Call for Expressions of Interest for ASKAP Survey Science Projects

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Dear Colleagues

The international community is invited to submit Expressions of Interest for an initial set of Survey Science Projects for the Australian SKA Pathfinder (ASKAP).

Expressions of Interest are the first stage of a three-stage process to define Survey Science Projects that are envisaged to utilise at least 75% of ASKAP's observing time during the first five years of its science operations, starting in 2012.

Expressions of Interest can be up to four pages in length (min. 11 point font) and must be submitted in PDF format as an attachment in an email to atnf-askap-ps@atnf.csiro.au.

The closing date for submission of an Expressions of Interest is 2300 AEST on 2008 Dec 15 (equivalent to 1300 UT 2008 Dec 15).

Information about the Call for Expressions of Interest, ASKAP Survey Science Projects and ASKAP in general is described in this document and available online at http://www.atnf.csiro.au/projects/askap.

You are strongly encouraged to read the Draft ASKAP User Policy at **http://www.atnf.csiro.au/projects/askap/policy** if you are intending to submit an Expression of Interest.

Contents

1. WHAT IS ASKAP?

The Australian Square Kilometre Array Pathfinder (ASKAP) is a next generation radio telescope on the strategic pathway towards the staged development of the Square Kilometre Array (SKA). ASKAP will incorporate novel receiver technologies and leading-edge ICT systems to enable vastly improved survey speeds compared with any existing radio telescope. It will comprise an array of 36 antennas each 12m in diameter, capable of high dynamic range imaging and using wide-field-of-view phased array feeds operating in the frequency range 700-1800MHz with an instantaneous bandwidth of 300MHz.

The technological innovation of ASKAP and the unique radio-quiet location in Western Australia will enable a powerful synoptic survey instrument, which will undertake full science operations in late 2012. The system parameters for ASKAP are given in **Table 1** and the sensitivities for the ASKAP configuration for various angular resolutions are given in **Table 2**; further detailed information including the array configuration and relevant sensitivities can be accessed from http://www.atnf.csiro.au/projects/askap.

Table 1: *ASKAP system parameters to be used for the Proposal Submission Stage. Note that the field-of-view of ASKAP is frequency independent and that better system performance than given in this table may also be achieved.*

Number of dishes	36
Dish Diameter (m)	12
Dish Area (m^2)	113
Total Collecting Area (m^2)	4072
Aperture Efficiency	0.8
System Temperature (K)	50
Field-of-view (deg^2)	30
Frequency Range (MHz)	700-1800
Instantaneous Bandwith (MHz)	300
Maximum number of channels	16384
Maximum Baseline (km)	6

Table 2: *Indicative survey speeds and sensitivities as a function of angular resolution for the initial ASKAP configuration assuming 50K system temperature and an aperture efficiency of 0.8 at an observing frequency of 1.4 GHz.*

	10”	**18”**	**30”**	**90”**	**180”**
Survey Speed (deg^2 hr^{-1})					
Continuum (300MHz, 100μJy $beam^{-1}$)	220	361	267	54	17
Spectral Line (100 kHz, 5mJy $beam^{-1}$)	184	301	223	45	14
Surface Brightness (5 kHz, 1K)	-	-	1.1	18	94
Sensitivity in 1hr					
Continuum (300 MHz, μJy $beam^{-1}$)	37	29	34	74	132
Spectral Line (100 kHz, mJy $beam^{-1}$)	2.1	1.6	1.9	4.1	7.3
Surface Brightness (5 kHz, K)	-	-	5.2	1.3	0.56

1.1 ASKAP Commissioning with BETA

There will be an initial commissioning array called the Boolardy Engineering Test Array (or BETA) that comprises the first six ASKAP dishes and has full field of view capabilities and a prototype correlator. BETA commissioning will begin at the end of 2010 and will continue operating until ASKAP begins science operations in late 2012.

BETA will be a test bed for all kinds of ASKAP engineering and science verification including data analysis, pipeline testing, imaging and calibration. ATNF staff, in conjunction with the Survey Science Teams, will carry out science verification testing on BETA and the data will be placed in the ASKAP Science Archive (if appropriate) once adequate quality control is performed.

The configuration of BETA is currently being considered, but it will be a subset of the ASKAP configuration and likely yield an angular resolution of approximately 60 arcsec. The continuum and spectral line sensitivities and survey speeds for BETA are given in **Table 3**.

Table 3: *Indicative survey speed and sensitivities for BETA with 50K system temperature and an aperture efficiency of 0.8 at an observing frequency of 1.4 GHz.*

BETA	**~60”**
Survey Speed (deg^2 hr^{-1})	
Continuum (300MHz, 100μJy beam^{-1})	10
Spectral Line (100 kHz, 5mJy beam^{-1})	8
Sensitivity in 1hr	
Continuum (300 MHz, μJy beam^{-1})	180
Spectral Line (100 kHz, mJy beam^{-1})	10

2. WHAT ARE SURVEY SCIENCE PROJECTS?

During the first five years of science operations, it is envisaged that at least 75% of observing time will be allocated to an initial set of large and coherent surveys called Survey Science Projects. ASKAP Survey Science Projects will utilise ASKAP’s wide field-of-view and fast survey speed to enable major science outcomes early in its lifetime. Survey Science Projects are distinguished from other classes of ASKAP science projects by the following:

Survey Science Projects are large (>1500 hours) and coherent science projects, which address widely recognized astrophysical issues and that could not be reasonably addressed by any combination of Guest Science Projects.

Survey Science Projects will enable scientific results that are intended to be of general and lasting importance to the broad astronomical community.

Survey Science Project data and data products will enter the public domain in a timely way to enable effective opportunities for follow-up observations and for archival research both with ASKAP and other observatories.

Scheduling of Survey Science Project observing time will occur sometime in early 2012 after the Survey Science Teams have completed design studies.

3. SURVEY SCIENCE PROJECT SELECTION PROCESS

A three-stage process involving a proposal stage, a design study stage and a scheduling stage will be employed to select the first set of ASKAP Survey Science Projects. A description of these stages is given below and the timeline shown **Tables 4a** & **4b**.

Table 4a: *Survey Science Project Selection Process Stages*

Stage	Description	Commencement Date
I	Proposal Submission	2008 Nov 1
II	Design Study	2009 Aug 1
III	Scheduling & Science Operations	Early 2012

Table 4b: *Survey Science Project Timeline*

Stage	Date	Event
Ia	2008 Nov 1	Call for Expressions of Interest
	2008 Dec 15	Expressions of Interest Deadline
Ib	2009 Mar 15	Survey Science Project proposal invitation
	2009 June 15	Survey Science Project proposal deadline
	2009 Aug 1	Survey Science Projects announced
II	mid 2009-late 2011	Survey Teams carry out Design Study
	mid 2010	Design Study progress review
	mid 2011	Final Design Study progress review
	Late 2011	Outcomes of reviews of Design Studies
III	Early 2012	Scheduling of Survey Science Project observing time
	Late 2012	Science Operations begin

3.1 Description

Stage I: Proposal Submission

Ia: Expressions of Interest (deadline 2300AEST 2008 Dec 15)

Instructions for submitting an Expression of Interest are given in Section 6.

- The EoI Evaluation Committee will evaluate the Expressions of Interest in terms of scientific, technical and operational feasibility. Expressions of Interest *will not* be ranked.
- The EoI Evaluation Committee will identify projects where merging seems practical and reasonable and will suggest that these groups consider submitting a merged Stage Ib Survey Science Project proposal.
- Principal Investigators of those Expressions of Interest that broadly meet the feasibility checks will be invited to submit Stage Ib Survey Science Project proposals.
- The title, list of investigators and abstract for all Expressions of Interest will become publicly available on 2009 Mar 15 along with the invitations to proceed to Stage Ib.

Ib: Survey Science Project proposal (deadline 2009 June 15)

- Instructions for proposers will be issued prior to 2009 Mar 15. It is expected that submission of proposals will be via the OPAL scheme used for proposal applications to other ATNF facilities. The deadline will be 2009 June 15.
- The Survey Science Project Assignment Committee will rank the Survey Science Project proposals based on the following clearly defined selection criteria.

  (i) The overall scientific merit of the proposed Survey Science Project, including the lasting and important scientific value to the astronomy community, the contribution to maximising the overall scientific return of ASKAP and the uniqueness of the utilised ASKAP capabilities in advancing knowledge in the proposed area of research.

  (ii) A realistic and credible plan that describes the individual Survey Science team members' commitment of effort to play a lead role in survey design, software instrument design, early science commissioning, pipeline testing, data processing and quality control.

  (iii) The overall technical feasibility of the proposed Survey Science Project, and the likelihood of achieving its stated scientific goals in a timely manner.

  (iv) The extent to which the Survey Science Team propose to develop value-added data products and/or software analysis tools that would enrich the overall scientific return from the Survey Science Project or other ASKAP data.

(v) A realistic and credible plan that described how the Survey Science Team leader will organise and manage the scientific, technical and personnel aspects of the project.

(vi) A realistic and credible plan that describes the individual Survey Science Teams benefit to the broad astronomy community in terms of education (e.g. PhD theses)\

(vii) Whether there is opportunity to carry out the proposed Survey Science Project in parallel with other proposed ASKAP surveys.

(viii) The extent to which the Survey Science Team is prepared to take responsibility for the quality control of data products that will be placed in to the ASKAP science archive.

Stage II : Survey Science Project Design Study

- Survey Science Projects that are highly ranked in Stage Ib will proceed to a Design Study stage lasting for at least two years, from mid 2009 to mid 2011.

Outcomes from the Design Study

- Science simulations which refine and improve the expected scientific returns from the Survey Science Projects.
- Design and characterisation of the software pipeline necessary to produce the required data products for the ASKAP Science Archive.
- Results and analysis of the commissioning data from BETA and identification of software/hardware issues relating to any systematic effects in the data.
- Strong connection with groups at other wavebands to identify common scientific goals and sky coverage.

Survey Science Teams Opportunities

- The ATNF will support each of the top-ranked Survey Science Teams by dedicating post-doctoral staff to activities such as science simulations, technical studies and software development of direct relevance to each Survey Science project. The scope of such support that is currently foreseen is between 0.5 and 1 FTE per project.
- The ATNF will fund workshops related to Survey Science Projects.
- Survey Science Teams will have access to observing time on BETA as an aid to optimizing survey design and technical issues.
- Survey Science Teams will have ample opportunities to influence aspects of the ASKAP design and software instruments that remain under discussion as well as be in an optimal position to analyse the survey data as soon as possible.

Survey Science Teams Responsibilities

- Providing input to aspects of the ASKAP design that remain under discussion, such as the survey design and implementation, software instruments, database design, data quality control and processing;

- Developing and participating in end-to-end simulations that are required in advance of 2012, in order to take full advantage of ASKAP as soon as possible after first light;
- Participating actively in the commissioning of BETA by using early engineering and test data to undertake science pipeline tests, and thus determine the data quality, identify any systematic effects, etc., and recommend ways to address any problems that are identified.

Review of Design Studies

The standing Survey Review Committee will conduct annual reviews of the Survey Science Projects and Teams. The reviews will include scientific and technical progress towards achieving the goals of the Survey Science Project, management of Survey Science Teams and personnel issues, and any external factors such as the changing scientific landscape.

Stage III : Scheduling and Science Operations

Time allocation will depend on the outcomes of the reviews of the design studies. Observing time will be scheduled for Survey Science Projects whose design studies have demonstrated credible outcomes.

4. ASKAP USER POLICY

The Draft ASKAP User Policy is available from http://www.atnf.csiro.au/projects/askap.

5. HEADLINE SCIENCE GOALS & SCIENCE CASE

The science goals for ASKAP and indicative year long surveys that could achieve these goals have been outlined in the ASKAP science case published in summary form in PASA in 2007 and in a more complete form in Experimental Astronomy in 2008. These are available from http://www.atnf.csiro.au/projects/askap/Memoseries.html.

The science case must necessarily evolve with time and neither the surveys outlined in the science case nor the contributing authors should be taken as constituting already established ASKAP surveys or teams. In addition, the science case was written before the ASKAP array configuration was determined.

6. INSTRUCTIONS FOR SUBMITTING AN EXPRESSION OF INTEREST

The Expression of Interest has four parts and should be a **maximum of four pages** with a **minimum 11-point font**. Expressions of Interest must be submitted in PDF format as an attachment in an email to atnf-askap-ps@atnf.csiro.au. Authors will be acknowledged via email that their Expression of Interest has been received.

The closing date for submission of an Expression of Interest is 2300 AEST on 2008 Dec 15 (equivalent to 1300 UT 2008 Dec 15). Assistance with technical or other issues related to submitting an Expression of Interest can be sought by contacting the ASKAP Project Scientists (see Section 8 for contact details).

1) Title, investigators and their affiliations and a brief (1-2 paragraphs) abstract
This part of the Expression of Interest will become publicly available.

2) Expected Science Outcomes

3) Technical Details
Here you should give technical details including approximate/expected values of your survey parameters, some examples of which are given in the list below.

- Observing time and possible piggyback/commensal surveys
- Angular, spectral and time resolution
- Instantaneous and total required bandwidth
- Observing frequency
- Survey speed & point source and/or brightness sensitivity
- Dynamic range (spectral or continuum)
- Required data products
- Required polarisation products & polarisation purity,
- Sky coverage
- Survey strategy
- Any other relevant details for technical assessment (e.g. tied array beams, VLBI capability).

4) Concept Design & Commissioning Contribution
A brief statement of commitment of effort to carry out the concept design and commissioning studies that are the proposed responsibility of each Survey Science Team (see Stage II description). The roles of the investigators should be listed.

7. RELEVANT READING MATERIAL

A large amount of information on ASKAP is available from the ASKAP web pages, http://www.atnf.csiro.au/projects/askap/ including:

- The Expression of Interest Information Pack (this document)
- The ASKAP Science Cases
- The Draft ASKAP User Policy
- The Initial ASKAP Array Configuration document

8. FREQUENTLY ASKED QUESTIONS:

1. **Why should I contribute to a Survey Science Project? What's in it for me?**
    - The opportunity to influence software instrument development and survey design and implementation.

- The distinct scientific advantage which comes from a deeper understanding of the instrumental capabilities and the survey data products.
- Direct participation and collaboration with the ATNF hardware and software engineering teams developing the survey instruments.
- Access to commissioning time including data from BETA.
- Access to data during the period used for quality evaluation.
- The ATNF will support each of the top-ranked Survey Science Teams by dedicating post-doctoral staff to activities such as science simulations, technical studies and software development of direct relevance to each Survey Science project. The scope of such support that is currently foreseen is between 0.5 and 1 FTE per project.
- Opportunities to involve students in leading edge scientific, computational and engineering research.
- Survey Science Project design or data release papers will be cited by users accessing this data from the ASKAP Science Archive.

2. **The ASKAP science case has already been written and the ASKAP science priorities are also set. So is this really an open process?** Yes it really is. ASKAP telescope time will be assigned to astronomical research projects subject only to scientific merit and to technical and operational feasibility. No a priori guaranteed science time will be allocated to particular countries, institutions, nor to any individuals currently on existing (2008) working groups.

3. **How will similar Expressions of Interest from different groups be handled?** A committee will review the Expressions of Interest. The committee will identify projects where merging seems practical and reasonable and will suggest that these group consider submitting a merged Stage Ib Survey Science Project proposal.

4. **Are there restrictions on Survey Science Team leaders or members in terms of nationality?** No. Membership, including leadership, of ASKAP Survey Science Teams will be open access in accordance with ASKAP User Policy principles 1.1 and 1.2. However, to facilitate interactions with ASKAP designers, each Survey Science Team should include at least one person associated or affiliated with ATNF.

5. **Does the Expression of Interest need to include a full team or can I apply alone?** The Expression of Interest does not require a full team to be in place. However, a brief statement of commitment of effort will be required and the Stage Ib Survey Science Project proposal will include details of a Survey Science Team.

6. **What is the frequency coverage and array configuration for ASKAP?** Details of the array configuration and performance can be found on the ASKAP web pages. Frequency coverage will be 700 to 1800 MHz with a maximum instantaneous bandwidth of 300 MHz and a maximum of 16384 frequency channels.

7. **Will the Survey Science Project data be made public?** Yes. All data and data products produced by the software instruments (subject to storage capacity) will be made publicly available through the ASKAP Science Archive on a time scale determined by operational issues (e.g. quality control) and not proprietorial interests.

8. **Who do I contact for more information?** Email the ASKAP Project Scientists, Simon Johnston & Ilana Feain via atnf-askap-ps@atnf.csiro.au.

9. **When will ASKAP begin operations?** ASKAP is expected to begin operation in late 2012. BETA, which will consist of 6 antennas and a prototype correlator, will be commissioned in late 2010.

10. **What is the point of the Design Study stage?** The Design Study stage, which runs from mid 2009 to mid 2011, is an important step in determining the Survey Science Projects. The ATNF will endeavour to provide resources to the Survey Science Teams for activities during the Design Study stage and the teams will have access to observing time on BETA. The outcomes from the Design Study stage are expected to produce
    - Science simulations to refine and improve the expected scientific returns from the Survey Science Projects.
    - Design and characterisation of the software pipeline necessary to produce the required data products into the ASKAP Science Archive.
    - Results and analysis of the commissioning data from BETA and identification of software/hardware issues relating to any systematic effects in the data.
    - Strong connection with groups at other wavebands to identify common scientific goals and sky coverage.

11. **When will actual observing time for Survey Science Projects be allocated?** Observing time will be allocated to all Survey Science Projects whose design studies have demonstrated credible outcomes. Observing time will be scheduled in early 2012, with observations expected to begin in late 2012, and will depend on the outcomes of the reviews of the design studies.

12. **Will there be a chance to join a Survey Science Team closer to 2012?** Yes. It is the Survey Science Projects, not the Team members, that are being defined in this process. Teams will not be set in stone in early 2009. Evolution of the teams will necessarily occur – people may join and/or people may leave depending on different circumstances. Management of the Survey Science Teams will be an important component of the review process both during the Design Study stage and once ASKAP is fully operational.

13. **Can I submit a Survey Science Project proposal (Stage Ib) if I don't submit an Expression of Interest (Stage Ia)?** Maybe. Principal Investigators of those Expressions of Interest that broadly meet the feasibility checks will be invited to submit Stage Ib Survey Science Project proposals. If the review committee evaluating the Expressions of Interest perceives that a specific scientific area has not been covered, it may decide to issue a further call for proposals in those specific areas.

9. FURTHER REQUESTS FOR INFORMATION?

1. Check Online: http://www.atnf.csiro.au/askap

2. Contact the ASKAP Project Scientists (Simon Johnston & Ilana Feain):
   Email: atnf-askap-ps@atnf.csiro.au