# Dual use of MID-AA's: Space Applications

## Asking the Questions

Carla Sharpe

# What is Space Debris

Orbital debris is any man-made object in orbit about the Earth which no longer serves a useful function. Such debris includes nonfunctional spacecraft, abandoned launch vehicle stages, mission-related debris and fragmentation debris

- 500,000 pieces of debris or "space junk" are tracked in orbit around the Earth
- There are more than 20,000 pieces of debris larger than 10 cm in diameter orbiting the Earth
- The debris travels at speeds of up to 17,500 mph
- The speeds are fast enough for a relatively small piece of orbital debris to damage a satellite or a spacecraft
- Items above 10 cm require avoidance maneuvers
- Between 1 and 10 cm are too small to track and too big to shield against
- Below 1 cm can be shielded against damage

# How is Space Debris tracked

Many countries participate in global space debris detection.

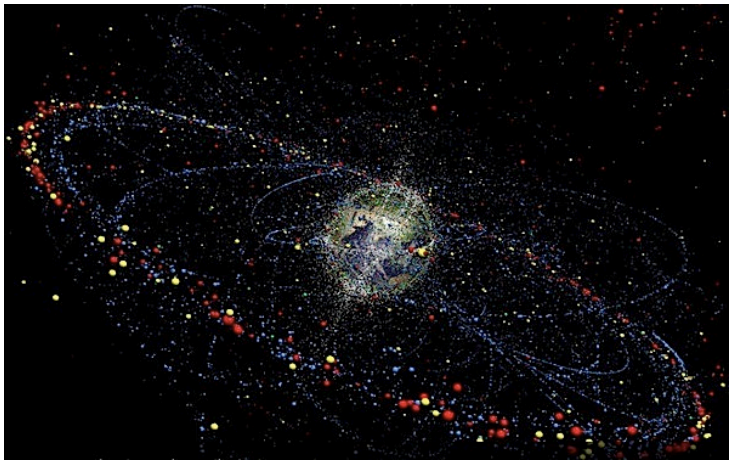
The Space Surveillance Network of the USA Dept. of Defense tracks objects larger than 5 cm in low Earth orbit and a metre in diameter in Geosynchronous Orbit.

ESA's Space Surveillance and Tracking team is based at the Space Surveillance Test and Validation Centre (SSTC) located at ESAC, ESA's European Space Astronomy Centre

Infrastructure such as surveillance radars and telescopes are used to track debris globally

These sensors produce images of the Earth-orbiting objects which are transformed into plots that describe the path or trajectory of any particular object

# Space Debris



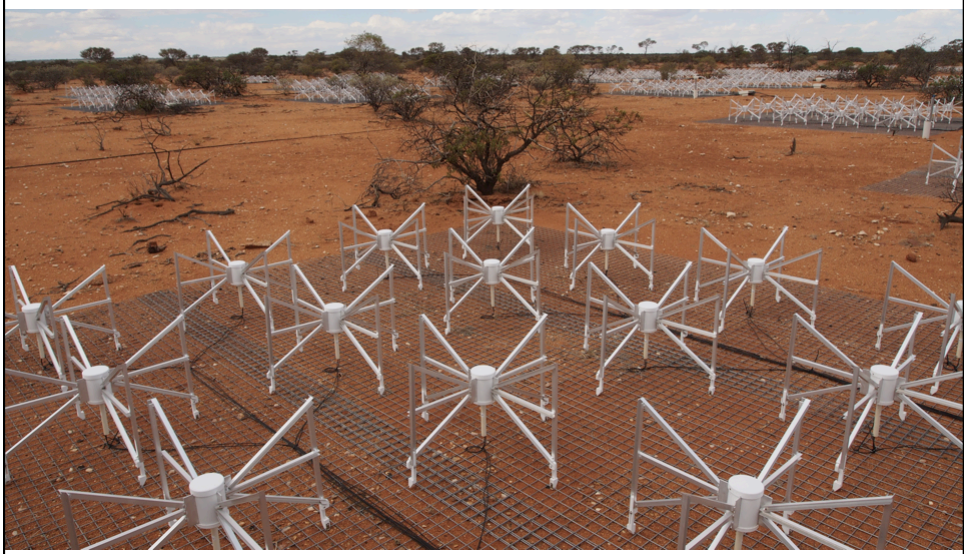
# Space Debris


# Near Earth Asteroid Tracking

- Increased awareness and global interest in Near Earth objects
- NASA and JPL have invested in the Near Earth Object Program
- In a time of budget constraints, the USA Federal Budget for NEO is 2,5 times the 2012 budget
- More than 13,500 near-Earth objects of all sizes have been discovered to date

# Aperture Array

- Innovative, efficient and low cost
- Aperture array antennas provide a large field of view and are capable of observing more than one part of the sky at once
- By simultaneously using different sets of timing delays, beam forming can be used to create multiple independent beams, increasing the gain within the total field of view
- The number of useful beams produced, or total field of view, is essentially limited by signal processing, data communications and computing capacity



# Dual uses: Mid Frequency Aperture Array Challenges

- Frequency required for tracking smaller items may not be feasible for MFAA
- Dedicated transmitter?
- Near Earth asteroid detection… is it possible?
- Transmitter of opportunity such as FM Radio signal for Low Frequency arrays such as MWA
  - TV? Cell Phone?
- What is the maximum distance from Earth that we could track
- Application of tracking algorithms

# Why Dual Use

- Funding Constraints
- Sustainable Business Case
- African Development
- Opportunity for collaboration across countries and disciplines
- Scheduled use e.g. Daytime hours when high sensitivity science is not possible


Thank you