



# SKA timeline (brief)

- 1988 Independent suggestions for a Large Radio Telescope
- 1990 10<sup>th</sup> anniversary of VLA – the visions merge
- 1993 URSI GA Kyoto resolution
- 1994 IAU forms a Large Telescope WG
- **1996 OECD Global Science Forum activities start**
- 1998 “SKA” name adopted (1kT, SKAI, ...)
- 2000 International MOU signed
- 2001 Logo competition
- 2002 SKA activities in South Africa
- 2005 EC funding starts
- 2009 Agencies SKA Group formed (ASG)



# OECD Global Science Forum



- 1996 Mega Science Forum
  - Looked at big science models
  - High impact in smaller countries
- 1998 Task Force on Radio Astronomy
  - Astronomers
  - Regulators
  - Satellite Communications Industry
  - International protection from Satellite communications in selected areas
  - Not what ITU can do
- 2003 GSF on Astronomy
  - Global collaboration on funding processes - failed



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# SKA International Steering Committee

- 18 members representing 11 countries
  - 6 European (UK, Germany, Netherlands, Sweden, Italy, Poland)
  - 6 United States
  - 2 Canada
  - 2 Australia
  - 1 China
  - 1 India
  - 2 at large members



- MOU signed IAU Manchester August 2000



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# Choosing a logo





# SKA Logo

**SKA**

**SQUARE KILOMETRE ARRAY**





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- **2009 Agencies SKA Group formed** (Richard Schillizzi)

20 years



# The Technology Challenge



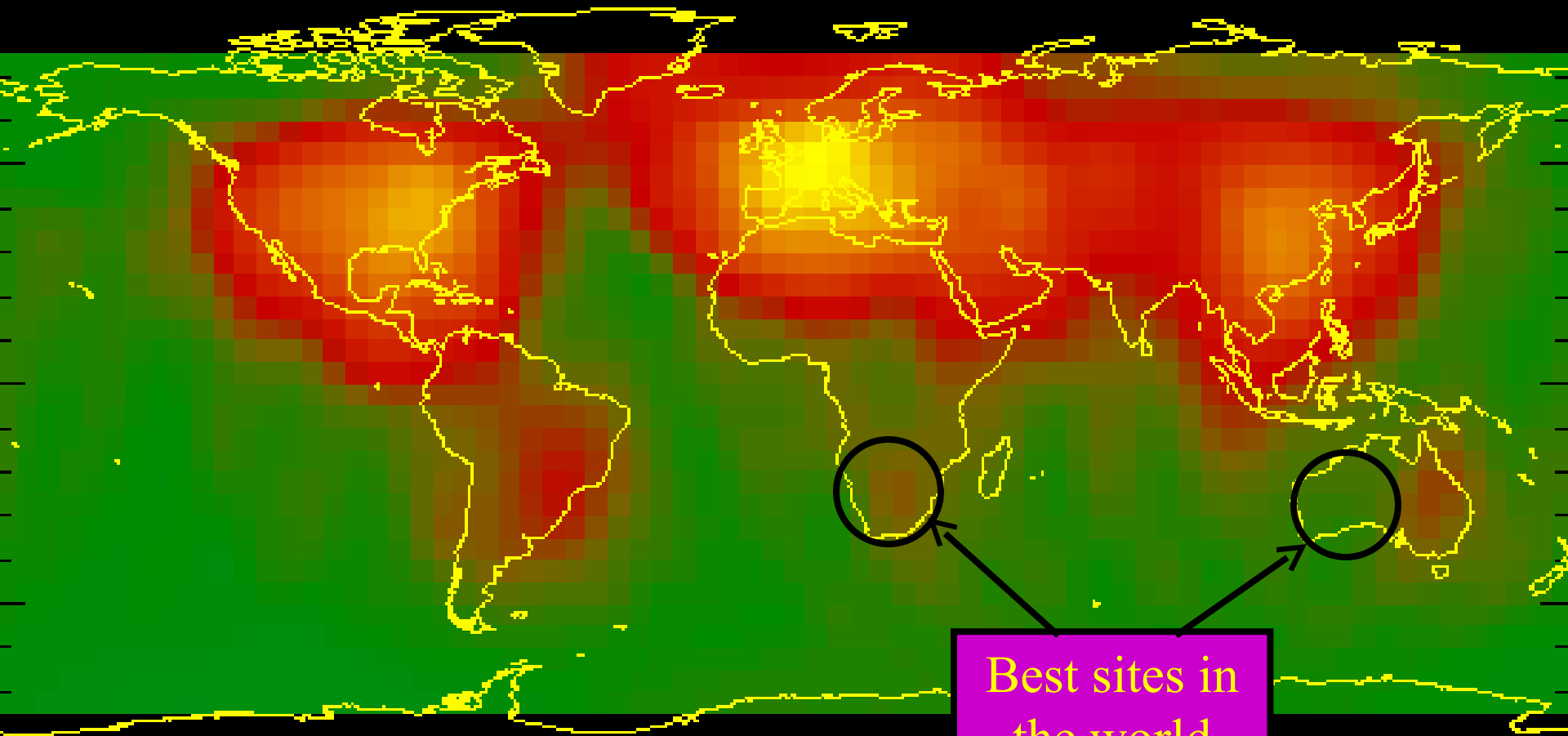


# The Quietest Locations in the World

## Radio Noise Levels

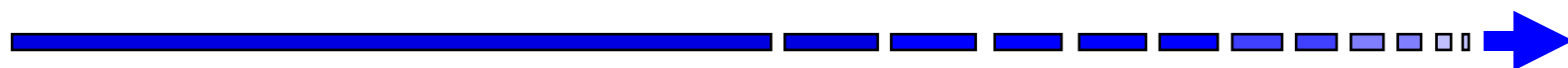


Forte satellite: 131MHz



Best sites in the world

# The instrumental path



Good range of pathfinder instruments: in technology and science!

# Existing global fibre connections for radio astronomy



Small text at the bottom left of the slide, likely a source or attribution.



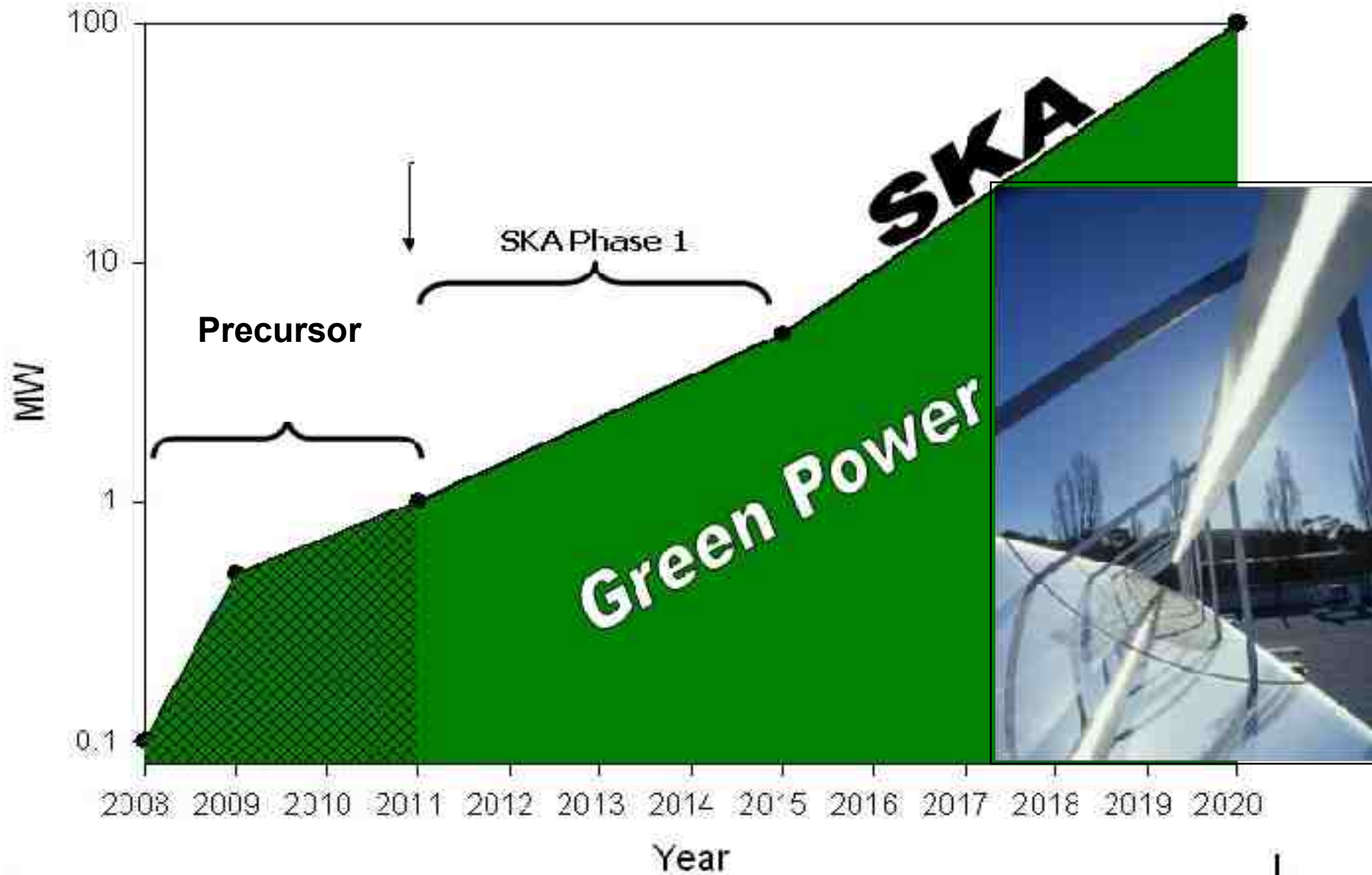
International  
Centre for  
Radio  
Astronomy  
Research

## Wideband Fibre Network – SKA telescopes



March 2010

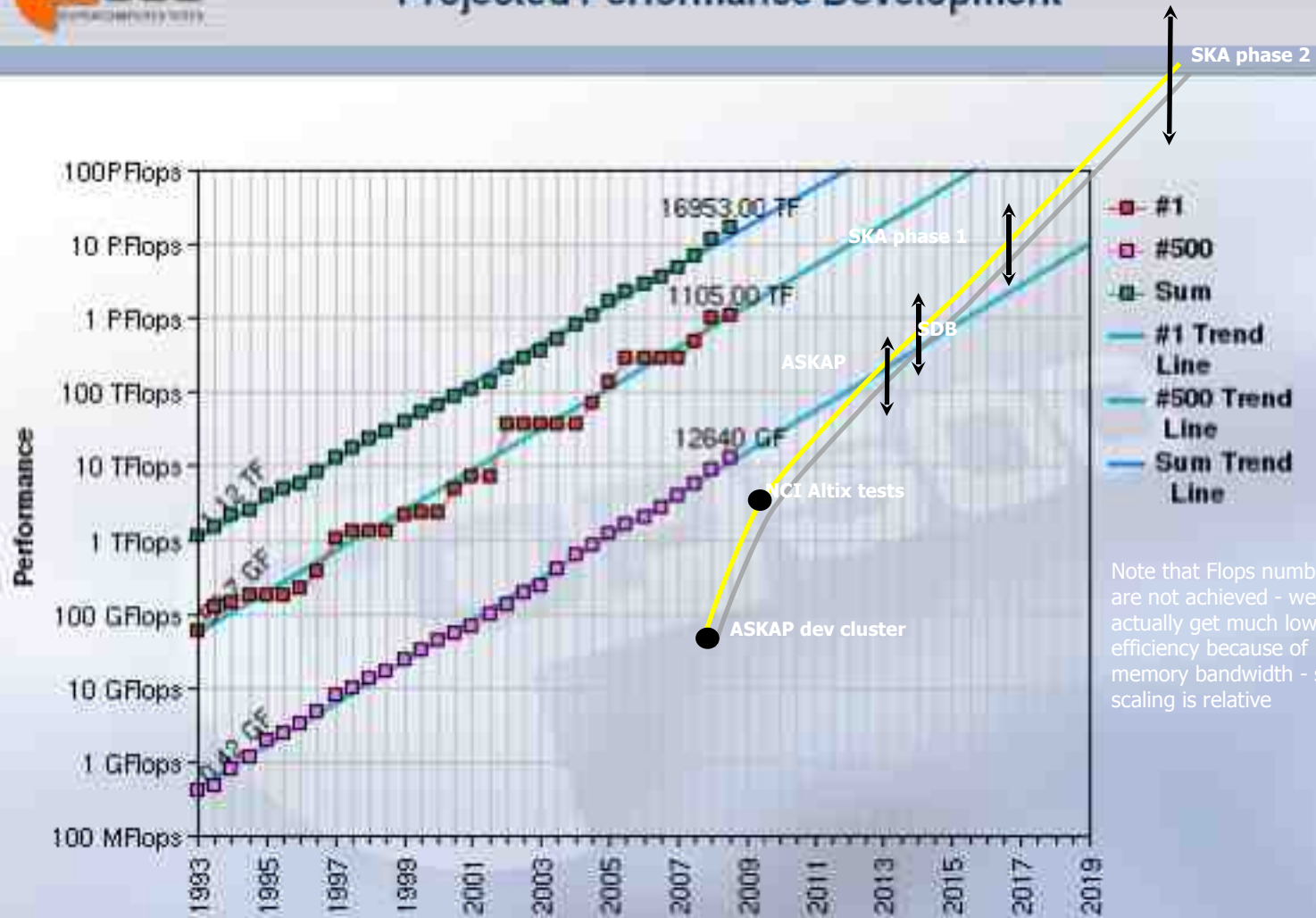
# SKA Power Requirements



# Climbing Mount Exaflop



## Projected Performance Development



Note that Flops numbers are not achieved - we actually get much lower efficiency because of memory bandwidth - so scaling is relative



# Spin-off



# VLA New Mexico

Spinoff is unpredictable





*“Rome wasn’t built in a day”*

The story of the  
IEEE 802.11 wireless network

With contributions from Bob Frater, VP Innovation, ResMed Ltd



# The Netherlands

## 1970

- Steven Hawking - black holes radiate
- Small black holes evaporate in less than the age of the Universe
- Martin Rees - a radio pulse might be observable when they disappear





# The Netherlands

## 1970

- John O'Sullivan and collaborators build a special instrument to look for the exploding black holes using the Dutch radio telescopes





# IEEE 802.11

## wireless network standard

- 1970's John O'Sullivan searches for Exploding Black Holes – *“there has to be a better way!”*
- 1977 O'Sullivan explains why adaptive optics works
  - Paper based on redundant calibration in radio astronomy
- 1980's Fourier Transform on a chip
- 1996 CSIRO obtains US patent #5,487,069
- 2001 Skellern develops a wireless chip meeting IEEE standard
- 150 million devices sold using this technology
  - Estimated that 500 million will be sold by 2009

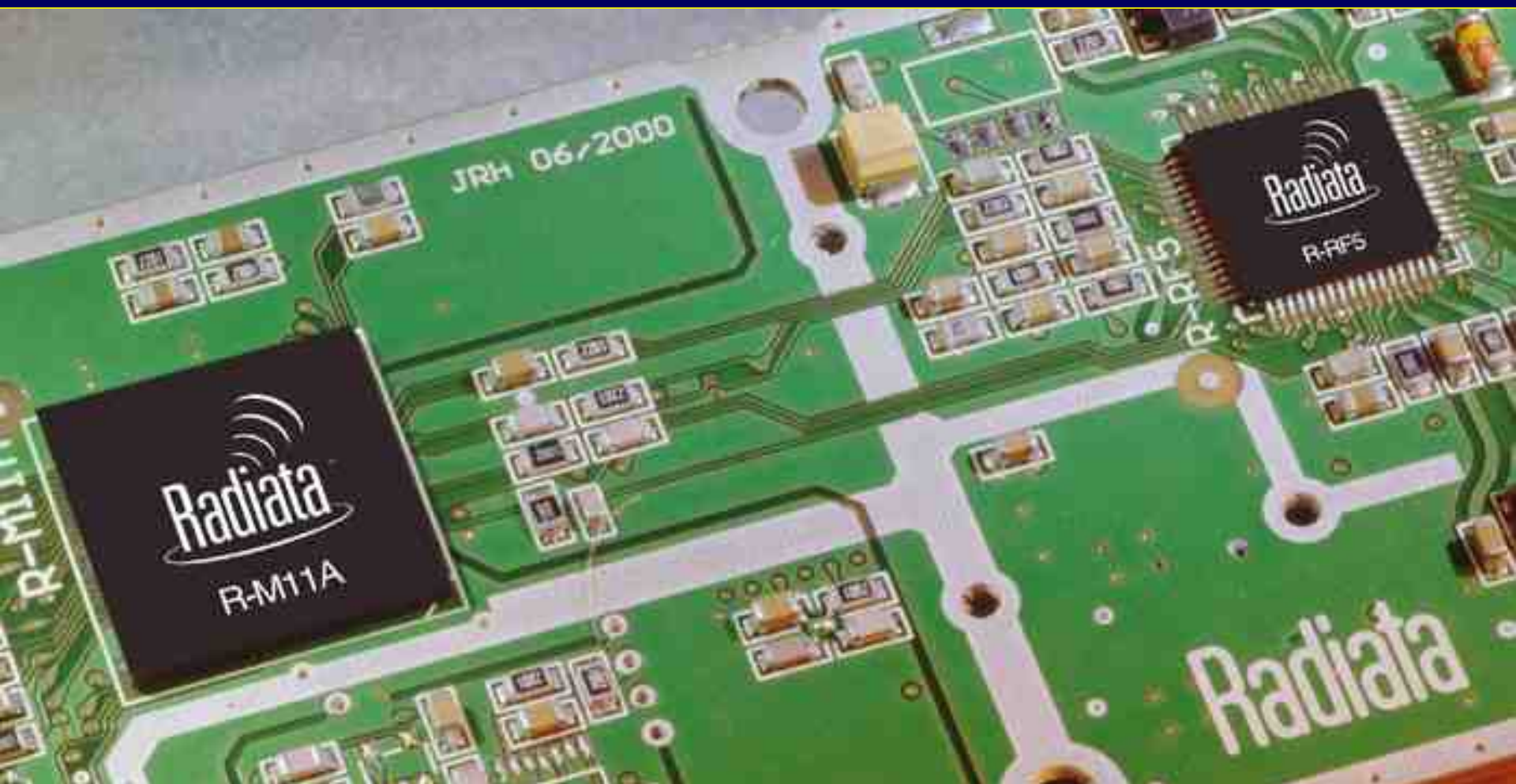


Big deal . . . Dr David Skellern, front, and Dr Neil Weste have developed a computer chip that allows wireless communication. PHOTO: MICHEL BUNN

# Cable-free guys hit the big time

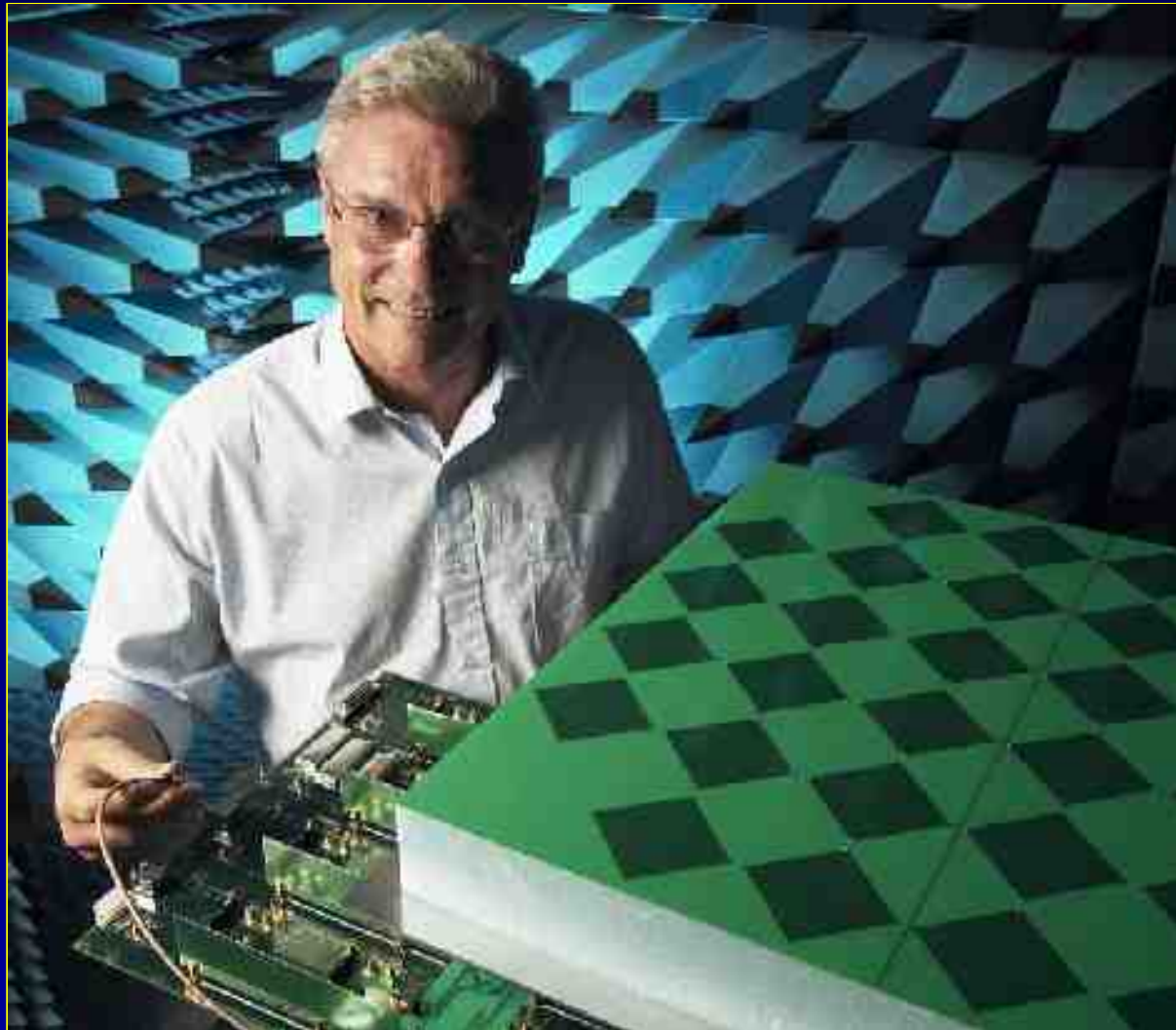


# Radiata Board





# John O'Sullivan with the checkerboard feed for SKA







# Intangible Networks

- Networks are critical
  - Networks come from mobility and diversity of experience
  - Without networks, new ventures are bound to fail
- The importance of movement between industry and academia cannot be underestimated
- These networks can be critical to achieving more favorable odds in the inherently risky process of innovating.
- It is important to recognise the intangible ‘asset values’ created by networks of highly skilled scientists, engineers and entrepreneurs

Bob Frater and Mark Mathews, based on an analysis of the Radiata innovation

# Science



First Stars



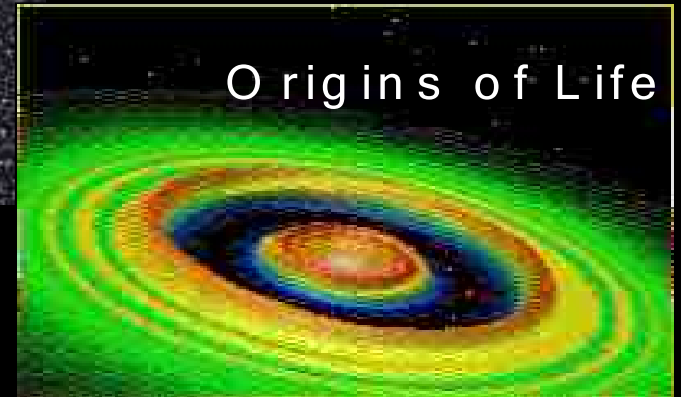
Cosmic Evolution



Cosmic Magnetism



Gravitational Physics



Origins of Life



**Let's make it happen!**

Ionised Hydrogen in Cyg X  
CGPS (Penticton)