Astronomy Australia Ltd

2011/12 EIF Annual Business Plan

31 May 2011

Executive Summary

The AAL EIF Project will begin in July 2011 and consists of nine discrete projects. AAL has executed subcontracts covering four projects, and a fifth project is covered as part of Australia's participation in the International Gemini Partnership Agreement. Some highlights for the projects in the coming financial year include: the commissioning of the new GPU-based supercomputer gSTAR at Swinburne University of Technology; the majority of the integration and testing of the HERMES spectrograph being completed at the AAO; two of the four cloud cameras being deployed by the University of Adelaide to the Pierre Auger Observatory; and the construction and testing by CSIRO of the prototype receiver for the C/X upgrade at the ATCA.

Material variations from the AAL EIF project plan

(1) The HERMES project milestones have slipped very slightly from those in the project plan. The instrument will now be transported to Siding Spring in 2012/13.

(2) The AAOmega upgrade project milestones now see the detectors characterised in 2012/13.

(3) gSTAR will now be installed in two phases, rather than just one as described in the project plan. Normal operations of the entire supercomputer will still occur during 2011/12.

(4) The subcontractor engaged to carry out the Pierre Auger Observatory cloud camera upgrade has changed from University of Adelaide to Adelaide Research and Innovation Pty Ltd, the commercial development company of the University. In addition, $11,000 of the funds for this project will now be paid in 2011/12 rather than 2012/13 to enable four identical cameras to be purchased in one order.

(5) Further details of the AST3 project for Antarctica have not become available since the project plan was written. UNSW will discuss with the Chinese partners of the project and make its final recommendation to AAL for AAL's approval.

(6) The MWA project has been de-scoped since the project plan was written. The MWA Project will now deliver a 128T array, not 512T as originally envisioned. The core infrastructure for 512T will also be implemented to allow for a new project to extend the size of the array should funding become available in the future.

Key risks and their mitigation

A number of the projects have technical risks associated with them and AAL will be monitoring progress throughout the life of the projects. One particular risk is with the AAO's HERMES project where the delivered VPH grating prototype is performing below specification. The AAO is aware of the risk and is conducting technical work to address it. Another risk is in the lack of visibility of the gSTAR facility to the astronomy community. AAL will work with the astronomy community to ensure the uptake of time on gSTAR when it becomes available and users will have available technical support through the two recently appointed NCI/Swinburne supercomputer support positions.

MWA remains the highest risk project for AAL as it is a new telescope with a number of new design components. Curtin University maintains a detailed risk assessment of the project and AAL will receive regular progress reports to be assessed by the Board and AAL's Radio Telescopes Advisory Committee.

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Status of the Project as of 31 May 2011

AAL has signed subcontracts to perform parts of the AAL EIF project with the following institutions:

- CSIRO, for the upgrade of the Australia Telescope Compact Array C/X receivers. This contract is for $1,471,000.
- The University of New South Wales, for the Antarctic astronomy project to create PLATO-R and contribute to the AST3 project at Dome A. This contract is for $1,000,000.
- Adelaide Research and Innovation (representing University of Adelaide), for the Pierre Auger Observatory cloud cameras. This contract is for $50,840.
- Swinburne University of Technology, for the gSTAR supercomputer. This contract is for $1,040,000.

The remaining subcontracts to be signed are with the AAO and with Curtin University.

AAL is currently operating with 2.3 FTEs at offices provided by Swinburne University of Technology. In 2010 AAL gained the University of Adelaide as a member, bringing the total number of members to fifteen. Thus AAL's member organisations include all of the major Australian institutions with a research capability in astronomy.

Project Infrastructure & Milestones

Astronomy Australia Ltd

AAL will continue to maintain clear and open communications with the Australian astronomy community through a regularly updated website. Quarterly electronic newsletters, AAL's annual reports, reports to DIISR and other reports of importance to the astronomical community will be made available from this website.

Community input into individual projects is coordinated at the project level.

Period	**Activities and Milestones**
By 1st July 2011	Execute five EIF subcontracts (UNSW, CSIRO, Adelaide, Swinburne, AAO)
2011-12 Q1 (Jul11-Sep11)	Poster presentation at the Annual Science Meeting of the ASA in Adelaide Eighteenth Board meeting held Quarterly newsletter published Curtin EIF subcontract executed 2010/11 Annual Report published
2011-12 Q2 (Oct11-Dec11)	Nineteenth Board meeting held 2011 Annual General Meeting held Quarterly newsletter published
2011-12 Q3 (Jan12-Mar12)	Twentieth Board meeting held Quarterly newsletter published
2011-12 Q4 (Apr12-Jun12)	Twenty-first Board meeting held Quarterly newsletter published 2012/13 astronomy EIF Annual Business Plan submitted to DIISR

Australian Astronomical Observatory

HERMES 4th Arm

The new fourth near-infrared channel is an integral part of the HERMES design and of the overall project plan. This means that the fourth channel does not have its own separate plan of work.

In 2011/12 the AAO expects to complete the majority of integration and testing of the whole HERMES instrument at the Epping facility with this being completed early 2012/13. HERMES will then be shipped to Siding Spring Observatory for integration onto the Anglo-Australian Telescope with the handover for science commissioning being during 2012/13.

Period	Activities and Milestones
2011-12 Q1 (Jul11-Sep11)	Commence VPH grating procurement Commence spectrograph frame procurement
2011-12 Q2 (Oct11-Dec11)	Received spectrograph frame
2011-12 Q3 (Jan12-Mar12)	Complete assembly spectrograph frame Commence assembly and test collimator, cameras, Slitlet, fold mirrors, beamsplitters and detectors.
2011-12 Q4 (Apr12-Jun12)	Commence assembly and test VPH gratings

AAOmega Upgrade

AAOmega is an existing spectrograph on the Anglo-Australian Telescope (AAT). The spectrograph is a dual beam system, with a blue arm and a red arm, and the AAO will upgrade the AAOmega spectrograph with two new CCDs (detectors).

The down-select of detectors has been completed, and in 2011/12 the detectors will be ordered. These will typically take 9-10 months to be delivered and so this year the project will focus on procurement, setup for the test cryostat and developing AIT documentation for the detectors.

Period	Activities and Milestones
2011-12 Q1 (Jul11-Sep11)	Commence test cryostat discussion
2011-12 Q2	Place order for detectors

(Oct11-Dec11)	
2011-12 Q3 (Jan12-Mar12)	Commence setup for test cryostat
2011-12 Q4 (Apr12-Jun12)	Develop assembly, integration and test documentation

Facility and Data Access

HERMES and AAOmega are both instruments on the Anglo-Australian Telescope (AAT). Applications for observing time on the AAT are assessed by the Australian Time Assignment Committee (ATAC). This independent, peer-reviewed time allocation procedure is based on ATAC ranking all proposals by scientific merit, without regard to the nationality of the applicants.

No charge is made to users of the facility allocated time under this process. Basic costs associated with travel/accommodation to carry out the observations at the AAT are provided by the AAO, although some costs are borne by the users. Data archive/management costs are borne by the Observatory. All data are made freely available to the international scientific community via a web-based archive, following a proprietary period of 18 months during which the scientists awarded the time have sole access.

CSIRO Astronomy and Space Science: ATCA upgrade

CSIRO is upgrading the C/X receiver systems of the ATCA, which is part of a larger upgrade to the telescope. The ATCA C/X receiver upgrade will involve significantly modifying seven receivers, one on each of the six ATCA dishes, and an operational spare. The upgrade will be carried out in two phases: prototype development; and production and installation.

In 2011/12 the prototype development phase will be carried out. This phase will involve the development of prototype LNAs and RF interface modules leading to development of a full C/X receiver prototype. Preliminary LNA development is being performed by CASS as part of the current L/S receiver upgrade. The prototype C/X receiver system will be extensively tested in the laboratory and on the ATCA.

Period	**Activities and Milestones**
2011-12 Q1 (Jul11-Sep11)	4-12 GHz LNA prototype completed Design of receiver hardware commenced
2011-12 Q2	4-12 GHz LNA prototype evaluation completed

(Oct11-Dec11)	Manufacture of prototype receiver hardware commenced Design of RF interface modules completed **Design of prototype receiver system completed**
2011-12 Q3 (Jan12-Mar12)	4-12 GHz LNA production commenced Prototype receiver assembled Prototype RF interface modules completed **Prototype receiver completed**
2011-12 Q4 (Apr12-Jun12)	Prototype receiver evaluation completed

Facility and Data Access:

The Australia Telescope Time Assignment Committee (TAC) ranks all proposals received for observing time on Australia's national radio telescopes on the basis of scientific merit and technical feasibility, and assigns each successful proposal an appropriate amount of observing time. All researchers, irrespective of nationality, are able to apply.

No charge is made to users of the facility allocated time via this process. Users are expected to cover costs associated with travel and accommodation to carry out the observations at the telescopes.

Data archive and management costs are borne by the Observatory. All data taken with ATCA are freely available to the international scientific community via a web-based archive, following a proprietary period of 18 months, unless a special case for extended proprietary rights is accepted by the Director or Time Allocation Committee. The CASS Director may override the release of data at his discretion.

Swinburne University of Technology: gSTAR

Swinburne University of Technology (SUT) will use EIF funds to create and maintain a next-generation GPU-based supercomputer for the Australian astronomy community. SUT is to provide a newly built Data Centre to house gSTAR with the necessary power and cooling requirements. This facility will be linked to national facilities through a 1 Gb link to AARNET. The Data Centre is currently under construction at the SUT Hawthorn campus and is scheduled for completion in FY Q3 2010/11.

SUT will conduct the procurement process in two phases. Phase 1 will be completed by the end of FY Q1 2011/12 and will involve the purchase of a minimum of 48 nodes each with a minimum of two graphics cards (or GPUs). This will also include a minimum of 2 high-density GPU nodes (approximately 8 cards each; minimum 4 Tflop/s double precision performance) and the 200 TB storage component. Thus

Phase 1 will comprise the purchase of a minimum of 112 graphics cards. Completion of this phase will provide the gSTAR community with an operational facility on which to become familiar with GPU-based simulations and/or conduct high-performance simulations from an early stage.

Phase 2 will proceed in FY Q3 2011/12 and will involve the addition of a minimum of 32 GPUs (or the difference between 160 and the number of GPUs purchased in Phase 1, whichever is greater). The timing of this second phase will allow the design to take advantage of advances in GPU technology, communication bandwidth between CPU and GPU (PCI-e Gen3 technology) and CPU development (Intel "SandyBridge" chipset). The particular design of the GPU-nodes (low or high-density) will be informed by GPU-usage from Phase 1.

Period	**Activities and Milestones**
2011-12 Q1 (Jul11-Sep11)	Location for gSTAR ready (building complete, air-conditioning installed) Components for gSTAR (Phase 1) ordered gSTAR (Phase 1) installed Normal operations (Phase 1) commenced
2011-12 Q2 (Oct11-Dec11)	-None-
2011-12 Q3 (Jan12-Mar12)	Components for gSTAR (Phase 2) ordered
2011-12 Q4 (Apr12-Jun12)	gSTAR fully installed and operational

Facility and Data Access:

All astronomy research staff and students at publically funded research institutions throughout Australia will be eligible for an account on gSTAR. SUT will undertake the responsibility of providing (or arranging for) a software environment for gSTAR that meets the needs of the userbase.

A maximum of 25% of gSTAR time, in acknowledgement of the investment made by SUT, will be set aside for use by SUT staff and students, and is intended to be partly used for commissioning and training purposes. The remaining time will be given over to national access for astronomers.

Up to 50% of the national access time will be made available to "Grand Plan" proposals. These proposals can be submitted at any time through a web interface and will be judged on a quarterly basis by a merit allocation committee (MAC).

To reduce overheads the MAC will be incorporated with the MAC recently created by NCI for judging astronomy proposals for the 1,000,000 hours allocated to the NCI/AAL Specialised Support program. This centralised MAC will also be able to determine which hardware is most relevant to a particular proposal (and avoiding the same proposal being submitted to multiple overlapping schemes). This MAC format will be a trial for the first year, after which its format will be reviewed by AAL.

The remaining national access time will be made available to the general gSTAR user community through a job queue. This queue will implement a fair-usage policy that gives higher priority to jobs submitted by users with lower usage statistics to-date.

SUT will also operate a CPU-based supercomputer in concert with gSTAR. The MAC may request that cycles for Grand Plan proposals be traded between the Swinburne and gSTAR machines if deemed that this will be beneficial to a proposal.

gSTAR will incorporate a minimum of 200 TB of disk space. This disk space will be made available to users and is primarily to facilitate active computations made on gSTAR.

Data generated from simulations on gSTAR will be kept on the gSTAR storage system for a minimum of three months from the time that it is created. There is no obligation for SUT to provide long-term storage (greater than three months) for gSTAR users. Such storage should be negotiated between the user and their home institution. Larger allocations of disk space can be requested through a "Grand Plan" proposal and will be considered by the MAC. This includes requests for data storage for periods exceeding three months.

The MAC will require a successful "Grand Plan" proposal to make the resultant dataset available to the general public 18 months after completion of the associated simulations, unless a specific exception is made by the MAC.

University of Adelaide: Pierre Auger Observatory cloud monitors

The University of Adelaide will build four new cloud monitoring systems for the Pierre Auger Observatory in Argentina.

2011/12 sees the University of Adelaide construct and deploy two of the four radiometric cloud camera systems. These cameras will be shipped to Argentina and tested by University of Adelaide and Observatory personnel. A third camera system is planned to be constructed and tested by the end of 2011/12. In 2012/13 the fourth camera will be constructed and tested, and the third and fourth cameras will be deployed at the Observatory.

Period	**Activities and Milestones**
2011-12 Q1 (Jul11-Sep11)	System 1 constructed and tested at University of Adelaide

2011-12 Q2 (Oct11-Dec11)	System 1 deployed to Pierre Auger Observatory and tested on site
2011-12 Q3 (Jan12-Mar12)	System 2 constructed and tested at University of Adelaide
2011-12 Q4 (Apr12-Jun12)	System 2 deployed to Pierre Auger Observatory and tested on site System 3 constructed and tested at University of Adelaide

Facility and Data Access:

Currently the University of Adelaide is the only Australian institution with access to the Pierre Auger Observatory, although the University has noted that it welcomes interest from other Australian groups and has from time to time solicited interest from other Australian high energy astrophysicists.

In general, the Observatory is different to other observatories because it continually views the whole sky, 24hrs every day. Therefore it does not need a system in place for astronomers to request time to observe a specific object. Data collected by these 24hr observations are then available from a dataset which is filled, calibrated, and analysed through the work of The University of Adelaide and other collaboration members.

Currently, full and immediate access to Auger data is available only to Collaboration members. Australian universities wishing to have full access to the data would need to join the collaboration and pay the yearly subscription of around $5k per academic member and take on some task or responsibility within the Observatory.

At present, a representative 1% of the dataset is freely available to the public and it is expected that Auger will develop a policy on public access to its full dataset. That process is not complete, but it is necessary as the funding agencies in some collaborating countries require it.

Due to the modest nature of the investment for the cloud monitoring infrastructure through EIF no Time Assignment Committee will be put in place to give Australian national access to the Observatory data. Interested parties will simply contact the Principal Investigators at the University of Adelaide if they wish to access some of the lower level data collected by them.

University of New South Wales: Antarctic astronomy

UNSW will undertake two projects as part of this EIF project:

- construct PLATO-R robotic observatory for deployment by the University of Arizona to Ridge A on the Antarctic Plateau, and

- contribute, at the 5-10% level, to the new Chinese Centre for Antarctic Astronomy's AST3 facility at Dome A which is based on Chinese prototype project CSTAR.

In 2011/12 UNSW will begin work on PLATO-R, with plans for construction to be finished and PLATO-R to be deployed in 2012/13. However, The University of Arizona may decide to bring forward its deployment of PLATO-R by one year, to December 2011.

UNSW will negotiate with the Chinese partners of the AST3 project to determine UNSW's contribution to the AST3 project. A special report will be provided by UNSW to AAL by 30th September 2011 which will outline in detail the nature and timing of UNSW's contribution to the AST3 project. The AAL Board will review this report at their November 2011 meeting. If the AAL Board approves the content of the report, then the allocated AAL-EIF funding for the UNSW contribution to AST3 will be made available.

Period	**Activities and Milestones**
2011-12 Q1 (Jul11-Sep11)	Agreement negotiated with University of Arizona on PLATO-R specification. Agreement negotiated with Chinese Center for Antarctic Astronomy on project plan for AST3 wide-field telescope development program at Dome A. Advertisements placed for engineering staff. Special report provided to AAL on UNSW confirmed contribution to AST3 project.
2011-12 Q2 (Oct11-Dec11)	Conceptual design of PLATO-R completed. Engineering staff hired to support AST3 wide-field telescope development program.
2011-12 Q3 (Jan12-Mar12)	Detailed design of PLATO-R completed.
2011-12 Q4 (Apr12-Jun12)	Major components for PLATO-R ordered.

Facility and Data Access:

PLATO-R

The PLATO-R project for Ridge A is an equal partnership between Australia and the University of Arizona.

The data collected by "HEAT" and any other instruments supported by PLATO-R will be in the form of survey data and will come in two forms – data that are returned via Iridium satellite, and hard-disk data. The satellite data is a synopsis of the data taken by the instruments, and once sent is archived at UNSW. These data will be made available on request to the PIs.

The hard-disk data will be collected by University of Arizona personnel on future service missions. An archive system will be organised by University of Arizona, with a mirror site at UNSW. After a proprietary period of no longer than 18 months the data would be made available, through this Australian archive, to Australian astronomers.

AST3 project

The hard disk data from instruments physically located at Dome A is retrieved by the Chinese team on their summer traverse, and shipped to Fremantle WA, where it is copied by researchers from UNSW. The original hard disks then go to China. Currently, all collaborators in the CSTAR project at Dome A have equal access to all data, and all papers published using the data cite all collaborators.

General access to this data for the Australian astronomy community is not yet formalised. However, it is a requirement of the current LIEF grant for PLATO-A that this be done. The principles for data access are as per Article III 1(c) of the Antarctic Treaty: "scientific observations and results from Antarctica shall be exchanged and made freely available." UNSW is working with the Australian Antarctic Division (AAD) to realise this principle, which needs to happen in conjunction with China (the major partner at Dome A). UNSW will discuss data access arrangements with the partners in AST3 and the agreed arrangements will be included in the special report to be provided to AAL due on 30th September 2011.

Curtin University: MWA

The MWA project submitted a revised project plan to AAL in April 2011. This plan outlines how, with existing allocated NCRIS and EIF funding, a 128 tile array can be deployed, along with the core infrastructure for a 512 tile system. The remainder of a 512 tile system would be deployed should further funding become available.

The subcontract with Curtin University for MWA has yet to be signed and therefore no milestones for the EIF funded portion of the project have been agreed.

Answers to specific questions regarding revised plan from DIISR regarding MWA:

- Is 2Gbit/s still considered to be the required post-RTC bandwidth from a 512-tile MWA?

Correct – on top of the 2 Gb/s is some level of technical "metadata" from the array, but this is relatively minor compared to the 2 Gb/s. The 2 Gb/s data rate does not depend on the number of tiles in the array. This is a data rate calculated from transmission of a certain number of images per second, of a given size per image. A smaller array (e.g. 128T) still produces the same amount of image data as a larger array (e.g. 512T), it is just that the 512T images are of a higher quality than the 128T images.

- To what extent will the de-scoped MWA plan provide for the RTC system, e.g. will there be sufficient housing, power and computing hardware for just the de-scoped array, or will there be sufficient computing for the de-scoped array but with housing and power provision that could support a larger RTC system if it is eventually required, as part of the 'core infrastructure'?

In terms of the requirements of the RTC, the project will be building sufficient housing and power to enable a full 512T RTC, within the central building. This is part of the core MWA site infrastructure work to take place over the next 6 months, along with trenching, power distribution and intra-site data transport. All MWA infrastructure will be built to 512T capacity. The size of the RTC will match the final number of tiles deployed, currently planned to be 128T.

- To what extent will the 'core infrastructure for a 512-tile array' include provision for data transport to the CSIRO MRO building from the larger MWA array? For example, would it comprise additional trenching and conduits, or fully installed dark fibre, or would it include a lit fibre link capable of providing the full (2GBit/s) data capacity?

The core MWA infrastructure to be deployed will have the full capacity required to support a 512T array. This includes all data transport infrastructure from the tiles in the field to the MRO central building. Note that these intra-site communications links over fibre are very high data rate links, far higher than 2 Gb/s. Groups of eight tiles are connected to receivers in the field. Each receiver is connected via fibre to the central building and produces approximately 5 Gb/s. There will be 64 receivers for the 512T array, giving an aggregate data rate from the MWA instrument to the MRO central building of approximately 330 Gb/s. These data are ingested by the correlator and then into the RTC, for imaging and calibration. Both the correlator and the RTC are housed in the MRO central building and the space and power allowances for the correlator and RTC are based on a full 512T array. The data out of the RTC are at the rate of 2 Gb/s and it is these image and calibration data that need to be archived.

- If there is to be a reduced data transport capacity from the RTC to the CSIRO building at MRO in the de-scoped MWA project, will the back-haul links from the MRO be future-proofed in anticipation of the larger data requirements of a possible 512 tile array, by reserving the necessary bandwidth capacity or dark fibre in the CSIRO link from MRO to Geraldton and in the link from Geraldton to Pawsey?

As explained above, the intra-site data transport is factored into the MWA core infrastructure at the 512T level. Moreover, the sense of data flow is from the field into the RTC, located in the central building. The RTC produces 2 Gb/s of output data which requires archiving in Perth (ideally at Pawsey). Thus, it is the 2 Gb/s data that must be transmitted off site, from the MRO to Geraldton and then to the Pawsey Centre. CSIRO have confirmed in writing (and soon to be listed in the MWA Site License between CSIRO and Curtin University) that the MWA has access to a 10 Gb/s connection between the MRO and Geraldton. The Geraldton to Pawsey Centre link is being discussed with CSIRO and AARNet which should result in the MWA to having access to a 10 Gb/s connection from Geraldton to Pawsey. The 10 Gb/s link will be sufficient for MWA science and technical data, and comfortably allow expansion to 512T and beyond (if required), or transmission of more technical data from the array, if required.

<u>Facility and Data Access:</u>

The MWA consortium is constituted under two formal agreements. First, a Statement of Intent (SoI), which is signed by all MWA consortium members, identifies the high level intent to collaborate on the

MWA, the lead organisations in Australia, the USA and India, and high level governance for the project. Second, a Statement of Collaboration (SoC), signed by the Australian, USA, and Indian lead organisations, Curtin University of Technology, Massachusetts Institute of Technology – Haystack Observatory, and Raman Research Institute, respectively, sets out details of the MWA collaboration.

Parts of these statements are expected to form the basis for the facility access and data access arrangements for MWA.

Part of the SoC says that assigning observing time will be on the following basis:

"(a) During Early Science Operations, the EOR [Epoch of Re-Ionisation] and the SHI [Solar, Heliospheric and Ionospheric] MWA Science Collaborations shall be given priority.

"(b) During Operations, Open Skies shall be the fundamental guiding principle for allocating observing time, giving due consideration to the needs of the Key Science Programs.

"(c) Observing time allocation shall be determined by the MWA Time Allocation Committee, subject to policies set by the MWA Board."

In addition the SoC outlines formulation of publication policies:

"Publication policies shall be formulated by the MWA Science Council, subject to approval by the MWA Board. While every effort shall be made to implement a uniform publication policy across the project, it is recognized that one or more major MWA Science Collaborations may require individual policy provisions.

"Observing time, data access, and publication policies may vary among the Key Science Programs, and may include proprietary periods for MWA Science Collaboration members."

Gemini Instrumentation

AAL has hedged the Gemini Instrumentation payment in USD retiring the exchange rate risk. These funds are part of Australia's national funding commitment to Gemini as a 6.2% partner in the Gemini Observatory and are therefore not formally contracted to be used for Australia's desired purpose of funding the upgrade of GMOS-S CCDs. However, following discussions with the management of the Gemini Observatory, the upgrade of GMOS-S CCDs has been incorporated into the Gemini instrumentation plan for 2011 and 2012.

<u>Facility and Data Access:</u>

Applications for access to the Australian share of the Gemini Telescopes are made to a single national time assignment committee, the Australian Time Assignment Committee (ATAC). ATAC ranks all Australian proposals for observing time on Gemini on the basis of scientific merit and technical feasibility, and recommends an appropriate number of nights observing time to each successful proposal. These successful proposals are then passed on to the Gemini international TAC (ITAC) (on

which Australia has a representative) to make the final scheduling recommendations, taking into account possible multi-partner participation programs (each national TAC having provided its assessment of the scientific merit of any particular program) and any program conflicts/duplication. The ITAC is careful to maintain appropriate partner-share balance in its final assembly of the telescope schedule.

No charge is made to users of the facility allocated time via this process. Time on the Gemini telescopes is awarded on both a 'classical' and 'queue' basis. Observers who are granted classical time are expected to travel to the telescope to conduct the observations, and bear the costs associated with this. Observers awarded queue time will have their observations conducted for them and the resultant data distributed to them.

Data archive/management costs are borne by the Observatory. All data are freely available to the international scientific community via a web-based archive, following a proprietary period of 18 months.

Data Access Infrastructure

To maximize scientific return from the new investments, the astronomy community has advised Astronomy Australia Ltd that a system for federation of astronomy data is needed. Data federation would involve creating the hardware, tools and services to bring together radio, optical and simulation data from Australian facilities. The federation of astronomy data would be an effective mechanism to enable astronomers to participate in global, multi-wavelength survey science and to share the science projects based around Australian survey facilities.

AAL released a Request for Tender for services to provide a concept design study for the federation of astronomy data and will soon sign an NCRIS sub-contract for this concept design study. AAL will then work with NeCTAR and RDSI to develop a plan for allocating the $300,000 to achieve one component of the federation of astronomy data.

Finance and Risk Management

Budgeted financial transactions (ex GST)

Date	Item	From / To	Revenue	Expenses
31-Aug-11	EIF grant	DIISR	$5,000,000	
30-Sep-11	AAOmega	AAO		-$300,000
30-Sep-11	Antarctica	UNSW		-$230,000
30-Sep-11	ATCA	ATNF		-$350,000
30-Sep-11	GMOS-S CCDs	Gemini		-$328,306
30-Sep-11	gSTAR	Swinburne		-$1,040,000
30-Sep-11	HERMES	AAO		-$420,000
30-Sep-11	MWA	Curtin		-$2,306,274
30-Sep-11	Pierre Auger	Adelaide		-$25,420
30-Nov-11	EIF grant	DIISR	$2,500,000	
31-Dec-11	AAOmega	AAO		-$60,000
31-Dec-11	Antarctica	UNSW		-$230,000
31-Dec-11	Data	tbd		-$300,000
31-Dec-11	HERMES	AAO		-$420,000
31-Dec-11	MWA	Curtin		-$763,726
31-Dec-11	Pierre Auger	Adelaide		-$11,000
31-Mar-12	AAOmega	AAO		-$60,000
31-Mar-12	Antarctica	UNSW		-$90,000
31-Mar-12	ATCA	ATNF		-$50,000
31-Mar-12	HERMES	AAO		-$420,000

Opening balance 1 July 2011: $0

Projected closing balance 30 June 2012: $95,274

Due to the timing of expected cash receipts and cash payments the interest to be earned by the EIF grant is expected to be minimal. AAL will report EIF interest earnings in its Annual Report and hold that interest in reserve to be used on one or more of the astronomy EIF projects.

Risk Considerations

HERMES

The Final Design Review for HERMES has been conducted. The most significant outstanding technical risk to the project is in the prototype VPH grating efficiency in the blue. The AAO is aware of the risk and is conducting technical work to address it.

While other potential risks such as delays in commissioning or increases in expenses from the current budget could occur, AAL does not believe these pose a significant threat to HERMES being successfully finished and commissioned on the AAT. That is, the AAO is well positioned and appropriately funded to finish the project.

AAL Action: Monitor progress through regular Quarterly Reports and through reports to AAL's Optical Telescopes Advisory Committee.

AAOmega

The AAOmega upgrade is a low technical risk project for which designs exist for all parts. Fully exploiting the power of these new detectors also requires new VPH gratings with new blazes, and a new dichroic beam splitter with a crossover wavelength allowing continuous spectral coverage over both arms of the dual-beam AAOmega spectrograph. AAO has other sources of funding for this portion of the project and it is beyond AAL's risk assessment.

AAL Action: Monitor progress through regular Quarterly Reports and through reports to AAL's Optical Telescopes Advisory Committee.

C/X upgrade to ATAC

The success of the C/X upgrade is reliant on the development of a low noise amplifier to cover the nominal 4-12 GHz band specified for the project. CSIRO has strong expertise in the field and a history of being able to deliver octave band amplifiers but to mitigate the risk presented by the new amplifier they have undertaken to develop a prototype amplifier in the earliest stages of the project. This allows time for revision and modification should it be required.

Another technical risk is that the performance of the upgraded systems may be compromised by the current plan to use the existing Compact Array feed and ortho-mode transducer. The development work

to rectify this is out of the scope of the AAL contract and CSIRO may elect to accept the poorer performance or use its own funds to improve the performance after a cost benefit analysis is conducted that includes input from the astronomical users.

Other elements of the project, for example RF modules and electronics, carry a lesser risk but prototypes of these elements will similarly mitigate that risk.

The risk that CASS resources may be insufficient to undertake the project has been mitigated by the identification of staff and their assignment to the project with recognition by CASS of the need to deliver on this contract.

AAL Action: Monitor progress through regular Quarterly Reports and through reports to AAL's Radio Telescopes Advisory Committee.

gSTAR

The main risk to the gSTAR project is the potential lack of uptake in the community due to low visibility. The technical risks to the project are low, as the project will purchase commercial hardware to be installed by an appropriate contractor. The machine room to host gSTAR is nearly ready.

In the broader context of eResearch initiatives for astronomy AAL is in the process of planning for the appropriate support and communications to the community regarding gSTAR. Communications will happen through AAL's Astronomy eResearch Advisory Committee and through the Time Assignment Committee for gSTAR. There will be technical support for users of gSTAR through the two recently appointed NCI/Swinburne supercomputer support positions.

AAL Action: Increase awareness of gSTAR facility through interaction with the astronomy community. Monitor progress through regular Quarterly Reports and updates to AAL's Astronomy eResearch Advisory Committee.

Pierre Auger Observatory

The cloud-camera project for the Pierre Auger Observatory is a low technical risk project using off-the-shelf components with costs well understood.

AAL Action: Monitor progress through regular Quarterly Reports.

Antarctic astronomy

PLATO –R

While three PLATOs have been built, and two deployed to Antarctica, one deployed PLATO (PLATO-F) has suffered two hardware failures. The first failure, of a battery circuit breaker in PLATO-F, does not affect the module's performance but leaves the instrument with reduced redundancy and battery capacity. The second failure, of one of the four solar arrays, will only affect the performance minimally during daylight hours.

AAL is in communications with UNSW regarding these technical concerns.

AAL Action: Monitor technical issues and progress through regular Quarterly Reports and reports to AAL's Antarctic Astronomy Advisory Committee.

AST-3 project

This project is yet to be fully scoped and so no risk assessment is available at this time.

AAL Action: Once the report outlining UNSW's contribution to the final project is received, scope the risk for the project.

Murchison Widefield Array

The Murchison Widefield Array (MWA) will be a new type of radio telescope, with no moving parts, and dependent on prodigious computer power to create real-time wide-field images of the radio sky. The instrument design approach taken by MWA is without precedent and there is, therefore, a significant degree of technical risk inherent in the Project. The MWA Project Office at Curtin University maintains a detailed risk profile of the project and reports every three months to AAL.

The recent decision by the National Science Foundation (US) to cease funding of the MWA means that the array delivered by the Project will be limited to 128-tiles (2048 dipoles) instead of the 512-tiles (8192 dipoles) originally planned. This down-sizing of the instrument has a raft of positive implications for the Project's technical risk profile.

The top four technical risks are:

1. Radio Frequency Interference (RFI) — RFI characterisation of the MWA instrument is problematic as the sub-systems are still under development. An RFI testing program focussing on sub-systems with high RFI risk (Beamformer and Receiver) is currently underway. Testing is being carried out on pre-production prototypes in order to retire the risk prior to issuing production contracts.

2. Correlator sub-system — Hardware constraints and the availability of appropriately qualified FPGA programmers result in a high degree of technical risk for the Correlator sub-system. The downsizing of the instrument reduces the technical complexity of the sub-system requirement and has prompted a re-examination of the approach taken—including the hardware architecture.

3. Monitor and Control (M&C) sub-system — The technical risk inherent in the M&C sub-system is derived from the high number of system state parameters that must be monitored, controlled and recorded to support the science objectives of the instrument. This risk is moderated to some extent by the recent reduction in the scale of the instrument. Further, development of this sub-system has recently been consolidated at Curtin University under the direction of a discipline specialist.

4. Reliability — The performance and reliability of the electronic components of the instrument when exposed to the diverse environmental extremes that characterise the MRO constitute a significant technical risk. The Project's mitigation strategy is an ongoing campaign of field trips to iteratively validate system design under field conditions.

The MWA is also subject to a variety of organisational and external risks. For example, the Project Consortium includes more than ten contributing institutions from Australia, the United States and India. The Project also has a number of dependencies on CSIRO for elements of the site and infrastructure that will support the MWA. The Project manages these risks through proactive, robust and ongoing liaison with its diverse and complex stakeholder network.

AAL Action: Monitor progress through regular Quarterly Reports and reports to AAL's Radio Telescopes Advisory Committee.

Gemini Instrumentation

AAL considers the upgrade to the GMOS-S detectors as low technical risk as the upgrade is based upon commercially available detectors. Note the EIF funding is not formally contracted to be used for Australia's desired purpose of funding the upgrade of GMOS-S CCDs. However, following discussions with the management of the Gemini Observatory, the upgrade of GMOS-S CCDs has been incorporated into the Gemini instrumentation plan for 2011 and 2012.

AAL Action: Monitor progress via reports from the Gemini Board Member to AAL's Optical Telescopes Advisory Committee.

Data Access Infrastructure

This project is yet to be defined and so no risk assessment is available.

AAL Action: Once the project has been defined, scope the risk for the project.