The Advanced Instrumentation Technology Centre (AITC)

David Brodrick
Research School of Astronomy and Astrophysics
2021-05-28

Australian
National
University

AITC @ Mount Stromlo Observatory

- Within the ANU Research School of Astronomy and Astrophysics.
- ~40 AITC staff - professionals and academics. ~140 total staff in RSAA.
- Largely self-funding through instrumentation contracts for global clients.
- Long experience in astronomical instrumentation (visible and IR).
- Growing involvement in space applications.

Adaptive Optics

The incoming wavefront from a point source reference (guid star) and the nearby object of interest has been distorted by the atmosphere
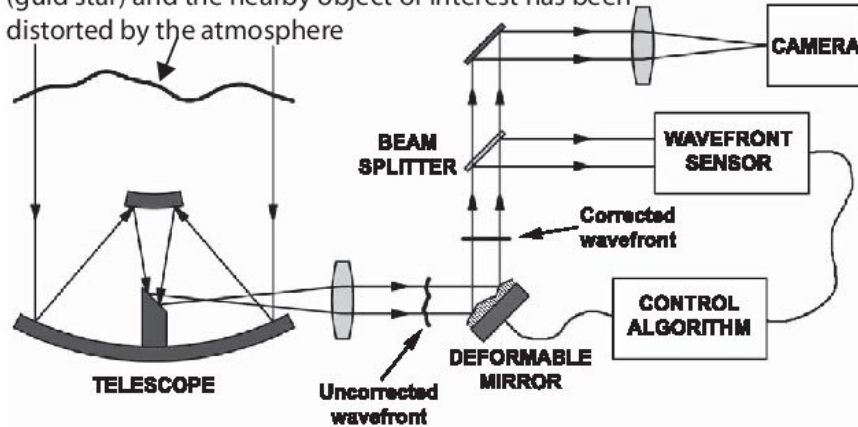
CAMERA

BEAM SPLITTER

WAVEFRONT SENSOR
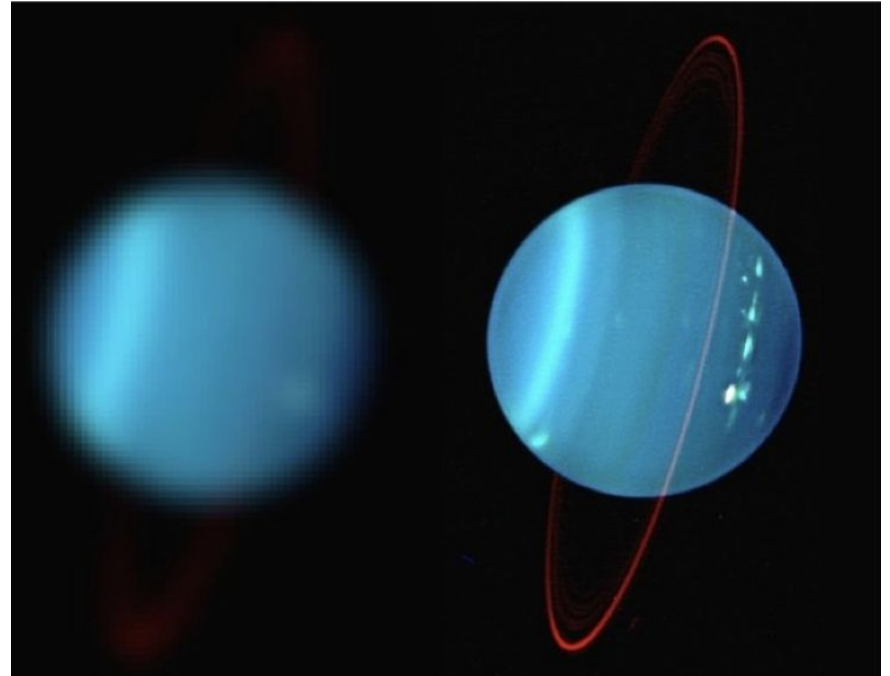
Corrected wavefront

CONTROL ALGORITHM

TELESCOPE

Uncorrected wavefront

DEFORMABLE MIRROR

Image: Tani, Mishra, Wen (2013).

Image: Uranus without, and with AO (Keck II).

Australian National University

Sodium Laser Guide Stars (Celine D'Orgeville)

- Natural guide stars are not always available where you want them.
- 589nm lasers excite sodium in the upper atmosphere.
- LGS provide high order distortion information but still need tip-tilt.
- World leading expertise at AITC.
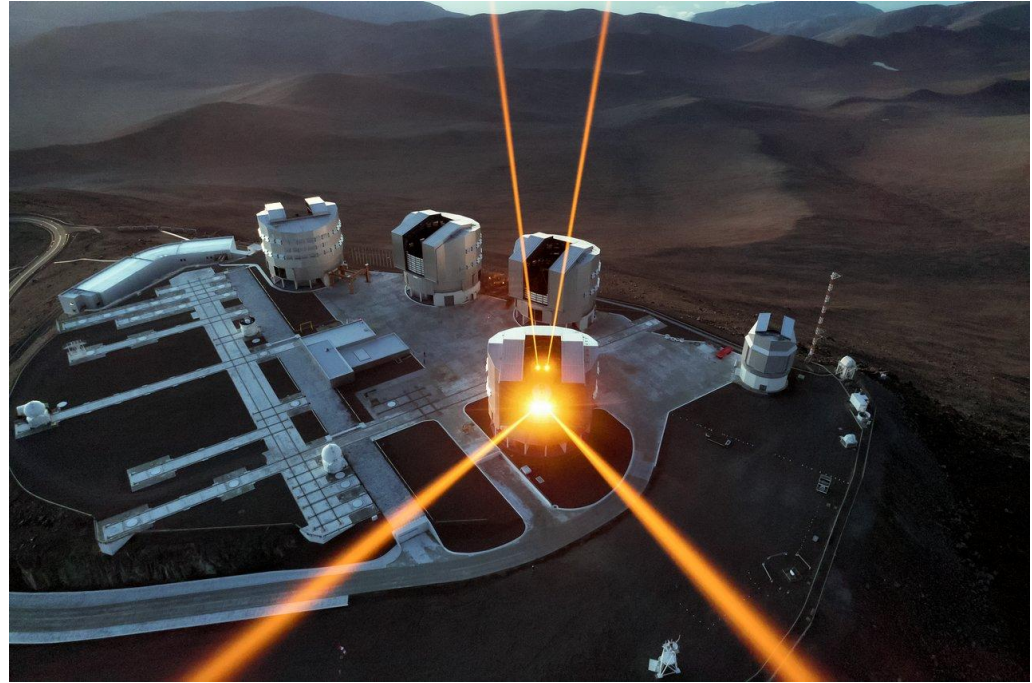- Involvement in projects to develop next generation guidestar lasers.

Image: 4LGSF on VLT UT4 (ESO).

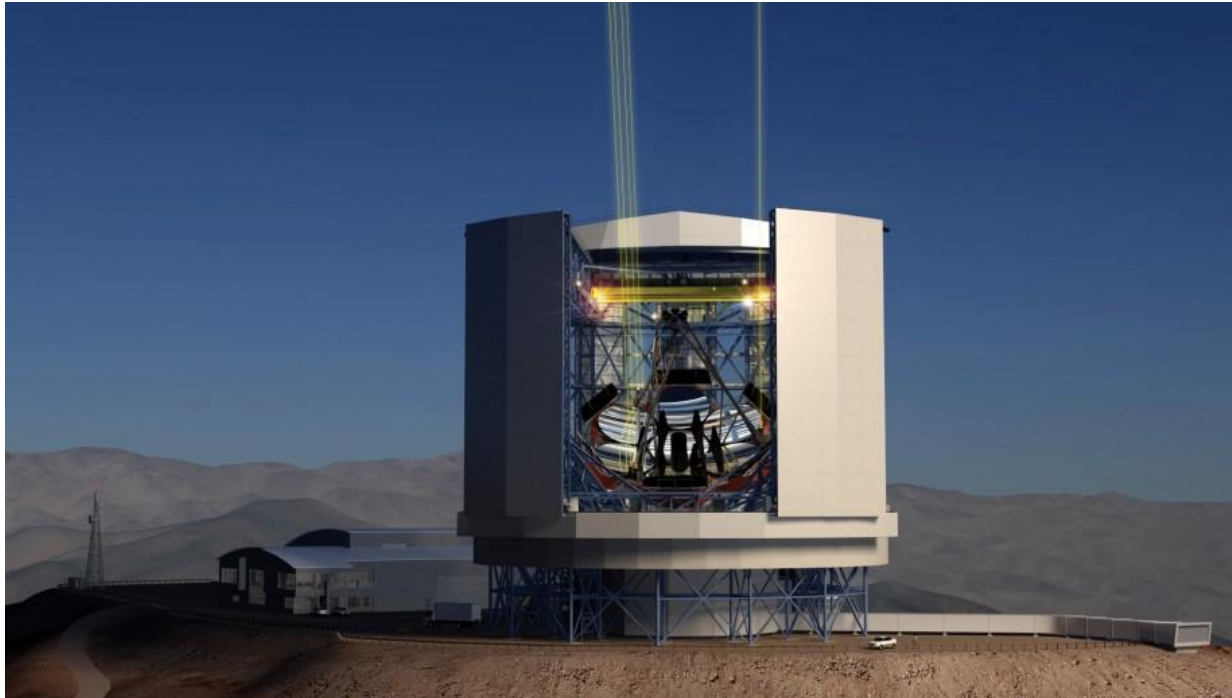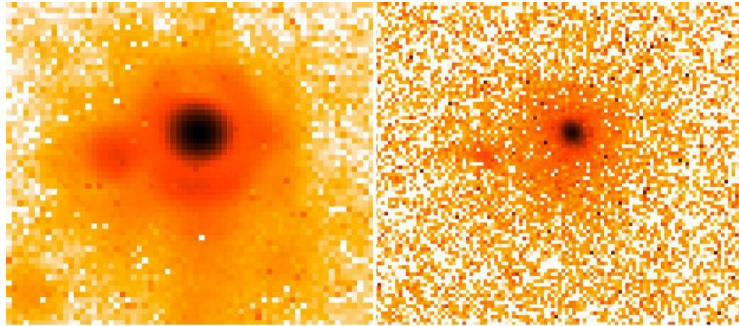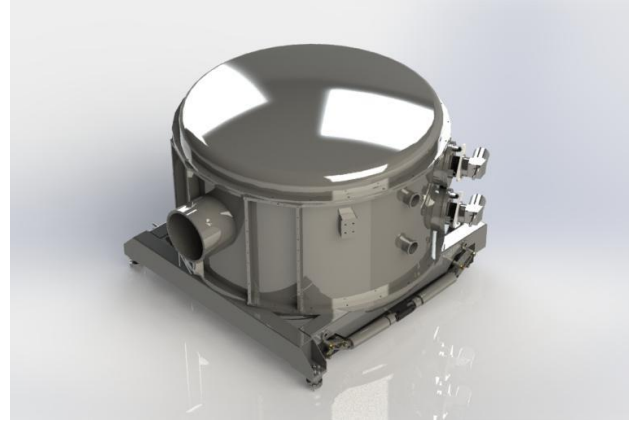# GMTIFS for the Giant Magellan Telescope
(PI: Rob Sharp)

Image: Giant Magellan Telescope Organization

GMTIFS

- Imager and Integral Field Spectrograph for the GMT.
- Wavelength range 0.9 - 2.5 microns.
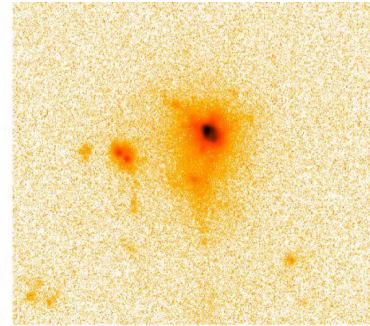- 20.4x20.4" field of view.
- 4mas pixels.
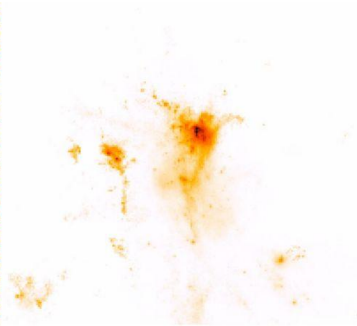
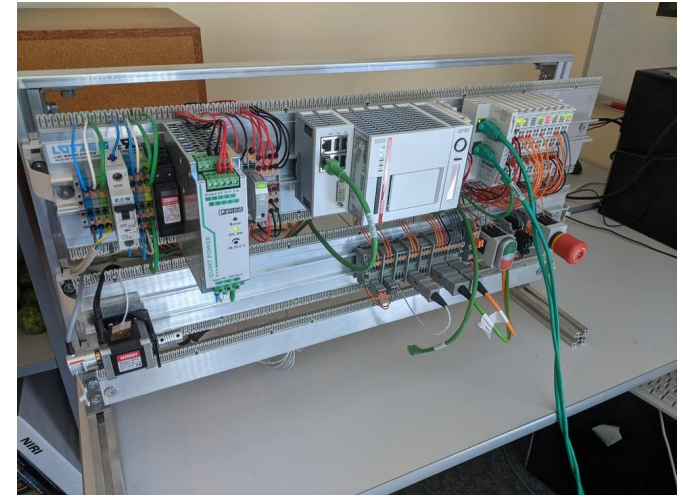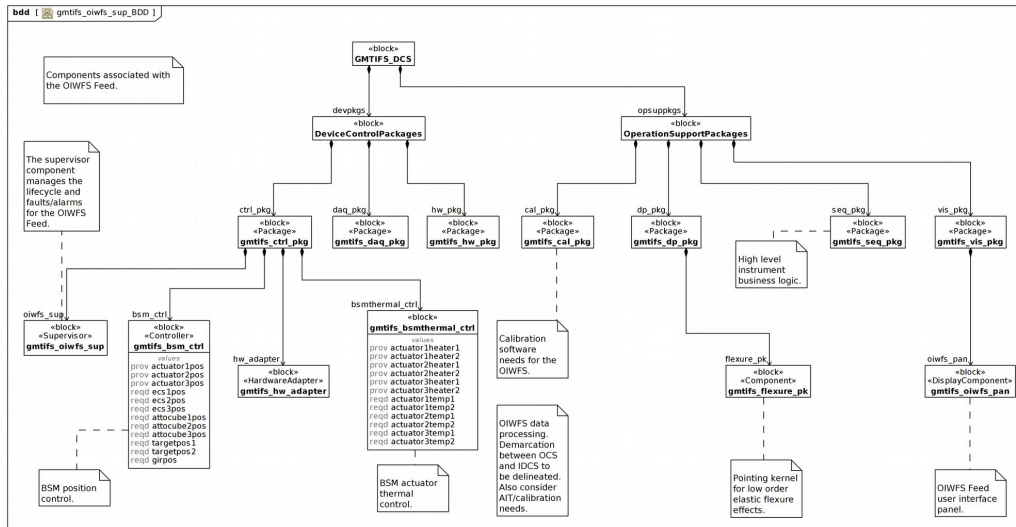JWST   GSAOI   Simulation   GMTIFS

30 hours on source - z~8 galaxy simulation.

GMTIFS Controls

- Uses GMTO Software and Controls System (SWCS) SDK (Filgueira et al.).
- Prototypes and conceptual design completed in 2020/21.

MAVIS
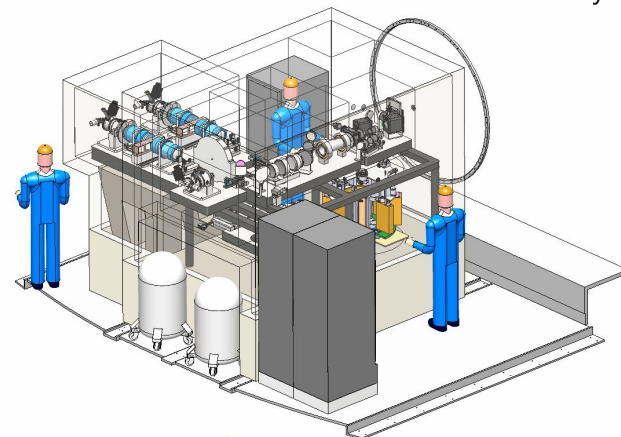**Sharper than JWST, Deeper than HST**

8 Laser Guide Stars

30"×30" Field of View

Resolution 3× sharper than HST (18mas @ V band)

4k×4k imager and 4k-15k λ resolution IFU

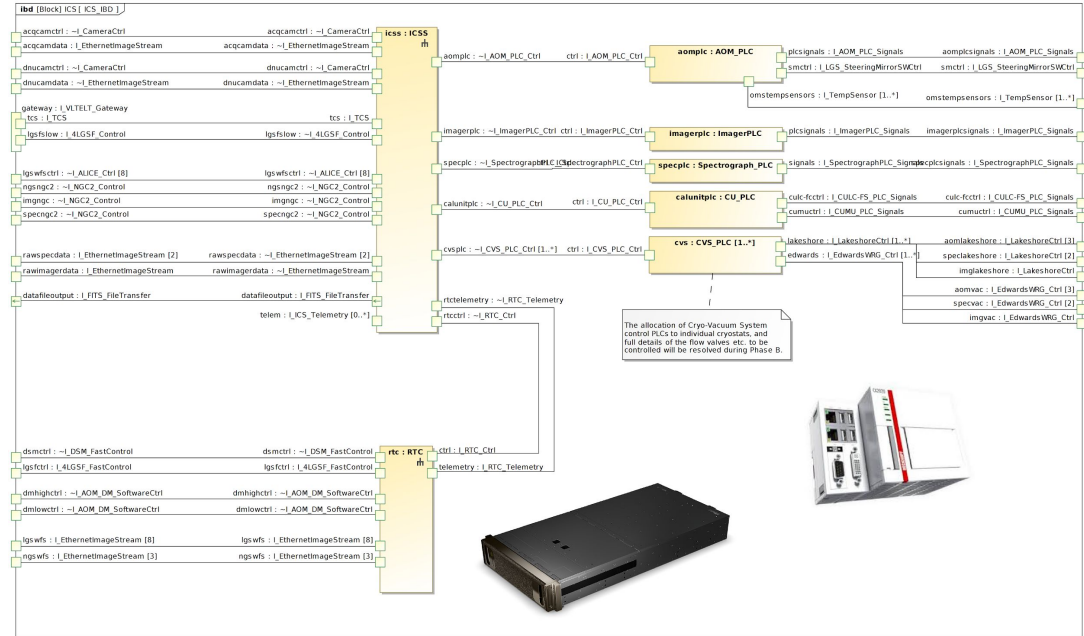**VLT 8-m ∅ Adaptive Optics Facility optical feed**
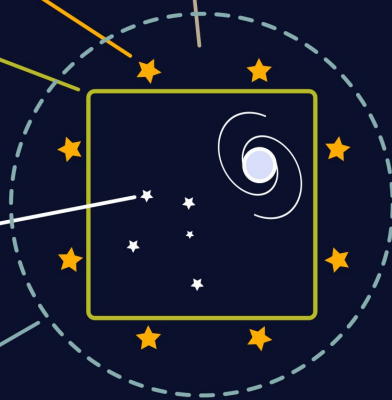
Australian National University

MAVIS

Project PI: François Rigaut

MAVIS Controls

- MAVIS controls are being developed using the new E-ELT controls framework developed by ESO.
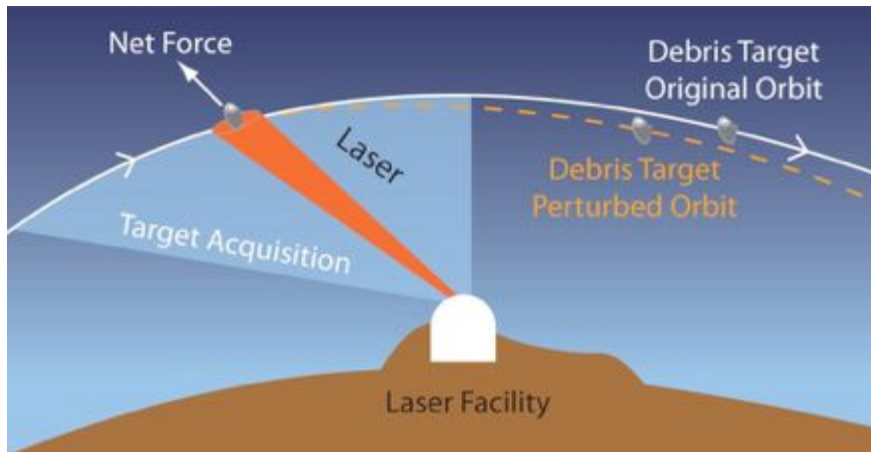- Controls effort led by our partners at INAF Padova in Italy.

COSMIC – AO Control (Damien Gratadour)

- Next generation *Real Time Controller* for AO.
- Will be used for MAVIS.
- Recently commissioned for Keck.
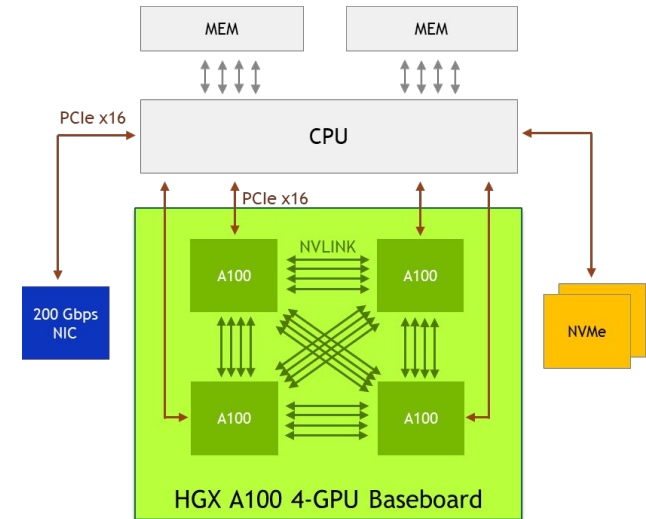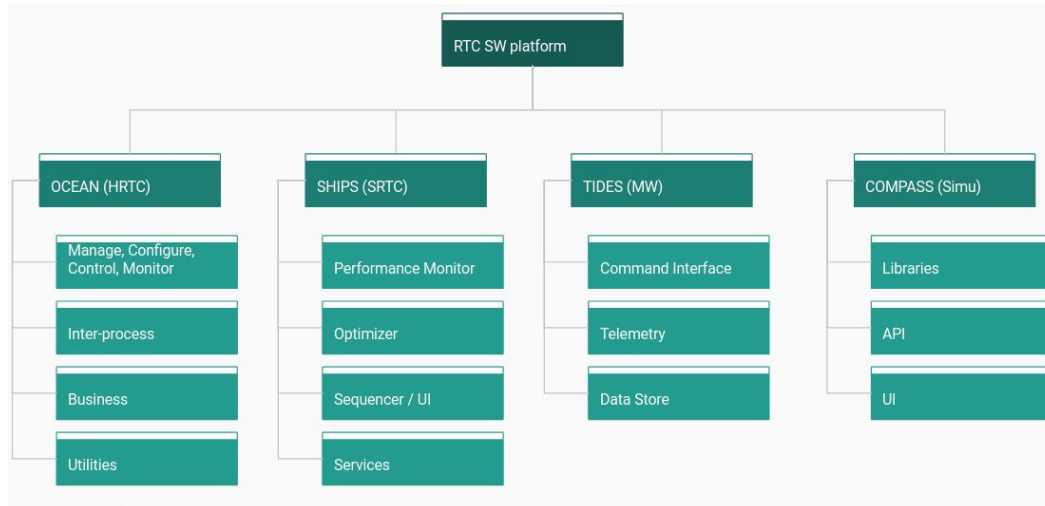
Space Environment Research Centre

- Applying AO to the near-Earth space environment.
- Including project to use photon pressure to modify space debris orbits to prevent collisions.

Siding Spring Observatory

3.9m AAT

2.3m ANU

TAROS – for ANU 2.3m

DRAMA – for AAT
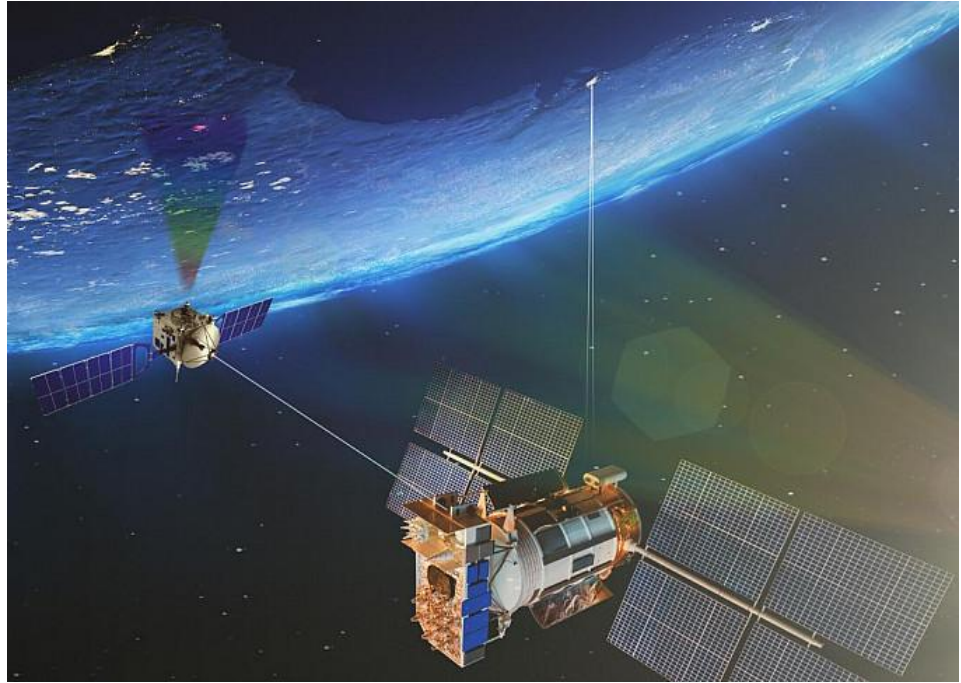

Image: http://drama.aao.org.au/
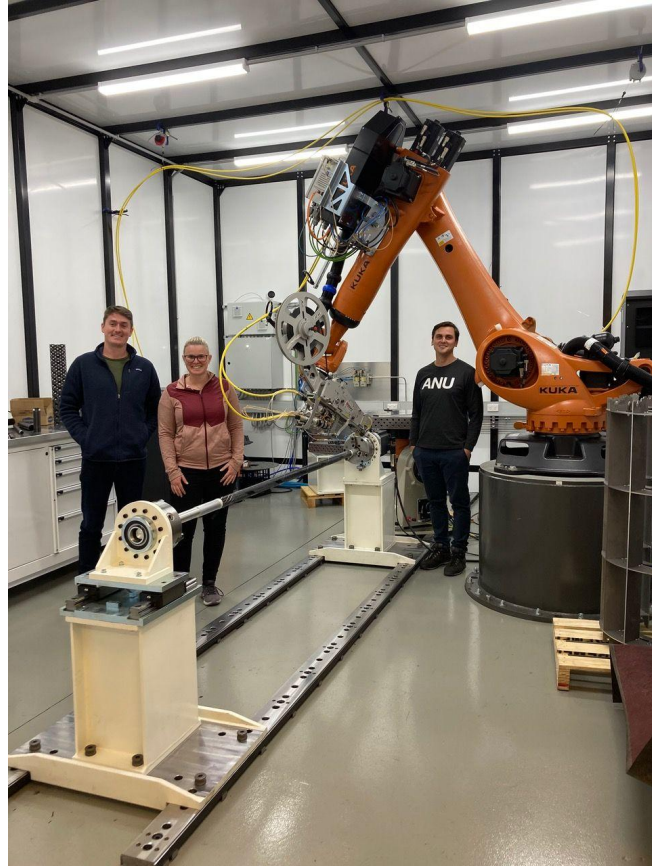
SkyMapper (B. Schmidt, C. Wolf, et al.)
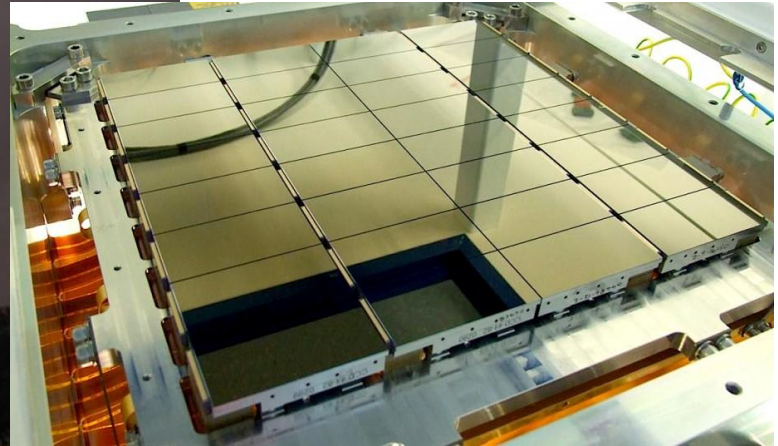
- AITC now developing DREAMS (wide FoV IR) (Anna Moore, Tony Travouillon)

Satellite Laser Communication (Francis Bennet)

- Secure communications using quantum key cryptography.

- ANU leading the field.

- New ground station under construction at Stromlo.

ANU CECS Advanced Composite Material Manufacturing

National Space Test Facility (Eduardo Trifoni)