ASTRONOMY IS BIG BUSINESS
ASTRONOMY IS GLOBAL SCIENCE
GOAL
To integrate and enhance Australia’s research capacity in optical and radio-astronomy

To attract part of the multi-billion dollar global business in astronomical technology to Australia including SKA → rural Australia

To inspire a new generation of Australians in the physical sciences with the discoveries made by Australian scientists using Gemini and SKA
Strategies for Success

PRIORITIES IDENTIFIED BY THE AUSTRALIAN COMMUNITY IN THE MID-TERM REVIEW

double Australia’s share in Gemini
construct SKA prototype
integrate effort in astronomical instrumentation
Australia’s strengths

- International reputation for excellent science
- Established track record in innovative instrumentation
- Close links between radio & optical communities
Australian Astronomy Community

- 25 institutions
- 160 astronomers
- 250 engineering & technical staff
- 80 postgraduate students
  - 50% go directly to industry or government
- New undergraduate courses in 20 universities
  - revitalising education in the physical sciences
Science Impact

- Astrophysics ‘top performer’
  DIST Report 1997

- Astronomers comprise 9 out of 33 Australian citation laureates
  ISI 2001

- High profile young researchers:
  – Gaensler
  – Schmidt

Impact relative to world average (%)

- Astrophysics
- Agricultural Sci
- Geosciences
- Plant & Animal
- Multidisciplinary
- Engineering
- Ecology / Env
- Pharmacology
- Mathematics
- Chemistry
- Clinical Medicine
- Computer Sci
- Materials Sci
- Education
- Biology
- Psychology
- Physics
- Neurosciences
- Microbiology
- Immunology
- Social Sciences
- Molecular Biology
- Economics
VISION
To create most detailed 3-dimensional map of the Universe ever

INNOVATION
Build state-of-the-art equipment for Anglo-Australian Telescope

INSPIRATION
World class science

COMMERCIALIZATION
Overseas orders

Cost: A$4 000 000
Return: A$8 000 000
Australian Innovation in ‘External’ Instrumentation

Successful beginnings...

NIFS project $3M (Gemini)

OzPoz project $3.2M (ESO)

Australian Industry
Auspace
Prime Optics
Broens Industries
O’Brien Aluminium
Lintek
Craigie Industrial
Artronics
Chess Engineering
Analytical Systems
ASP Plastics
Bishops Manufacturing
Queensland Manufacturing
METS
Hunter Industries
Breseight Aus Pty Ltd
AUSTRALIA'S GLOBAL POSITION

- World-leader in astronomy
- Reputation for technological innovation
- Successful in attracting overseas $$

Opportunity for Australia
Astronomy Funding

US         7
France   6
Italy        5
UK          5
Germany  4.8
Canada   3
Australia  1.5

($A/capita/annum)
Closeup of IRS8, resolving the bow-shock of a fast-moving star.

Gemini North Adaptive Optics Image of the Galactic Center

(Crosshairs indicate location of Galactic Center)
Adaptive Optics sharpens Gemini’s view of the Universe.

MCAO is a key technology for Gemini and beyond.

Uncorrected Image

With Adaptive Optics

Multi-conjugate adaptive optics (MCAO)
Quasar galaxy at 8 billion light years from Earth. 75% of the age of the observable Universe.

**Gemini Image**

- **Gemini key science goal**: To understand how galaxies formed in the early Universe.
- **SKA key science goal**: To understand how the early Universe came out of the “dark ages”.

8 billion light years away, 75% age observable Universe.
Telescopes Look Back in Time

“Primordial soup” - matter and energy

“Dark Ages” - before the stars

Early galaxies - stars light up

mm-waves

radio

light

COBE satellite NASA

SKA

Gemini
Australia & Radio Astronomy

1961 Parkes: Australian icon

1988 Australia Telescope: Australian-built

Opportunity for Australia to host – international visibility
Next step: use Moore’s law to get rid of all the cogs and steel!
New Technology
The Luneberg Lens

SKA Telescope Fly-Through

CSIRO ATNF
Commonwealth Scientific & Industrial Research Organisation
Australia Telescope National Facility

Ben Simons, Sydney VisLab
www.vislab.usyd.edu.au
This is the next big step for international radio-astronomy - but where to build it?
For cm radio-astronomy, Australia offers similar natural advantages to those of Chile and Hawaii at optical wavelengths.
An SKA centred in SA
A radio-quiet reserve?:
Industry Benefits


- Beginning of the communication service industry in SE Asia
Industry Link: CEA Technologies

- Canberra based
- 150 employees, $20M turnover
- Modular S and X-band radars sold internationally
- Will be involved in SKA prototyping
From pure research to commercial innovation
(the Radiata story)

Australia’s Astronomical Future: Gemini and SKA
Management Structure

Members
Funding
Coordination
National Facilities

International SKA consortium

CSIRO

ATNF

Australia Telescope Steering Committee

Australia Committee for Astronomy

Anglo-Australian Telescope Board

AAO

ARC

ANU RSAA

MSSSO

International GEMINI Board

Australian Astronomy MNRF Board of Management

Industry

SKA

Australian SKA Consortium

Australian GEMINI Steering Committee

GEMINI Observatory

$
Members of the Australian SKA Consortium Committee

• Government Research Bodies (4)
  – ATNF, AAO, CTIP

• University Representatives (4)
  – Sydney, UNSW U. Melbourne, ANU

• Industry Representatives (5)
  – ResMed, CISCO, Institution of Engineers Aust, CSSIP, Australian Photonics CRC

• Ex-Officio (2)
  – Chair of Australian SKA Science and Engineering Working Group
MNRF Funding distribution

- MCAO Imager $10M
  - RSAA prime contractor
- IRMOS $6M
  - AAO prime contractor
- Gemini operating costs $4M/yr
- SKA prototype $7M
- SKA enabling technologies $14.6M
  - ATNF prime contractor

Managed by AABOM
1. Outcomes

Immediate

• Australian time on Gemini doubled
• Significant enhancement in Australian international scientific profile

Within 3 years

• Enhance operation of Australia Telescope Compact Array
2. Outcomes

Completion of MNRF

- Two leading-edge astronomical instruments for Gemini
  - New science on Gemini
    - directly relevant to SKA
  - Enhanced Australia’s capability to compete effectively on the global instrumentation market
- SKA prototype constructed
  - Enhanced science return from Australia Telescope National Facility
  - Australia in compelling position to host SKA
3. Outcomes

Beyond 2006

• SKA sited in rural Australia
  – $1 billion program
• Australian innovation helping to drive the design/construction of 30m optical telescope
  – $1 billion program
• Integrated national capability for astronomical instrumentation
• Vibrant, world-leading astronomical community
Innovation  

Inspiration 

ASTRONOMY 

A 21st Century Production 

Commercialization