



www.csiro.au

Introduction to ATNF Facilities

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CSIRO Astronomy and Space Science



Welcome!

- Selamat Datang!
- Namaste!
- Youkoso!
- Huan-ying ni-man!
- Hwangyong-hamnida!
- Haere mai!
- Welkom!
- Willkommen!
- Bienvenidos!
- Dobro pozalovat!
- Ehryagowenmayd!



Overview

- Introduction to LOC & SOC
- Safety induction
- CSIRO
- CASS and ATNF
- Why are we here?
- Final words of reassurance

Introduction to LOC & SOC

- **Local Organising Committee**

- Robin Wark, Margaret McFee, Liza-Jane McPherson
- Jamie Stevens, Mark Wieringa, Brett Hiscock
- Peter Mirtschin, Tim Wilson, Clarrie Leven
- All staff!

- **Scientific Organising Committee**

- Tom Franzen (Chair)
- Alex Hill
- Dave McConnell
- Naomi McClure-Griffiths
- Phil Edwards



BEFORE PROCEEDING PLEASE TURN OFF ALL



PHONES



PDA's



LAPTOPS



TWO-WAY RADIOS



OTHER TRANSMITTERS



All transmitting and receiving equipment
should be powered off before proceeding



Help us listen to whispers from space



CSIRO

Request

- This is a radio-astronomy observatory
- Observations are being made now
- Please turn off your
 - Mobile phone
 - Wi-fi
 - Bluetooth
 - Radio transmitters
 - Microwave ovens
 -

Safety

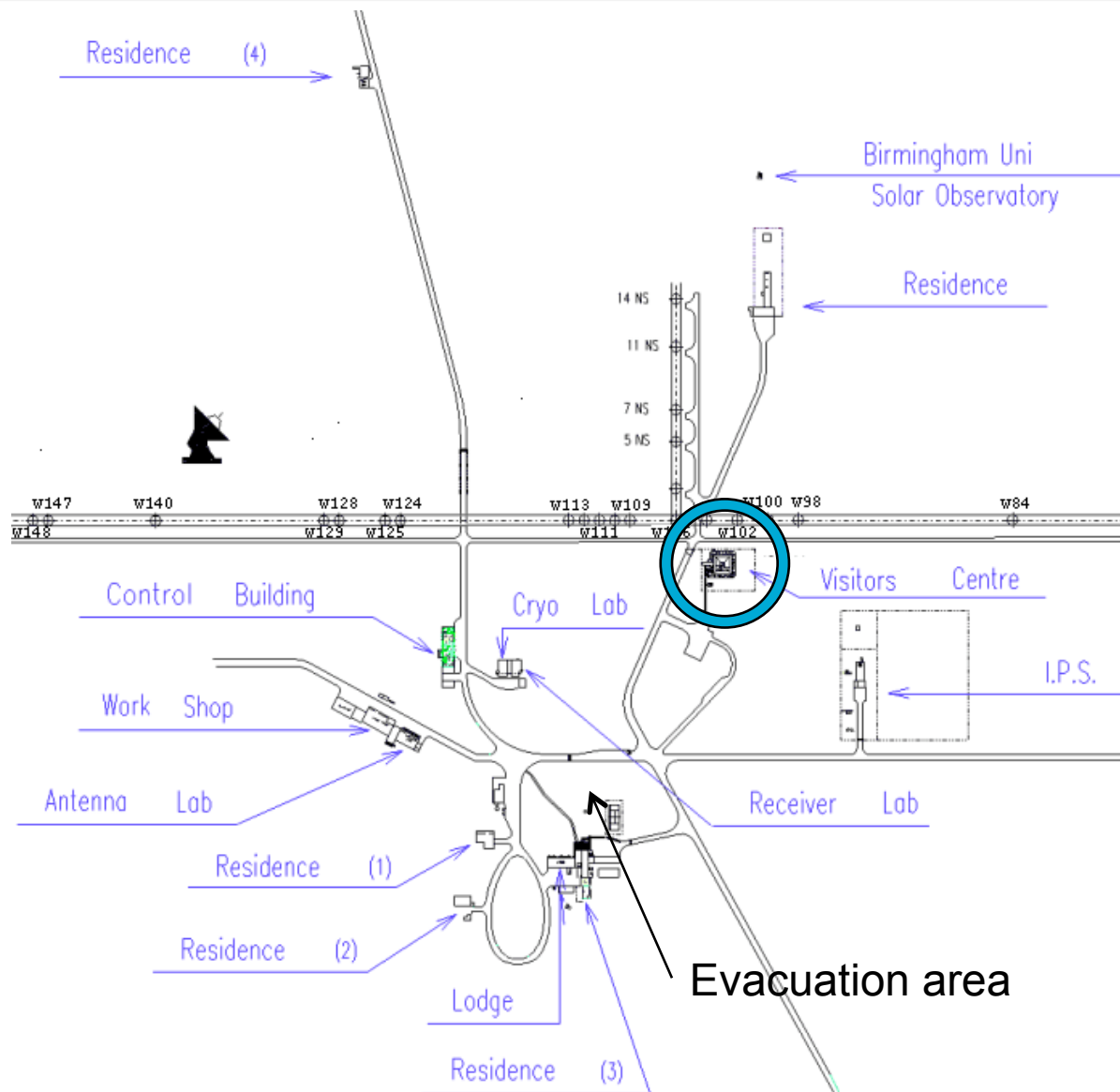
- The Observatory is a safe place
- Please be careful of
 - The sun (sun screen is available)
 - The paths (watch where you're going)
 - Heights (antenna tours are optional)
 - Kangaroos (don't get too close)
 - Mosquitoes (cover up; repellent is available)
 - Snakes (if you see one on-site, let us know)
- If you have any questions, ask a member of the LOC or local staff or SOC

Fire alarm

- If an alarm sounds once, do not evacuate, but stay alert
- The alarm will be stopped by Observatory staff, who will investigate
- If the alarm sounds a second time, move to the evacuation area



Site map



CSIRO

- The Council for Scientific and Industrial Research (CSIR) was founded in 1926
- In 1926, CSIR had a staff of 41
- CSIR became the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in 1949
- In 2012, CSIRO has a staff of 6500 in 13 Divisions, and an annual budget of a little over \$1000 million, roughly half from government and half external revenue



CSIRO Divisions

1. Astronomy & Space Science
2. Earth Science & Resource Engineering
3. Ecosystem Sciences
4. Energy Technology
5. Food & Nutritional Sciences
6. Information & Communication Technologies Centre
7. Land & Water
8. Livestock Industries
9. Marine & Atmospheric Research
10. Materials Science & Engineering
11. Mathematics, Informatics & Statistics
12. Plant Industry
13. Process Science & Engineering



Australia Telescope National Facility

- The CSIRO Division of Radiophysics was established in 1939
- ATNF became a separate division in 1989
- CSIRO Astronomy and Space Science formed in 2009, combining ATNF, CDSCC (Tidbinbilla Deep Space Network station), and other space activities
- ATNF currently has 4 themes
 - Astrophysics
 - Operations
 - Technologies for Radio Astronomy
 - ASKAP (the Australian Square Kilometre Array Pathfinder)

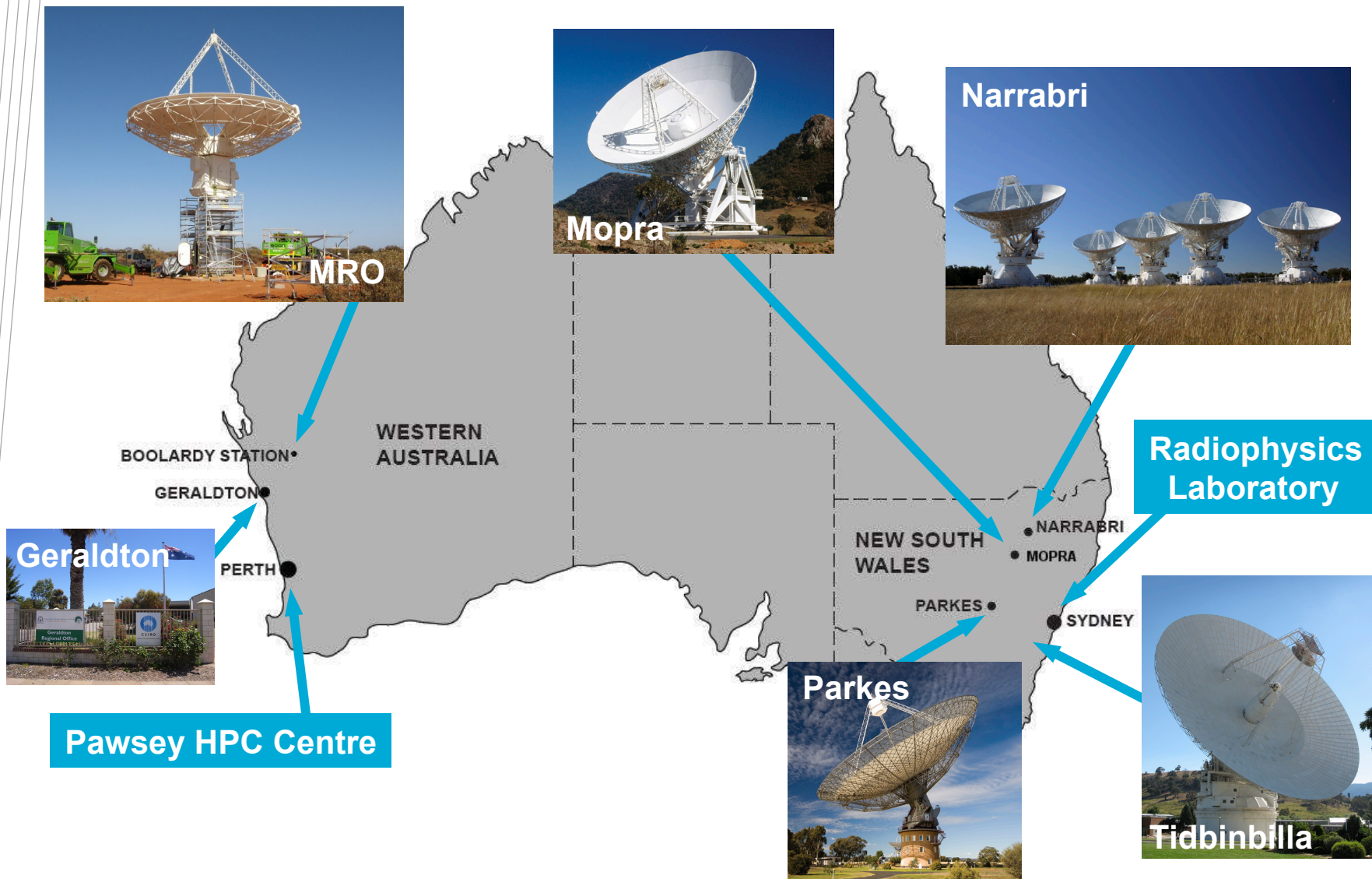


CASS Mission

- To operate and develop the Australia Telescope as a national research facility for use by Australian and international researchers
- To exploit the facility's unique southern location and technological advantages to maintain its position as a world-class radio astronomy observatory
- To meet NASA's needs for continuous communication with its fleet of spacecraft throughout our solar system, and thereby contribute to humankind's understanding of space
- To further the advancement of knowledge



CASS Divisional Sites



ATNF Facilities: Parkes 64m



Parkes



<http://www.smh.com.au/technology/sci-tech/date-with-the-milky-way-led-to-stars-20110622-1gfij.html>



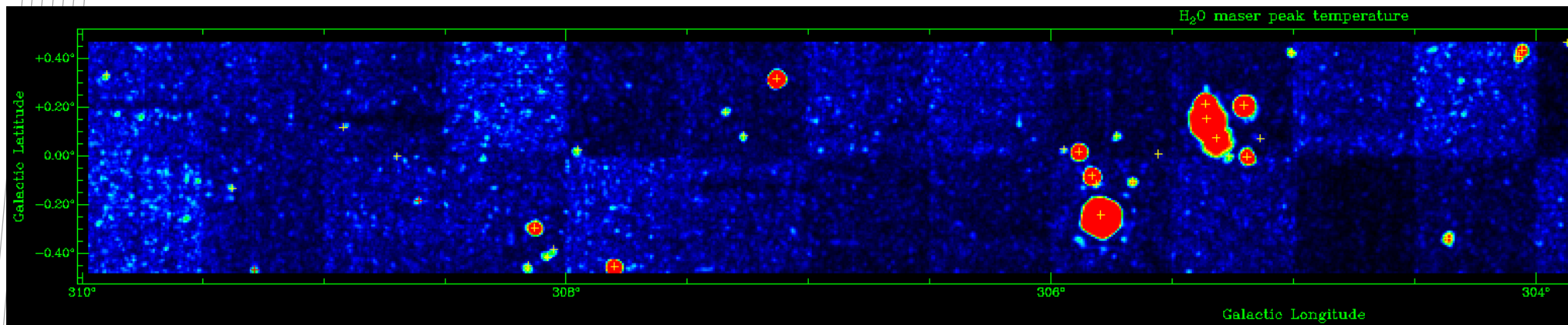
APOD 100803



ATNF Facilities: Mopra 22m



The 22m Mopra telescope is located between Coonabarabran and Siding Springs



Portion of the map of the inner galactic plane from the HOPS 12mm survey

Mopra 22m (12mm, 7mm, 3mm)

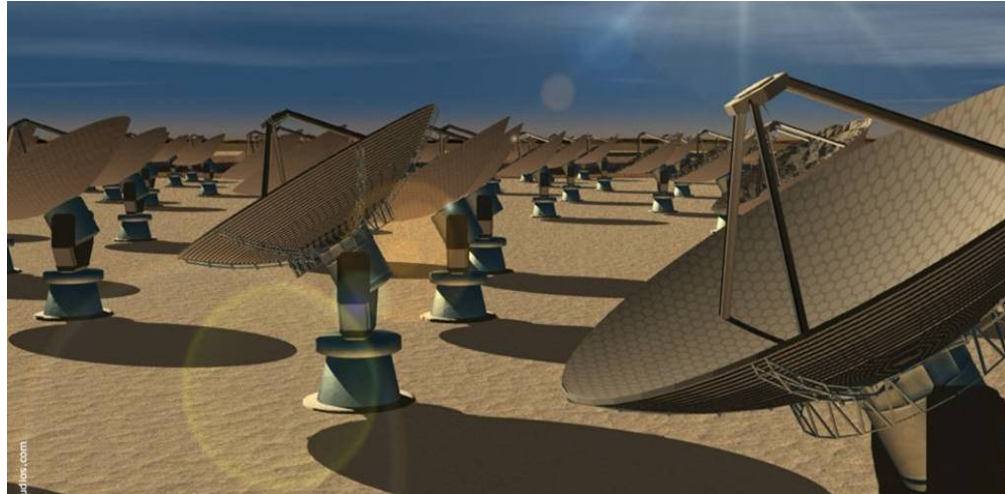
- New 3mm system in 2005
- New 12mm system in 2006
- MOPS 4x2.2 GHz backend in 2006
- Remote observing from Narrabri 2006
- Remote observing from further afield 2007
- New 7mm system in 2008
- Mopra observing from Marsfield encouraged 2011
- New operational model from Oct 2012

- Large surveys: HOPS, CMZ, MALT-90 ...

Mopra



ASKAP at the Murchison Radio Observatory



Antennas	36 x 12m diam., 3-axis rotation
Max baseline	8 km
Frequency	700–1800 MHz
FOV	30 deg²
Bandwidth	300 MHz
Channels	16k
PAF	10x10x2
T_{sys}	35 K
First antenna on-site 2010, Six element test array (BETA) in 2013	

First ASKAP antenna



ATNF Facilities: ATCA 6 x 22m



APOD 080310 White & Cozens

The ATCA

- Operates 24 hours a day
- 82% astronomical observing
- 15% maintenance, testing, array reconfigs
- 3% downtime or idle time
- The proposers are the observers
- Observers visiting from around the world
- Opened 2nd September 1988



Australia Telescope Compact Array

- Six 22 metre diameter antennas
- Five antennas on a 3km east-west track
- One antenna 3km to the west
- A 214 m north-south spur added, 12mm & 3mm receivers added, panels replaced (1998-2002)
- Change array configuration every ~3 weeks
- The ATCA can observe in 6 (soon 5) bands:
 - wavelengths between 21cm and 3mm,
 - frequencies of 1 GHz to 105 GHz
- CABB upgrade in 2009 increased bandwidth from 2x128MHz to 2x2GHz

Australia Telescope Compact Array

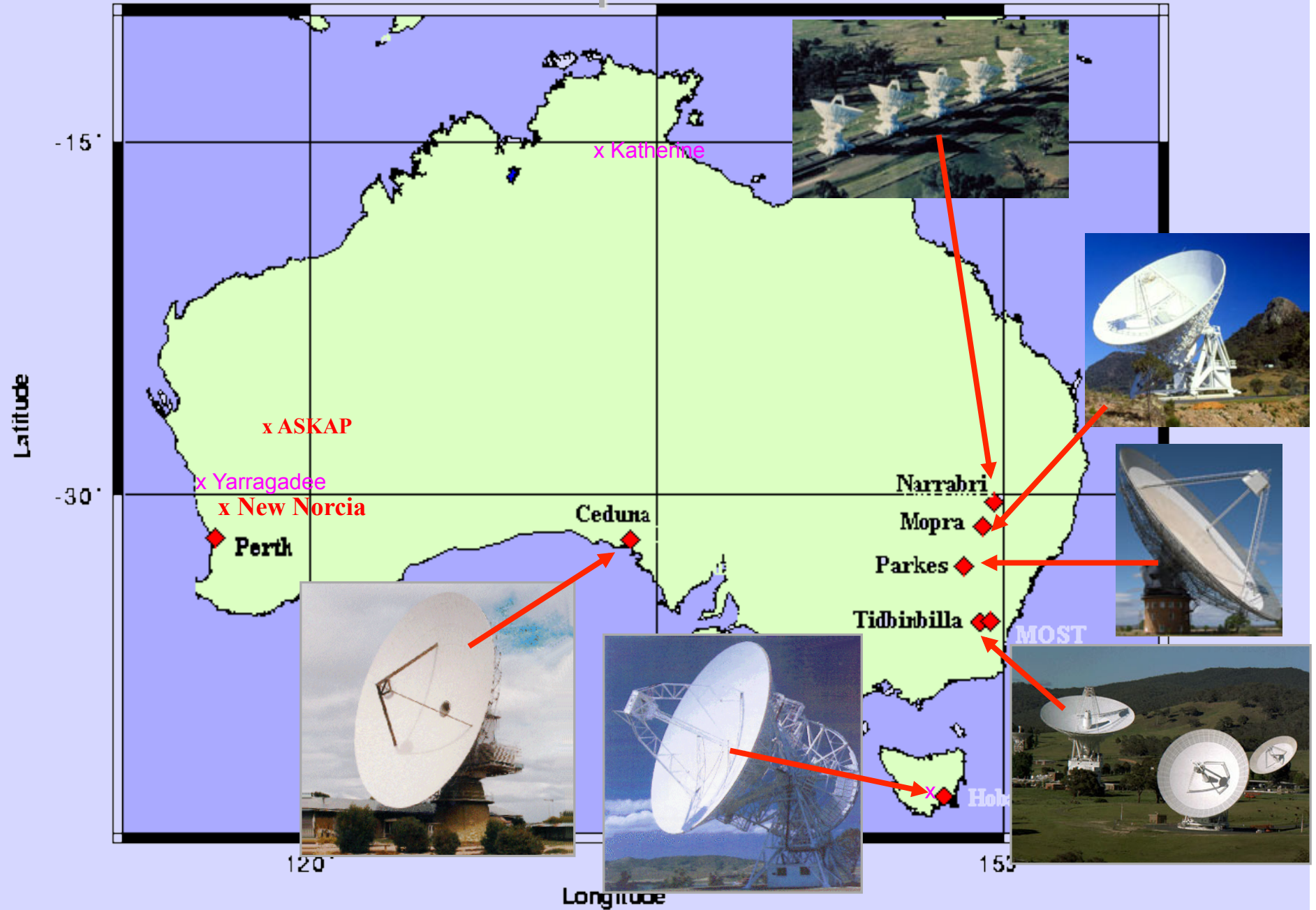
- The ATCA is a synthesis telescope
- 6 telescopes → 15 baselines (except at 3mm)
- Each baseline samples a Fourier component of the source structure (recall $\theta \approx \lambda/D$)
- The Earth's rotation sweeps all baselines around the (u,v) plane
- A 12 hour synthesis covers all baseline orientations
- Standard imaging assumes the source is unchanging on this timescale
- <http://www.narrabri.atnf.csiro/astronomy/vri.html>



ATCA strengths

- Location
- Frequency coverage
- Co-axial 20/13cm (from 2010, a single band) and 6/3cm
- Frequency agility
- Array configurations (factor of 80 in linear scale)
- Linear polarizations
- The proposers are the observers
- Ability to remote observe
- ATOA – the Australia Telescope Online Archive (atoa.atnf.csiro.au)
- CABB
- Local staff
- Engineering excellence
- National facility support: TAC, web, assistance

Radio Telescopes in Australia



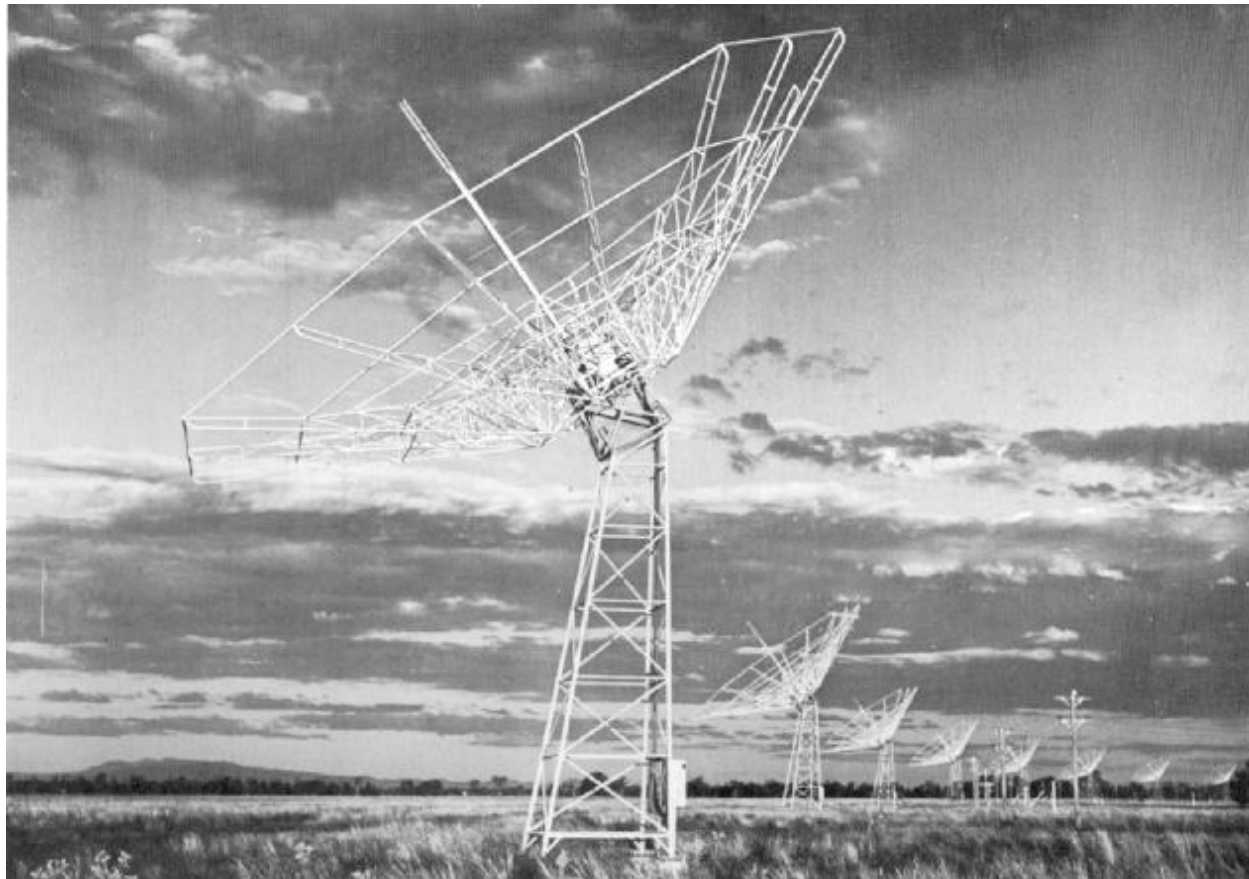


Why are we here?

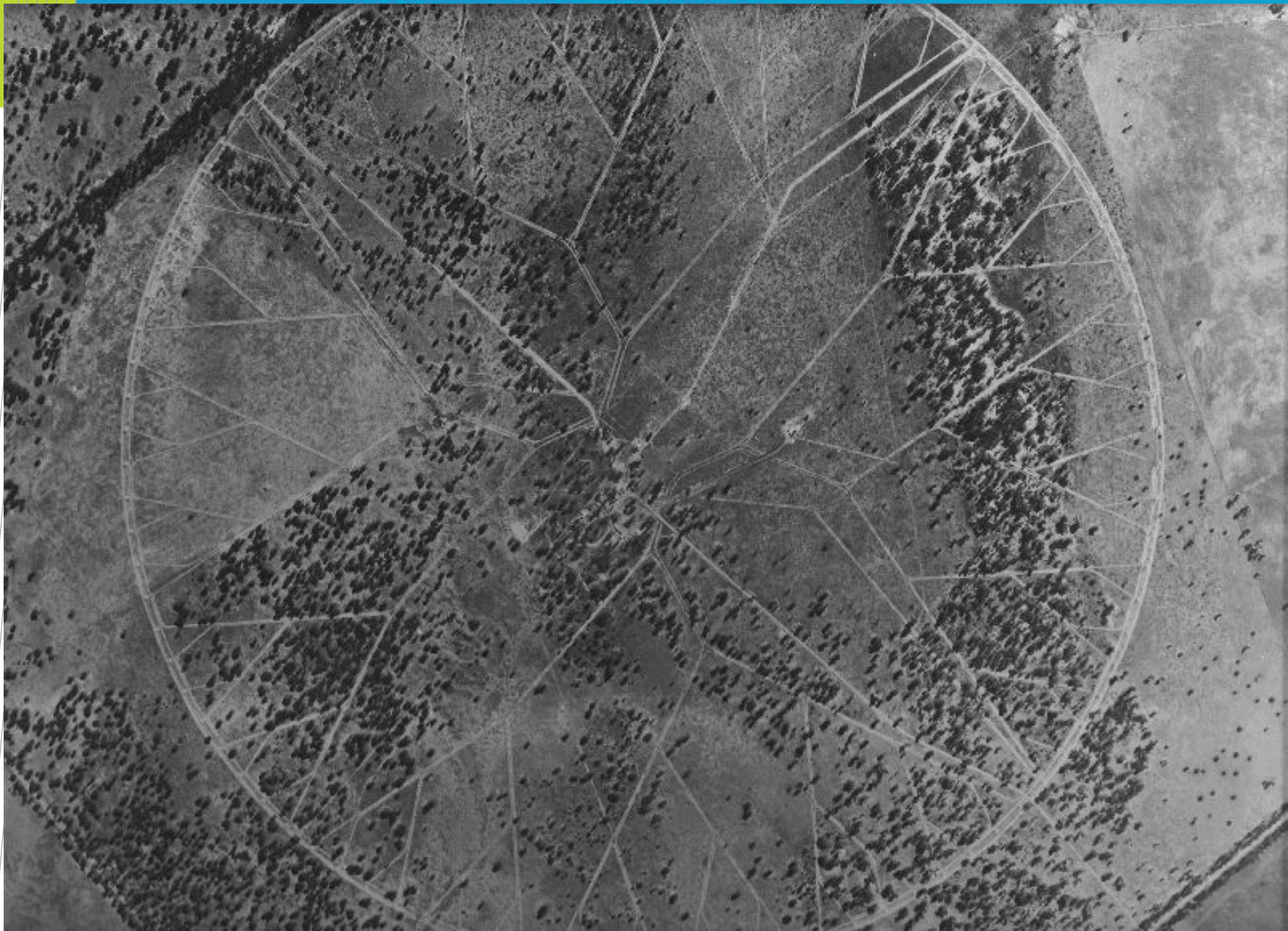
The Culgoora Radio Heliograph

- First planned to be located at Parkes.
- Culgoora selected as large flat area with
 - suitable soil
 - free from flooding
 - relatively free from RFI
 - easy access from Sydney
- CSIRO DAP elected to base solar optical observatory at the same site.
- Funding (US\$550,000) granted by Ford Foundation in April 1962
- Construction from mid-1962 to mid-1967

The Culgoora Radioheliograph



1967 to 1984



Paul Wild

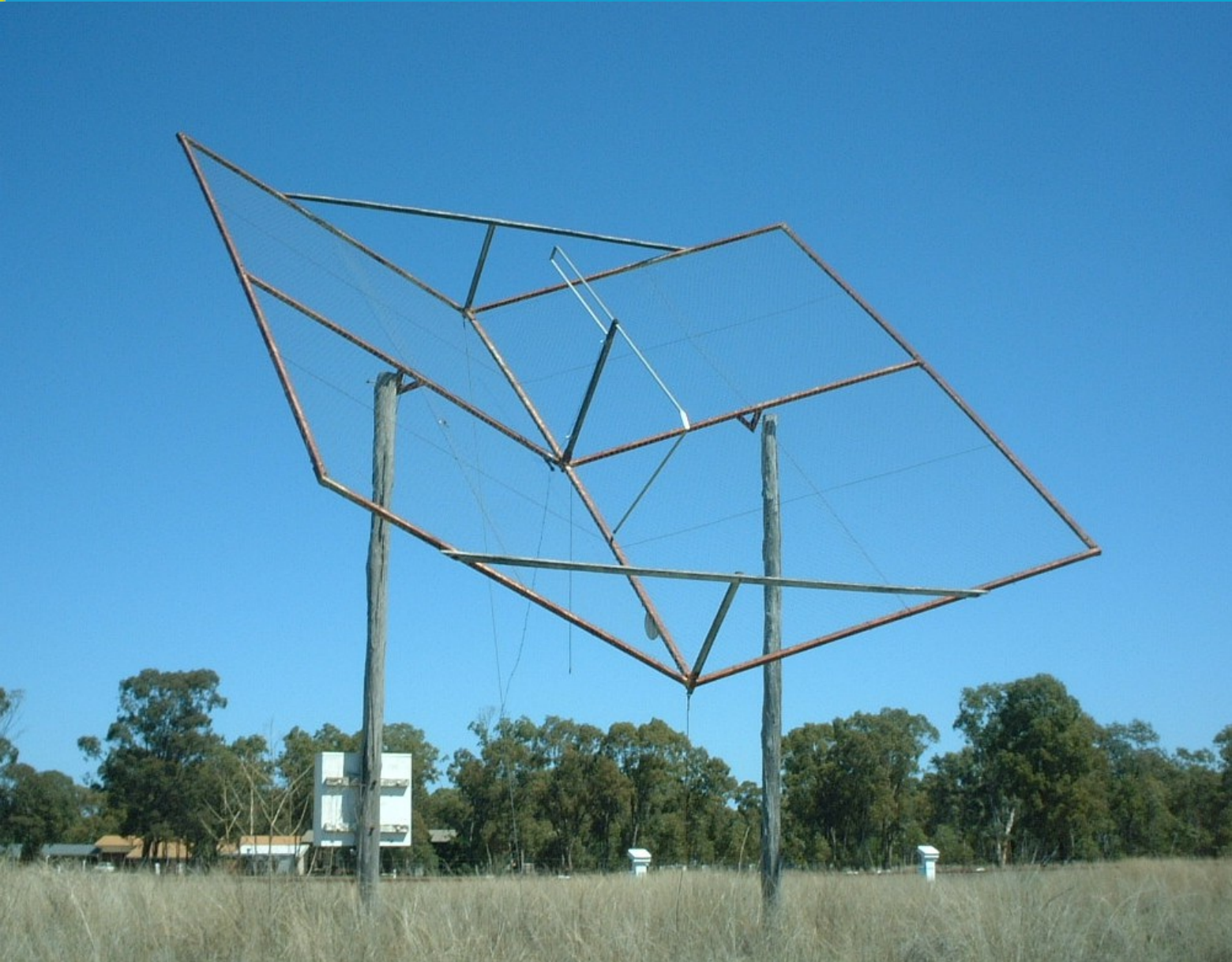


- b. 17 May 1923, Sheffield, UK
- Joined CSIR in 1947
- Led the team that built and operated the Culgoora radioheliograph
- Chief of Division of Radiophysics 1971 to 1978
- Chairman of CSIRO 1978 to 1985
- d. 10 May 2008

Radio Heliograph

- A ring of 96 wire-mesh antennas of 13.7m diameter, in a circle with a 3km diameter
- Covered HA range of +/- 2.5 hr
- Operated initially at 80MHz (with 3.8' beam), later also at 160 MHz and (with a concentric array of 48 corner-reflector antennas) 43 MHz
- Signals transmitted from antenna to control building along open transmission lines (320km of copper wire used!)
- 48 pencil beams (N-S) scanned (E-W) across sun every second, as a phased array





Radioheliograph results

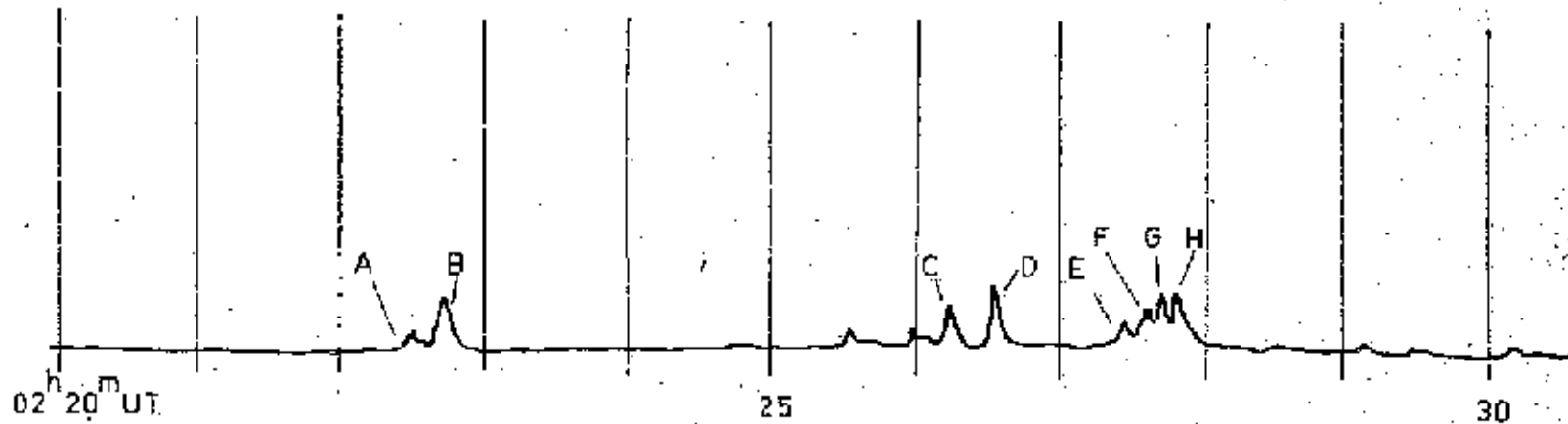
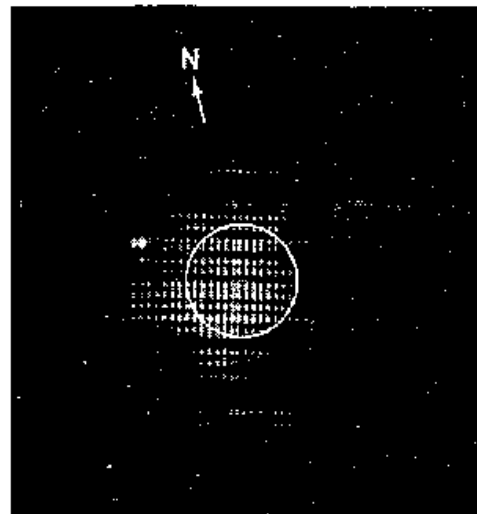
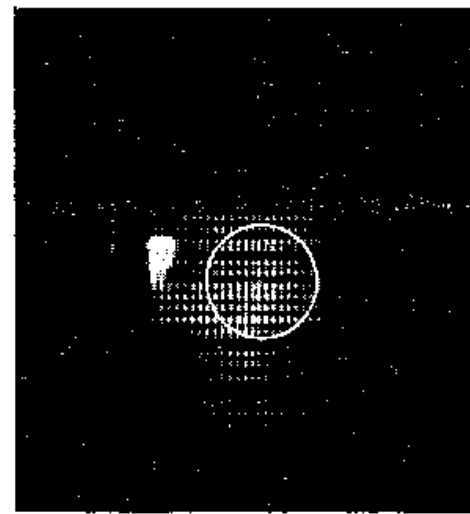


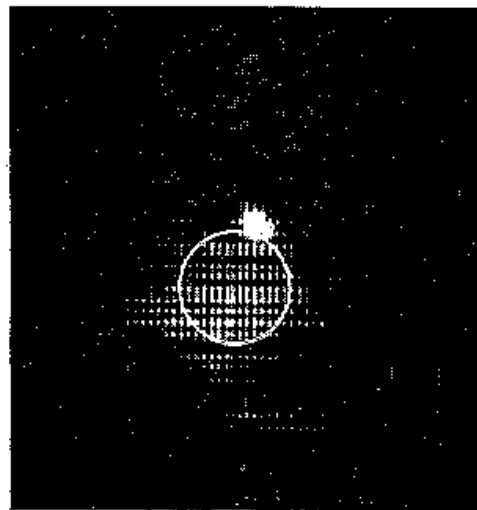
Figure 1.—Radiometer record of the total solar flux at 80 MHz during an event of September 2, 1967.



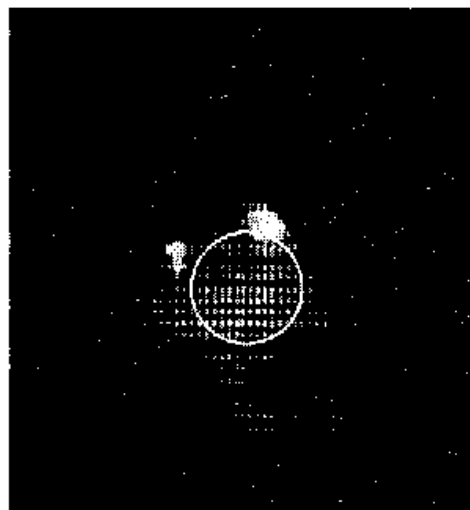
(a)



(b)



(c)

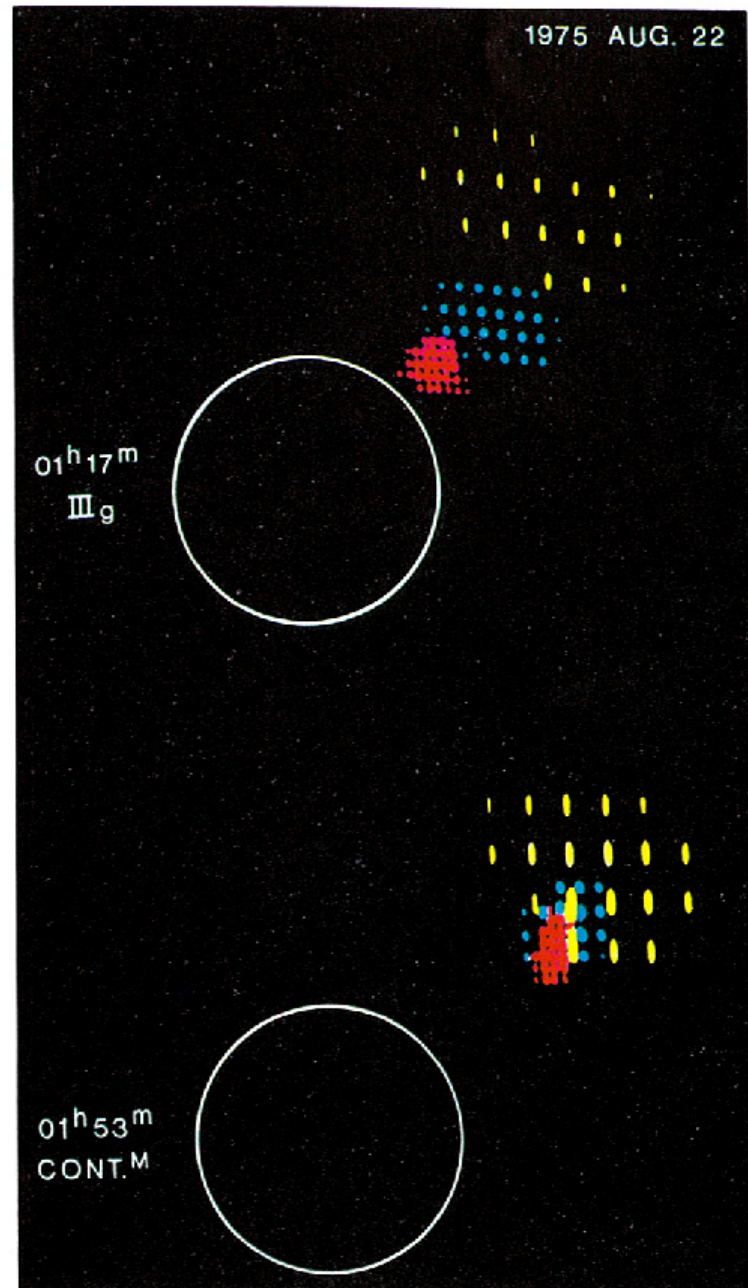


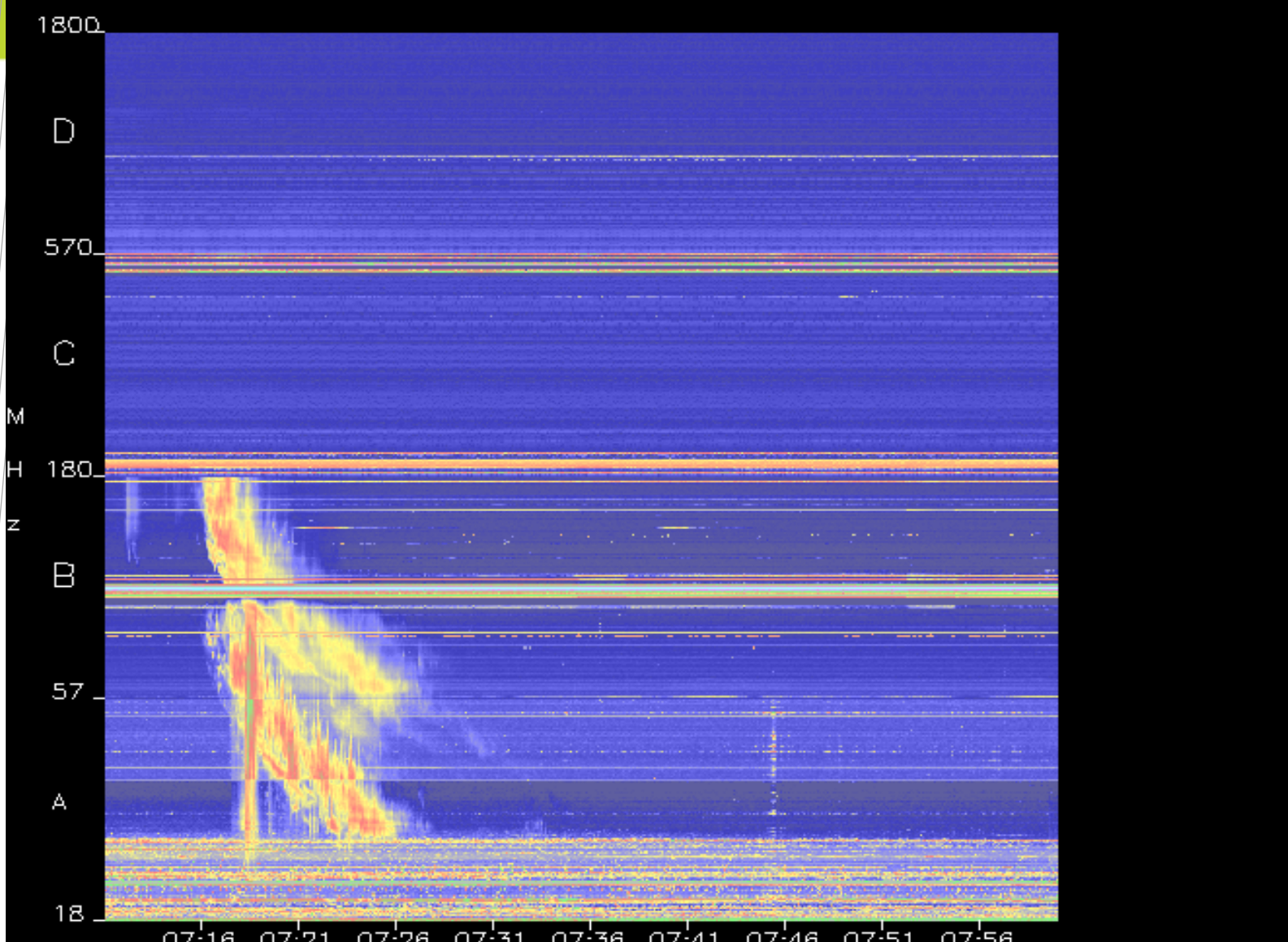
(d)

Figure 2.—Radioheliograph (80 Mc) pictures taken for the event shown in fig. 1. Superimposed on the quiet Sun are :
 (a) burst A of fig. 1 ; (b) burst B ; (c) bursts C and D ; and (d) bursts E, F, G, and H.
 Burst E occurs in the eastern (left-hand) region and bursts F, G and H in the northern. The circles indicate the optical limb of the Sun.

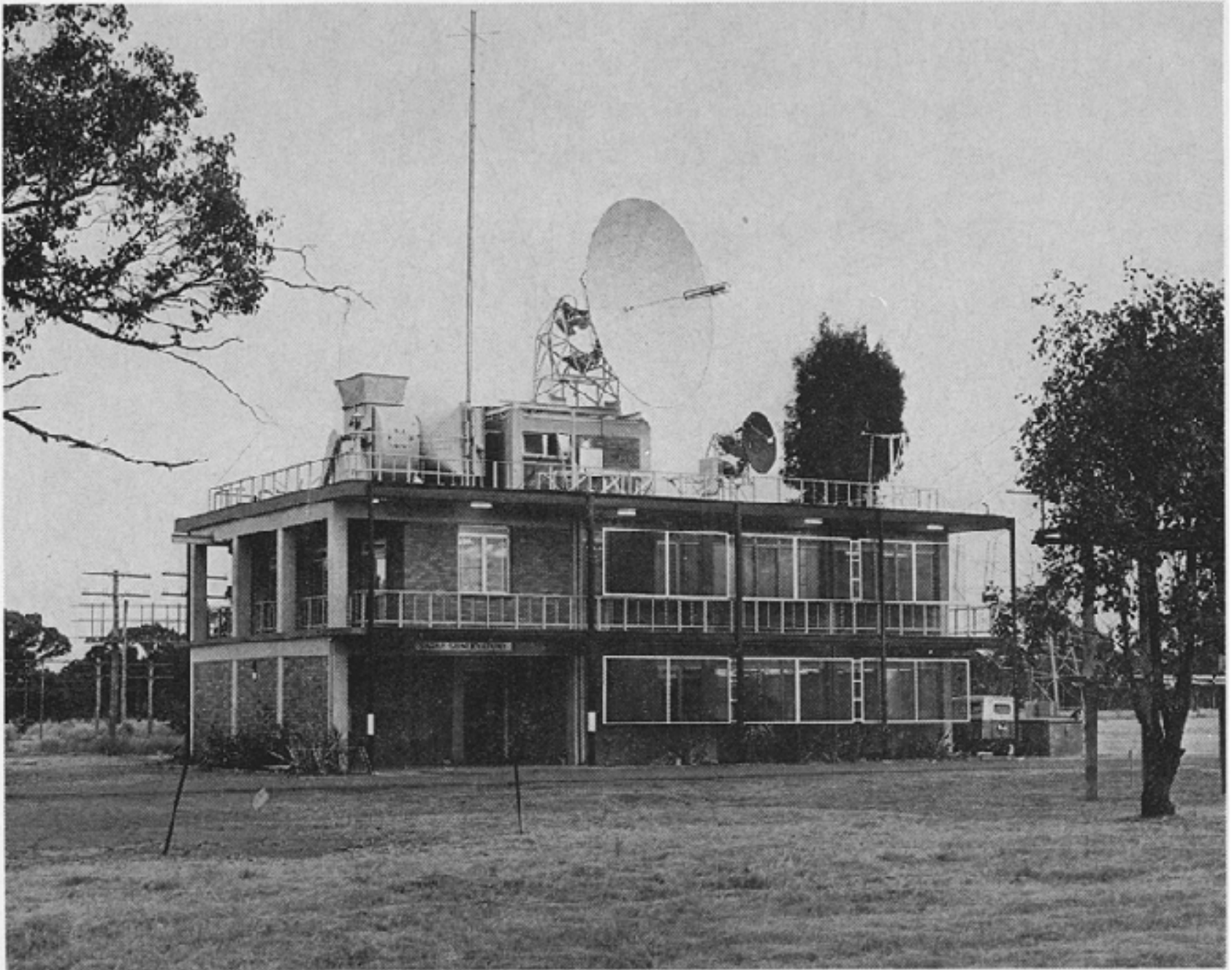
Bursts

- Superimposed radioheliograms at 160 MHz (red) 80 MHz (blue) and 43MHz (yellow) of a type III burst (top) and a type IV moving source (bottom)
- The different frequencies are separated by 1 sec in time





Culgoora Spectrograph (18-1800MHz) Period: 27-04-04 07:11:03UT to 27-04-04 07:59:54UT



IPS today



- The Ionospheric Prediction Service, a unit of the Bureau of Meteorology, is the Australian Space Weather Agency. The Culgoora site monitors the sun daily at radio and optical wavelengths.

Thoughts for the week

“You don’t need to understand everything to learn something useful”

“The next best thing to knowing something is knowing where to find it”

-- Samuel Johnson

“Experience is a wonderful thing, it enables you to recognize a mistake when you make it again”

“What we learn with pleasure with never forget”

-- Alfred Mercier



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Thank you

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