

**OPTICAL AND RADIO ASTRONOMY  
NCRIS INVESTMENT PLAN  
PROCESS, OUTLINE & OPTIONS**

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Australian Government  
Department of Education,  
Science and Training

# NCRIS PRINCIPLES AND GOALS

- Investments should enhance R&D contributions to national priority goals
- Focus on areas where Australia is, or potentially is, world-class and can provide international leadership
- Development on a collaborative, national basis to serve the research and innovation system broadly
- There should be as few barriers as possible to accessing major infrastructures
- Consideration of whole-of-life costs and operational funding where appropriate

# NCRIS Roadmap Recommendations 1

Extracts from the NCRIS Roadmap (pp37-38)...

- “For Australia to remain a major international contributor to astronomy it is essential that we continue to have a strong presence in leading-edge international infrastructure, both the current and next generations. Australia also needs to maintain the domestic infrastructure which constitutes the bulk of observing capacity for Australian astronomers.”
- “The Australian astronomy community has identified its priorities for infrastructure investment in the Australian Astronomy Decadal Plan 2006-2015. Consistent with that plan, the Committee considers that the priority areas for NCRIS investment in optical and radio astronomy should be (in no specific order):
  - ▶ Additional support for the Anglo-Australian Observatory (AAT);
  - ▶ [contribution to] Delivery of the Square Kilometre Array (SKA) Phase 1 radio telescope;
  - ▶ Access to the equivalent of 20% of an 8m-class telescope through the existing Gemini partnership and new telescope & instrument agreements.”

# NCRIS Roadmap Recommendations 2

- “The Committee recommends that the Australian Academy of Science’s National Committee for Astronomy develop a detailed proposal by September 2006 for the implementation of this capability through a phased series of investments. The proposal would need to:
  - ▶ clearly **prioritise** the infrastructure requirements and provide a range of cost options;
  - ▶ provide a clear **timetable** for the investments; and
  - ▶ recommend **governance** arrangements whereby the investments can be managed effectively & appropriately on behalf of the astronomy community.”
- “It is expected that major instrumentation upgrades to Gemini and the development of the SKA Phase 1 (with Australia in both cases playing a role in technology development) will deliver an order of magnitude improvement over existing capabilities in optical and radio astronomy worldwide. Australian participation in Gemini and SKA Phase 1 would keep Australian astronomers at the forefront of astrophysical research for at least the next decade.”

# NCRIS Roadmap Recommendations 3

- “The NCRIS Committee recognizes the importance to the astronomy community of participation in next generation of instruments, an ELT and full implementation of the SKA, but notes that investments in these are beyond the scope of the NCRIS program and will need to be dealt with through separate processes. In addition the timescale for the full SKA project puts it effectively beyond the horizon of the Strategic Roadmap.”
- “The Committee considers the National Committee of Astronomy’s recommendation that a Giant Magellan Telescope Landmark Facility Committee be established by relevant government, business and academy partners to work towards Australian participation in the GMT consortium has merit and encourages the parties to consider it.”
- *Since the Roadmap, the NCRIS committee has provided a funding envelope for the optical and radio astronomy capability that ranges from \$35M to \$50M. The committee also seeks advice on “unconstrained” requirements.*

NCRIS Facilitator: Brian Boyle  
Plan Coordinators: Matthew Colless (AAO) Warwick Couch (Gemini) Michelle Storey (SKA)  
Develop Plan within NCRIS framework (final version not yet available)  
Contract 'Business & Legal' support

## Timeline

Late March: NCA meeting  
Early April: Indicative Funding Envelope from DEST: \$35m-\$50m  
April 21: Community Meeting  
mid-May: Facilitator road-trip  
End-May: First draft of Investment Plan NCA  
Early June: Draft available to community  
Mid June: Feedback received  
Early July: 2nd draft of Investment Plan (ASA)/submitted to DEST  
July/August: Iteration with NCRIS committee/DEST  
Sep 8: Final draft submitted to DEST



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# Role of the NCRIS Facilitators

- The facilitation process is consistent with the core goals of NCRIS – collaborative, open, outcome focused
- Facilitators need to work with the research community, the NCRIS Committee and DEST to achieve the greatest strategic impact possible from NCRIS investments

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# NCRIS Investment Framework

- Explains to the public how NCRIS will be implemented
- Describes the role of the NCRIS facilitators
- Explains the content that is required in an Investment Plan
- Explains how an Investment Plan will be assessed

- **Criterion 1: An investment plan must result in excellent research infrastructure that addresses the national requirements of the relevant capability area described in the NCRIS Roadmap.**
- **Criterion 2: An investment plan must result in research infrastructure that is accessible by researchers on the basis of merit at reasonable prices, and that encourages collaboration in research.**

- **Criterion 3: An investment plan must include a facility ownership and management structure that will result in the efficient and effective operation of the infrastructure.**
- **Criterion 4: An investment plan must include an implementation strategy and business case that will result in the efficient implementation and effective ongoing financial management of the infrastructure.**

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# NCRIS Facilitator Deliverables: 7 July Progress Report

- Advice on progress against the project plan and dollars spent
- Summary of existing research infrastructure
- Description and prioritisation of future infrastructure needs: unconstrained, higher NCRIS limit, lower NCRIS limit
- Enabling platform infrastructure highlighted in each case



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# **NCRIS Facilitator Deliverables: Draft Investment Plan**

- Due 8 September
- Content will be based on the NCRIS Investment Framework
- NCRIS committee will provide an Investment Plan template

- The Decadal Plan specifies the following desired capabilities for *optical* facilities:
  - ▶ 8m telescope: equivalent of 20% access to an 8m telescope
    - The current 6.19% share in Gemini (12.4% 8m access)
    - The corresponding share in the Gemini Aspen instrument program
    - The equivalent of an additional 7.6% of 8m-class telescope access
    - Ideally this is additional *share*, but in reality may have to be *nights*
  - ▶ AAT: available as front-line facility for the decade 2006-2015
    - Refurbishment and upgrade to existing telescope infrastructure
    - An internationally competitive new instrument for the telescope
  - ▶ ELT: Minimum 10% share, costing ~AU\$80M over 2006-16
    - Short-term: AU\$8M for 10% of GMT design & development 2006-9

■ 8m access:

- ▶ Cost of 6.19% of Gemini operations for the 5-year period 2006-07 to 2010-11 is \$17.2M (assuming AU\$1=US\$0.70)
- ▶ Cost of 6.19% of the Aspen instrument program is \$6.3M
- ▶ Cost of 7.6% additional equivalent 8m access is \$5.8M
- ▶ Costs defrayed by existing MNRF & LIEF funding of \$8.3M
- ▶ Total = \$17.2M + \$6.6M + \$5.7M - \$8.3M = \$21.2M

■ AAT:

- ▶ Contingent on AAO DEST review
- ▶ Cost of essential refurbishments over NCRIS period is \$4.1M
- ▶ Cost of proposed new instrument for AAT is \$5.9M
- ▶ Costs defrayed by \$3M staff effort from AAO recurrent budget
- ▶ Total = \$4.1M + \$5.9M - \$3.0M = \$7.0M

## ■ GMT indicative costs

- ▶ The full estimated construction cost of GMT is US\$550M
- ▶ A 10% Australian share would cost  $0.10 \times 550 / 0.70 \sim \$80M$
- ▶ Design & development phase estimated to cost US\$58M
- ▶ A 10% share in DDP costs \$8M over 2006-2009
- ▶ Initial buy-in is US\$1M; one year's contribution is ~\$3M

## ■ Seed funding

- ▶ Gain early influence in project
- ▶ ANU joining GMT provides an opening wedge

# NCRIS Costs of Other OIR Capabilities

- Two other optical capabilities given high priority by the Decadal Plan are...
- PILOT: Antarctic 2m telescope, pathfinder for larger telescopes
  - ▶ Cost: \$6M for a 50% share in PILOT
- SSO: Australia's premier on-shore site for optical astronomy
  - ▶ Cost: unclear at this time, but depends on facilities supported
  - ▶ ANU may require recovery of shared site costs from users
  - ▶ Perhaps seek support from NSW/local governments

- Some possible options for the optical astronomy component of the NCRIS plan assuming the upper funding envelope...
- Option #1 (\$50M total, \$30M:\$20M optical:radio, AU\$1=US\$0.7)
  - ▶ 8m access = Gemini+Aspen+7.6% addnl = 20% = \$21.2M
  - ▶ AAT = refurbishment + new instrument = \$7.0M
  - ▶ GMT = match ANU = \$1.8M
- Option #2 (\$50M total; \$30M:\$20M optical:radio, AU\$1=US\$0.7)
  - ▶ 8m access = Gemini+Aspen+5.1% addnl = 17.5% = \$19.3M
  - ▶ AAT = refurbishment + new instrument = \$7.0M
  - ▶ GMT = joint 5% share with ANU = \$4.0M

- Some possible options for the optical astronomy component of the NCRIS plan assuming the lower funding envelope...
- Option #3 (\$35M total, \$21M:\$14M optical:radio, AU\$1=US\$0.7)
  - ▶ 8m access = Gemini+Aspen+2.6% addnl = 15% = \$17.4M
  - ▶ AAT = refurbishment only (instrument only) = \$4.1M (\$2.9M)
- Option #4 (\$35M total; \$21M:\$14M optical:radio, AU\$1=US\$0.7)
  - ▶ 8m access = Gemini+Aspen+7.6% addnl = 20% = \$21.2M
- N.B. adding PILOT (\$6M) would mean removing the AAT (\$7M) or reducing 8m access level from 20% to Gemini-only (12.4%).

- Australian Astronomy Decadal Plan (2006-15) identifies SKA as the highest priority new program for Australian radio astronomy
- NCRIS Roadmap identifies delivery of the SKA Phase 1 radio telescope facility as the priority area for radio astronomy
- Radio astronomy indicative funding envelope AUD14M – AUD20M
- Collaborators involved in preparation of radio astronomy component include:
  - ▶ ANU-RSAA, CSIRO, Curtin Uni, Harvard-Smithsonian CfA, MIT, Uni. of Melbourne, Uni of Sydney, Uni of Tasmania, ANITA

- Construction and operation of international facility radio telescope on WA Radio Astronomy Park
  - ▶ Wide bandwidth, wide FOV
  - ▶ Highly leveraged, builds on
    - xNTD (~0.7-3 GHz)
      - AUD25M + AUD10M ATNF (existing)
    - MIT-led Low Frequency Demonstrator (80-300 MHz)
      - LFD ~ AUD10M (confident)
    - Radio Astronomy Park in WA
      - AUD4.2M+
    - SKAMP developments and science

## ■ NCRIS funds

- ▶ Combined facility planning/coordination/operations
- ▶ Effective operation as international facility
- ▶ x 2 increase in survey speed of xNTD to provide science demonstration of single dish/focal plane array
- ▶ x 2 increase in collecting area of LFD
- ▶ Associated combined increase in digital signal processing, computing
- ▶ Possible systemic infrastructure (data transport, national connectivity, computing centre) for telescope and theoretical astrophysics

- Together with SKAMP, astronomers will have access to unprecedented bandwidth coverage.
  - ▶ Science includes: epoch of re-ionisation, heliosphere, transients, HI spectral line surveys at cosmologically interesting red-shift, continuum and polarisation surveys
- Progress development of international SKA Phase 1
- Catalyst for establishment of Radio Astronomy Park and raising international profile of Australian SKA site
- If lower funding envelope (AUD14M)
  - ▶ Option 1: remove LFD expansion and integration
  - ▶ Option 2 (favoured): more uniform scale back to technology/science demonstrators, but limited national facility capability

## NCA proposal

- Initial Governance Bodies (subject to agreement):
  - ▶ Gemini → ARC
  - ▶ AAO → AATB
  - ▶ SKA Phase 1 → CSIRO
- Move towards single Governance structure for NCRIS

## Establish 5/6-member WG

- Consult widely with community stakeholders in considering Governance models for any NCRIS investment in optical and radio astronomy that:
  - ▶ best delivers on the stated NCRIS principles and goals
  - ▶ is consistent with the longer-term strategic goals for Australian astronomy Governance enunciated in the Decadal Plan
- Report on options to the NCA by May 30

## ■ General principle

- ▶ NCA consensus 60:40 optical:radio split

## ■ Phasing of NCRIS funds...

- ▶ 8m access: due to existing MNRF/LIEF funding, funds need to ramp up in 2007-8 and reach their full level from 2008-9.
- ▶ AAT: refurbishment can be evenly spread over the period; the new instrument is more valuable if delivered quickly.
- ▶ GMT: if seed funding is to be provided, should be early
- ▶ SKA: LFD component level: xNTD ramp up towards end

## ■ Further consideration to be given to 'unconstrained' scenario...

## ■ Additional matching funding that might be included or leveraged?