

SKA and ASKAP

Some industry considerations

Talk to Industries in Perth WA
24 Aug 2007

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Disclaimer: Views expressed in this talk are personal and are neither endorsed by nor commit Cisco to any liability or obligation.

Introducing me

1970s

**BA(Hons) politics (LaTrobe Uni)
diplomat
university lecturer**

1980-2002 – RAAF

**intelligence
security
capability development (\$2bn portfolio of projects
with associated R&D sponsorship)**

Nov 2002

**joined Cisco – “internet in space”
1 of a team of 16 world-wide
Canberra-based**

Chair:

**Australia Telescope Steering Committee
Australian Antarctic Astronomy Advisory
Committee
Australian Defence Information and Electronic Systems
Association**

Agenda

- Introduction
- 1% of the money is real
- What does this mean for WA?
- Industry view of SKA
 - People
 - Organisation
 - Sustainment
 - Training
 - Equipment
 - Doctrine
- Key point: Relationships within (and beyond) Australia
- Discussion

Australian SKA Industry Cluster – Friends of SKA



Astronomy Decadal Plan

Blueprint for astronomy investment in next decade

SKA

Anglo Australian Telescope
Investing in overseas optical telescopes (Gemini, GMT)

Antarctic astronomy

INTENT

New Horizons

A Decadal Plan for
Australian Astronomy
2006 – 2015

Prepared by the National Committee for Astronomy of the Australian Academy of Science November 2005



Square Kilometre Array

- New kind of radio telescope
 - 100 x more powerful (1 000 000 m² collecting area)
 - Antennas on continental scale connected by fibre-optic cable and a very complex network
 - **MOTHER OF ALL NETWORKS**
- International project
 - 17 nations, 46 research institutions
 - Budget Euro1billion, operations Euro100m/year
 - Europe – 33%
 - US – 33%
 - Rest of World – 33%
 - Australian/NZ contribution - 10%
 - **ORGANISATIONALLY VERY HARD**

COMPLEX

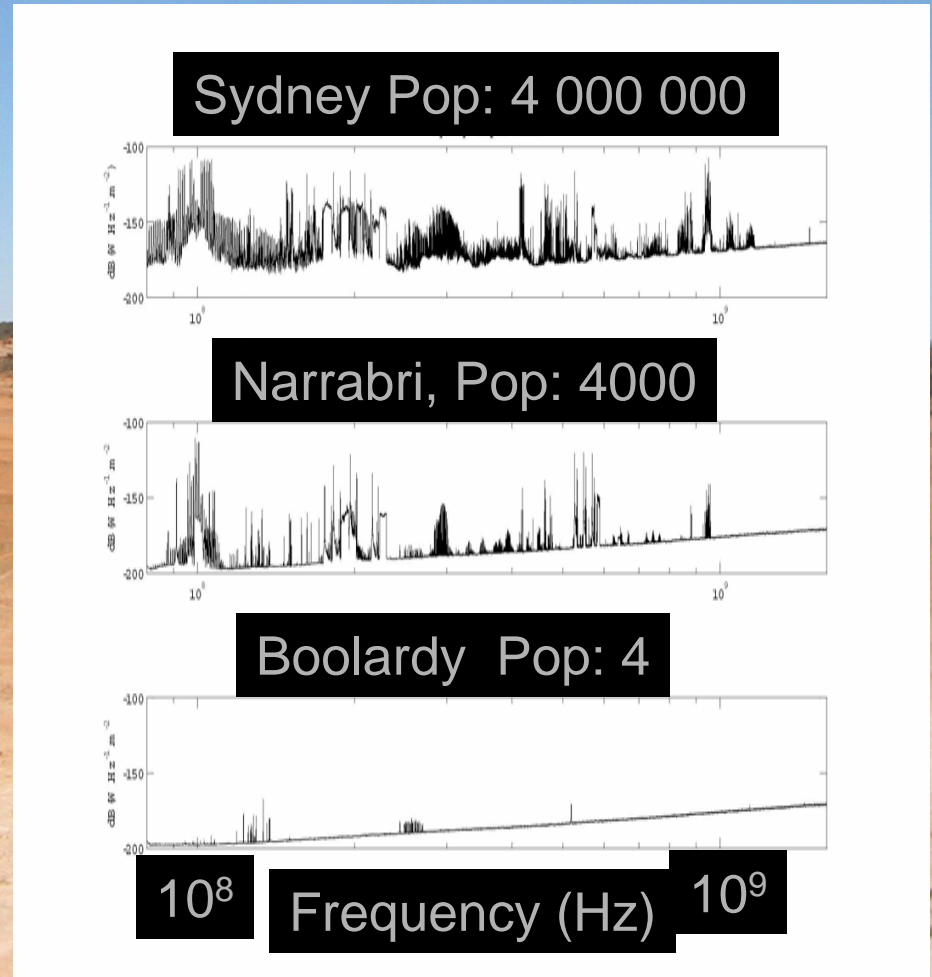
Square Kilometre Array

- Australia and South Africa still in the running to host SKA
 - Final site decision 2009
 - AS (Boolardy Station), the best site (profoundly radio quiet today and unlikely to change c/f South Africa)
 - Australian site secure
- Money for 1% demonstrator, ASKAP, at Boolardy in WA – tech pathfinder to SKA
- Also South African money for a 3% demonstrator – old technology
- National and international governance strengthening
- SKA industry cluster established
- www.skatelescope.org

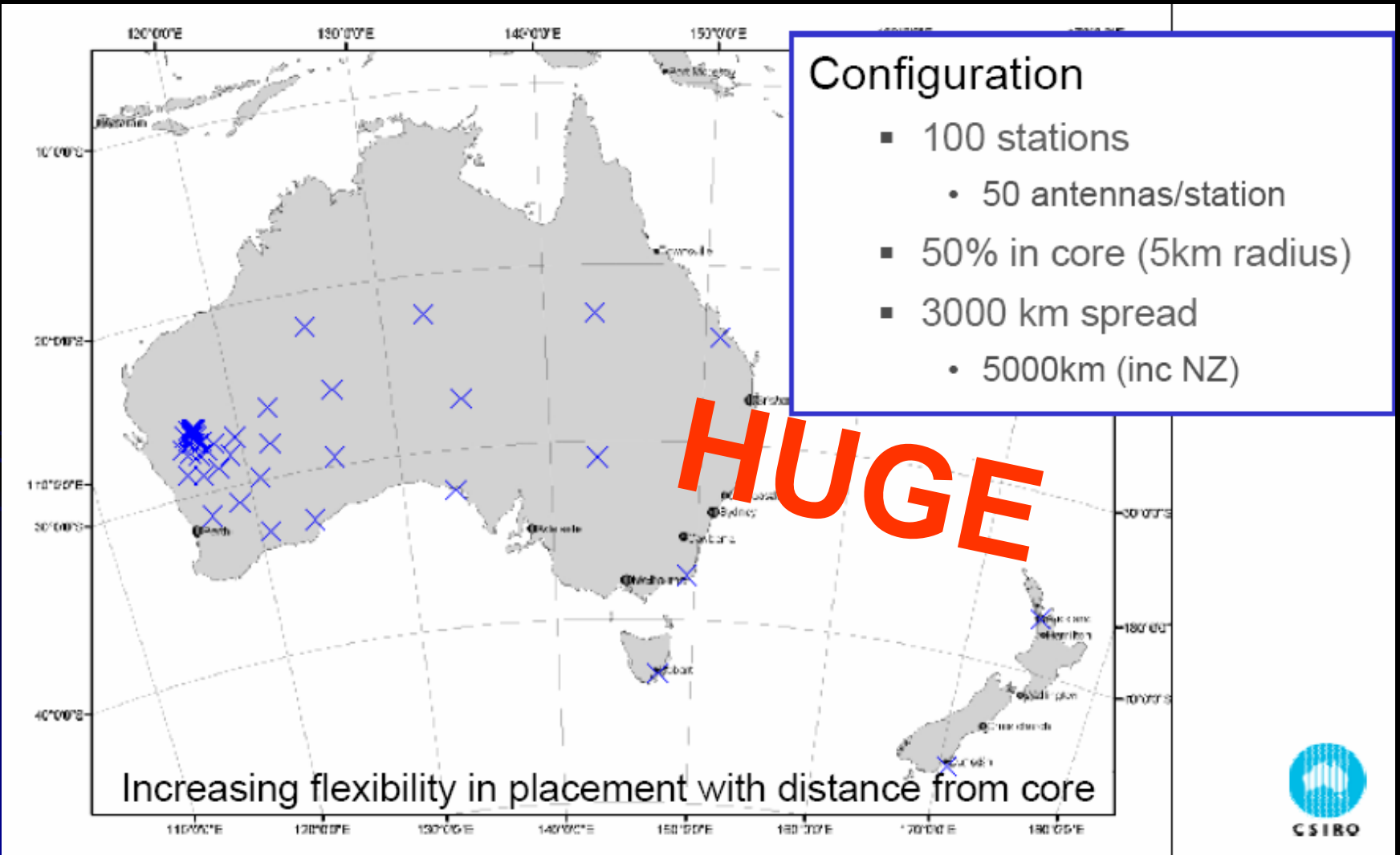
COMPETITION

A quiet place in the bush

REMOTE



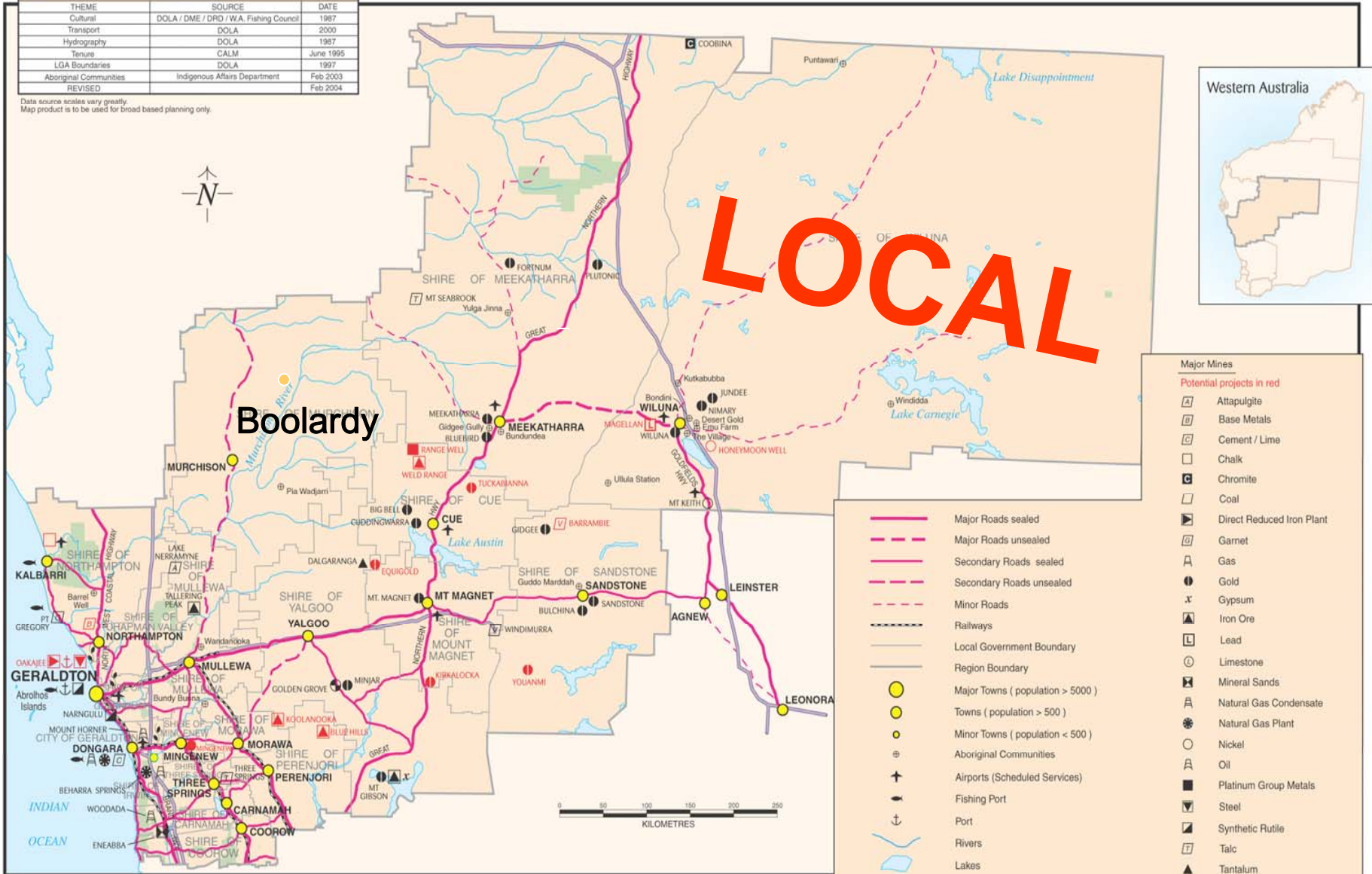
SKA: Candidate Locations in AS/NZ



WA Midwest

DATA DIRECTORY		
THEME	SOURCE	DATE
Cultural	DOLA / DME / DRD / W.A. Fishing Council	1987
Transport	DOLA	2000
Hydrography	DOLA	1987
Tenure	CALM	June 1995
LGA Boundaries	DOLA	1997
Aboriginal Communities	Indigenous Affairs Department	Feb 2003
REVISED		Feb 2004

Data source scales vary greatly.
Map product is to be used for broad based planning only.



WA Boolardy site



ASKAP Telescope Specification

AMBITIOUS

ASKAP will be a new m/cm-wave radio telescope:

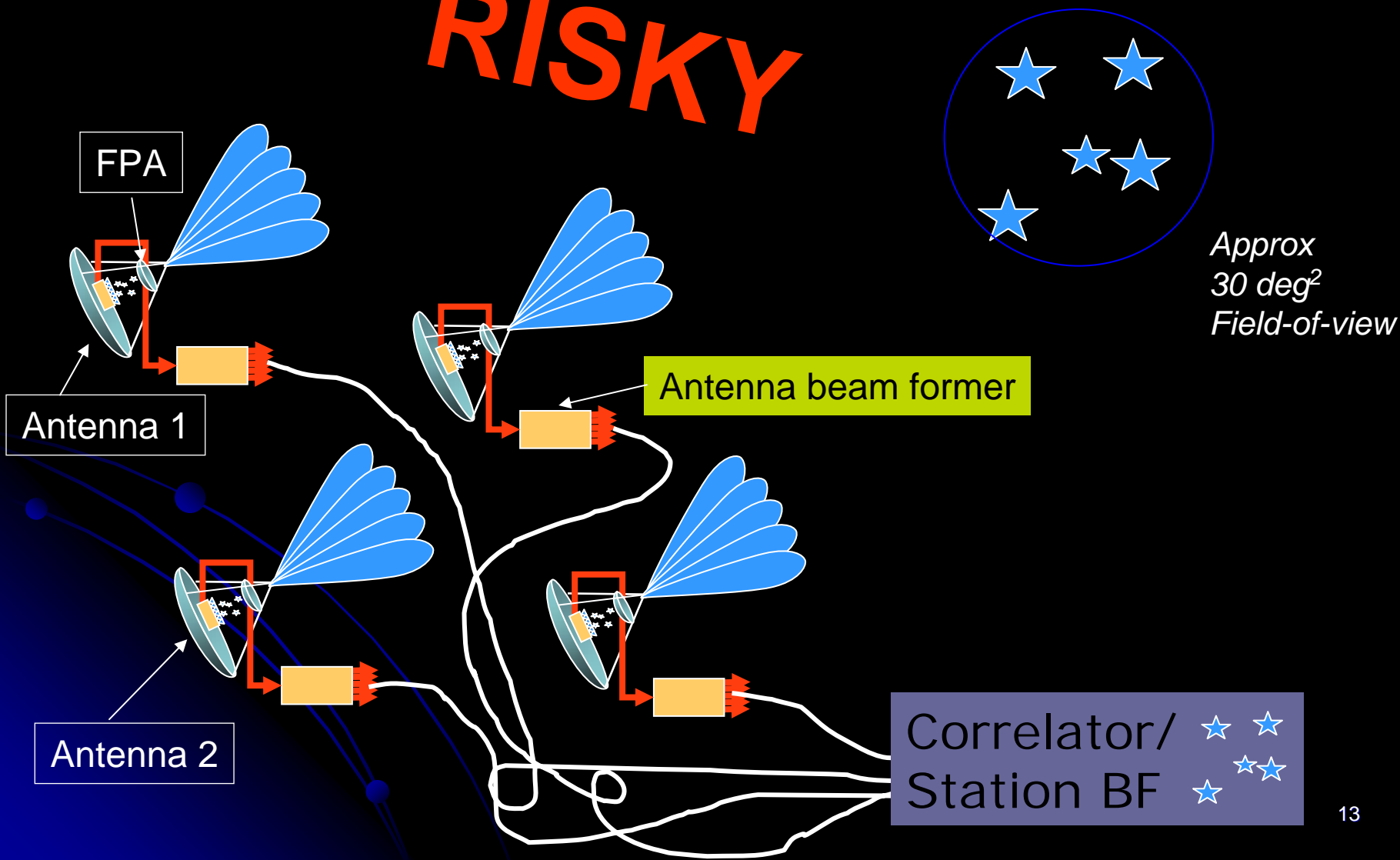
Number of dishes	45
Dish diameter	12 m
Max baseline	8 km
Observing frequency	700 – 1800 MHz
Field of View	30 deg ²
Bandwidth	300 MHz
Resolution	5 kHz
Channels	16k
Focal Plane Phased Array	~200 element feed
T _{sys} (cooled or uncooled)	35K

- Infrastructure for an entire operating observatory
- supporting other radio arrays at Boolardy
 - including fibre, computing, buildings etc



Focal Plane Arrays (FPA) & ASKAP

RISKY



CSIRO SKA R&D + ASKAP Funding

Strong legacy of investment in SKA related R&D:

2001-2007 MNRF SKA R&D \$10.5M + \$10M towards related technology projects

2007+ CSIRO & Aus Government funding for ASKAP

07-08	\$15.4M
08-09	\$27.6M
09-10	\$32.4M
10-11	\$20.8M
	\$96.2M (EUR 58M)



+ International Partner Collaboration

REAL MONEY

Current Situation

Situation

Trend

People

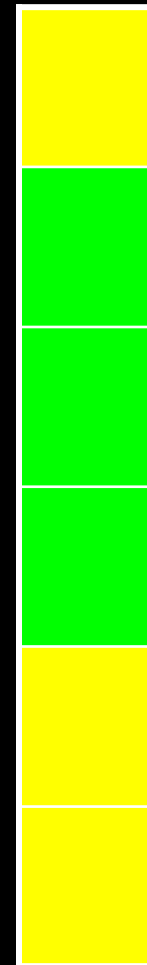
Organisation

Sustainment

Training

Equipment

Doctrine



People



Astronomers

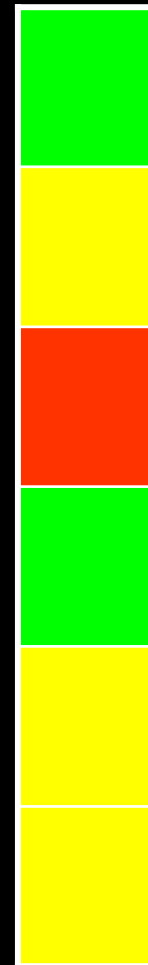
Software Engineers

System Engineers

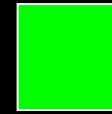
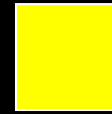
Civil/Elec/Mech

Tradesmen

Technicians/Operators



Organisation



National Governance

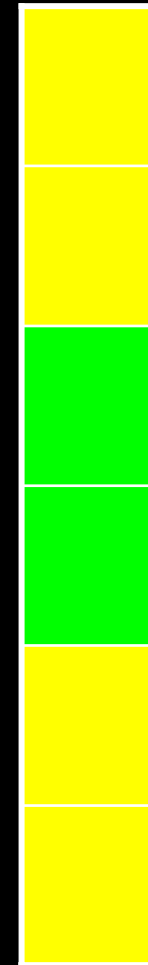
International Governance

Government Support

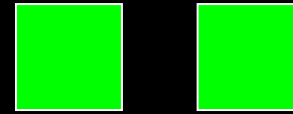
Community Support

Industry Engagement

Org Resilience (depth)



Sustainment



Planning

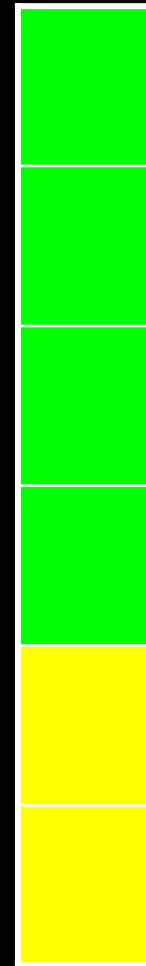
Funding

Risk ID and reduction

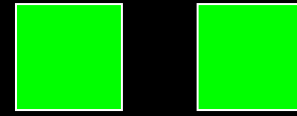
Legals (land, RQZ)

Industry Relationships

Org Resilience (depth)



Training



Astronomers

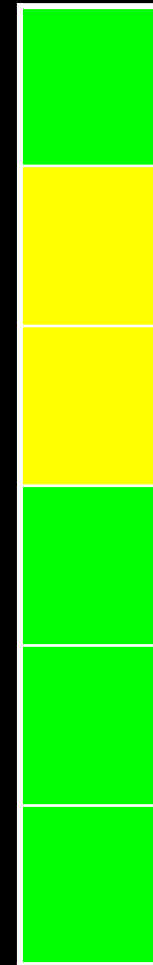
System Engineers

Software Engineers

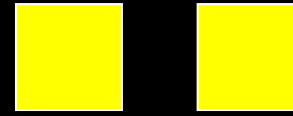
Other eng and techs

Quality and Access

Capacity



Equipment



Front end

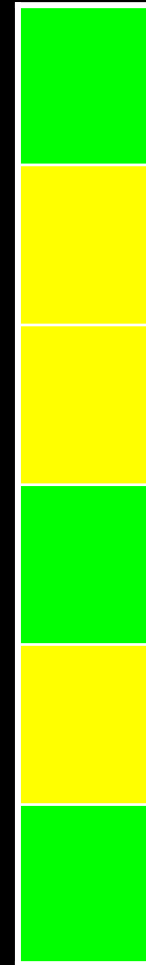
System

Software

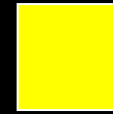
Infrastructure (non comms)

Simulator(s)

Project Mgt



Doctrine



Operational concept (why)

Concept of Ops (how)

Including new disciplines

Changing cultures

Managing expectations

Balancing present with future



SKA

Radio Astronomy: From Atoms to Electrons

From hand-crafted 'heavy metal' to COTS*



**LEADERSHIP
OPPORTUNITY**

* COTS = commercial off the shelf

Industry Opportunities: Budget

	Guess
● Infrastructure	10m
● roads	
● power (green options)	
● accommodation	
● Antennas/receivers	25m
● Digital Signal Processing	15m
● Communications and Networking	20m
● Computing	20m
● Contingency	10m
● Support (repairs, maintenance, upgrade)	10m pa

SKA: 2 orders of magnitude larger

Industry Opportunities: Questions

- How do company capabilities match to ASKAP?
- When to invest?
- How much to invest in:
 - Strategic BD
 - RFI response
- Synergies? (eg green power)
- What do you need to succeed?
 - What do you need from CSIRO/Gov't/Industry bodies to help

SKA: 2 orders of magnitude larger

Data rates - from ASKAP to SKA....

	ASKAP – 1% Pathfinder	SKA P1 – 10% Pathfinder	SKA
Number of 12 m dishes	45	500	5000
Frequency Range	0.7 – 1.8 GHz	0.3 – 10 GHz	0.3 – 22 GHz
Number of receivers	9,000	200,000	1,000,000
Bandwidth	0.3 GHz	2 GHz	4 GHz
DSP Processing	800 Top	40 Pop	400 Pop
Raw data rate (per hour) Computer Processing	4 Tbyte 1 Teraflop	200 Tbyte 5 Pflop	200 Pbyte 50 Pflop

Australian Government/Industry interaction

CSIRO (ATNF) to industry

- Conservative contracting model
- Culture of self-reliance: concern about being “ripped off” – a view that industry is too expensive
- Desire to retain control of architectures and design (assumption that CSIRO knows best and that industry has little innovative to offer)
- Part of the capability and capacity journey is to build the right relationships – this depends on trust and takes time

Contracting Models

- “Juste retour”, ESA Model (New Norcia) can lead to weird outcomes
- Best Value for Money, JSF Model – can lead to weird outcomes
- Committees, ALMA model (money doesn't go offshore) – can lead to weird outcomes
- A holding company model, Australian Astronomy Ltd – can lead to weird outcomes
- **PRICING:** fixed price vs cost plus – the business model **MUST** be in synch. with the capability model

Opportunity Costs and Challenges

- The mining boom
- Skills shortages and schedule
- Contracting templates – risk sharing
- Complexity
- New techniques, tools, standards
 - Implies industry investment
 - Beyond astronomy??
- Beyond astronomy – some bigger choices!

Summary

- SKA “Snowy Mountains Scheme’ like project
- Largest scientific instrument ever built by mankind
- The real \$\$\$ value lies in:
 - the long term support and improvement of ASKAP and the SKA
 - The spin-off technologies
- Understand the risks and costs

Thank you

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