Permission to operate an observatory is also required by ESO and AUI. For AUI, a new decree granting that permission for ALMA, replacing the prior decree granting permission for the Millimeter Array, has been signed by President Lagos and is expected to be published by the end of the year. For ESO, there is mutually agreed language for an amendment to the treaty between ESO and Chile that grants permission to operate ALMA. This amendment has been approved by the Foreign Ministry and President. It will be submitted to Parliament for approval using a "fast-track" procedure. Action is expected no later than the middle of 2003.

Finally, an Environmental Impact Statement was submitted (voluntarily) by the Executives on July 1, 2003. That started an approval process that requires 180 working days maximum, provided no questions arise. At six working days per week, that leads to expected approval in mid-2003.

1.2.2 Configuration Design

Both for the EIS and for the request for the land concession, it was necessary to define with precision the land required for ALMA. This meant selecting the configuration for the largest array planned, as this affects the outer boundaries of the land required.

A task force of the Science IPT had recommended the so-called Y+ Configuration for the largest array (up to 14 km baselines) instead of the alternate choice, which has the shape of a ring. There are compelling scientific and practical reason for the choosing the Y+ Configuration and it was decided and approved by the ACC in a telecom to go with this option.

At a meeting at IRAM the JAO reviewed the report of the configuration task force on the smaller arrays. The strong recommendation was to form the smaller arrays by expanding from the compact configuration in a series of steps that places antennas in expanding spirals, eventually connecting to the Y+ configuration. A complete plan was developed for all configurations up to 4 km baselines. It incorporates an efficient compact configuration, complemented by an elongated North-South version for sources at extreme declinations. The design provides continuous zoom capability from 150-m baselines up to 4 km baselines. Extensive studies of imaging properties demonstrate the excellent imaging obtainable with this plan, and it is favorable for operations in that it provides for efficient transport of antennas between configurations, minimizing operations costs. The

JAO will recommend adoption of this configuration design at the October 29 meeting of the ACC.

Further work is needed to finalize the Y+ configuration, but the basic layout is in place.

1.2.3 Selection of Route for the Access Road

In addition to specifying the land required for the ALMA site itself, it was necessary to define the land required for the access road to the site in the application for the land concession. Several options were studied.

The first was the use of the existing highway over the Pasa de Jama, a major high-quality road from San Pedro to Argentina that passes to the east of the ALMA site at a distance of about 10 km. This option was rejected for several reasons. The experience of the Japanese in transporting their 10m antenna from San Pedro to the high site demonstrated the trouble that would be encountered with regular traffic on the road were we to routinely move ALMA antennas between the site and the Operations Support Facility at 2800m where most maintenance work is to be done. We would need permission to use the road and it is not clear this could be obtained securely for a long period of time. And as only approved vehicles can transport such heavy loads, use of the highway would involve a transfer of the antenna between such vehicles and another suitable for the high site, increasing the risks associated with transporting antennas. This option was somewhat less expensive in capital investment than the private road options studied.

Four private road routes were studied. Of these, the two most attractive from a cost perspective were studied extensively by a consultant. In June the JAO reviewed the study and surveyed the recommended route first-hand. A route was selected as being most advantageous for operations and still affordable. The ACC approved this selection in a telecom and the land required was included in the concession request submitted to Bienes Nationales.

1.3 Japan

A meeting of the EACC was held on September 17-18, 2002, at which the Japanese presented a proposal for participation in ALMA. The ACC responded by appointing a Negotiating Team (C. Cesarsky, R. Dickman, A. Freytag, and R. Giacconi) through which all negotiations with the Japanese is to occur. The JAO was asked to provide this Negotiating Team with the technical support they may require. The Japanese were asked to provide a proposal with more detail.

Activities of the JAO in support of the Negotiating Team have been two-fold: prior to the EACC meeting the JAO met in Charlottesville with a delegation from Japan to discuss informally their proposal and the upcoming EACC meeting, and on October 20 the JAO is scheduled to meet with the Japanese in Tucson to discuss for the first time the technical material the Japanese are assembling for their more detailed proposal.

The JAO is anticipating a major task with respect to the Japanese proposal, namely, a costing of the enhancements to ALMA that Japan proposes to provide. This is essential to establishing the Value of the Japanese program in a combined ALMA project.

1.4 JAO Goals for the Next Period

- Define the requirements for the site.
- Conclude negotiations with Chile.
- Continue to develop antenna procurement strategy.
- Develop a front-end production plan.
- Bolster systems engineering.
- Begin costing of proposed Japanese enhancements.

2. Project Report

2.1 Management

2.1.1 European Project Office

Proposal for the organization of an ALMA Division at ESO was submitted to ESO management. The division will incorporate the ALMA European ALMA Project Office and come into being 1 Jan 2003. Vacant positions in system engineering will be filled in the coming months - E. Pangole and H. Rudolf on 1 Oct, and C. Haupt on 1 Dec 2002. Initial round of interviews for European Project Manager was held on 27-28 Sep. The successful candidate should start in early 2003.

The ECC and the ESO Council Working Group on ALMA met on 16 Sep just prior to the ACC and EACC meetings on 17-18 Sep at ESO. Work continued throughout the period to update the European project financial planning as a basis for inputs to the JAO for the ALMA 2003 budget and financial projections, and for inputs to the ESO 2003 budget and Long Range Plan. A budget change request has been submitted to the JAO by the European Project Office.

Accompanied the JAO on visits to European sites working on ALMA. Met with the Dutch groups working on ALMA in Groningen on 19-20 Sep (NOVA, SRON, DIMES, ASTRON) to learn about the work on Band 9, 2nd Generation Correlator, and Dutch plans for series production of hardware for ALMA. Met with RAL on 23 Sep to review the work on the cryostat, photonics, and planning for front end integration. Visited IRAM on 30 Sep/1 Oct to see their work on the front end subsystem (common optics, windows & filters, Band 7, front end integration planning) and software.

European members of the ALMA Safety Committee were nominated: M. Boecker, J. Eschwey, and U. Varas.

Acknowledgement was received from 10 European organizations intending to propose for European Phase 2 Work Packages in response to the Call for Proposals issued by ESO on 9 Aug. Proposals are due on 11 Oct.

2.1.2 North American Project Office

Each of the IPTs have submitted revised cost estimates for the construction phase of the project. These inputs have been collated and a review of the inputs is underway. The IPTs, the Executive Project Managers and the JAO are developing a set of Level Two Milestones, consistent with the Level One Milestones established by the ACC. These milestones will be used to conduct a detailed critical path analysis for the project.

As the detailed work plans within the IPTs have matured, the balance of work between North America and Europe has become unbalance. This has resulted from improved definition of the interfaces between deliverable modules within an IPT to increase overall production efficiency. This has resulted in a net shift of work from Europe to North America. A detailed accounting of these changes is being developed. The JAO and the Executives will negotiate a transfer of tasks to rebalance the work to reestablish parity.

The NRAO Director has convened a panel of experts from inside NRAO to review the technical details of those portions of the ALMA project assigned to North America. Darrel Emerson chairs the ALMA Technical Advisory Committee (ATAC). Other members of the committee are Barry Clark, Larry D'Addario, John Payne, Peter Napier, Dick Sramek and Dick Thompson. The ATAC is currently reviewing existing documentation and conducting interviews with key members of the ALMA North American staff. The committee will submit a report to the NRAO Director.

Congressional action on a FY2003 budget has been delayed. Until a budget is passed, funding for the North American portion of ALMA will likely be authorized by continuing resolutions at a pro rata rate of 95% of the FY2002 funding. This level should be sufficient to carry the project personnel and essential procurements for the first several months of the fiscal year. A lengthy delay in the budget process could require delays for some procurements. We will closely monitor our available commitment authority and minimize the impacts.

2.2 Site IPT

2.2.1 Main Activities

- Preparation of the infrastructure requirement questionnaires and distribution to other IPTs along with the agenda for the requirements review meeting scheduled for 2002 October 22 through 24.

- Starting of work with M3 Engineering under a letter of intent pending the approval of the contract. The initial scope includes the overall master plan, AOS architectural programming study of correlator cooling options, preliminary antenna stations interconnection and road layout, and participation in the requirements review.

- Assistance (guiding site visits) for the preparation of cost estimates of contractors for the access road opening for construction traffic and the antenna foundations.

- Preparation of the documentation for the Call for Tender for Design, Engineering, and preparation of construction documentation for the ALMA access road from the intersection of the road from San Pedro de Atacama to Toconao (C23) to the Operation Support Facility (OSF) and from the OSF to the to the Array Operation Site (AOS).

- Preparation of the documentation for the Call for Tender for Architectural, design, and engineering Services for the OSF Facilities.

- Received final power study from Fichtner.

- Received improved road map from Aerotop.

2.2.2 Concern - receiving access to the land on 1 January 2002.

2.2.3 Next Period:

- Tendering of Design/Engineering of Access Road and Architectural Design/Engineering of the OSF Facilities.
- Conducting the requirements review, analysing the results, and subsequent co-ordination of requirements.

- Layout implementation for foundation configuration at the AOS site and associated soil mechanical aspects.

- Continued interaction with M3 Engineering for design/engineering of the AOS facilities.

2.3 Antenna IPT

The Antenna IPT is fully focused on working with the Contractors to deliver the antennas on the project schedule. This is and will be a significant challenge since the current antenna schedules have very little margin. Several other significant time critical task as described below are being pursued in parallel at this very critical time. Solid progress is being made in all areas.

2.3.1 AEC Antenna

The improvement and redesign work on the antenna design can be considered finished with the successful completion of the Metrology Design Review. The Antenna now meets the ESO specification and a viable, and relatively simple wind metrology system has been defined. The Contractor is working on a detailed integration plan, with the aim to reduce the slip in the planning occurred with the procurement of some items, and in particular the BUS structure. Particular care has been demanded on the monitoring of the procurement of all parts and appurtenances in order to avoid any delays due to missing items either in Europe or at Socorro. ESO has demanded a weekly progress report from

the Contractor. A management meeting with ALCATEL directors took place where ESO reinstated the importance of the delivery date.

On the 7th of October a formal design review of the metrology system has been performed. The antenna meets the Specification. ESO has made clear that the few open actions do not affect the procurement of the system, based on off-the shelf sensors. The system will be integrated in the Antenna in Socorro.

The antenna steel structure is in integration at the Galbiati mechanical manufacturing plant in northern Italy, where a dedicated space and pit for the antenna assembly has been reserved. The mount base has been integrated into a dummy embedded beam in the pit as shown in Figure 1. The Azimuth cable wrap and the azimuth bearing were factory accepted and are undergoing integration in the base. The azimuth bearing can be seen at the factory in Figure 2 below. The yoke base has been heat treated and machined and it is now undergoing boring at Galbiati, for being ready for integration on the 15th of October. The yoke arms are being followed closely

The CFRP cabin is approaching completion one half of the cabin is at the Galbiati factory. The second is expected during in the next days. The tool for integration of the two cabin halves with templates for both the mating flanges of cabin and BUS is aligned and operational in the factory. After joining the two halves the cabin will be flame sprayed to make it RF resistant. The trunnions defining the axis of altitude will then be finally machined, together with the direct drive motor interface.

Figure 1. The AEC antenna pedestal being installed on test foundation connection.

The serious delay encountered on the BUS manufactured is being rectified. The first mold was corrected and measured within specification. The second mold is being manufactured in parallel with the production of the first (raw) slice, the latter being

expected for the September 18th. Finishing and parallel production with the second mold will profit from the experience on the first slice. The tool for the gluing of radial ribs is ready, while the one for the joining of the slice is being shipped to the Galbiati factory. The completion of the BUS is extending up to January 2003, the AEC consortium being in the process to review and secure the complete process. The possibility of performing parallel activities related to the positioning of the interfaces to the panel is presently being investigated.

Close to two third of the panels have been manufactured and measured. The investigation and the tests on the surface coating have been completed with the manufacturer (Media Lario) suggesting to use Rhodium for the coating, rather than the previously envisaged Aluminum. A coupon test has been obtained and is being tested at ESO. The Rhodium, if finally retained, will be applied by galvanic bath, therefore shortening and simplifying the coating process. Prototypes of the panel adjusters were successfully thermal tested. Detail design and functionality improvements were implemented in the pre-series.

An ACU communication test is planned in October followed closely by a close loop tests with motors. Interface to the metrology system will be taken into account.

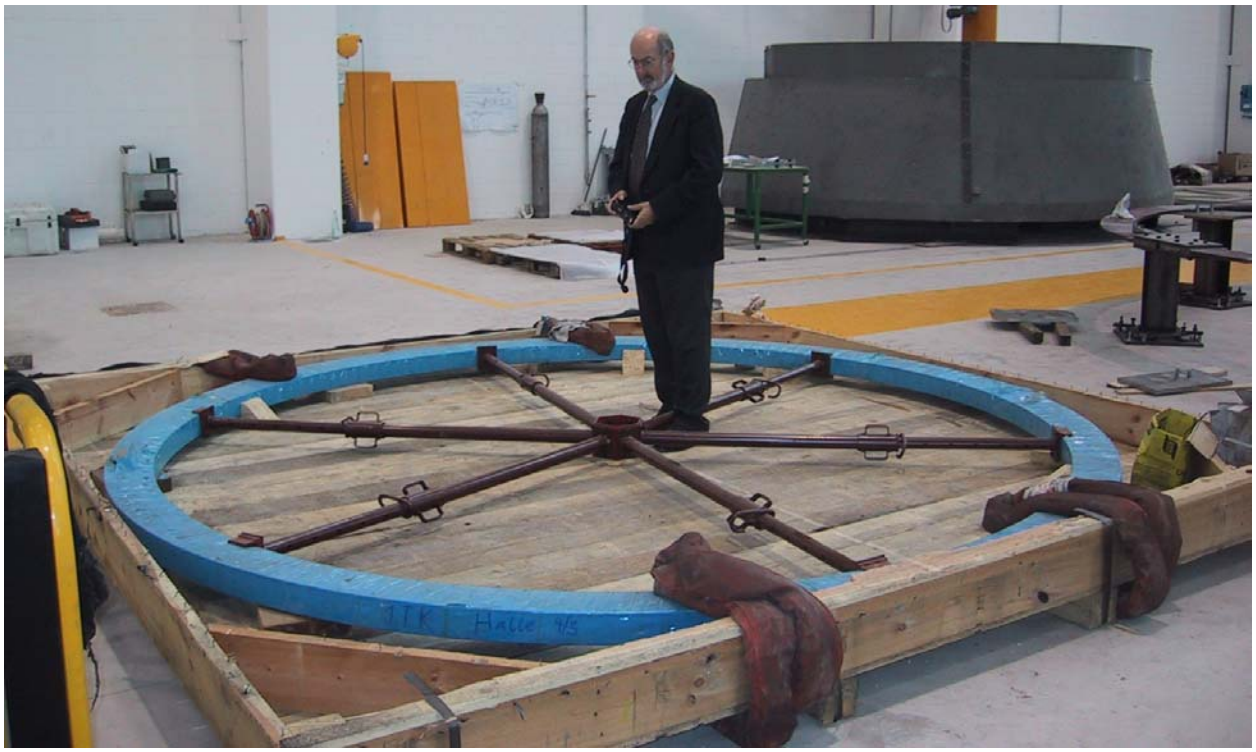

Figure 2. *The azimuth bearing along with a section of the CFRP receiver cabin in background.*

The completion of the pre-assembly of the mount in Europe is scheduled for mid of November, date at which dismounting and packing will start. (It is foreseen to integrate the motors, the brakes and the stow pins in Europe. The work of the mount on site is scheduled to start at mid January 2003.

The cabin will be fully completed and ready beginning of December. The plan is to ship the cabin only after having joined it once to the BUS structure. The completion of the date of the work on the BUS is under review by the consortium, but it is likely to extend

into February 2003. It is planned that both cabin and BUS will be air shipped with Antonov cargo airplane. The contractual date of 18th of April as Preliminary acceptance is still held valid by the Consortium.

2.3.2 VertexRSI Antenna

The VertexRSI prototype antenna is scheduled to be delivered to the ALMA project on November 18, 2002. Over the last few weeks the panel production and surface treatment, have delayed delivery of the final twenty-four panels that have cause problems in achieving the current schedule. A recovery plan is being negotiated with VertexRSI and through extreme means it is possible to hold the current schedule but it should be considered of high schedule risk with the details being finalized over the next week. Figure 3 below shows the panels installation progress on the antenna. Now on-site are 240 out of 264 panels. The panel delivery is still the critical path.

The ACU has been delivered to the site and the ALMA computing group has tested and released it for installation. They generated a punch list of items to be resolved before acceptance. The PTC has also been delivered and there have been communication problems that VertexRSI has now solved and the ALMA computing group expects to conclude there test in the next few day and release it for installation.

The HVAC system is undergoing leak pressure testing. Next week the Manufacture will arrive to charge the system and start testing it's performance. For this test a simulation front end box and equipment racks built by NRAO will be used in this testing. This simulation hardware will also incorporate the proper mass and inertia for dynamic testing of the antenna.

Over the last two week a VertexRSI engineer has been onsite checking out the electrical power system. Power has been applied to the antenna and several system have been actuated such as stow pins. Later this week the ACU will be powered up and other system will be checked. The antenna is not expected to be driven in elevation until all panel are installed. This work is considered the early phases of commissioning.

Several safety items have been addressed by the Contractor at the request of the local site safety people such as handrails, confined space and lock-out-tag-out systems. Weekly inspection by the NRAO site safety people has identified the above flaws early so they can be corrected without delay to the schedule.

The Contract verification and acceptance-testing document is in process that will be very similar for both antennas where possible. This document is in the final stage and has been delay due to addressing issues with the antenna schedule and other time critical items.

The spare parts for the antenna have been ordered and are expected to be delivered prior to the acceptance date.

Figure 3. *The antenna main structure erected showing current status of panel installation.*

2.3.3 Antenna Transporter

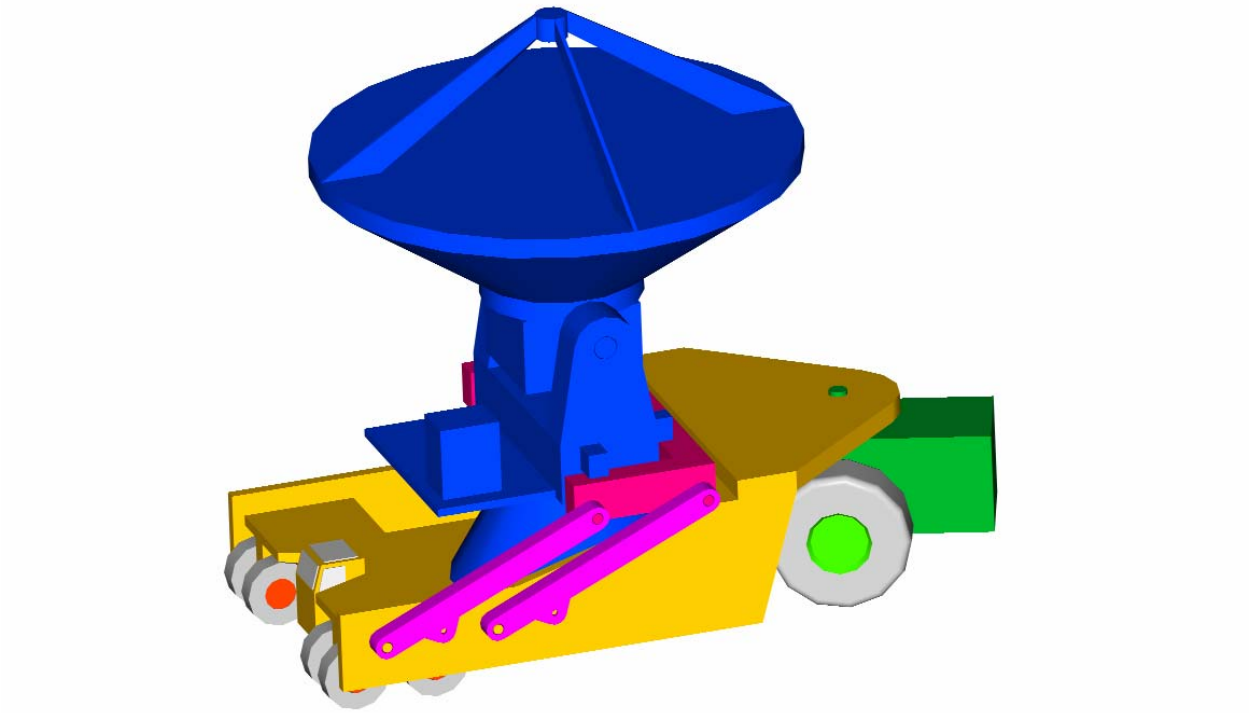

Figure 4. *The latest concept showing a possible antenna transporter meeting project requirements.*

Active progress is being made by ESO on the antenna transporter. The latest conceptual design is shown in Figure 4 that is meeting the project requirements. Improvements have been made limiting the antenna's vertical height during transition from transporter to the foundation. Progress on this concept will continue over the next few months.

A draft of the transporter requirements has been generated and is being reviewed. Later this month on October 24, 2002 there will be a transporter requirements review in Tucson in conjunction with the site requirements review.

2.3.4 Optical Pointing Telescope

The optical pointing telescope for the VertexRSI antenna is completed and undergoing final software and system testing. This telescope has been installed on the VertexRSI BUS and tested for several weeks. In the next few weeks the telescope will be installed on the antenna in preparation for antenna acceptance testing. Figure 5 below shows the telescope in the lab undergoing testing. Documentation for this instrument will be completed later this month. Spare parts have been delivered and will be collocated with the instrument.

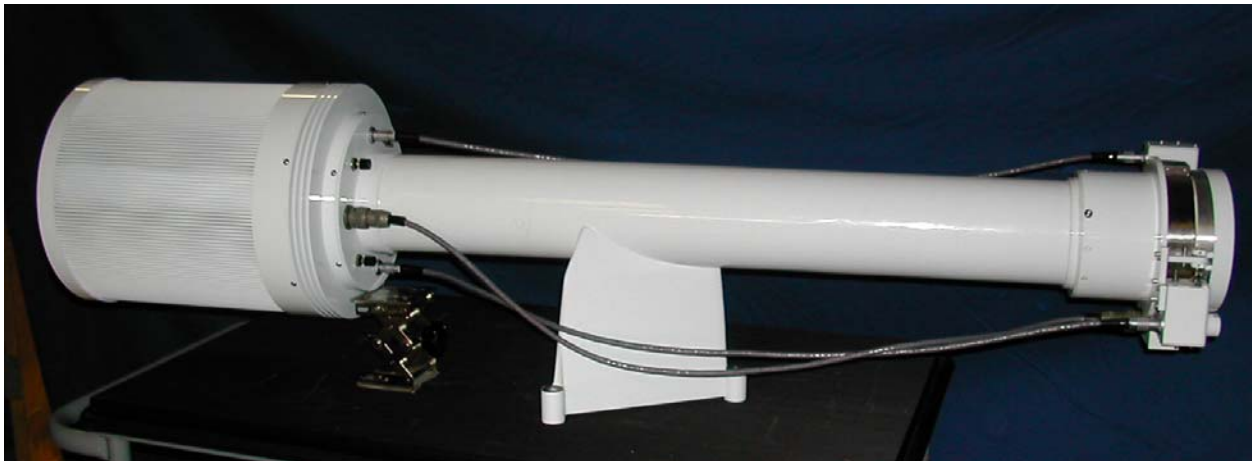

Figure 5. *The optical pointing telescope ready for installation on the VertexRSI antenna.*

Key parts have been ordered and delivered for the AEC antenna optical pointing telescope and construction will begin once mounting; clearance and location issues are resolved with AEC. Then the construction of this instrument can begin. These issues need to be resolved this month in order for the optical telescope to be delivered in April along with the AEC antenna as scheduled.

2.3.5 Nutating Subreflector

The nutating Subreflector is proceeding with close loop testing to occur later this month. The embedded hard has just been revised to address a few problems identified during testing. The mirror tooling and material are to be deliver this week so fabrication can begin with a delivery date of late November. In the mean time a simulation mirror is being used for testing as shown in Figure 6.

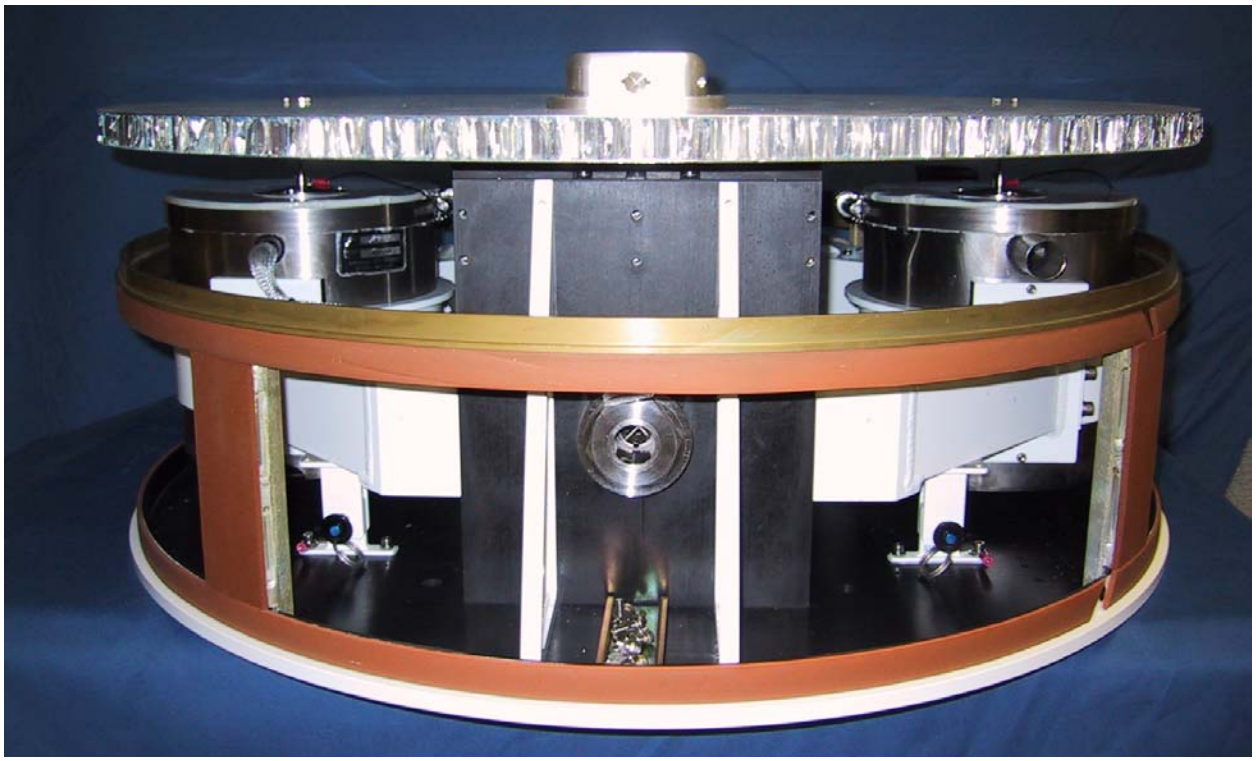

Figure 6. *The nutator for the VertexRSI antenna being tested with a simulation mirror.*

2.3.6 ATF Foundations

The foundation Contractor has been selected and this contract are being placed for both the AEC and NAOJ foundations. A kick off meeting is scheduled for October 18 with construction to begin on November 1, 2002. The contractor is expected to take eight week to complete the job with top priority being the AEC foundation. The AEC embedded beam arrive at the ATF on October 12, 2002 as shown below in Figure 7. The NAOJ embedded beam was delivered to the ATF on September 24, 2002. Both beams are now ready for the foundation Contractor.

Figure 7. *The AEC embedded beam at the ATF site being unpacked.*

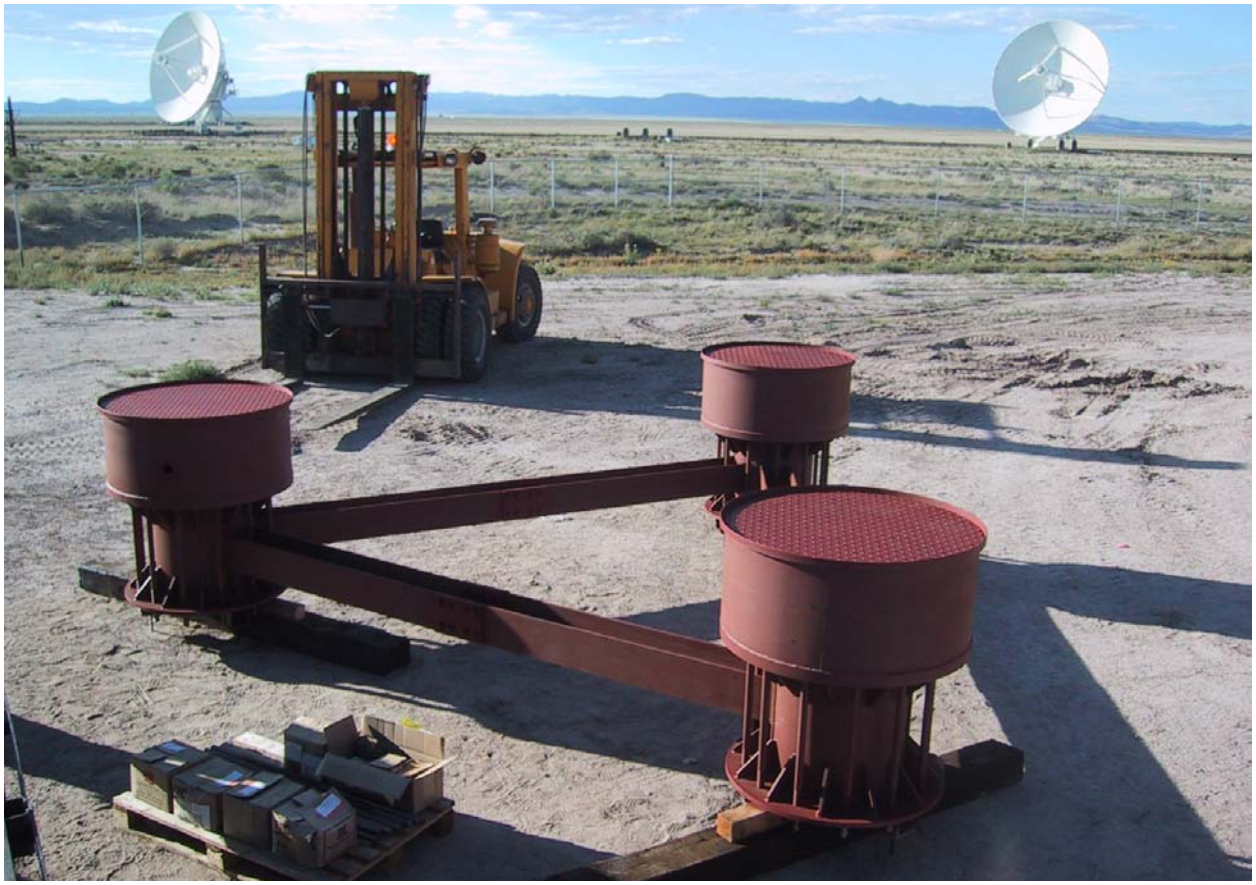

Figure 8. *The NAOJ embedded beam at the ATF site ready for foundation Contractor.*

2.3.7 Other Activities

The antenna group is engages in several other activates such as completing the Level 2 and 3 milestones along with the definitions for the project office. The RFQ for the VertexRSI antenna contract is due to the project office November 1, 2002 for approval. The NA side of the antenna group is in the process of an internal review by the NRAO Director.

2.3.8 Antenna Evaluation Group

Antenna Test Facility (ATF) Site Development:

Control Building - Most of the outfitting of the ATF Control Building is complete. With a goal of self sufficiency, the ATF Control Building includes a telescope control room, two offices, an electronics lab, and a lavatory. Computing resources are included in this facility, which is currently composed of four workstations and a color printer, all of which are served by a dedicated T1 ethernet link.

Weather Station - The weather station instrumentation mounted on weather tower \#1 has been functional and producing data for the past month. Regular updates to the information gathered from these monitoring devices is posted hourly to the ATF web page.

Measurement System Installation Planning - Members of the AEG (Albert Greve, Angel Otarola, Jeff Mangum) and Antenna IPT (Nicholas Emerson) held a three day meeting at the ATF site to discuss detailed planning associated with the installation and operation of measurement systems on the VertexRSI antenna.

RFI Characterization - The VLA staff has made a series of measurements which characterize the radio frequency interference (RFI) produced by the computing and electronics at the ATF. Sources of RFI which can interfere with VLA observations include computers and other electronic equipment. Following some improvements to the shielding of the ATF Control Building and the communications container on the weather station, the equipment currently installed on the ATF site has been found to be in compliance with VLA RFI limits.

Safety - The ATF Control Building has been equipped with a complete set of safety equipment, including safety goggles, hard hats, dust masks, gloves, and safety harnesses used when working on elevated structures. Several AEG and Antenna IPT members have received training and clearances associated with the operation of forklifts and manlifts, and with the safety procedures necessary for work at the top of the 50m holography tower.

Prototype Antenna Evaluation Planning:

Staffing - NRAO Tucson welcomed Jaap Baars to the staff. Jaap will spend the next two years in Tucson working on the prototype antenna evaluation. Dick Sramek has issued a job requisition for a technician to be associated with the AEG and the ATF. This

technician will be based in Socorro and will have primary responsibility for supporting the AEG.

Communications - The Antenna Evaluation Group (AEG) continues to hold bi-weekly teleconferences which are centered on the detailed planning associated with the evaluation of the VertexRSI and AEC prototype antennas. Most recently, this planning has taken the form of:

1. The production of reports which describe the installation and use of measurement systems to be used to characterize the prototype antennas.

2. Further definition and planning associated with the major antenna evaluation tasks, which are pointing, surface, radiometric, and monitoring and diagnostics evaluation.

3. Organization of the manpower necessary to execute the major antenna evaluation tasks.

4. Updates to the antenna evaluation task planning resulting of changes in the prototype antenna delivery dates.

Note that these teleconferences include the participation of representatives from the Computing (Ralph Marson, Kevin Long), Frontend (Antonio Perfetto), and Backend (Dick Sramek) IPTs.

Current AEG VertexRSI Evaluation Task Timetable - The current major evaluation task schedule start dates, based on a 2002-11-18 delivery date, are listed in the table below:

Initial Holography	2002-11-25
Optical Pointing	2003-01-20
Radiometric Evaluation	2003-02-18
Final Holography	2003-05-13

Problems and Concerns:

The continuing delays in the delivery of the VertexRSI antenna have significantly increased the risk associated with the evaluation of the prototype antennas. It is now difficult to believe that the evaluation of both prototype antennas can be completed by 2004-01-01. The AEG has submitted a memo to the JAO which requests a delay in this deadline. This problem will be addressed by the JAO at a meeting in Tucson in October.

The status of the Japanese participation in AEG activities needs clarification and will be addressed at the same Tucson meeting.

2.4 Front End IPT

Major work packages:

Band 3 Receivers (84-119 GHz)
Band 6 Receivers (211-275 GHz)
Band 7 Receivers (275-370 GHz)
Band 9 Receivers (602-720 GHz)
Receiver cryostats
Water Vapor Radiometers

2.4.1 Management

ASAC meeting in Socorro
JAO review of Band 9 at SRON in Groningen
JAO review of cryostat at RAL
JAO review of Band 6 at IRAM
Planning meeting in Leiden
Delivery of draft Level 2 Milestones for the Front-End (FE) IPT

This month considerable effort has been given on updating the FE costing. For most of the FE related work elements a more accurate cost figure has been established. Various discussions have been held with the JAO to clarify the new estimates. A revised project schedule for FE development and production has been devised. This project schedule aims at meeting the Level 1 project milestones. A major change compared to the previous strategy is that the new Project Plan assumes a pre-production run of 8 prototype front ends. These prototypes will be as close as possible regarding design and performance to the final series design, but might be eventually compromised to meet the time schedule. In depth discussions with individual design groups are in progress to consolidate this project schedule.

On the basis of this project schedule a set of Level 2 milestones has been extracted. These Level 2 milestones have been submitted to the JAO for approval. Dates for these Level 2 milestones need further study and consolidation with the groups responsible for the associated work to determine the dependencies.

2.4.2 Herzburg Institute for Astrophysics

The Canadian group is continuing Band 3 mixer tests using a cold feed-horn that eliminates the substantial correction for the warm feed used during tests made at the NRAO CDL. Problems with the optical and cryogenic arrangements have prevented accurate measurements to date but these problems being worked on.

An RF hybrid based on wave-guide has been designed and is being fabricated. This will be used together with the building-block mixers in a sideband-separating mixer.

Stephane Claude and Phillip Dindo joined the group. Stephane will lead the mm-wave group and Phillip will be responsible for the development of automated test-gear.

2.4.3 NRAO Central Development Lab

CDL staff have tested the baseline local-oscillator system with a Band 6 SIS mixer. After some initial problems with excess noise the system was shown to meet specifications. Further work will identify whether we need the YIG filter (currently added to the system) and whether any other design changes are required.

Two Band 6 frequency multipliers were delivered by Virginia Diode and were used in the tests described above. The Band 7 and 9 devices have been delayed and are due for delivery in 6 to 10 weeks.

The low-noise 4-12 GHz IF amplifier package is being redesigned to meet the space constraints posed by the new cartridge-optics design. The general cartridge layout work is continuing.

2.4.4 NRAO Tucson

The holography transmitter and receiver have been packaged in their final enclosures and retested. Some new software problems came to light and are being worked on.

The first of two evaluation receivers has been completed. The problem of digital noise on the DC bias lines has been rectified. We plan to cool the complete receiver on October 21.

In preparation for the North American receiver integration center, laboratory walls have been removed to rationalize the work-space.

Twenty Band 3 and four Band 6 OMT's have been delivered. The Band 6 devices are under evaluation. The VNA from Agilent has been delayed for 10 weeks and we have arranged to test the band 6 OMT's using the Green Bank VNA supplemented by our band 6 frequency-extenders.

2.4.5 Rutherford Appleton Labs

A major technical milestone occurred on September 24 when the first prototype cryostat was cooled to a temperature of less 3K. This result was obtained as part of the regular test program in the cryostat development at RAL. There has been a slight delay in the production of the prototype cartridges that will be delivered to the four cartridge design groups. This delay was caused by a flaw in the production of the glass epoxy supports. Delivery of these cartridges is now scheduled for the second half of October 2002.

2.4.6 SIS Junction Fabrication

Discussions between various European groups involved in SIS junction fabrication have been initiated. The objective is to obtain a more secure supply of the large amount of SIS junctions needed for the ALMA receivers. This more secure supply should be realized by having second source fabrication facilities and more harmonized production technologies. In the initial discussions groups from IRAM, DIMES (Tech. Univ. Delft) and Chalmers University are involved.

2.4.7 ESO Call for Proposals - Phase 2 Work Packages

All European institutions involved in the development of front end equipment in Phase 1 have been very busy in preparing detailed proposals for the continued development in Phase 2. This Phase 2 starts in Europe on the 1 January2003. Proposals are to be submitted to ESO not later then 11 October 2002.

2.5 Back End IPT

2.5.1 Data Transmission System

The new design of the 10 Gb/s mux daughter card was fabricated, populated and inserted on the digital formatter board. This daughter card is now working in the lab 10 Gb/s test link which consists of:

digital formatter board;
lab bench FO transmitter;
DWDM mux (just using one input);
25 km of fiber on spool;
FO amplifier;
DWDM demux;
FO receiver board delivered from Jodrell Bank Obs (JBO);
digital deformatter board.

The link is running continuously with only a few parity errors per day. Given the success of the new mux daughter card, a similarly designed demux daughter card was released for fabrication. At JBO, work continues on schematic design and parts selection for the ALMA FO transmitter controller card,

2.5.2 Low Frequency LO & Timing

Central Reference Generator, Central Reference Distributor and DC-DC Power Supply modules were shipped to Tucson for integration into the central LO rack to be used for the ALMA prototype antenna evaluation. LO Reference Receiver module is in the final stages of fabrication.

2.5.3 Photonic LO Distribution

Fabrication continues on the photonic microwave source for the holography transmitter.

2.5.4 IF Down Converter

Fabrication continues on the Total Power Back End modules for the ALMA prototype antenna evaluation. The total power digitizer printed circuit board was received back from the vendor and is being populated.

Component placement continues on the ALMA prototype integrated IF Down Converter evaluation board. This is a highly integrated design for the 2nd IF module.

2.5.5 Digitizer sampler

Two prototypes of our 2-bit samplers mounted on special PCBs, one BiCMOS6 2-bit (SCFL levels) and one BiCMOS7 2-bit (SCFL levels), have been tested on our Digitizer Test Bench now operational at the IRAM Back-End Laboratory. These high dynamic range tests show good long term behaviour but the indecision width is still too large.

The final technical report on the new 3-bit design (SiGe techno 7) has been accepted for distribution. Packaging specifications for the 3-bit design have been discussed with STMicroelectronics during a joint meeting organized in Grenoble early September. Electrical package modelization has been sent by ST to the Bordeaux group, the bonding diagram has been specified, etc. We expect to receive 10 packaged 3-bit samplers for tests on the Test Bench and 10 naked dies to investigate other bonding, packaging possibilities.

With ST we have investigated the acceleration factors needed to estimate reliability after Operating Life Tests of our packaged samplers mounted in modules. These tests should allow us to estimate a lifetime of the ALMA products. We expect in October a revised quotation from ST for the ALMA sampler production and life tests.

2.5.6 Digitizer Demux

Comparison of different digitizer demultiplexer architectures for ALMA has started. The design will be for 3 bits in a 1:4 Silicon circuit which will be followed by a commercial final demultiplexer stage.

2.5.7 Other Matters

A meeting was held at JBO for budgetary and organizational discussions related to the Data Transmission System. A response to the ESO call for proposals was prepared.

2.5.8 Second Generation Correlator

All details of the Agenda for the European 2GC workshop of early October in Arcetri, Florence have been prepared. The main goals of this workshop are: freeze 2GC current specifications and block diagrams of the European design, select a FIR filter architecture.

The three FIR filter architectures considered for the European design have been compared and a report issued. Initial detailed specifications of the complete European 2GC design have been circulated and commented in the European team in preparation to the Arcetri meeting.

2.6 Correlator IPT

A review of the baseline correlator development and production schedule was conducted, which resulted in generating a revised table of milestones.

Most of the minor design changes to the various correlator boards, which were deemed desirable after extensive testing of the prototype boards, were completed, and the designs were sent to layout. Designs were completed and awaiting review for the remaining boards which have not yet been prototyped; these are relatively straightforward signal distribution and motherboard cards.

The design of the prototype correlator rack was nearly completed, and almost all the parts required to build the prototype correlator were ordered. Enough of the custom ALMA-1 correlator chips are on hand to build the prototype.

Preliminary Interface Control Documents were written for the baseline correlator's three interfaces: site, Back End, and Computing.

2.7 Computing IPT

2.7.1 Progress

- New staff members: F. Cosson (IRAM), S. Farrow (UMIST), J. Pety (IRAM), R. Rusk (HIA), J. Uphoff (NRAO). (New staff since August 1).

- Interviewing for the final two ESO software positions was conducted. Discussions towards position approvals for the final NRAO positions were held.

- An architecture workshop was held September 9-14. The participants (18) mostly concentrated on interfaces between subsystems, although a variety of other discussions (methodology/procedures, PDR deliverables, technical architecture) was also held. This face to face workshop was an essential step in preparing for Internal Design Review (IDR) and later PDR.

- Two presentations were made to the ASAC meeting. Kemball on behalf of himself and Lucas presented the results of the IRAM/AIPS++ test. Phase 1 is successfully completed, Phase 2 started, and an outline for a future performance oriented Phase 3 were described. Glendenning described the DRAFT conclusions of the AIPS++ audit (66% of critical ALMA requirements are already available), and described the Computing IPT management approach and the approach taken for ATF support.

- The revision to the SSR requirements document (improved pipeline, archive, and simulation requirements) was reviewed. The document was approved, once it is revised to take into account the agreed reviewers comments.

- On-going work towards the next major release of ALMA Common Software (ACS), version 2.0 anticipated before the end of the year. Most notable is the work towards a new XML based configuration database, replacing the current system re-used from the VLT system.

- Internal development of an internal observing tool (OT) prototype to examine ideas concerning GUI's, definition of Scheduling Blocks (SB), and for investigating OT "business objects."

- Release testing and near-final additions to the next release of the Test Interferometer Control Software (TICS), version 0.5, aimed at initial ATF testing.

- As part of an investigation of Real-Time Linux (RTLinux), a partially successful port of important underlying libraries was made, particularly ACE/TAO. This has proven to be sufficiently difficult that a decision may be taken to retarget the effort to Intel compatible processors (from Power PC).

- The Vertex Antenna Control Unit (ACU) and Pointing Computer (PTC) were delivered. Stand-alone communications tests at the AOC commenced.

- Automated Source Lines of Code (SLOC) counting and capture tools were implemented. SLOC is a metric of some utility, if not over-interpreted.

- Three ALMA software papers were delivered at SPIE (Glendenning, Chiozzi, Raffi), and one at URSI (Lucas).

2.7.2 Issues

- The slip in the Vertex acceptance date means that the Control Software Group support activities are being compressed in time, particularly with regards to radiometry support. Planning to overcome this is in progress: it may involve deferring some developments (e.g., RTLinux evaluation) and re-deploying personnel into control software activities. As a consequence we will definitely cancel the all-hands meeting that would otherwise have been held in conjunction with IDR.

- The ACU and PTC were delivered by Vertex with no documentation. Assistance of Vertex personnel is of very high quality, but their availability is limited.

- All computing equipment can emit unwanted levels of RFI in the VLA observing bands (L band in particular). After some study, it has been determined that RFI levels are acceptable so long as they are in a shielded rack, shielded room in the control building, or inside the (now) shielded ATF trailer. This should present no serious obstacles, although it is somewhat awkward for early tests in which laptops or other computers might most conveniently be used in the open, e.g. the Azimuth platform. The adopted policy is that

computing equipment cannot be used in a non-shielded environment when the VLA is observing at frequencies below Since the VLA schedule appears only shortly before the beginning of the month, this makes it difficult to schedule testing for which it would be useful to have non-shielded computers early in a month.

- NRAO/AOC site administration has informed us that no office space is available for new ALMA Computing personnel. If this situation persists it would be a very serious development as according to Plan several new positions are to be filled at the AOC.

2.7.3 Activities planned for October 2002

- Draft software subsystem/subsystem ICD's to be available as a step towards IDR.

- Posting of revised SSR requirements document.

- Completion of ACU and PTC testing.

- TICS 0.5 release.

- Face to face meeting of the OT team Oct 7-11, Edinburgh.

- ACS training session, Garching, ~15 people. The occasion of the meeting will also be used to enable some face-to-face collaboration in the areas of Architecture and Control software between ESO and NRAO personnel.

2.8 Systems Engineering IPT

2.8.1 Activities

- Further development of the various system engineering processes and tools using the ALMAEDM document management system has occurred. This includes: refinement and processing of change requests using the ALMAEDM-based workflow as well as the organization and approval processing of various project documents. Various ICDs were collected, organised and submitted for review and approval.

- Training and implementation of project staff in ALMAEDM use has continued. Training sessions were conducted for the ALMA staff in Charlottesville, Socorro and Tucson. Arrangements were made for further training in Europe. Currently Stacy Oliver is travelling in Europe visiting various European ALMA centers.

- The recruitment of new staff for the System Engineering IPT has continued. In North America, final interviews for two new positions were completed and offers are expected in next week. It is hoped at least one new system engineer can be working by November. In Europe, one position has recently been filled by Eric Pangole who started work 1 October. Another position is being filled by Christoph Haupt who starts work in December. Once these recruitments are complete, the System Engineering staff will have increased from the current 3 persons to 6 persons. Plans are being made to arrange a

meeting of all the new system engineering IPT staff to start the process of forming an integrated team.

2.8.2 Problems/Concerns

- slow acceptance and use of almaedm by project staff.

- process of change requests and document approvals needs faster response from reviewers to enable backlog of documents to be processed.

- many new system engineer staff arriving over a short period hich will require guidance and supervision to introduce to the ALMA roject and the system engineering procedures and plans that have been developed.

- lack of baseline requirements documents defining basic sub-systems. Slow process of approval of project book and eventual revision to "to be constructed" status.

2.9 Science IPT

2.9.1 ASAC Meeting

All members of the NA Science IPT, as well as several EU Science IPT members, attended the ASAC Face-to-face meeting in Socorro Sept. 6-8.Several presentations on calibration, configuration and site issues were prepared and presented by Science IPT members to the ASAC (see SiteScape for presentations). The recommendations made by the ASAC on these topics can be found in the ASAC report (to be submitted to the ACC October 15), which will feed back into future Science IPT work. The logistical and organizational details of the meeting were handled by Butler and Wootten.

2.9.2 Configuration

During September, configuration leader Conway delivered a plan for configurations covering less than 4 km in extent to the JAO. For the compact array configurations, special attention was paid to minimizing shadowing losses as well as improved image quality of far Southern (e.g., Magellanic Clouds) and far Northern sources. For the intermediate configurations, the zoom spiral array design has been adopted, which is continuously reconfigurable. This plan has been reviewed critically by the JAO, in particular Guilloteau, and has been accepted as final.

Upon receipt of Conway's plan, Holdaway began designing the interface from the largest Conway spiral array to the more extended Y+ configurations. The choice of the Y+ configuration rather than the large 14 km ring array was made earlier this summer, with arguments including operational simplicity, the natural intermediate resolution configurations, the sometimes superior imaging quality, and the potential to expand to longer baselines in the future. The maximum baseline in the Y+ array is 18 km, leading to images of 13-16 mas at 300 GHz. In response to questions at the ASAC meeting,

further optimization of the Y+ array to image sources on the smallest angular scales is currently in progress. These simulations use a new topographical mask reflecting the ALMA concession boundaries, as well as the prescription used by Conway for the inner configurations.

2.9.3 Calibration

Butler, as leader of the Calibration Group, initiated a review process of all recent ALMA memos on calibration this summer. At least 3 independent reviewers were identified for each memo, with reports starting to appear in late August/early September. Discussion on the responses was started.

Efforts at absolute calibration at BIMA, led by Welch in collaboration with Butler, were also pursued. Using a comparison between a calibrated horn and an antenna, the BIMA group has been using Jupiter and MWC349 to improve the standards for absolute calibration, currently at 30 GHz. These will be compared with future VLA measurements of MWC349.

2.9.4 Site Characterization

Radford, together with summer student Selby Cull, provided analysis of the site data to the ASAC to work on their ACC charge. The results are summarized in the ASAC report.

2.9.5 Science Software Requirements

Kemball and Lucas finished a draft report on the testing of AIPS++ for the reduction of Plateau de Bure Interferometry data and presented the results at the ASAC meeting. Myers and other Science IPT members continued to work with the Science Software Requirements group on audit requirements for AIPS++. Details can be found in the Software IPT and ASAC reports.

2.9.6 Organization

The organization and planning for the Science IPT during the construction phase of ALMA was reviewed by Wootten and van Dishoeck, together with project scientist Guilloteau, in a number of face-to-face meetings in Socorro and Garching in September. Draft Level 2 milestones were made and discussed with Science IPT members. Weekly telecons between the three project scientists have been initiated, and monthly Science IPT telecons will start soon.

2.9.7 Meetings, Outreach and Public Education

Wootten finished his ALMA paper for the SPIE Hawaii meeting. Shaver attended the JENAM 2002 meeting in Portugal and presented a lecture on ALMA at a special ALMA session of the Spanish National Astronomy meeting in Toledo. Van Dishoeck gave several seminars on ALMA to Dutch astronomy and chemistry audiences.

Van Dishoeck and Shaver started planning for a European ALMA Science Day at ESO on November 8, with initial invitations sent to the community. Together with Cox, Richer and Booth, they also continued to investigate opportunities for financial support for ALMA activities within the European Union Framework 6 program (2004-2007). Discussions with the European radio and optical communities were held at workshops in Manchester and Paris.