RAFCAP

Radio Astronomy Frequency Committee in the Asia-Pacific region

RAFCAP Spectrum management concerns

Tasso Tzioumis (ATNF, CSIRO)

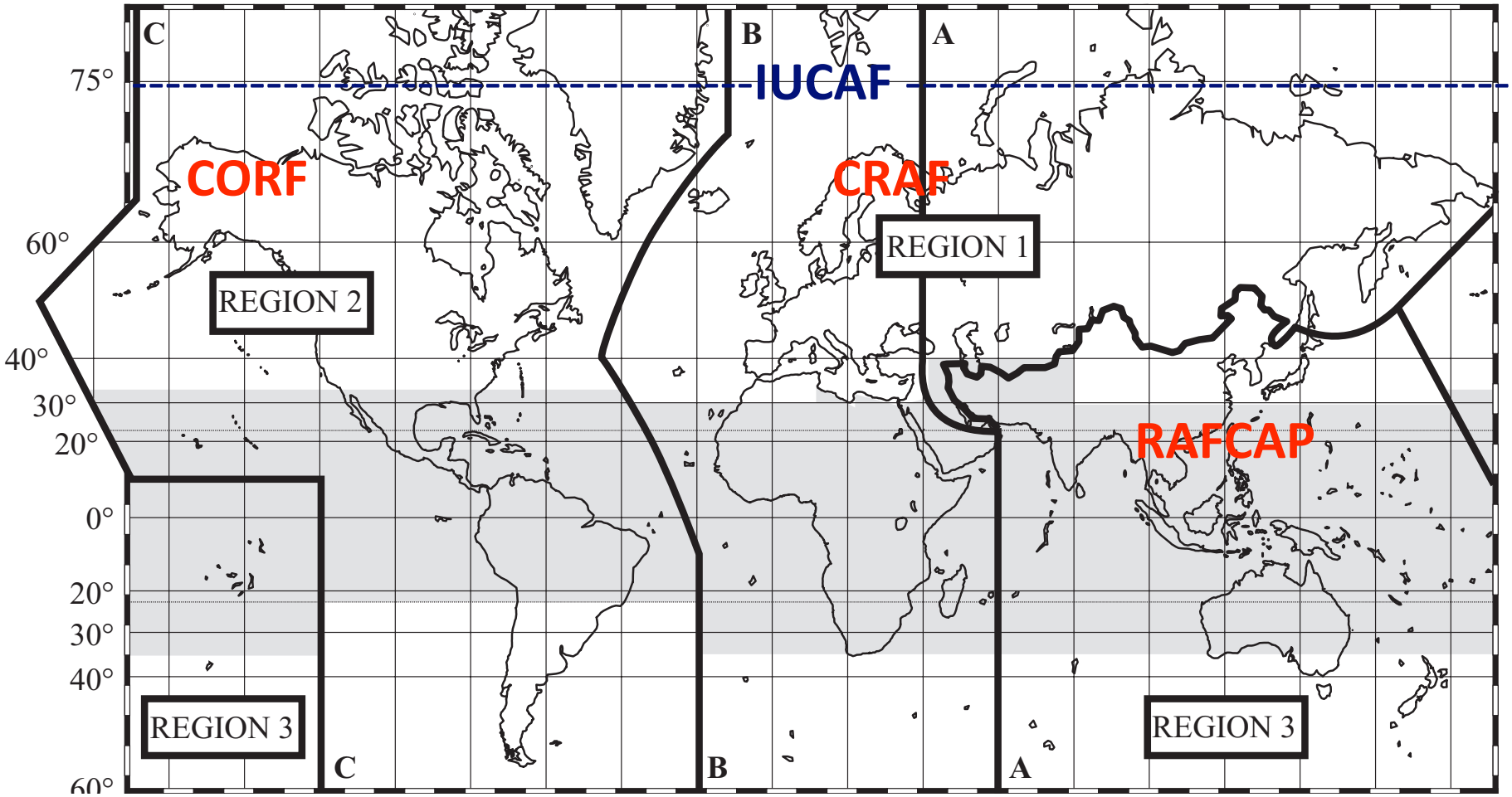
RAFCAP Chairman

CORF – 27 May 2009

Outline

- Regional groups
- RAFCAP
  - Intro & membership
- RAS facilities in the region
- Major spectrum issues in the region
- WRC11 AI of special interest

ITU-R Regions and radio astronomers' committees



African bloc: only RAS in South Africa; Arab bloc: no radio astronomy

RAFCAP

RAFCAP acts as the scientific expert committee on frequency issues for the Asia-Pacific radio astronomy and related sciences. The **mission** of RAFCAP is:

(a) to keep the frequency bands used for radio astronomical observations free from interference.

(b) to argue the scientific needs of radio astronomy for continued access to and availability of the radio spectrum for radio astronomy within the Asia-Pacific region.

(c) to support related science communities in their needs of interference-free radio frequency bands for passive use.

RAFCAP membership

- **Chairperson**: Tasso Tzioumis (ATNF, Australia)
- **Secretary**: Haiyan Zhang (National Astr. Obs., China)
- **Past Chair:** Masatoshi Ohishi (NAO, Japan)

- S. Ananthakrishnan and Praveen Kumar (GMRT, TIFR, India)
- Uday Shankar (RRI, India)
- Jiang Dongrong (Shanghai Obs. China)
- HyunSoo Chung (Korea Astr. Obs., South Korea)
- Hyo-Ryoung Kim (Taeduk Radio Astr. Obs., South Korea)
- Jeremy Lim (IAA, Chinese Taipei)
- Nafizah G Khan (Astronautic Technology, Malaysia)
- Kevin W. Sowerby (Auckland University, NZ

+ Associates (usually past members)

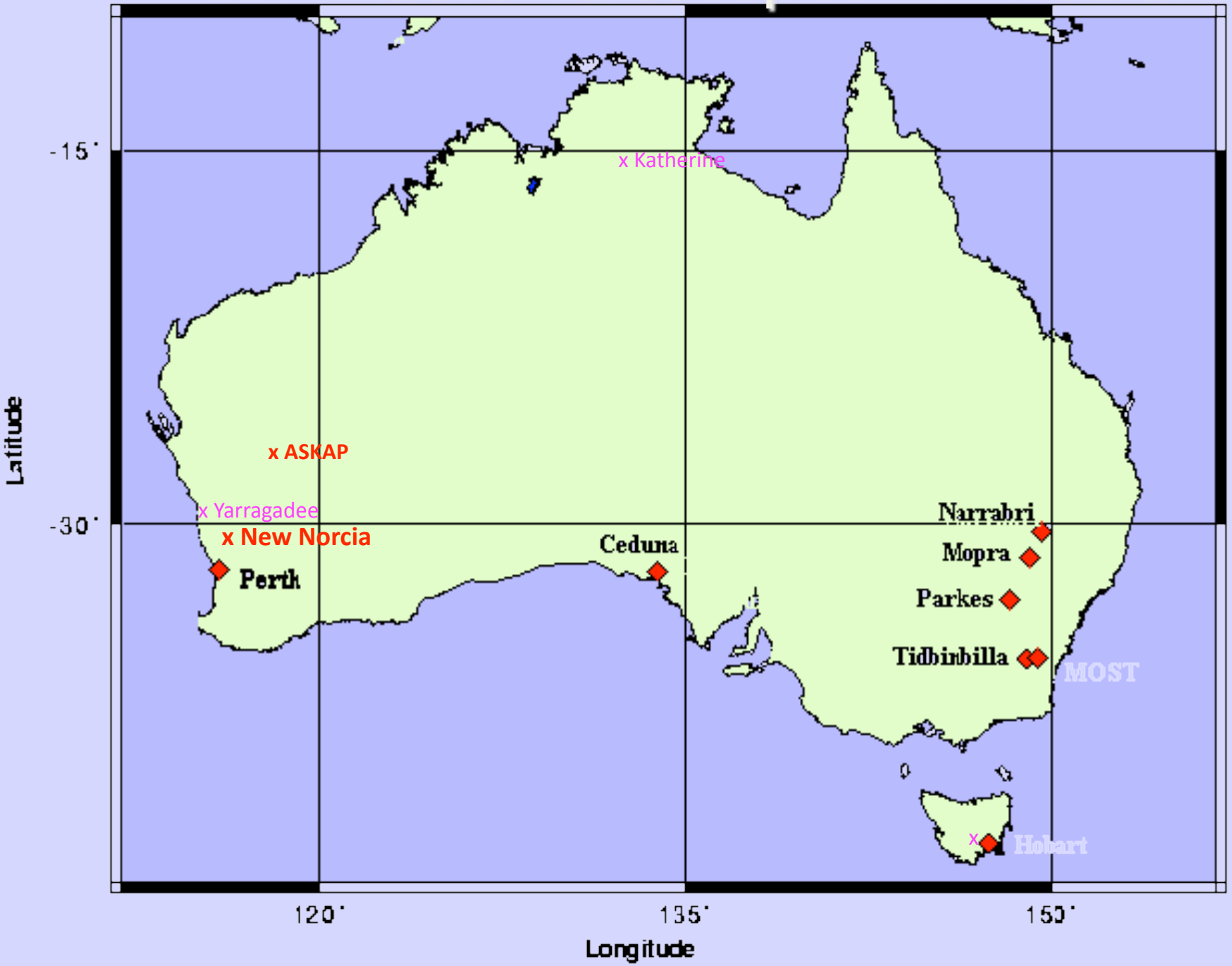
RAFCAP info

- Webpages: www.atnf.csiro.au/rafcap
- Modelled closely on CRAF
- Diverse regional cultures and languages
- Financial support directly from RAS observatories
- Invite and encourage participation by nations in region - even if no national RAS
- Main target is APT meetings (APG)
- Accepted into APT as “regional” entity
  - participate and input into APG → influence APT positions
- Aim to have ~1 annual meeting

RAS Facilities in APT Region

- Extensive list of Radio Telescopes in the Asia-Pacific and their operating characteristics in www.atnf.csiro.au/rafcap/AP_RT.htm
  - Australia (7)
  - China (5)
  - India (7) (includes Mauritius)
  - Japan (24)
  - Korea (7)
- NZ, Chinese Taipei, Malaysia -- no RAS (yet) but in RAFCAP
- New Facilities under construction
  - ASKAP (Oz); FAST (China); KVN (Korea); ….
- → **SKA (Square Kilometer Array) – Australia?**

LBA Radio Telescopes in Australia



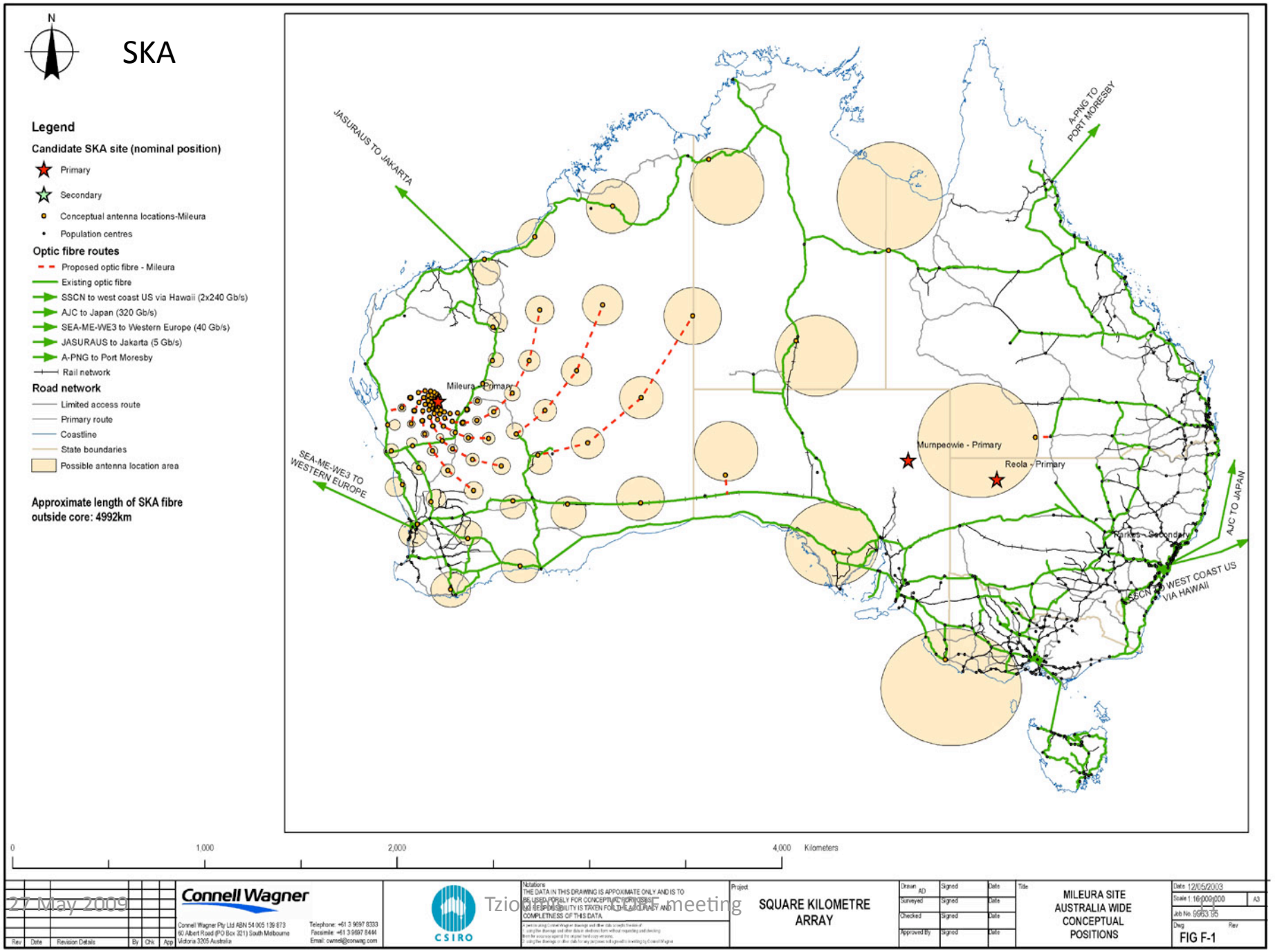
East Asian VLBI Network

17 radio telescopes
2, 8, 22, 43, 86, 110 GHz

Optical, Infrared and Radio Telescope Facilities

(Operational and planned)

SKA in Australia – possible configuration



Major RAS Spectrum issues in APT region

Major “Low” Frequency RAS facilities

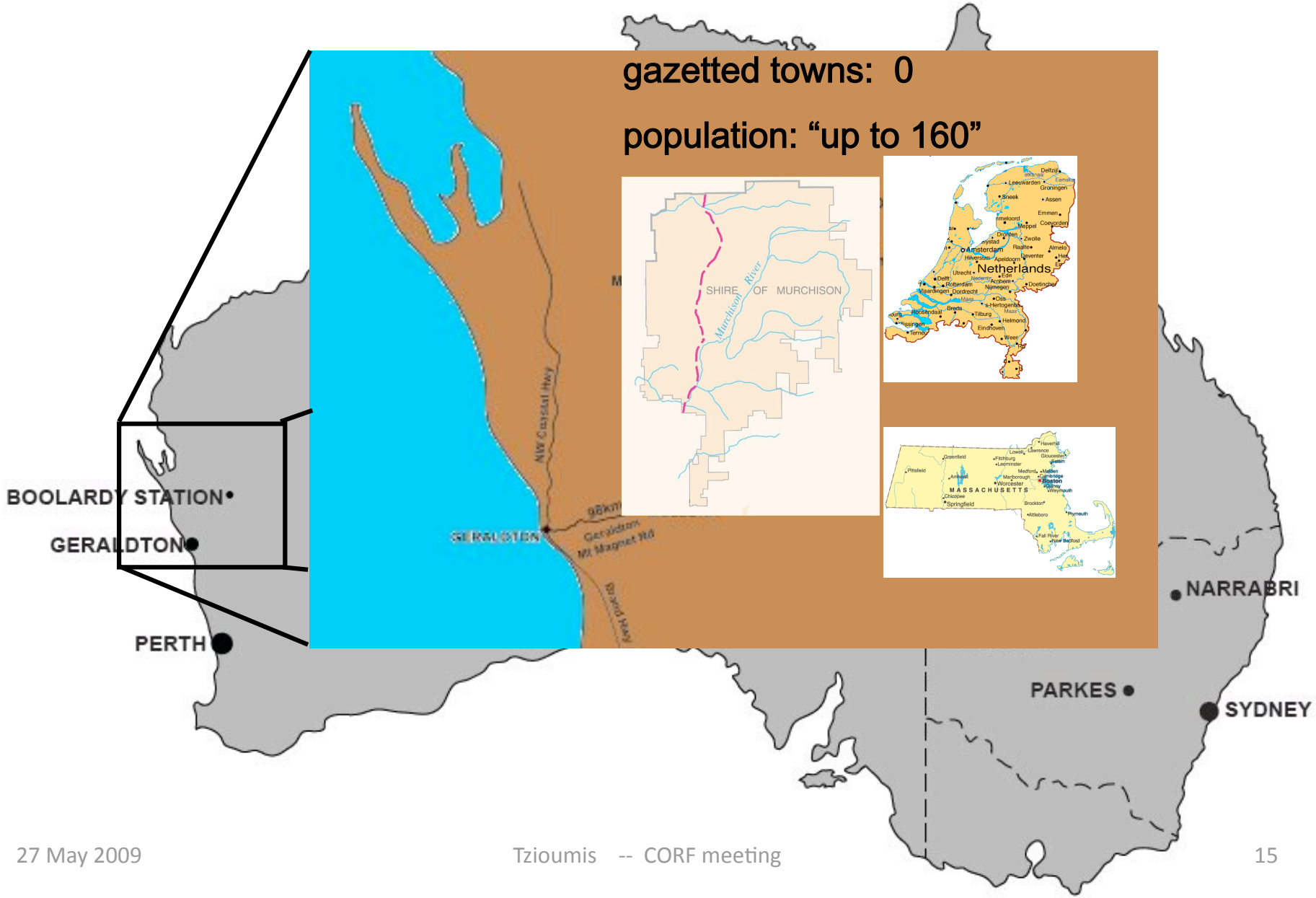
- GMRT (India) - unique current facility
  - Array operating in 37.5-1670 MHz
- ASKAP (Australia) – SKA pathfinder under construction
  - Array operating in 700-1700 MHz
- MWA (Australia/USA) – under construction
  - Array operating 80-300 MHz
- FAST (China) – under construction
  - 500m spherical reflector (300m effective)
  - Operating in 70 MHz – 3 GHz

Special issues for Low-Frequency RAS

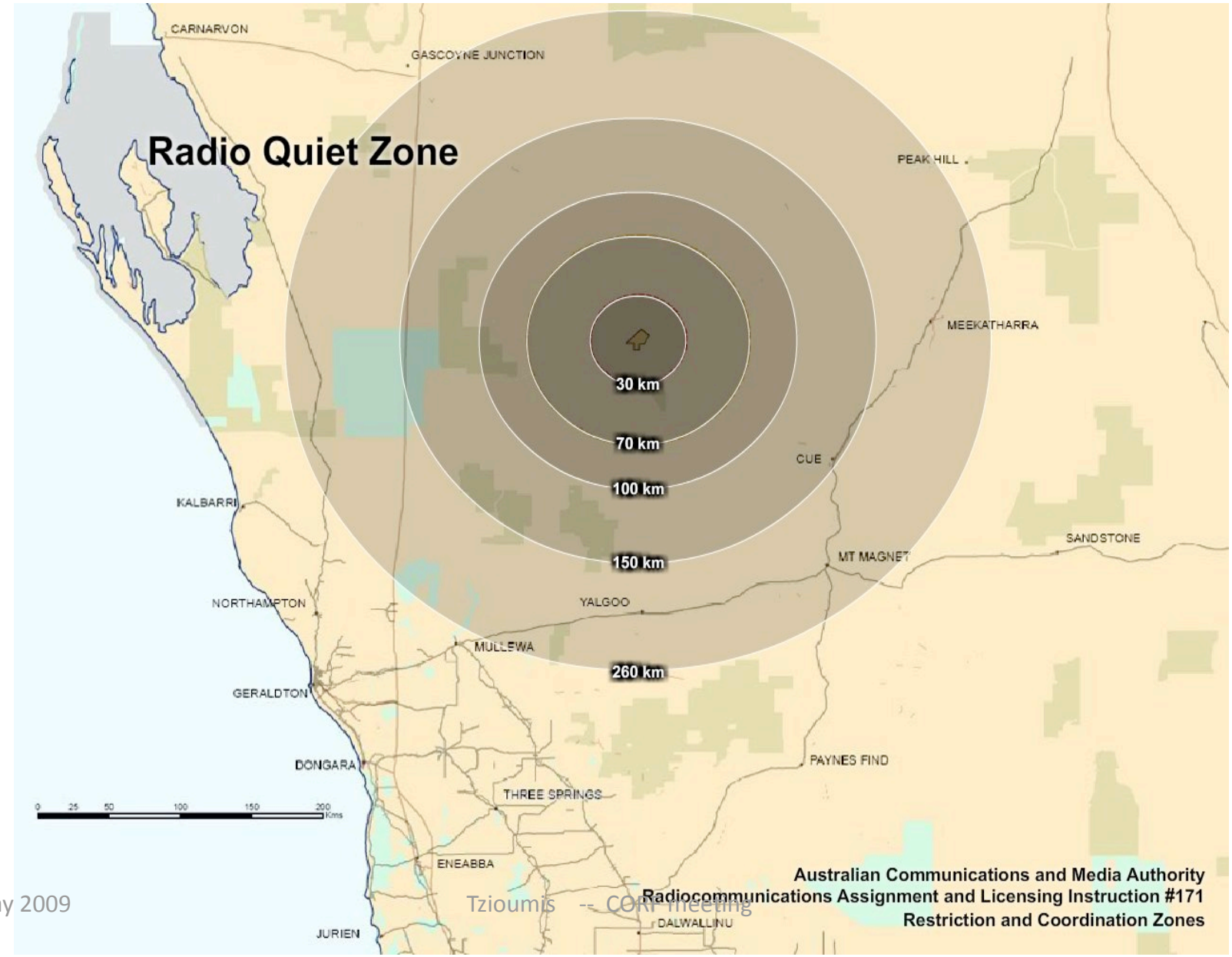
- Congested part of the spectrum
  - Many communications services – terrestrial & space
  - OoB issues (band-by-band studies)
- Few astronomy bands – operating over wide range
  - Strong "RFI" present
  - Digital TV & Digital dividend issues
- Propagation over the horizon
- Vulnerable to Aeronautical and Satellite services
  - AI1.3, 1.4, 1.5,1.7, 1.18 …..

- → Need for protected areas in isolated regions
- → → Radio Quiet Zones (RQZ)
  - E.g. RQZ for SKA site in Australia (includes ASKAP & MWA)
  - FAST radio quiet zone in China

Murchison Radio-astronomy

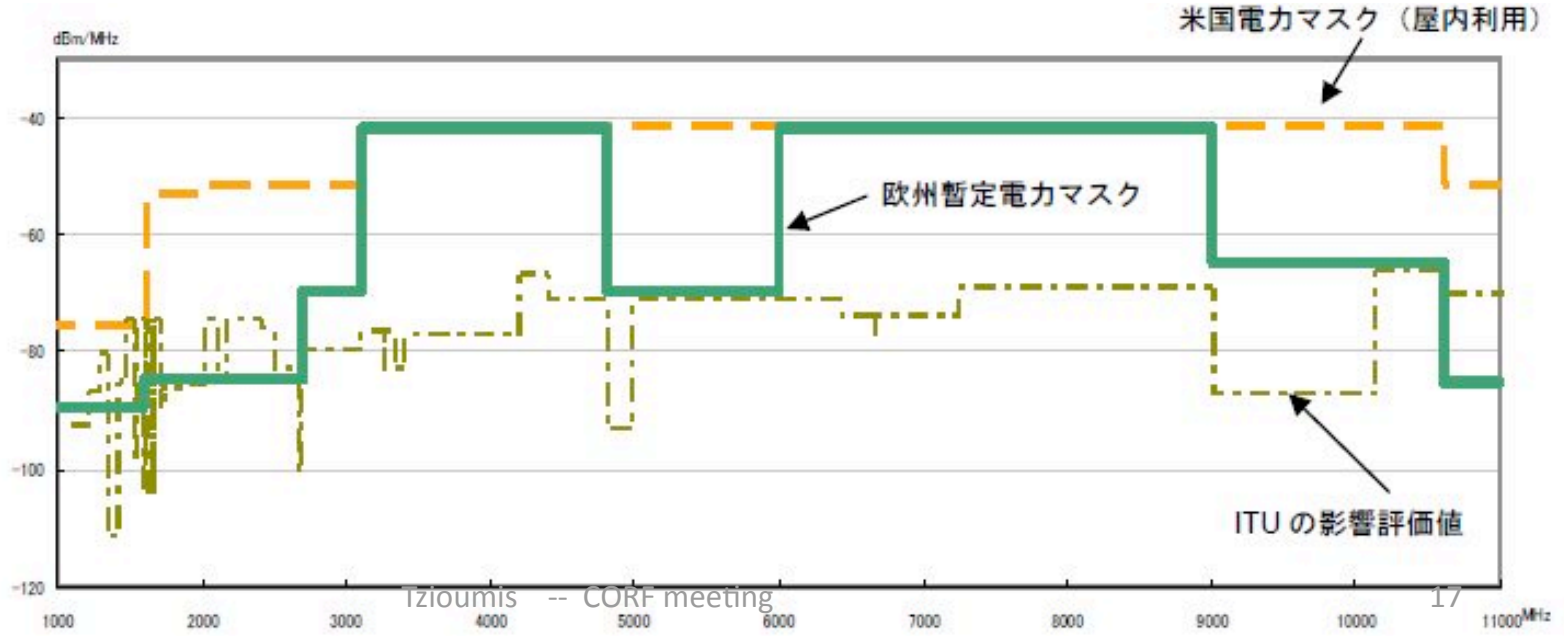


MRO Protection



Ultra Wide Band (UWB)

- UWB – 24 GHz radar for vehicle collision avoidance
- UWB (<10 GHz) – issues in Japan
  - Proposed separation distance for RAS ~ 10 km
  - Masks (US/EU) exceed ITU limits – especially for RAS
  - UWB wants to increase power! – many services opposing
  - No market penetration yet



Power Line Communication (PLC/PLT/BPL)

- Contentious but political support in Japan
  - RFI exceeds ambient man-made noise
  - Exceeds protection criteria for Broadcasting, Amateur and RAS
  - Japanese measurements in public domain
    - Submitted to WPs 1A and 6A by North American Broadcasters Association (NABA) – (Doc 1A/35)
    - Strong political reaction from Japan
  - Confirmed by measurements from Canada (NABA) & BBC (Doc 6A/189)
  - New contributions on emission mechanisms in preparation

Space Solar Power Satellites (SSPS)

- Japanese government call for public comment
  - Comments submitted
- Experimental SSPS launch within 3-5 years!
  - Assess feasibility
- No frequency allocation for such transmissions
- Severe RFI to RAS and other services
  - No ITU studies as yet

“High” Frequency RAS Facilities

- Many countries have mm-wave observatories
  - Korea 85-275 GHz; Australia to 110 GHz
  - Japan; India
- → AI 1.8: Fixed services 71-238 GHz
- Japan is partner in ALMA – 30-950 GHz
- → AI 1.6(part 1): Passive services 275-3000 GHz
- Optical/IR facilities in the region (many)
- → AI 1.6(part 2): Free space optical links

Other AIs of specific interest

- RAS operates even outside allocations
  - → Interest in (almost) all AIs
- AI1.11: SRS spectrum. Space missions (Korea; China)
- AI1.12: 37-38 GHz. Downlink for VSOP mission
- AI1.14: 30-300 MHz – "low" frequency telescopes
- AI1.20: HAPS (methanol masers)
- **AI1.19: SDR and Cognitive radio**
  - Inherently difficult for passive services
  - Potential problems for RQZs