

Astronomy from the Antarctic Plateau

Tony Travouillon, on behalf of ...
John Storey, on behalf of...
The PLATO team....



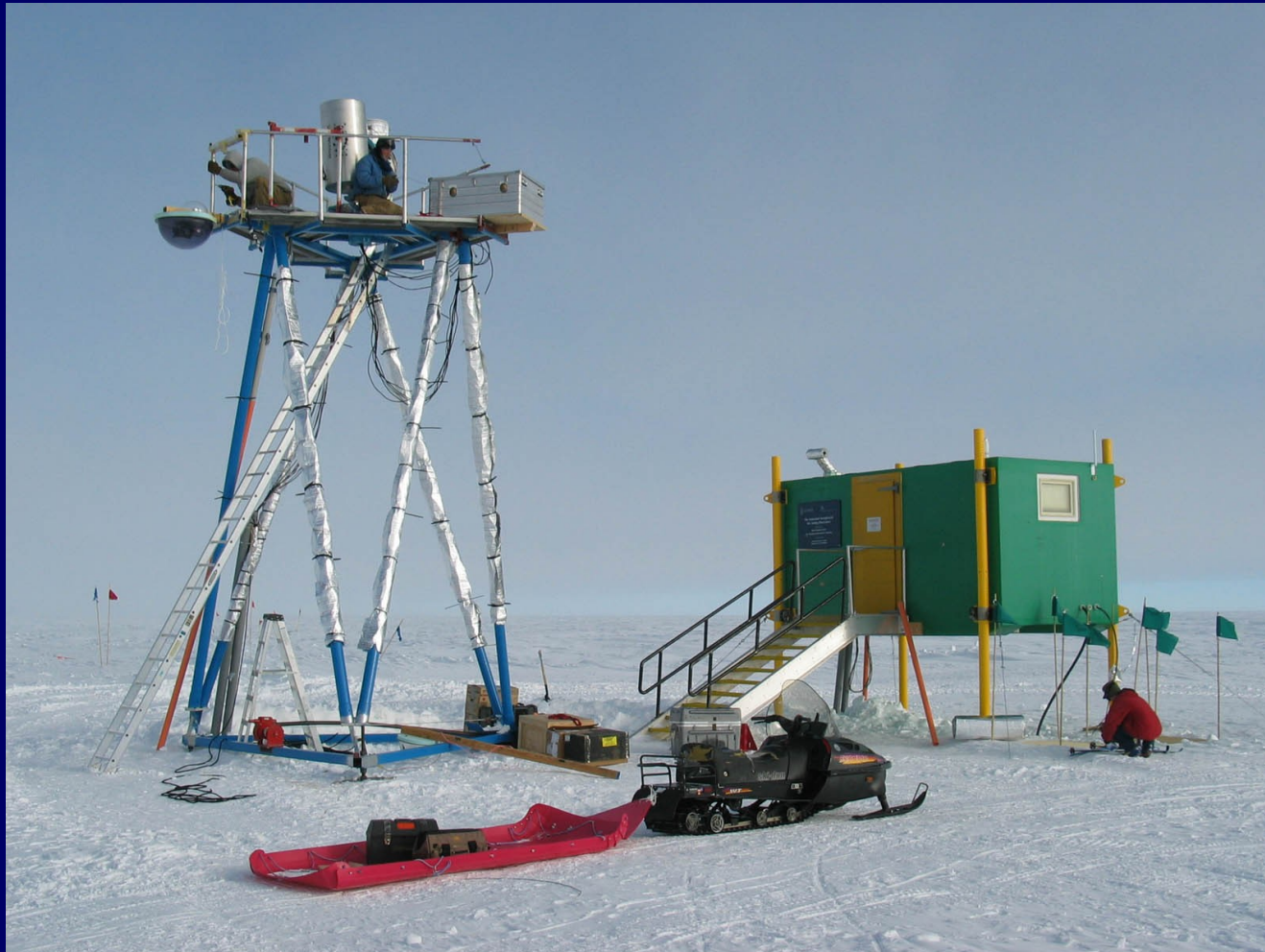
THE UNIVERSITY OF
NEW SOUTH WALES
SYDNEY • AUSTRALIA

Image: Daniel Luong-van



The Accademia del Cimento's experiment to observe the focussing of cold, ~1660 AD (G. Martillini, Tribuna di Galileo, Firenze).

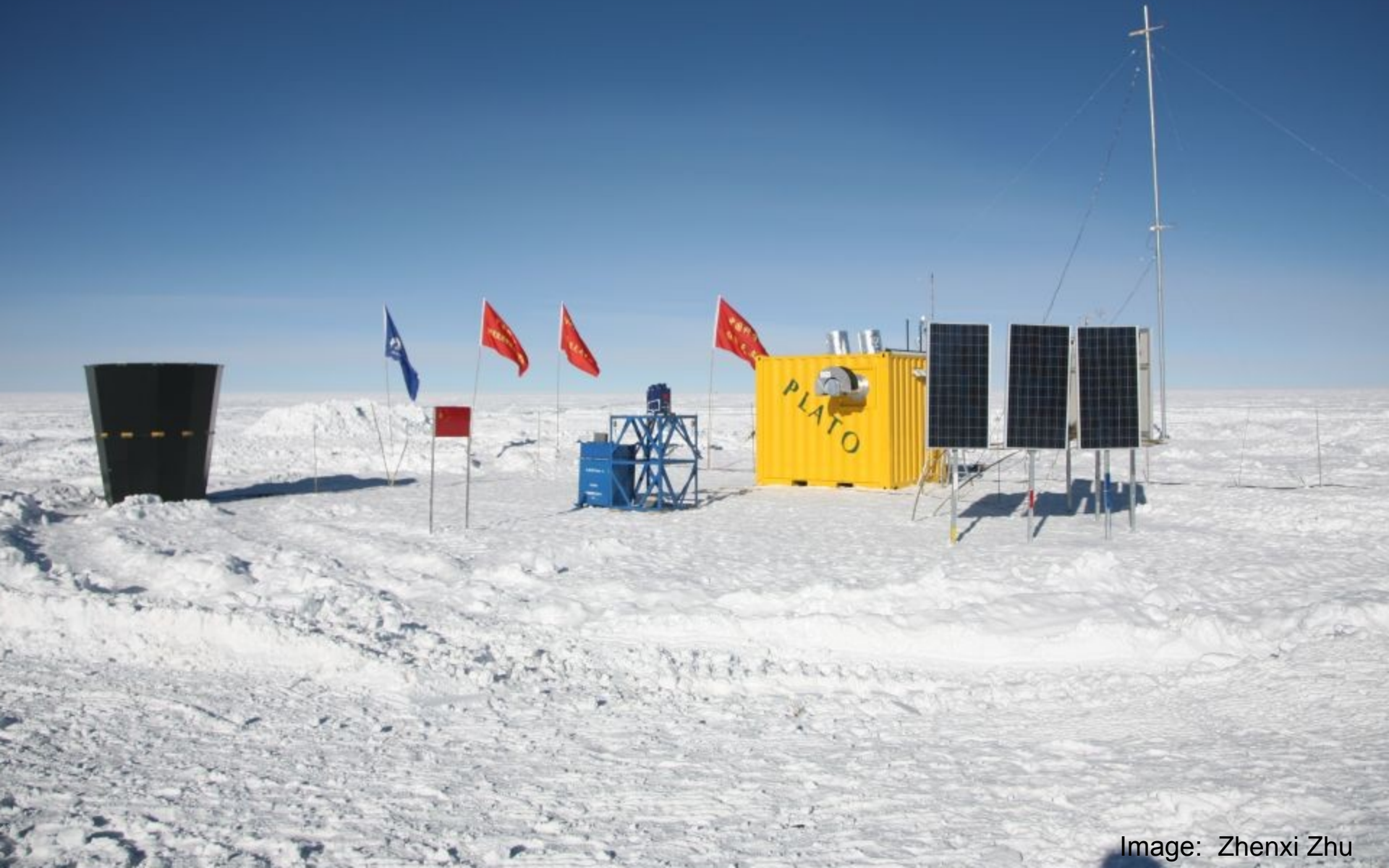
Started at the South Pole with the AASTO



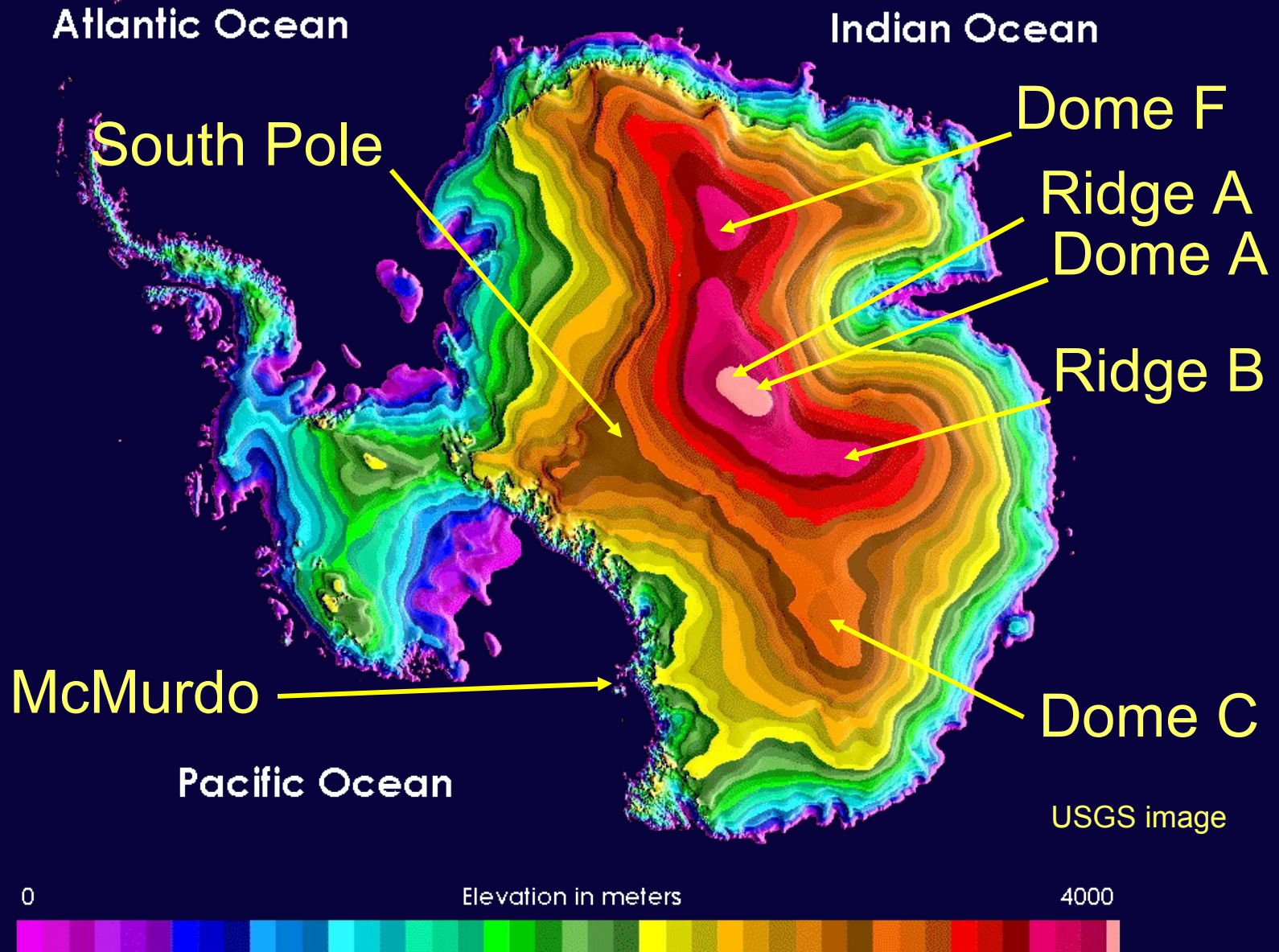
Then on to Dome C with the AASTINO...



And Dome A, January 2008



Contour map of Antarctica

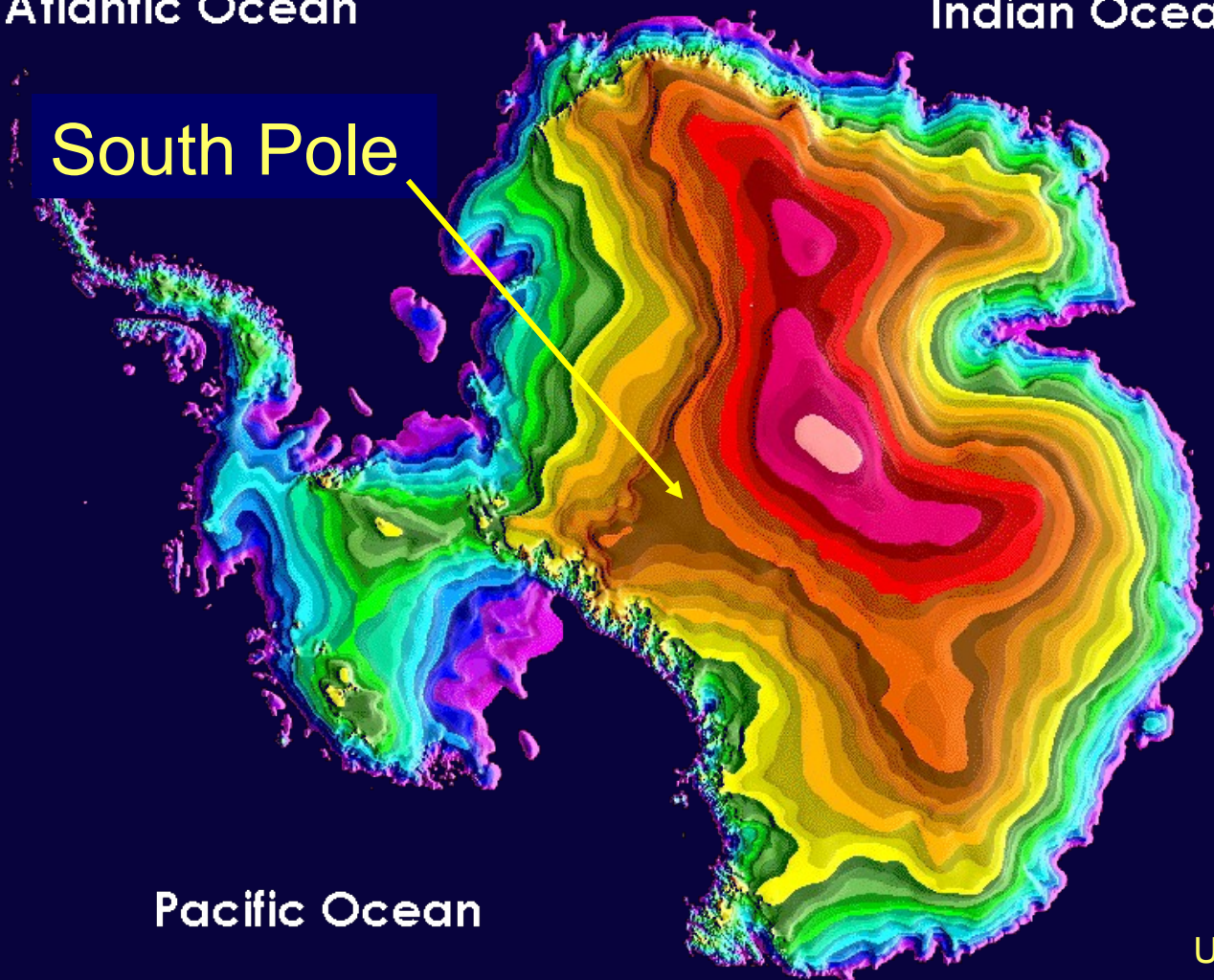


Contour map of Antarctica

Atlantic Ocean

Indian Ocean

South Pole



Pacific Ocean

USGS image

0

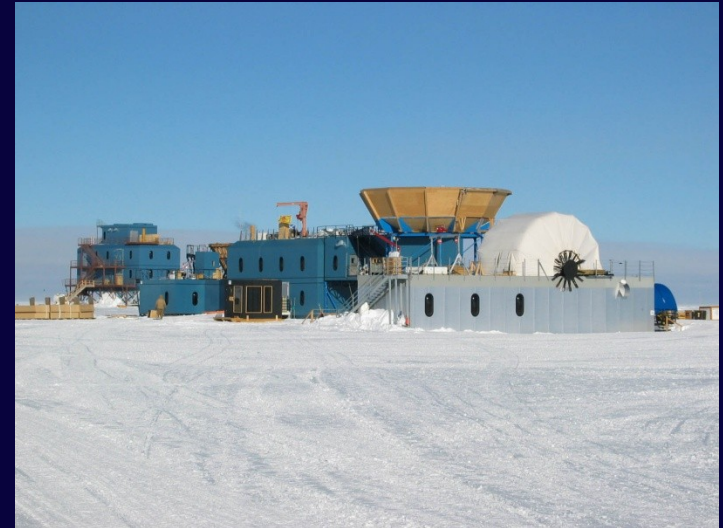
Elevation in meters

4000

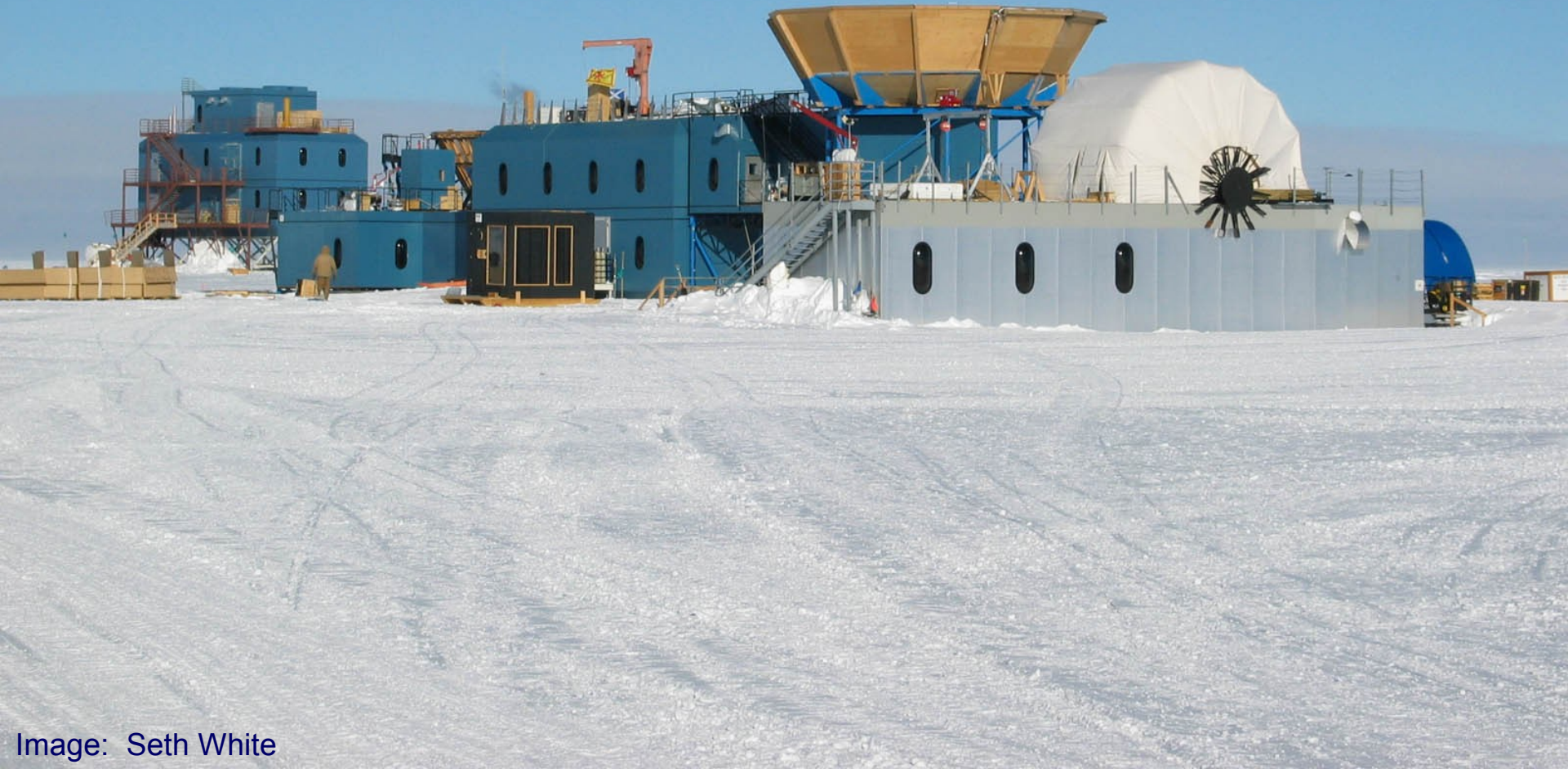


South Pole

Station owner	USA
Completion date	1957
Geostationary satellites visible	No
Advantages	Constant ZD sources
Disadvantages	Cloud cover Thick boundary layer Low elevation



Amundsen-Scott station, South Pole



Amundsen-Scott station, South Pole



These folk are astronomers, too.



Image:

Ice Top

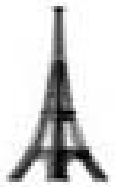
0 m
50 m

1000 m



South Pole Station

Snow Layer

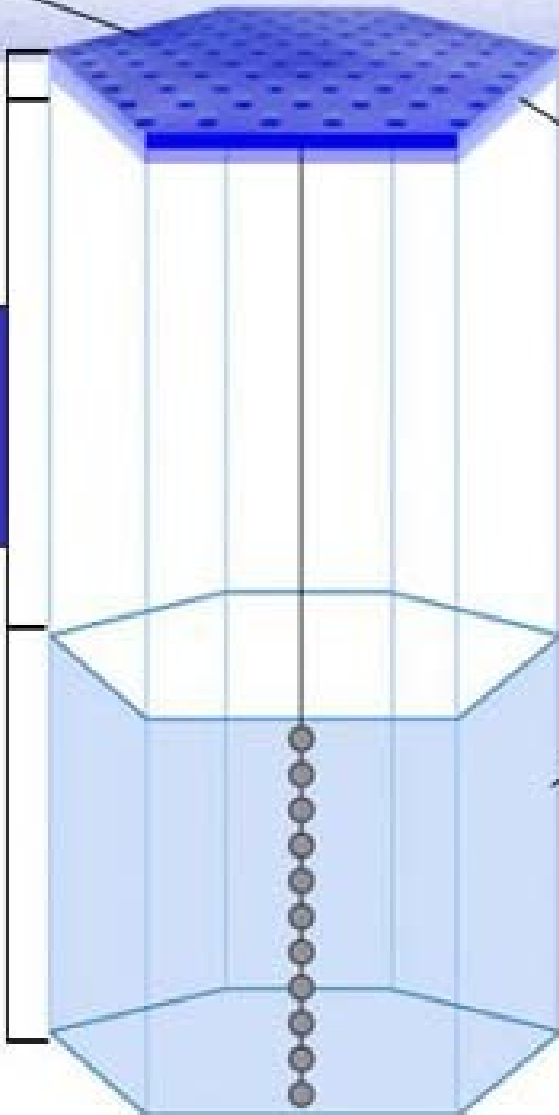


300 m

1400 m

2400 m

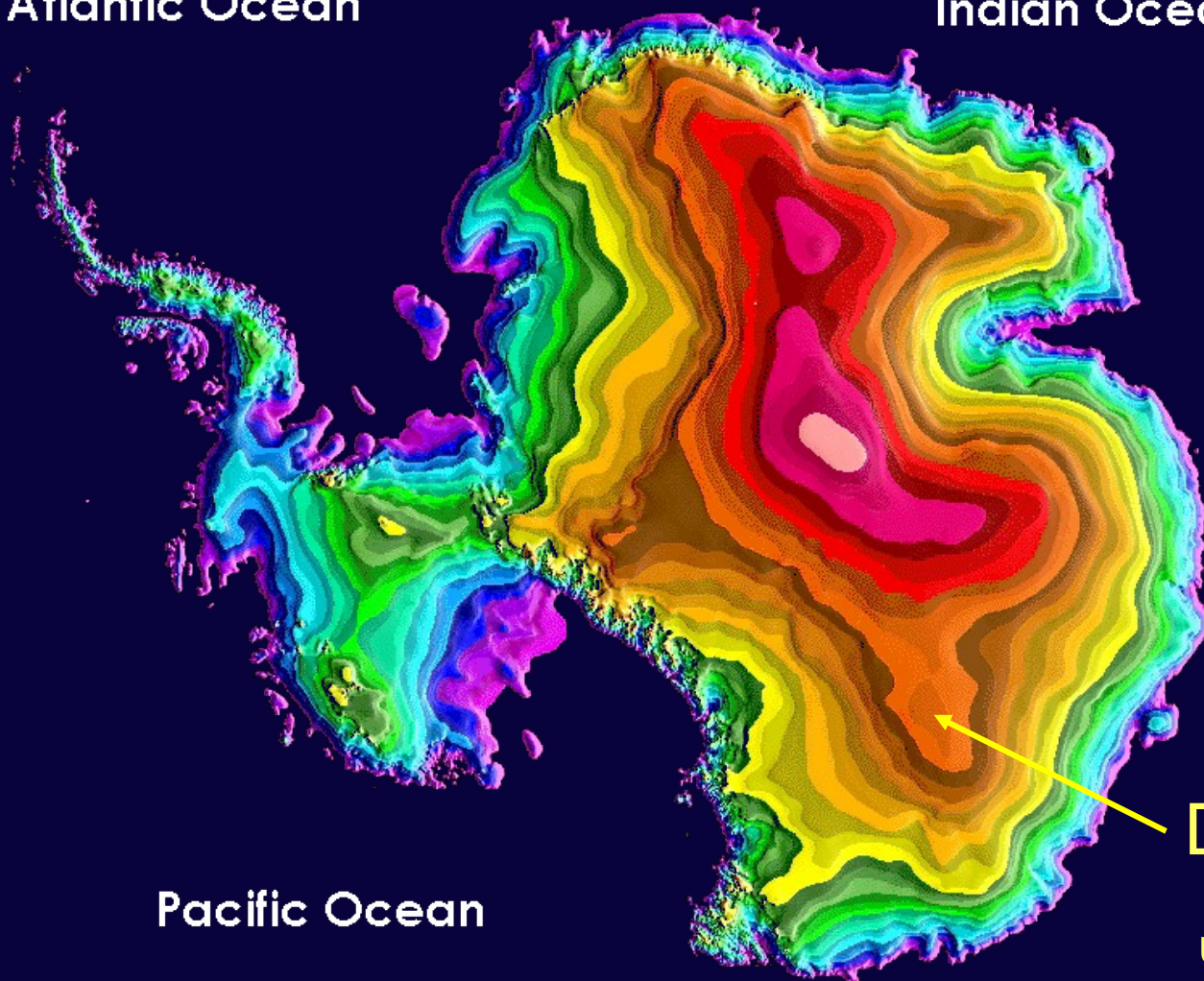
IceCube



Contour map of Antarctica

Atlantic Ocean

Indian Ocean



Pacific Ocean

Dome C

USGS image

0

Elevation in meters

4000



Dome C

Station owner	France/Italy
Completion date	2005
Geostationary satellites visible	Yes, but...
Advantages	Minimal cloud cover Thin boundary layer
Disadvantages	Rapid temperature variations



Dome A

Station owner	China
Completion date	2014
Geostationary satellites visible	Almost
Advantages	Very good THz transmission Thin boundary layer
Disadvantages	?





Dome A



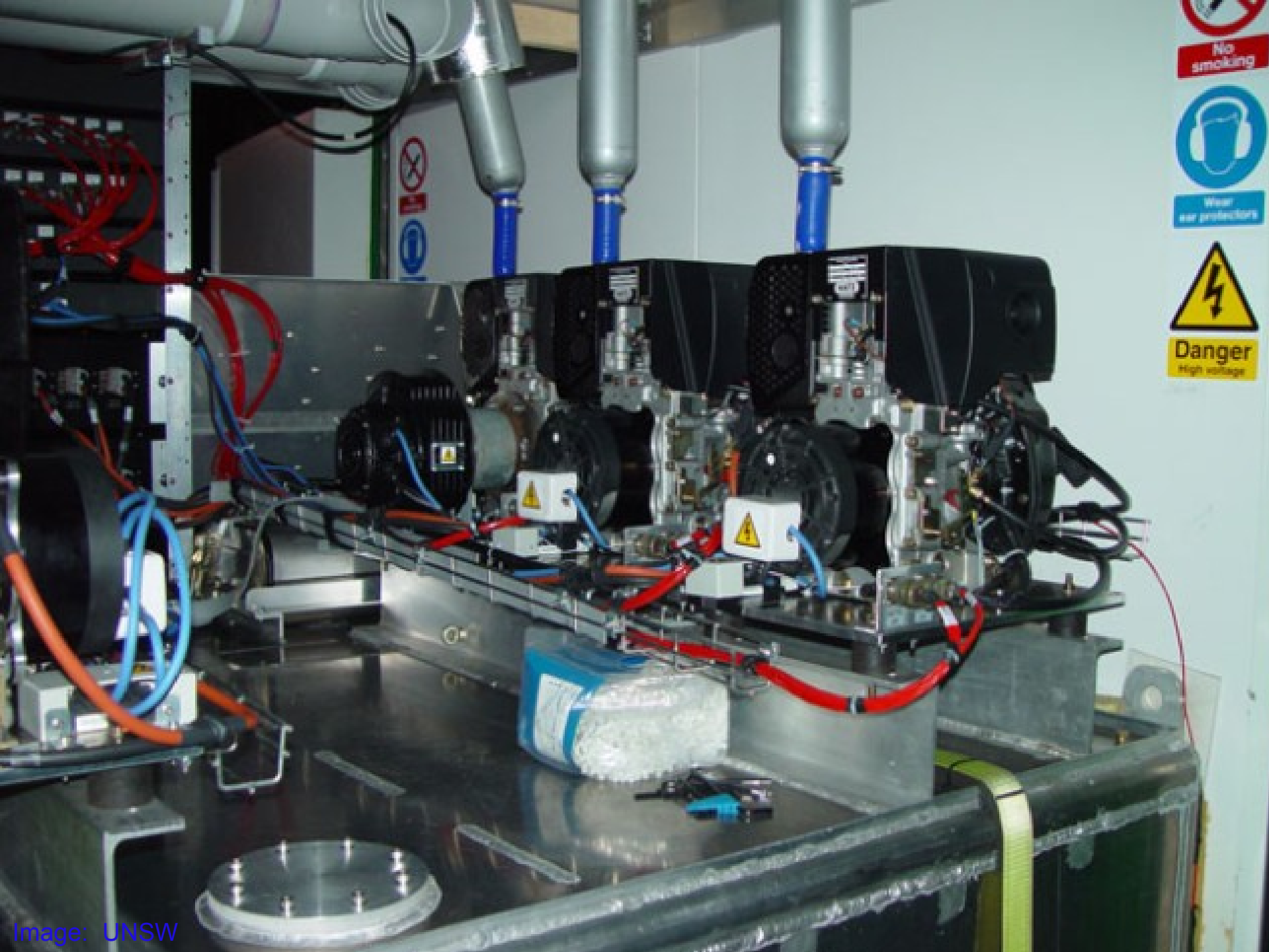
The PLATO Collaboration

- National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China
- Graduate University of Chinese Academy of Sciences, Beijing, China
- Chinese Center for Antarctic Astronomy
- University of New South Wales, NSW, Australia
- Nanjing Institute of Astronomical Optics and Technology, Nanjing, China
- Purple Mountain Observatory, Nanjing, China
- Steward Observatory, University of Arizona, Tucson, USA
- Macquarie University, NSW, Australia
- Anglo-Australian Observatory, Australia
- California Institute of Technology, Pasadena, USA
- Polar Research Institute of China, Shanghai, China
- Tianjin Normal University, Tianjin, China
- Texas A&M University, USA
- Thirty Meter Telescope Project, USA
- University of Chicago, Chicago, USA
- University of Auckland, New Zealand
- European Space Agency, Noordwijk, The Netherlands

M.C.B. Ashley, S. Bradley, Xiangqun Cui, Longlong Feng, Xuefei Gong, Jingyao Hu, C.A. Kulesa, J.S. Lawrence, Zhao ji Jiang, Genrong Liu, D.M. Luong-Van, Jun Ma, M.J. McCaughrean, A.M. Moore, C. Pennypacker, Weijia Qin, Zhaohui Shang, J.W.V. Storey, Bo Sun, N. Suntzeff, N.F.H. Tothill, T. Travouillon, C.K. Walker, Jiali Wang, Lifan Wang, Jianghua Wu, Zhenyu Wu, Lirong Xia, Jun Yan, Ji Yang, Huigen Yang, Yongqiang Yao, Xiangyan Yuan, D.G. York, Zhanhai Zhang, Xu Zhou, Zhenxi Zhu, Hu Zou

A large green metal container, identified as a PLATO power module, is the central focus. It has a double-door design with multiple locking bolts and handles. The container is situated outdoors on a paved area. In the background, there are trees, a white van, and a silver car. A red bollard is visible in the foreground to the left. A yellow text box is overlaid on the container's door.

PLATO power module



No smoking

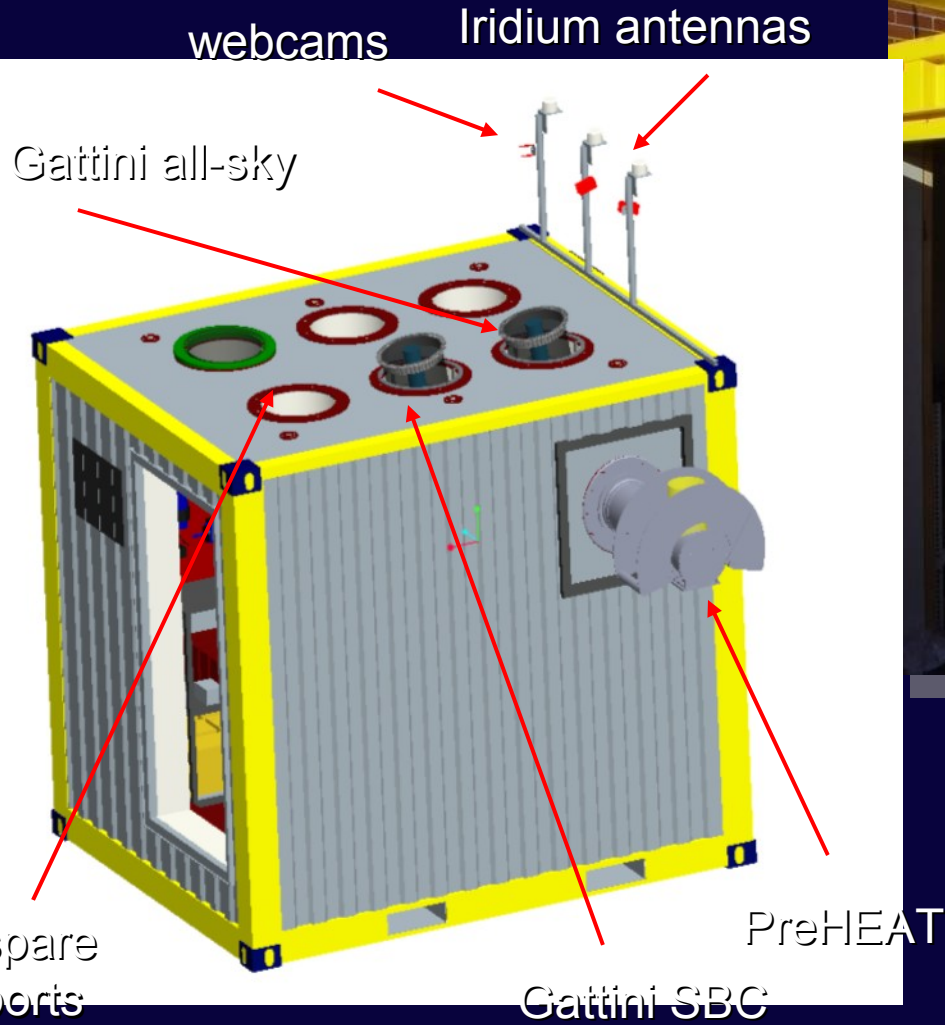


Wear ear protectors



Danger
High voltage

Instrument module



CSTAR, SNODAR, Sonics located externally on snow surface

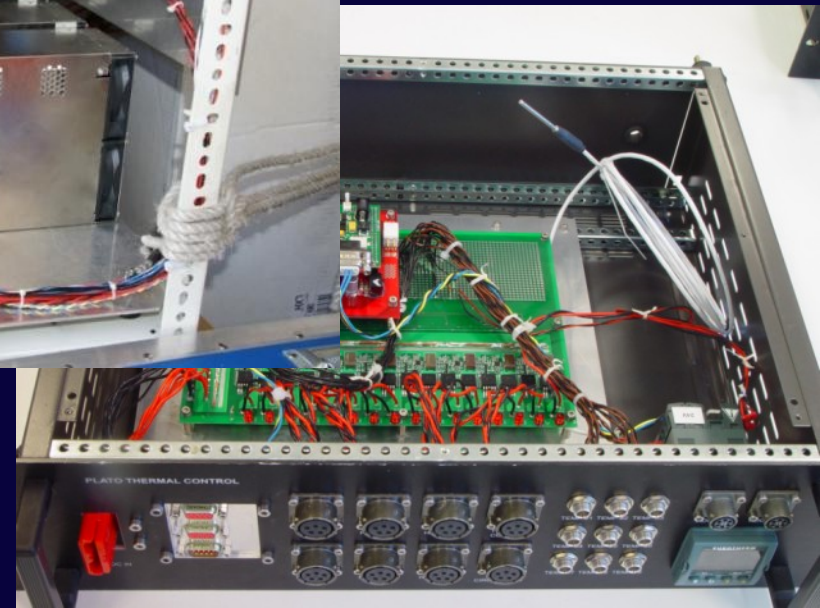
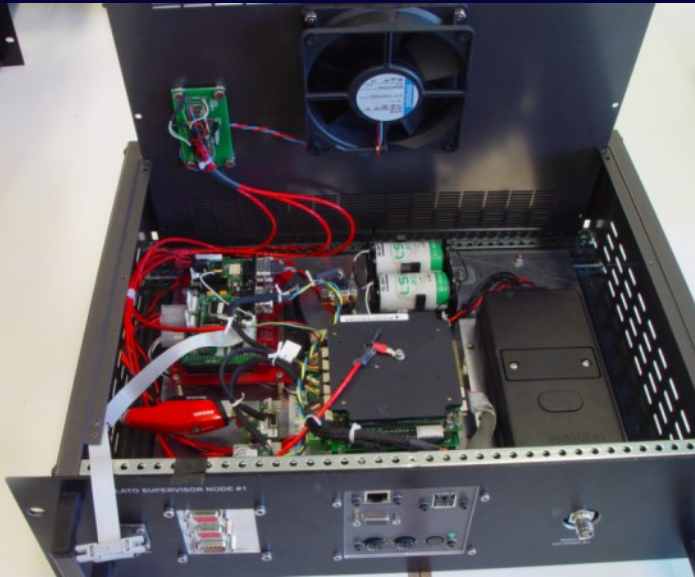
Instrument module

Supervisor nodes (x2)

- PC104 computer
- CAN microcontroller
- Iridium L band transceiver

Control units

- Power switching
- Analog monitoring
- Thermal control
- Engine monitor and control
- Ethernet hub



Power electronics system

- 24 VDC 320 Ahr battery bank
- 4 x high power 110→24 V DC/DC
- 2 x solar power MPPT

26 Nov 2007:
PLATO departs UNSW



29 Nov 2007: Final tests in Fremantle



30 Nov 2007: Xuelong loading and departure



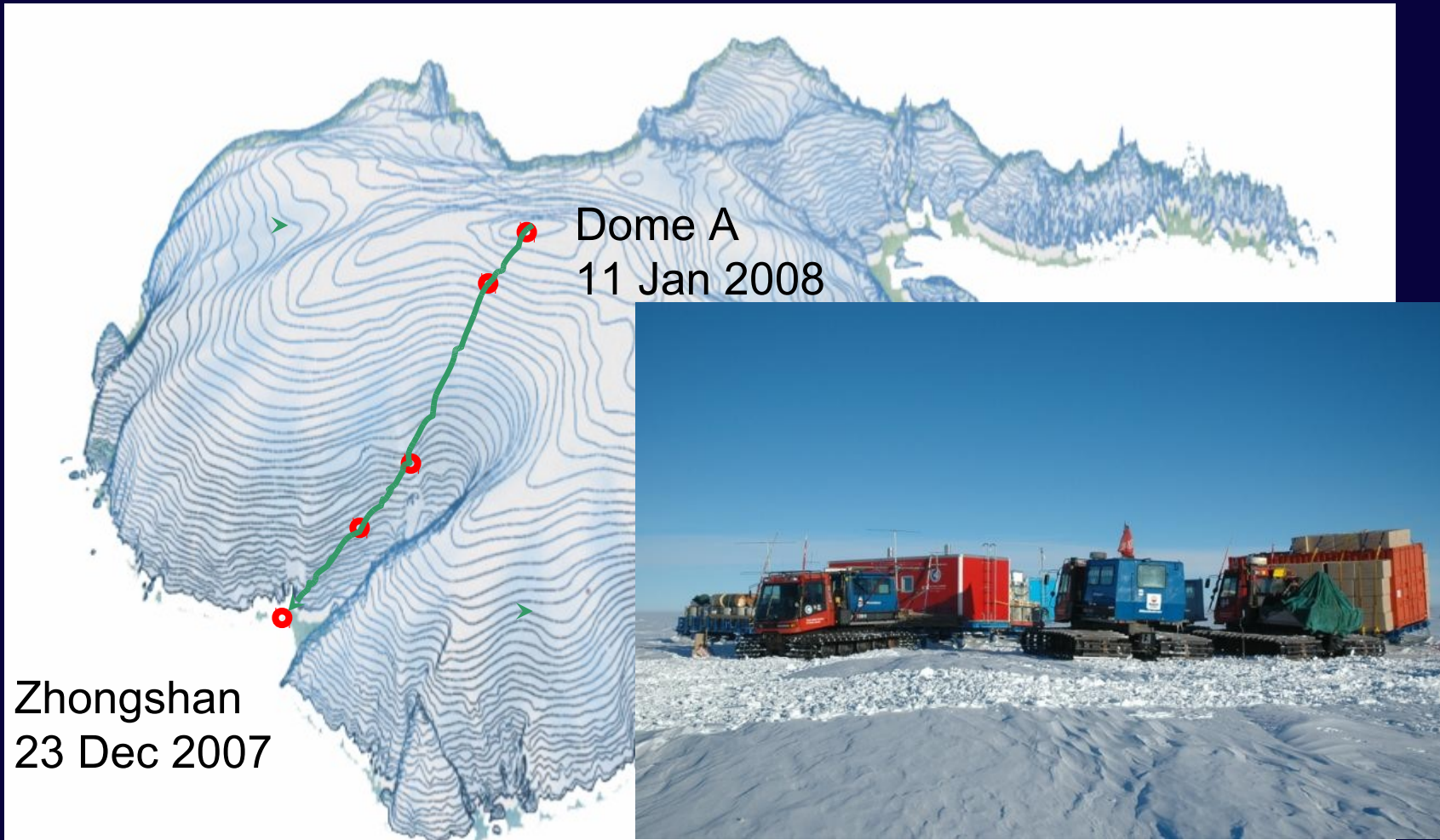
PLATO



Dome A traverse

Polar Research Institute of China tractor traverse 2008:

- 18 expedition members
- 2 astronomers: Zhou Xu (NAOC), Zhenxi Zhu (PMO)





PLATO

PLATO



PLATO

PLATO



24
CHINARE
内

中国第二十四次
24
CHINARE
南极科学考察队



24
CHINARE
南极科学考察队

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CHINARE
南极科学考察队





中國國家建設
CHINA





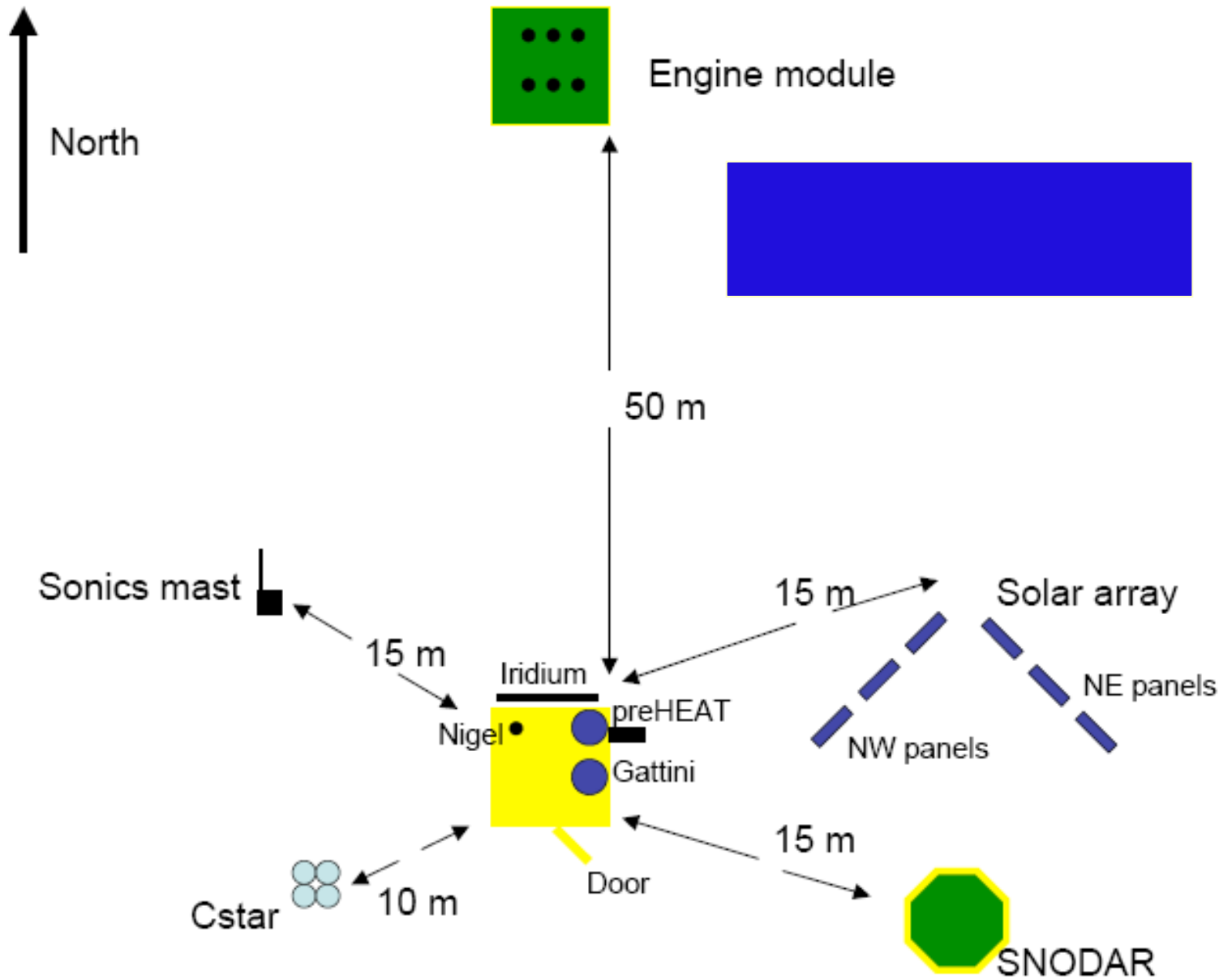
payload 8 to.

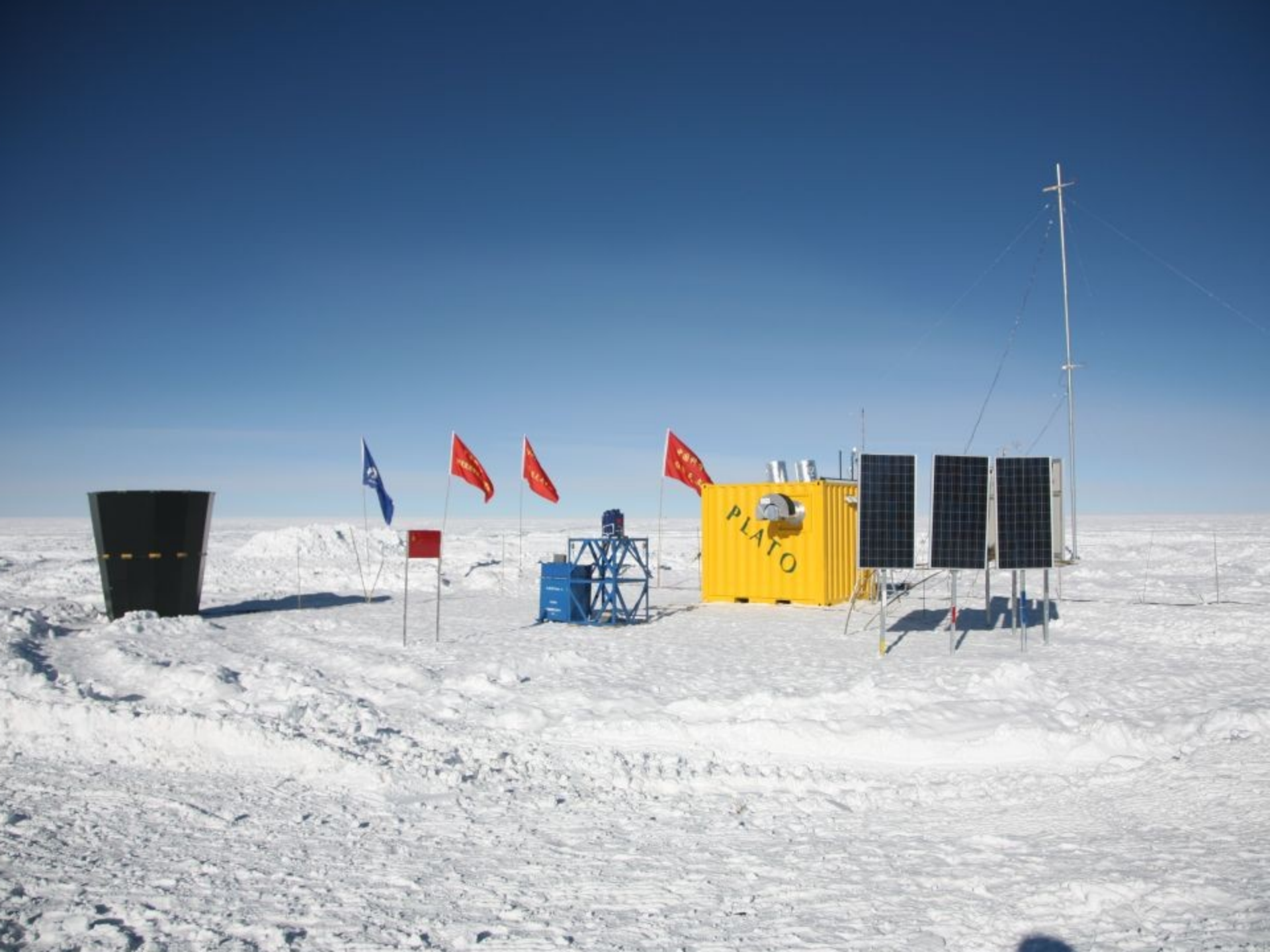


PLATO at Dome A



PLATO at Dome A



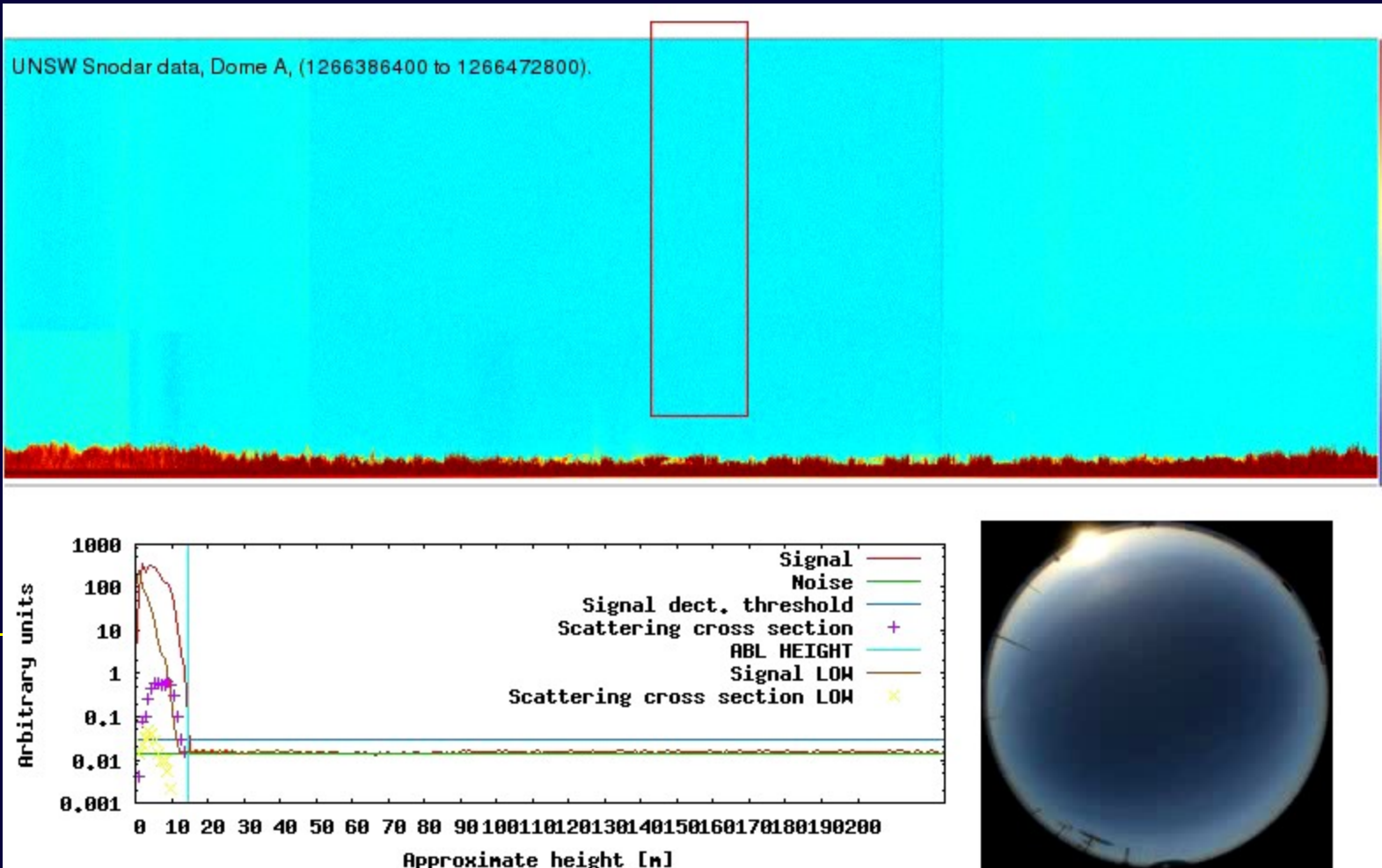


PLATO

Webcam



Dome A, boundary layer



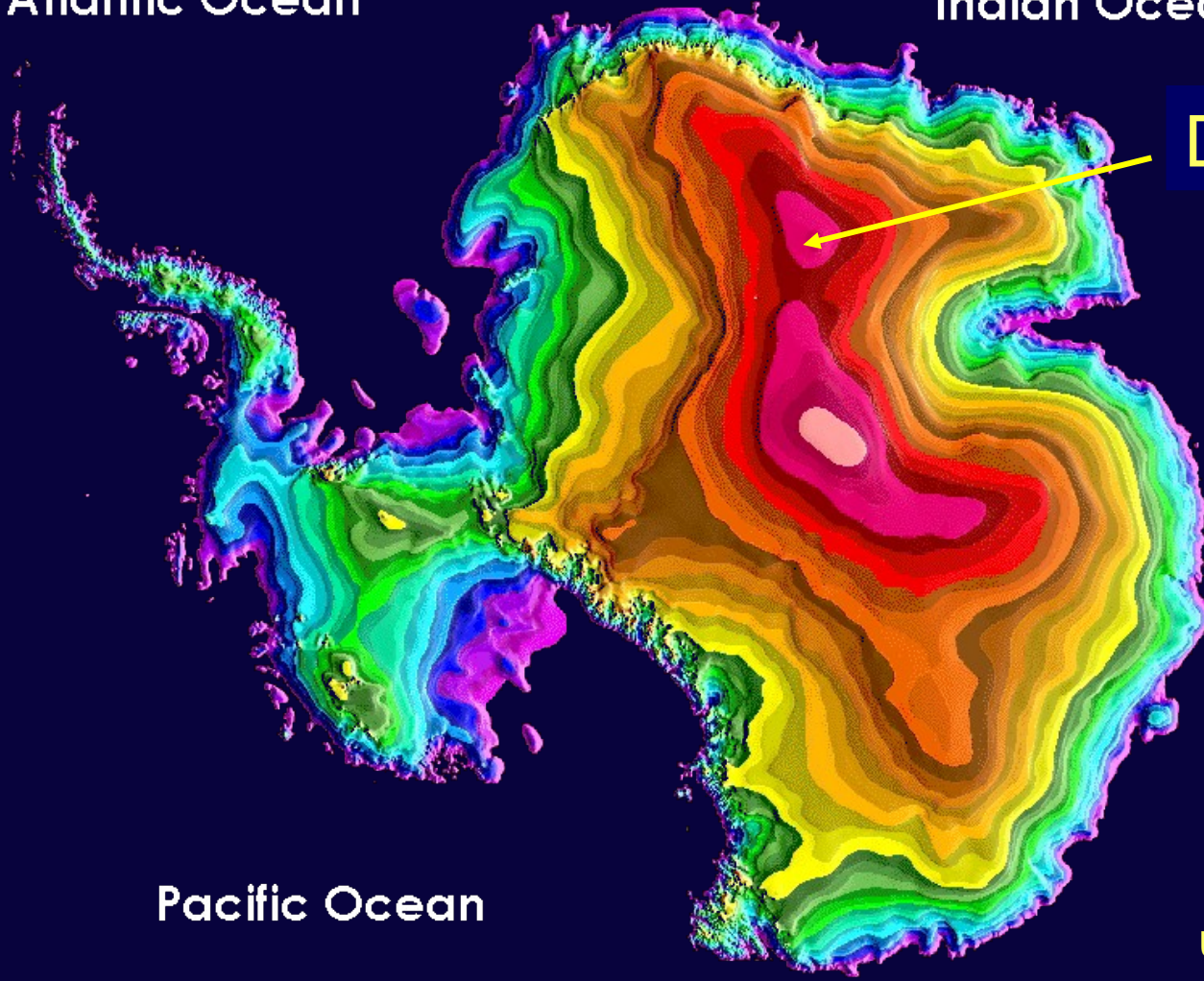
Data: PL

Contour map of Antarctica

Atlantic Ocean

Indian Ocean

Dome F



Pacific Ocean

USGS image

0

Elevation in meters

4000



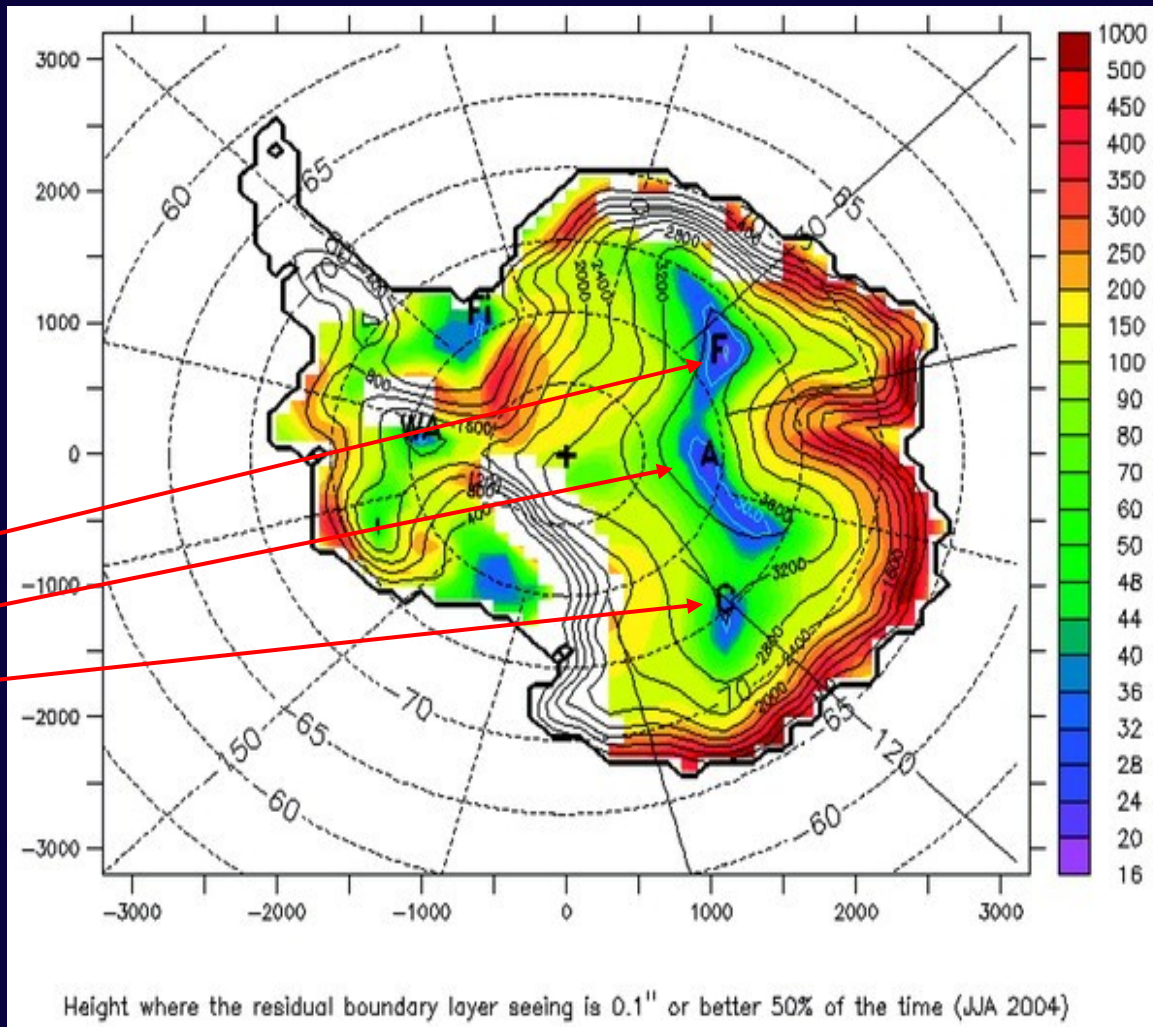
Dome F

Station owner	Japan
Completion date	2014
Geostationary satellites visible	Maybe
Advantages	High
Disadvantages	Aurora



Boundary layer height

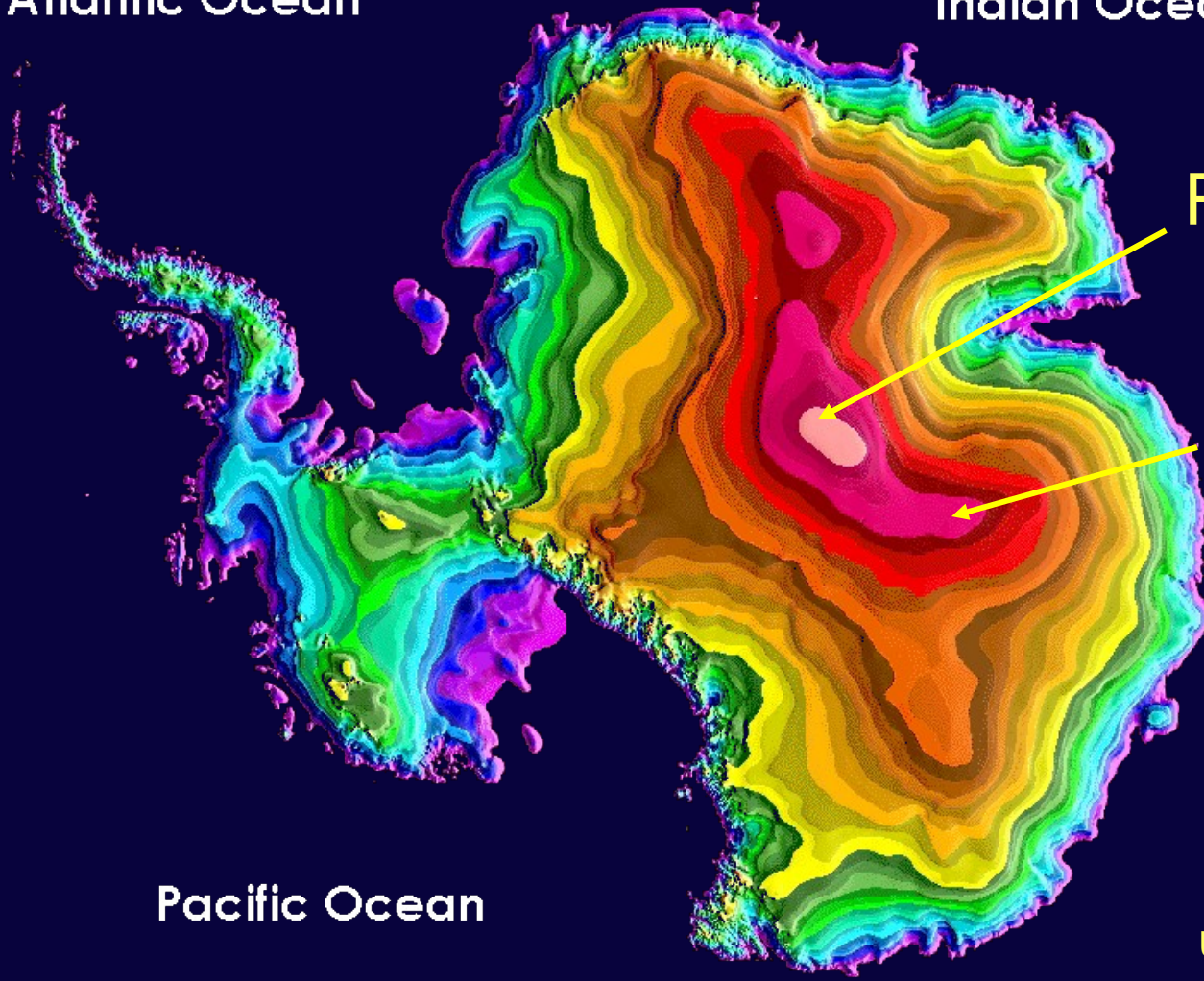
~18 m
~21 m
~27 m



Contour map of Antarctica

Atlantic Ocean

Indian Ocean



Ridge A

Ridge B

Pacific Ocean

USGS image

0

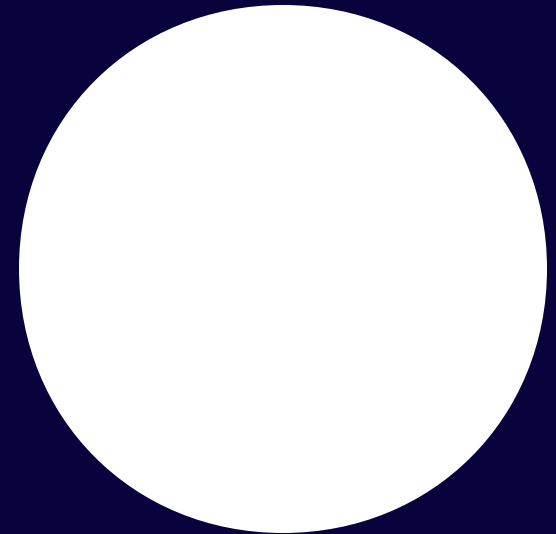
Elevation in meters

4000



Ridge A and Ridge B

Station owner	-
Completion date	-
Geostationary satellites visible	Ridge A: no Ridge B: yes
Advantages	Best overall
Disadvantages	No-one has ever been there!



Artist's impression of Ridges A and B

Identified by Saunders et al [*Publ. Astron. Soc. Pacific*, 121, (2009), 976] as potentially the best sites on the plateau (and hence on the planet) for astronomy.

THz Site Comparison

Site	25%ile winter PWV (mm)	50%ile winter PWV (mm)	Median winter transmission @0.66 THz (450 μ m)	Best 25% winter transmission @1.46 THz (205 μ m)	Best 10% winter transmission @1.90 THz (158 μ m)
Mauna Kea 4100m	1.0	1.5	15%	0%	0%
Chajnantor 5050m	0.35	0.6	47%	7%	0%
Dome A, 4100m	0.10	0.14	74%	28%	4%
Ridge A, 4050m	0.08	0.12	77%	33%	11%

Thank you, you can wake up now!

