



Welcome & Introduction

Aletha de Witt
AVN-Newton Fund/DARA 2018
Observational & Technical Training HartRAO



HartRAO

A Facility of SARAo

operated by the

National Research Foundation (NRF)

who report to the

Department of Science and Technology (DST)



HartRAO location in South Africa

Latitude $25^{\circ} 53' 27.1''$ South
Longitude $27^{\circ} 41' 12.7''$ East

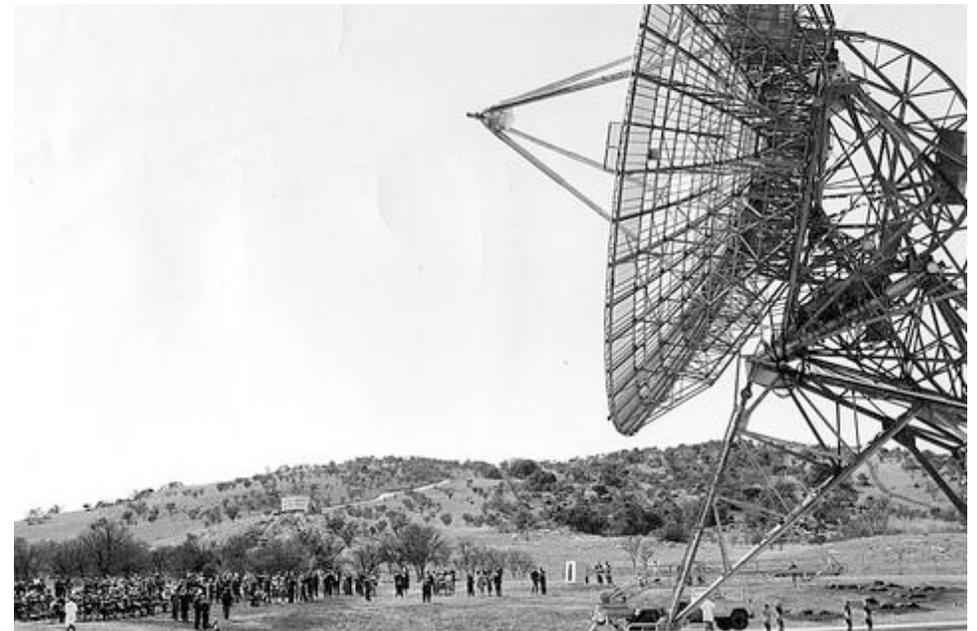
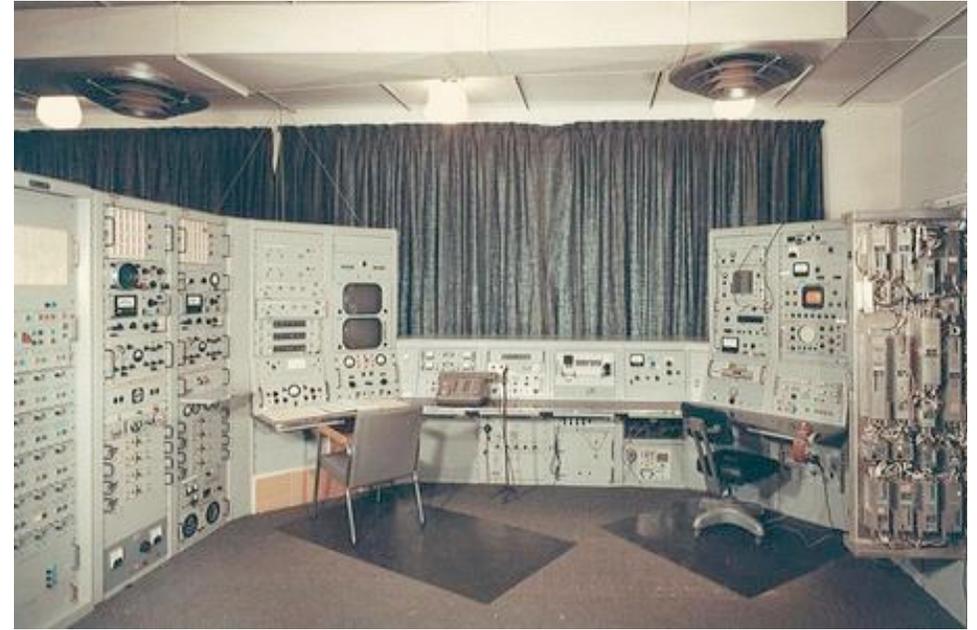


HartRAO location in South Africa

Latitude 25° 53' 27.1" South
Longitude 27° 41' 12.7" East



1961 - 1974 NASA Deep Space Station 51 operated by CSIR for NASA

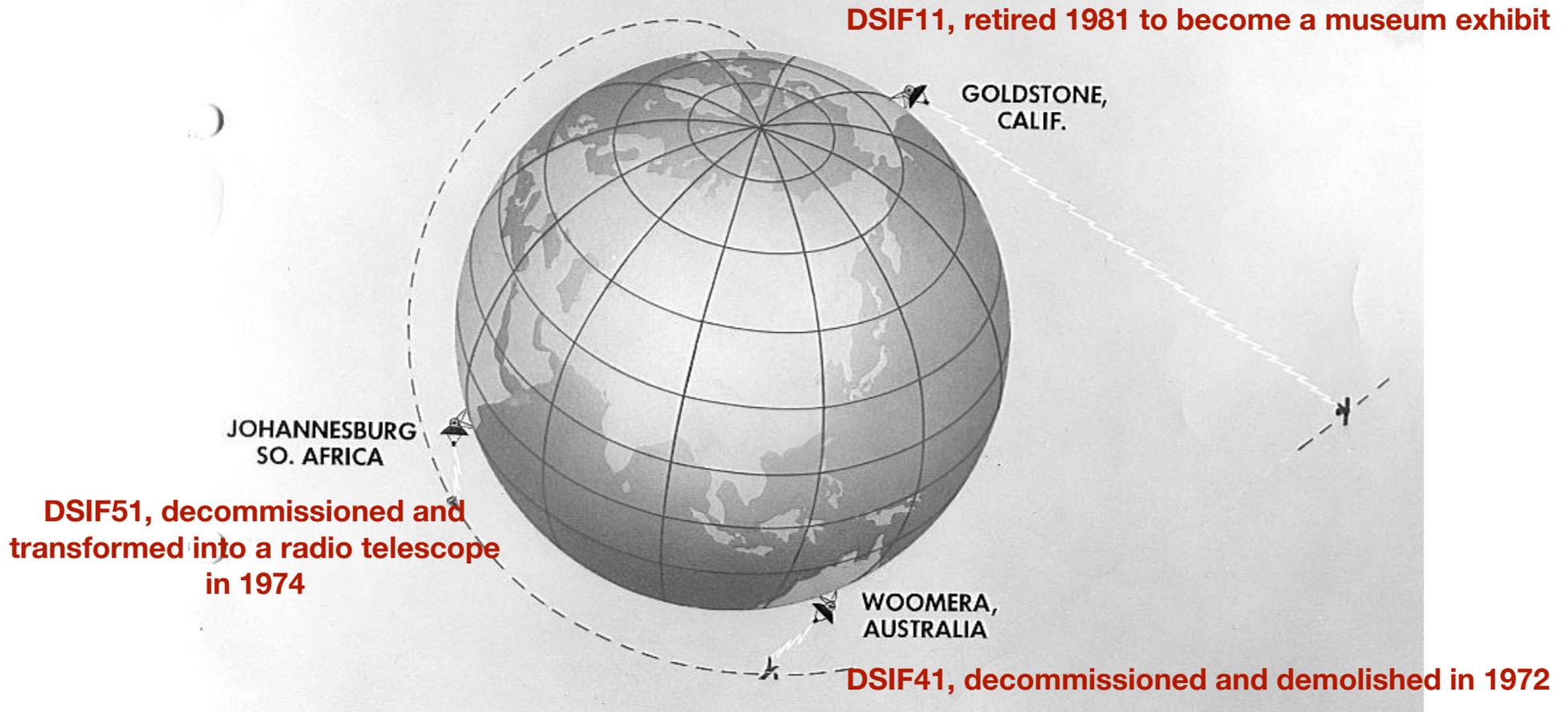


Origins of HartRAO - tracking station



Station locations of the Deep Space Network

STATION LOCATIONS OF DEEP SPACE NET



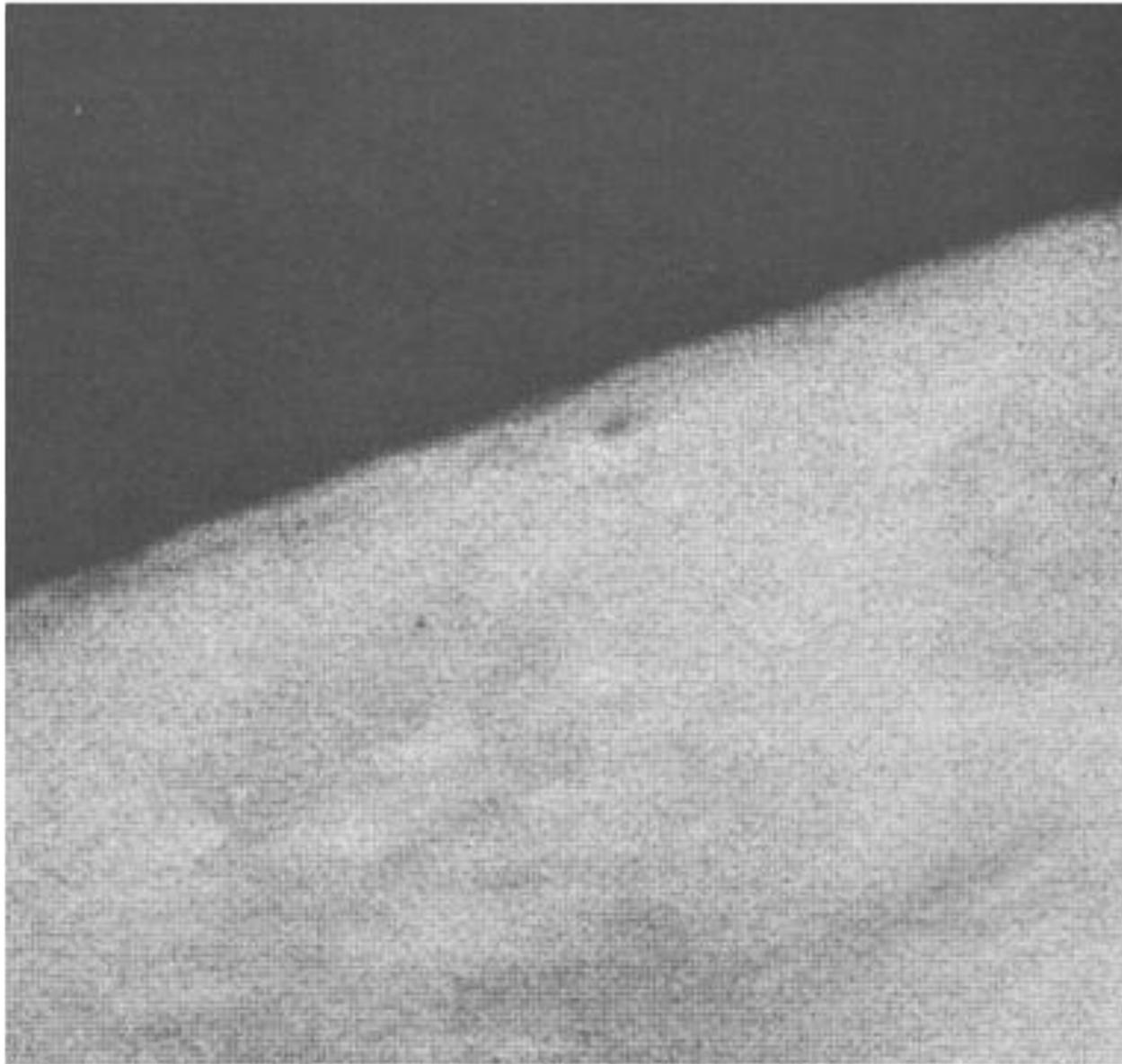
<http://www.hartrao.ac.za/other/dss51/dss51.html>

Origins of HartRAO - tracking station



1961 - 1974 NASA Deep Space Station 51 operated by CSIR for NASA

First pictures of another planet to be taken by a spacecraft !



Mariner IV obtained the first closeup photographs of Mars in a fly-by during 1965

The very first picture was received here at Hartebeesthoek on July 15 1965, when Mars was nearly overhead at Johannesburg.

Origins of HartRAO - tracking station



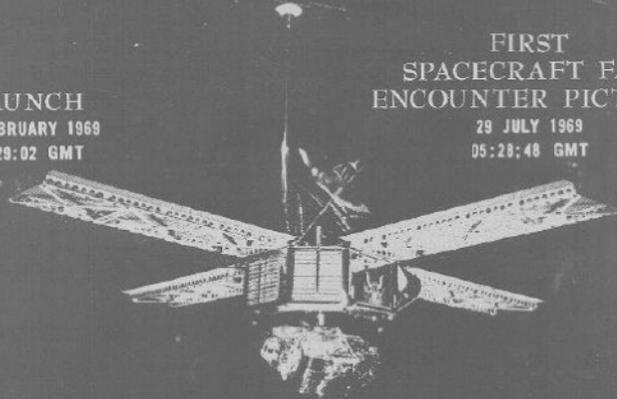
Mariner VI was able to send back colour pictures of Mars.



To Commemorate

LAUNCH
25 FEBRUARY 1969
01:29:02 GMT

FIRST
SPACECRAFT FAR
ENCOUNTER PICTURE
29 JULY 1969
05:28:48 GMT



END OF PRIME MISSION: 31 OCTOBER 1969

MARINER VI MISSION

Which obtained data during a near fly by of the planet Mars, relevant to the search for extraterrestrial life. Scientific investigations accomplished were dual television resolution imagery, infrared radiometry and spectrometry, ultraviolet spectrometry, S-Band occultation and celestial mechanics. All personnel are commended who participated in this successful mission at the...

JOHANNESBURG
DEEP SPACE STATION
DEEP SPACE INSTRUMENTATION FACILITY

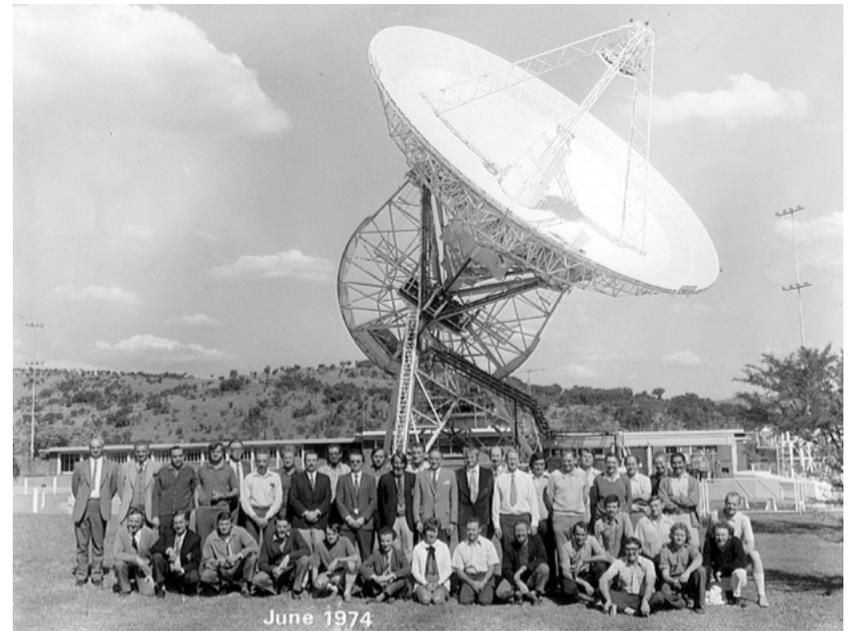
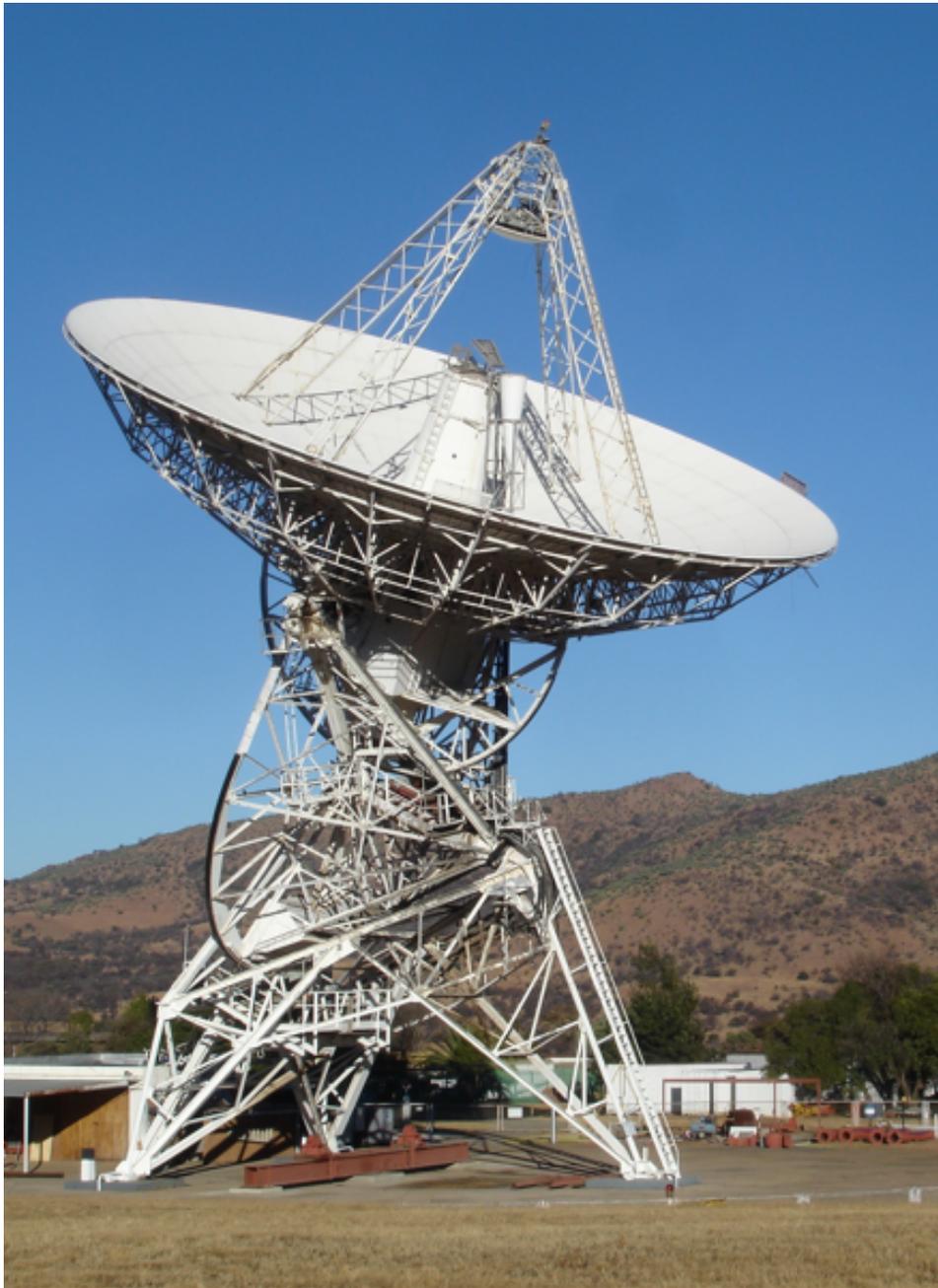
W. H. Pickering
DIRECTOR
JET PROPULSION LABORATORY

W. H. Bayley
ASSISTANT DIRECTOR FOR
TRACKING AND DATA ACQUISITION
JET PROPULSION LABORATORY

Origins of HartRAO - tracking station

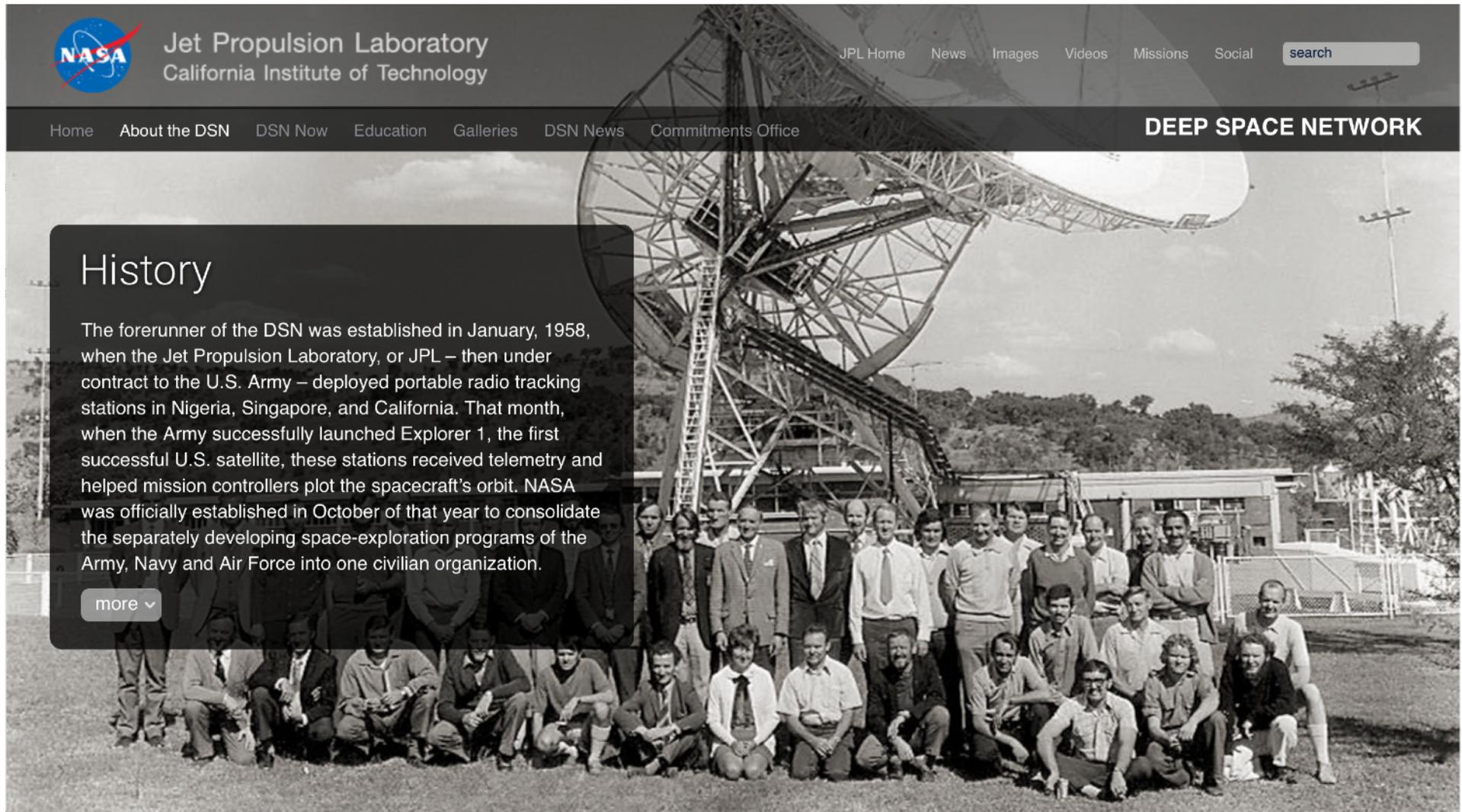


National Facility for Radio Astronomy and Space Geodesy



HartRAO since 1974

<http://deepspace.jpl.nasa.gov/about/history/#>



NASA Jet Propulsion Laboratory
California Institute of Technology

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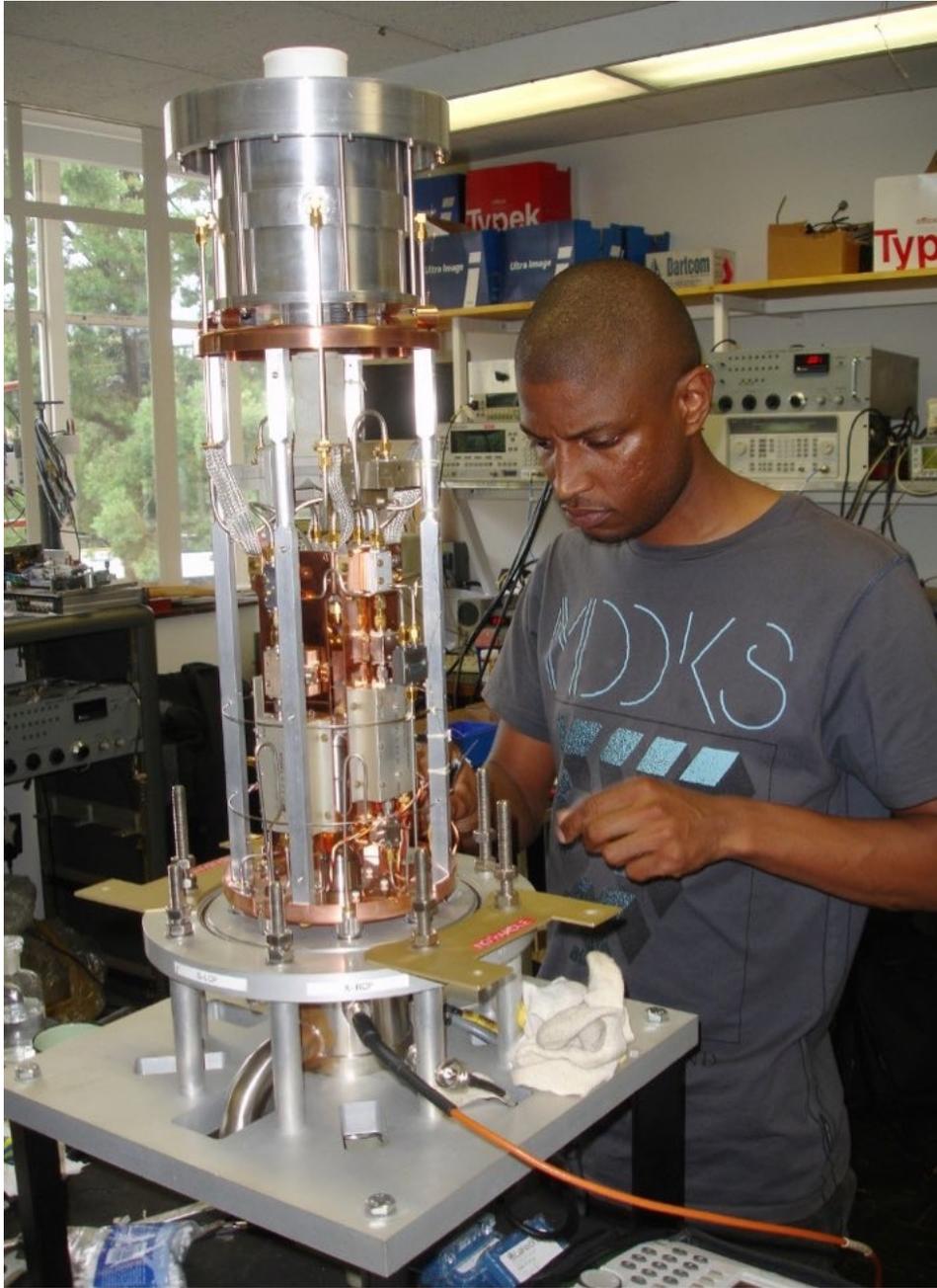
History

The forerunner of the DSN was established in January, 1958, when the Jet Propulsion Laboratory, or JPL – then under contract to the U.S. Army – deployed portable radio tracking stations in Nigeria, Singapore, and California. That month, when the Army successfully launched Explorer 1, the first successful U.S. satellite, these stations received telemetry and helped mission controllers plot the spacecraft's orbit. NASA was officially established in October of that year to consolidate the separately developing space-exploration programs of the Army, Navy and Air Force into one civilian organization.

[more](#)

HartRAO since 1974

Continuous upgrading to increase science capability



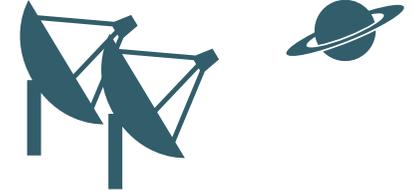
HartRAO since 1974



HartRAO today

What HartRAO does

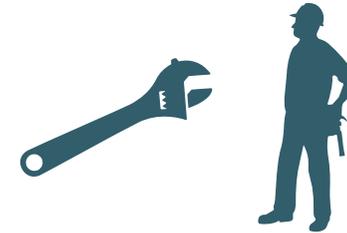
- Radio Astronomy Research -
Studying objects in the Universe that produce radio waves (VLBI)



- Space Geodesy Research -
Using radio astronomy and space techniques to study the Earth (VLBI)



- Engineering and Technical -
Maintenance, upgrading, testing and development

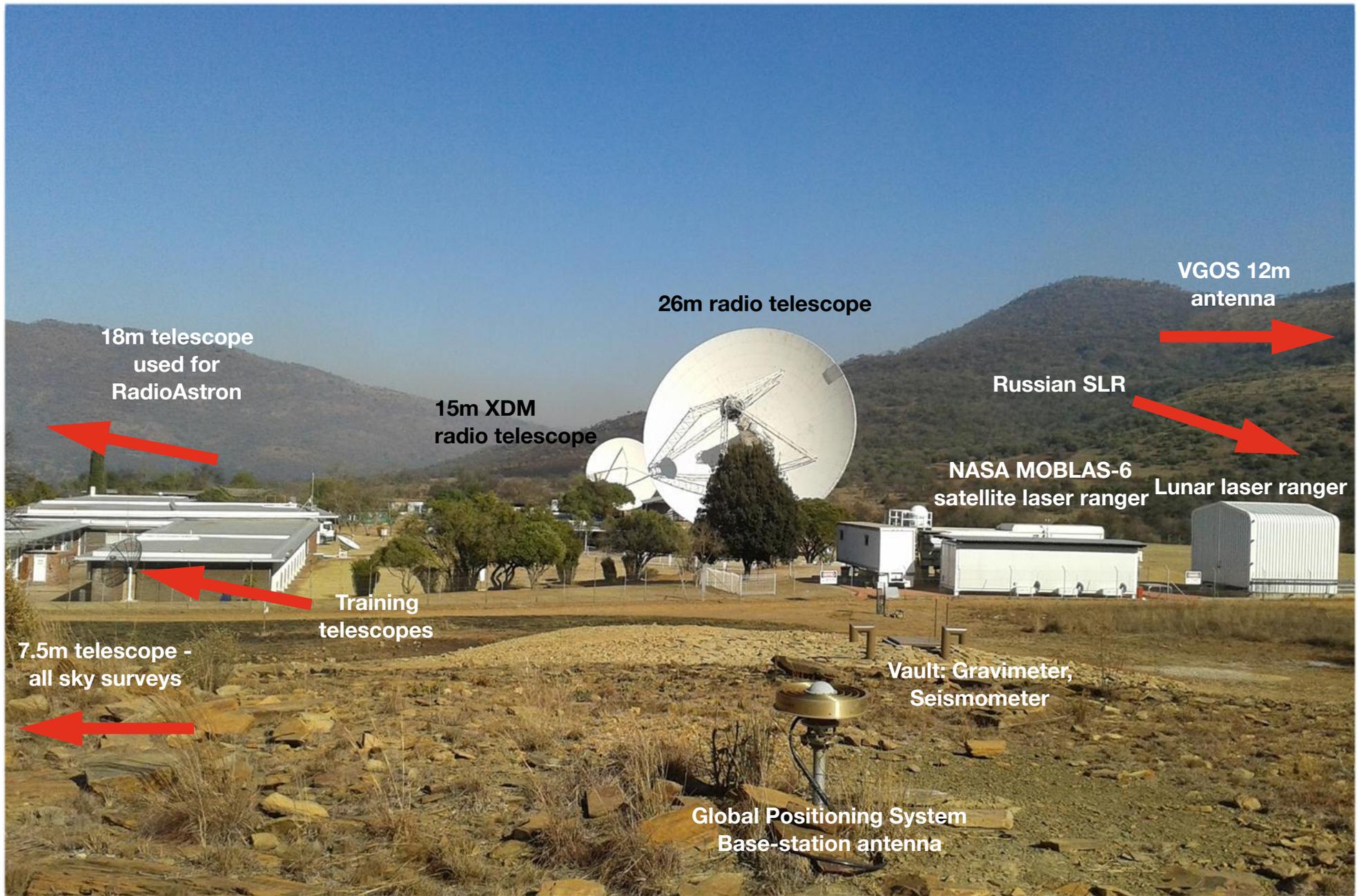


- Radio Astronomy Development -
e.g. SKA, AVN, C-bass, VGOS, ICRF-3



- Tertiary Education and Training & Science Awareness and Outreach
In association with Universities e.g. NASSP, WITS, AVN-Newton Fund/DARA
public and school visits and workshops for educators





HartRAO Facilities

Geodesy



New Russian SLR: Opening 27 February 2017



HartRAO Facilities

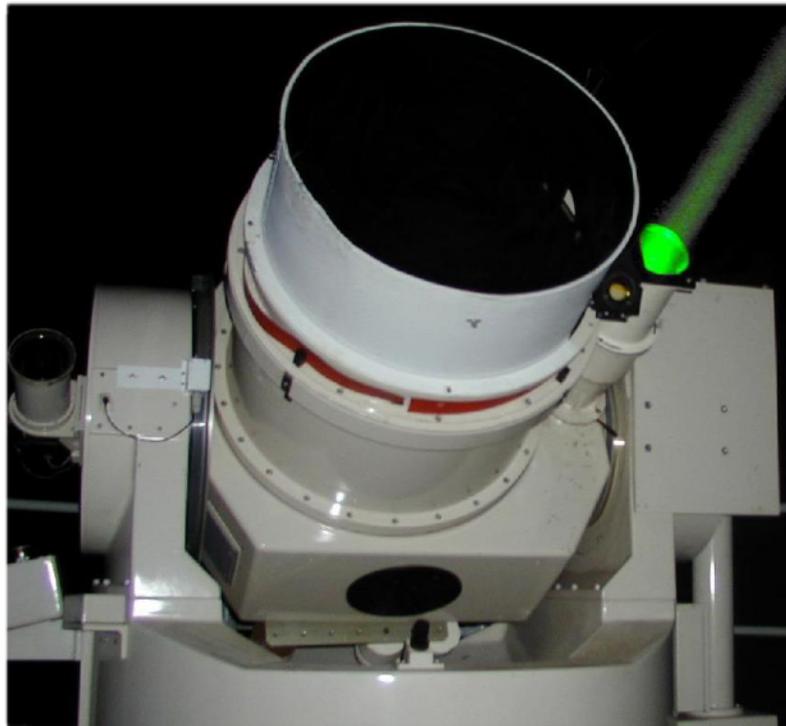


HartRAO Facilities



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HartRAO/NASA Satellite Laser Ranger

Global Navigation Satellite System (GNSS) receivers for GPS, GLONASS and Galileo, at HartRAO and at other locations, for geodesy

Gravimeter, Seismometer
Seismic network across SA, Gough and Marion island: 10 additional seismic stations.



HartRAO
Lunar Laser
Ranger



Gough Island **Tide Gauge** installed.

AVN-Newton Fund: Project overview



- **Funding for the SA/UK Newton Fund African VLBI Network (AVN) project was approved in January 2015**
- The aim of this project is to develop researchers in Radio Astronomy fields and related instrumentation, who can become part of the international science community and ensure optimum use of the new observatories deployed through the AVN project.

- **This project is a collaboration involving the following partners in the UK:**

- Universities of Leeds,
- Manchester,
- Oxford and
- Hertfordshire
- as well as the Goonhilly Earth Station Ltd.



<https://www.dara-project.org>

- **And the following partners in South Africa:**

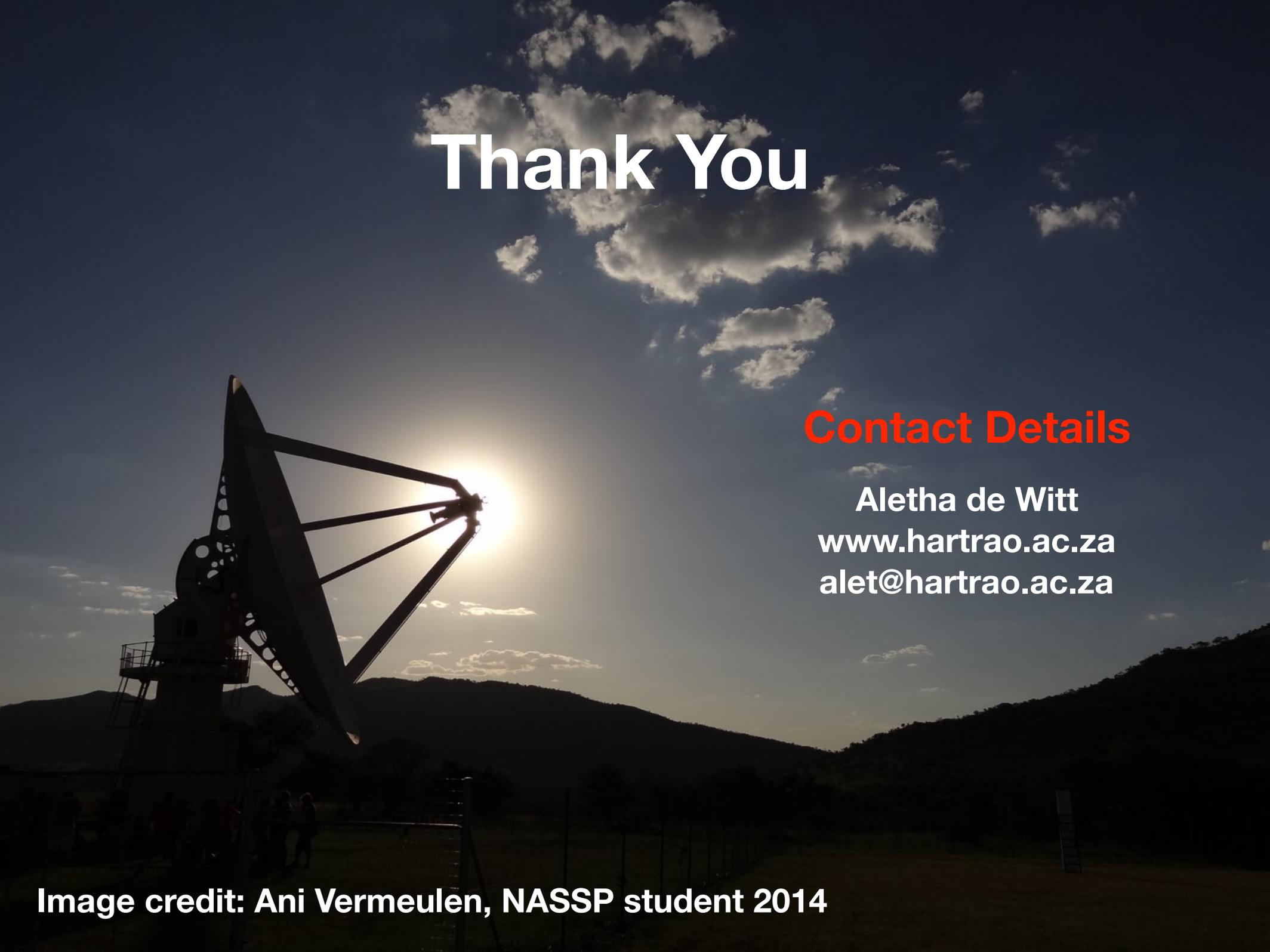
- the Hartebeesthoek Radio Astronomy Observatory (HartRAO),
- Square Kilometre Arrau (SKA)-SA,
- the Office of Astronomy for Development (OAD),
- the South African National Space Agency (SANSA),
- Universities of Cape Town, Rhodes, Western Cape, North West and South Africa.



AVN-Newton Fund: Project overview



- **Newton Fund (UK) and DST (SA) matching Funds:**
 - Principal SA Investigator: ~~Prof Ludwig Combrinck (Director: HartRAO)~~ **SARAO**
 - Principal UK investigator: Prof Melvin Hoare (University of Leeds)
- **Close collaboration with joint delivery and one Steering Committee from SA & UK:**
 - UK/SA 5 year collaboration
 - SA activities funded by DST
 - UK activities funded by Newton Fund
- **2 x sessions/yr**
- **First training in 2015/16 and 2nd training in 2016/17 - 2017/18 in progress**
- **Initial 3 year training programme (extended for another 2 years), using the available telescopes at HartRAO and Ghana:**
 - “Official” participants originally Zambia, Kenya and Namibia
 - Botswana and Madagascar and Mozambique now added



Thank You

Contact Details

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Image credit: Ani Vermeulen, NASSP student 2014