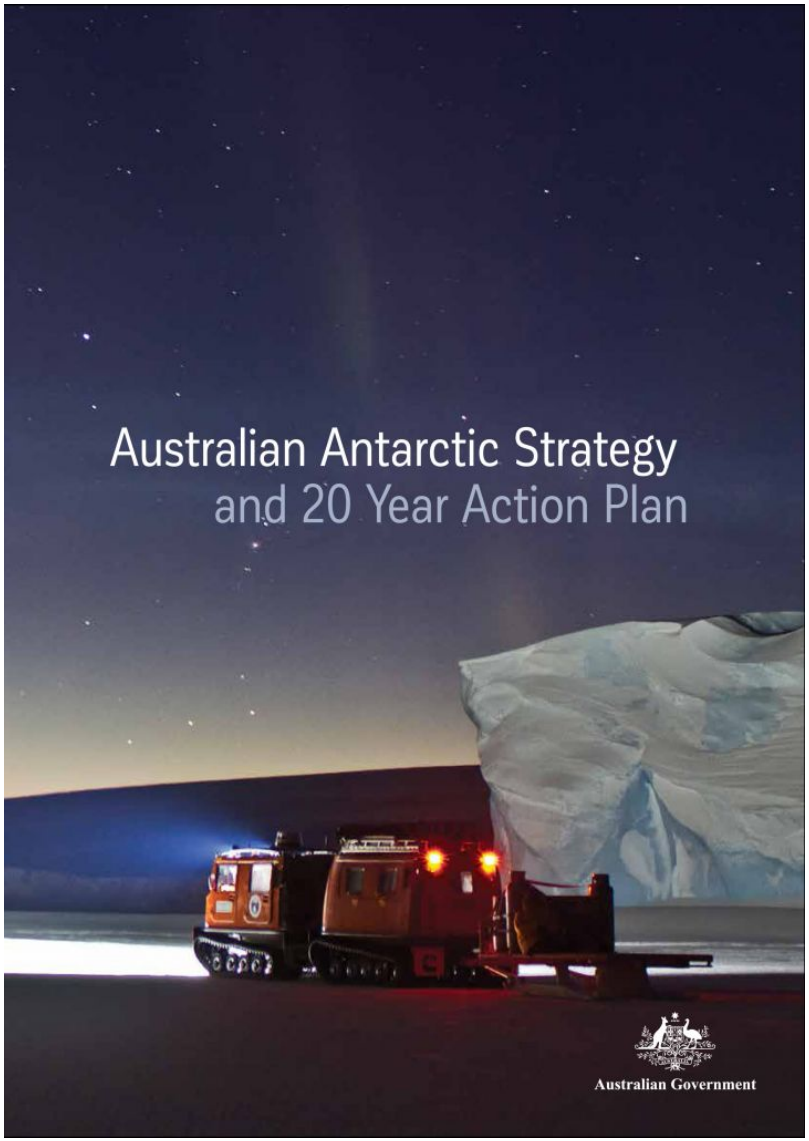
Australian Government
Department of the Environment
Australian Antarctic Division

AAD 20 Year Plan and the search for a Million Year Ice Core

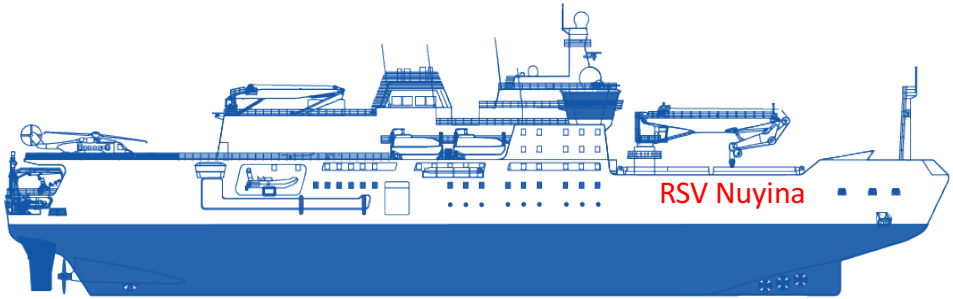
Sep 2017

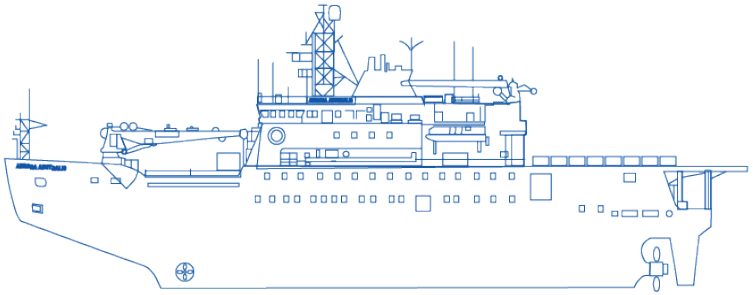


Key actions the Government will deliver:

- A new resupply and research icebreaker.
- Scoping study for expanded aviation capability.
- Re-establishing Australia's traverse capability.
- Establishing an inland mobile station capability.
- Funding for Ice Core drilling for a Million Year Ice Core
- Rebuilding Australia's Macquarie Is research station
- Greater collaboration and resource-sharing with other nations active in East Antarctica.
- Opportunities for public-private partnerships for new scientific research endeavours.

Australia's New Antarctic Vessel- Comparison with AA





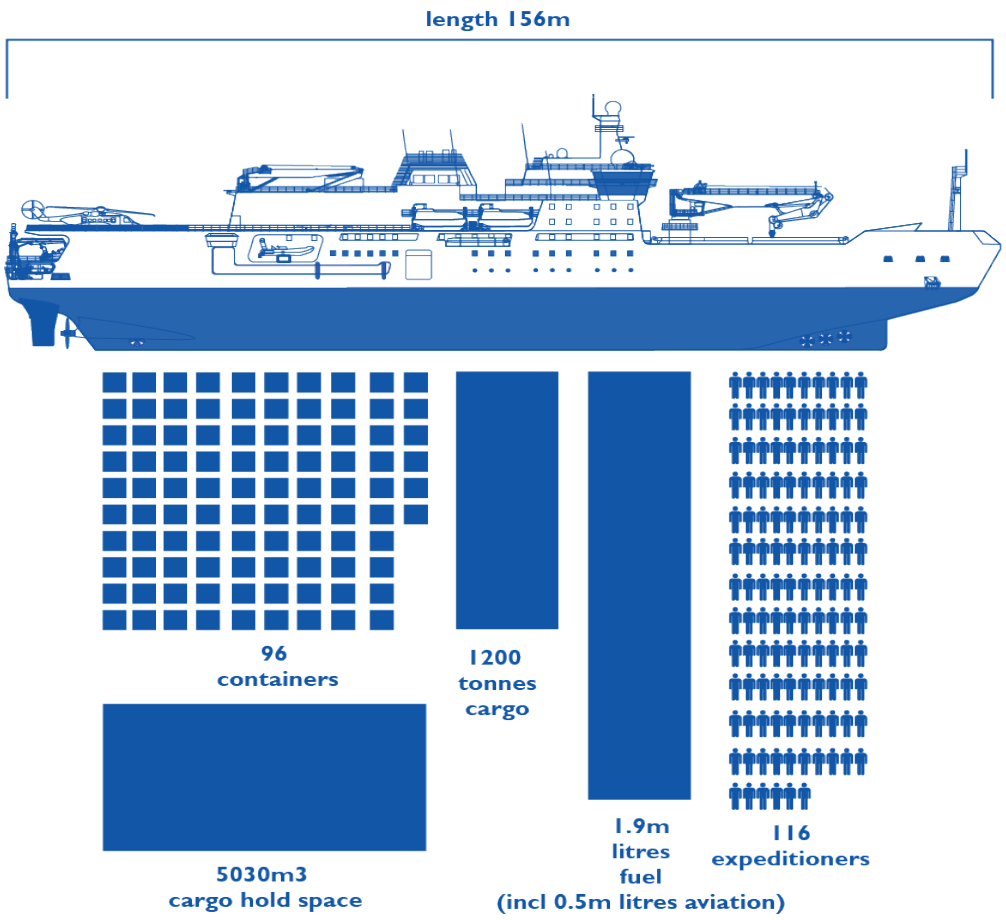
Proposed new vessel

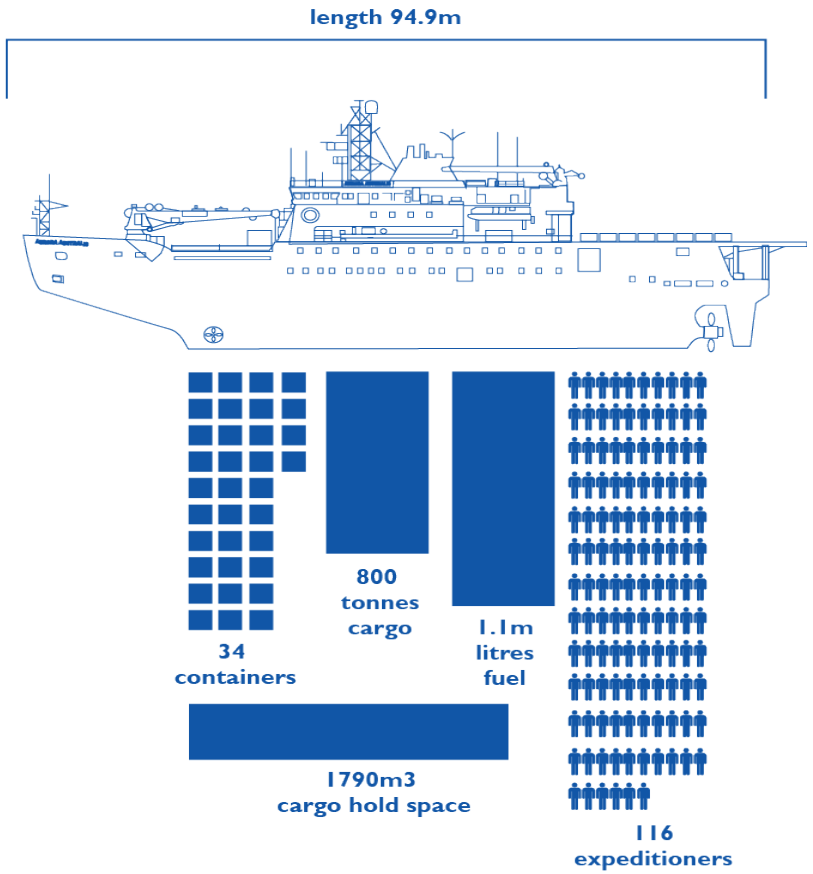
Length overall	156.0 metres
Maximum beam	25.6 metres
Maximum draught	9.3 metres
Displacement	23,800 tonnes
Icebreaking	1.65 metres at 3 knots
Speed	12 knots economical, 16+ knots max
Range	> 16,000 nautical miles
Endurance	90 days
Ship Fuel Capacity	4,234,000 litres / 3725 tonnes
Cargo Fuel Capacity	1,900,000 litres / 1671 tonnes
Container Capacity	96
Cargo weight	1200 tonnes
Passengers	116

RSV Aurora Australis

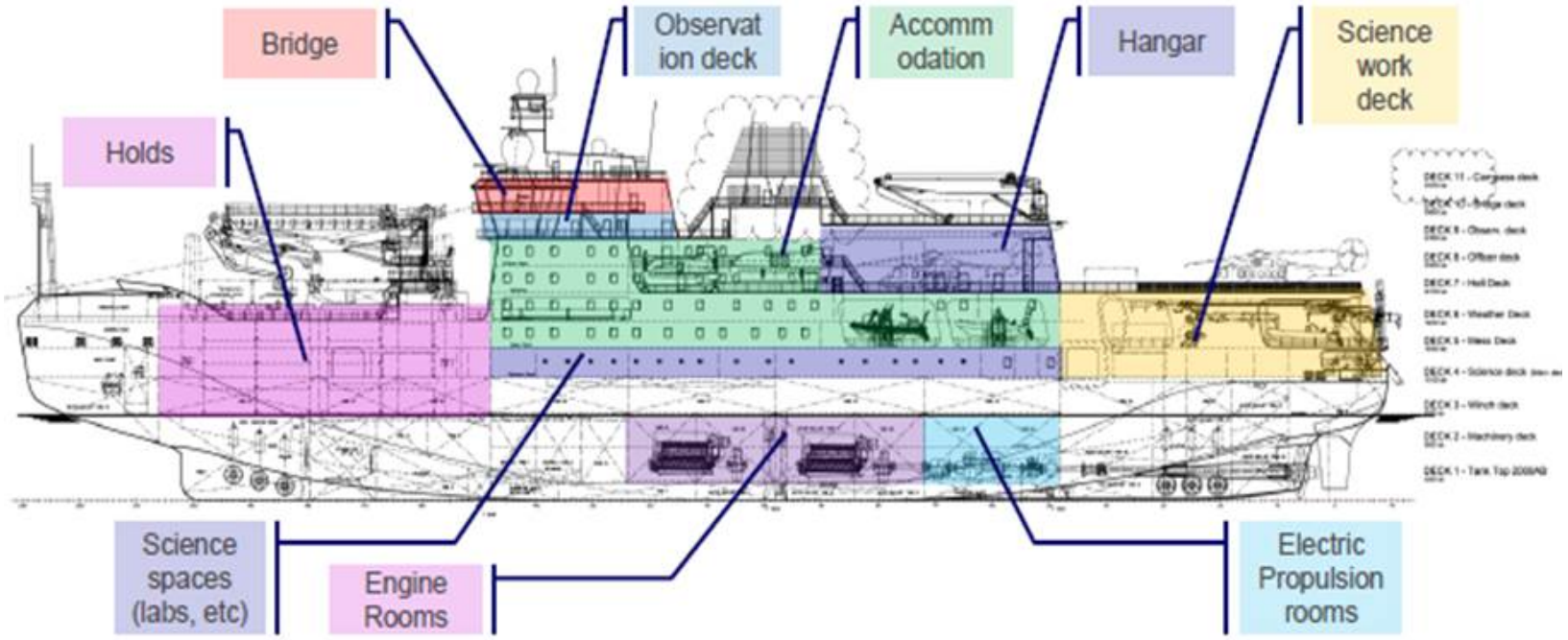
Commissioned	1990
Length overall	94.91 metres
Maximum beam	20.3 metres
Maximum draught	7.8 metres
Displacement	8,158 tonnes
Icebreaking	1.23 metres at 2.5 knots
Speed	11 knots economical, 16+ knots max
Cargo Fuel Capacity	1,100,000 litres / 968 tonnes
Container Capacity	34
Cargo weight	800 tonnes
Passengers	116

Australia's New Antarctic Vessel Logistics Comparison with AA

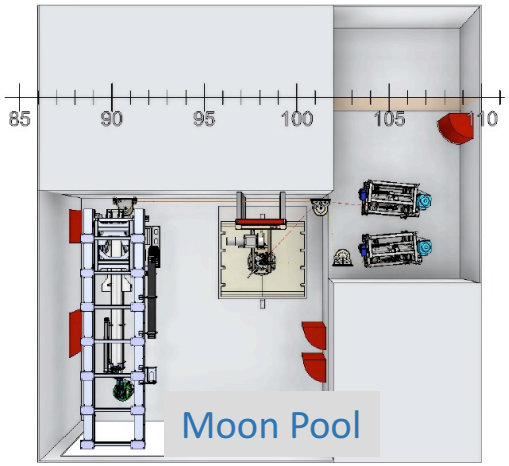


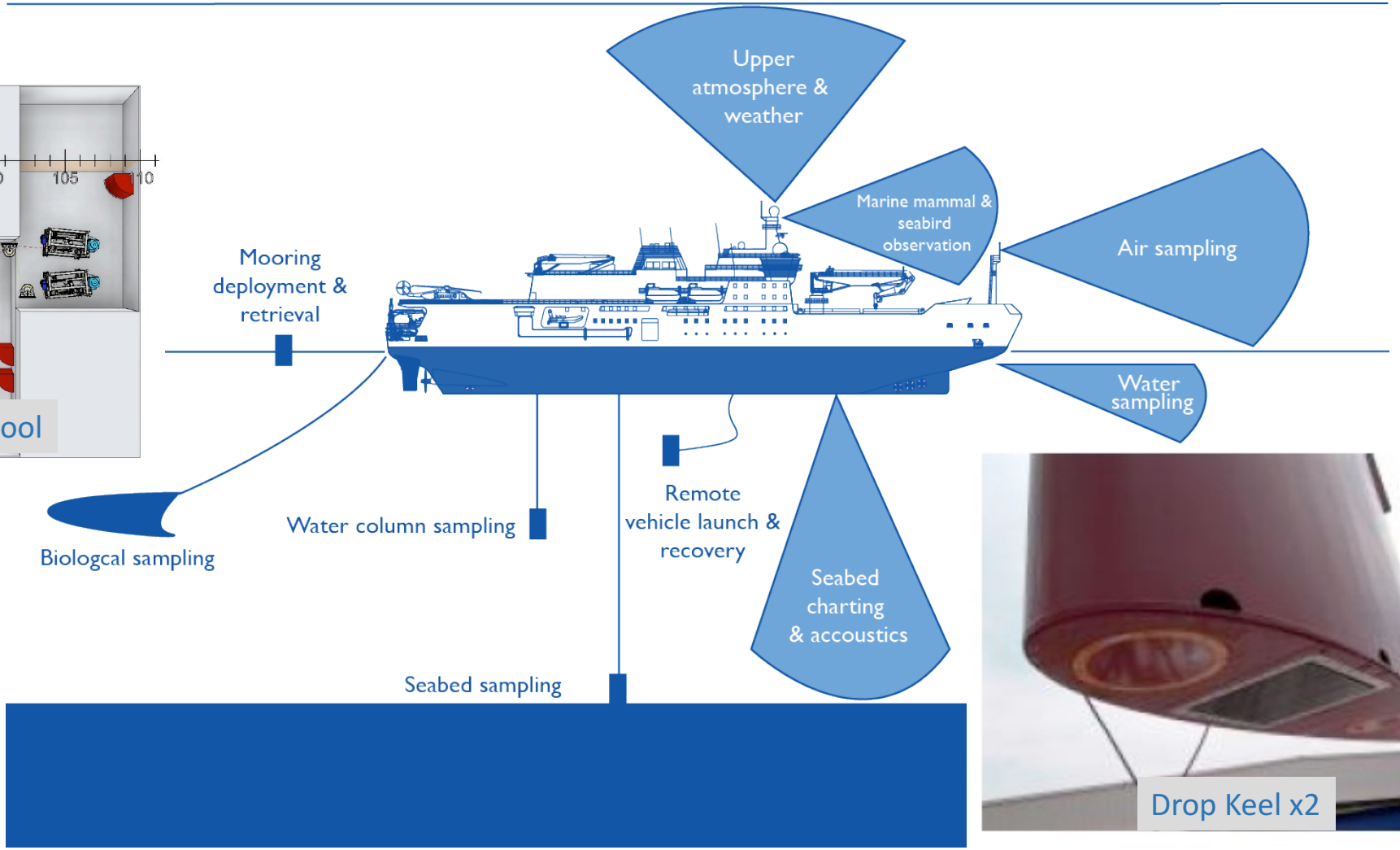


Australia's New Antarctic Vessel Functional Zones

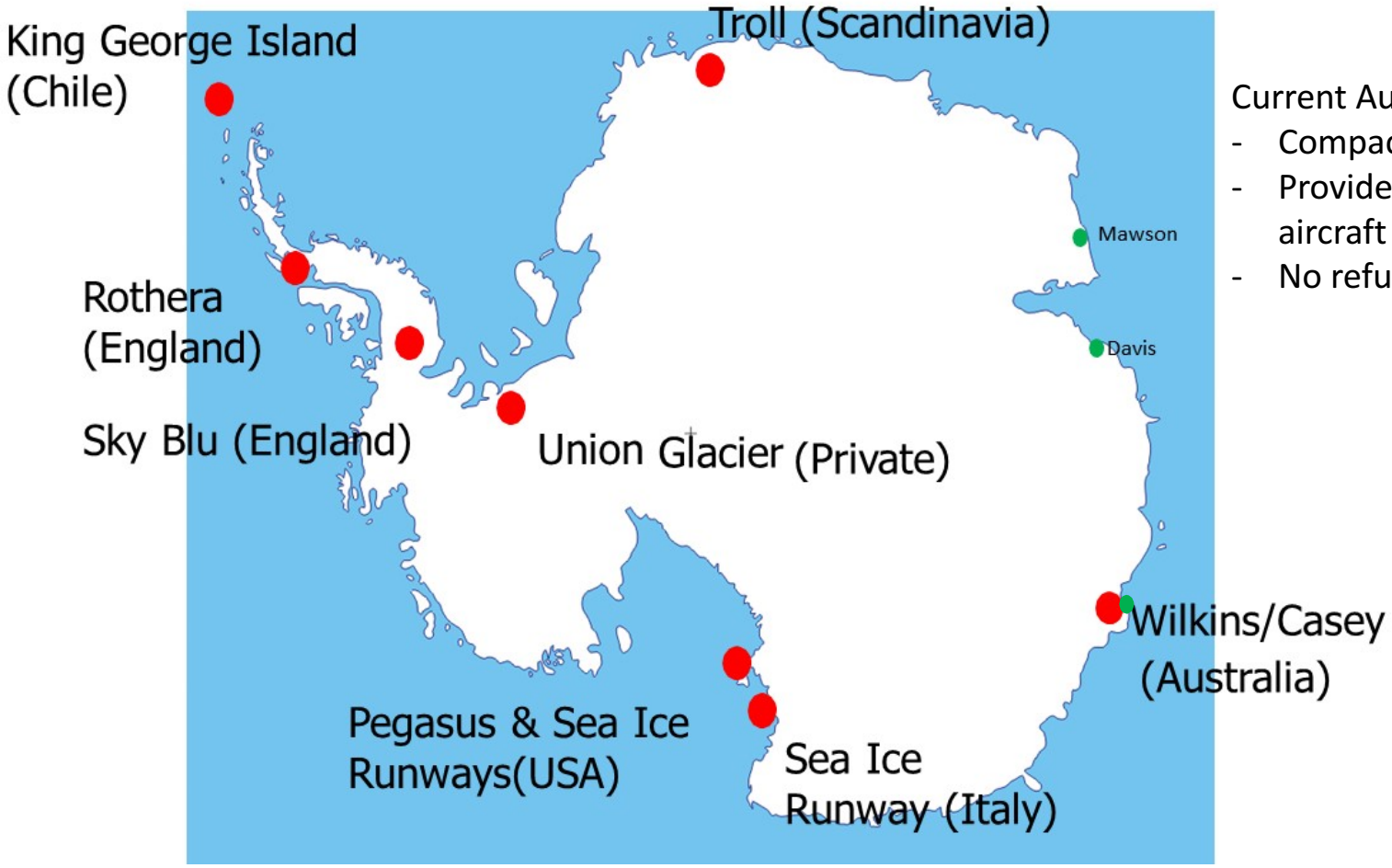


Australia's Antarctic Vessel Research Capability





Scoping study for an AAp Expanded Aviation Capability



Wheeled Runways in Antarctica

Current Australian Intercontinental Capability:

- Compacted snow Skiway at Wilkins
- Provides summer access for A319 and C-17 aircraft
- No refuelling capability

Existing Operational Plans

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
X	X	X	Programmed "No Fly" Temp	X							

X = Current AAp Flight Program

- Primary deployment/redeployment of ~450+ personnel
- Supports sustaining summer operations

Future Capability – One Concept

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
X	X	X	X	X	X/w	w	w	w	w	w	w

X = Existing Flights
X = Increased summer Capability
w = flight/month

- Primary deployment/redeployment of ~600+ person-flights + Cargo
- Supporting and sustaining all season operations

- Winter flights for improved access/efficiencies Supporting Science and outside "Traditional Austral Summer window" for for station maintenance and preparation reconstruction – potentially including intracontinental links

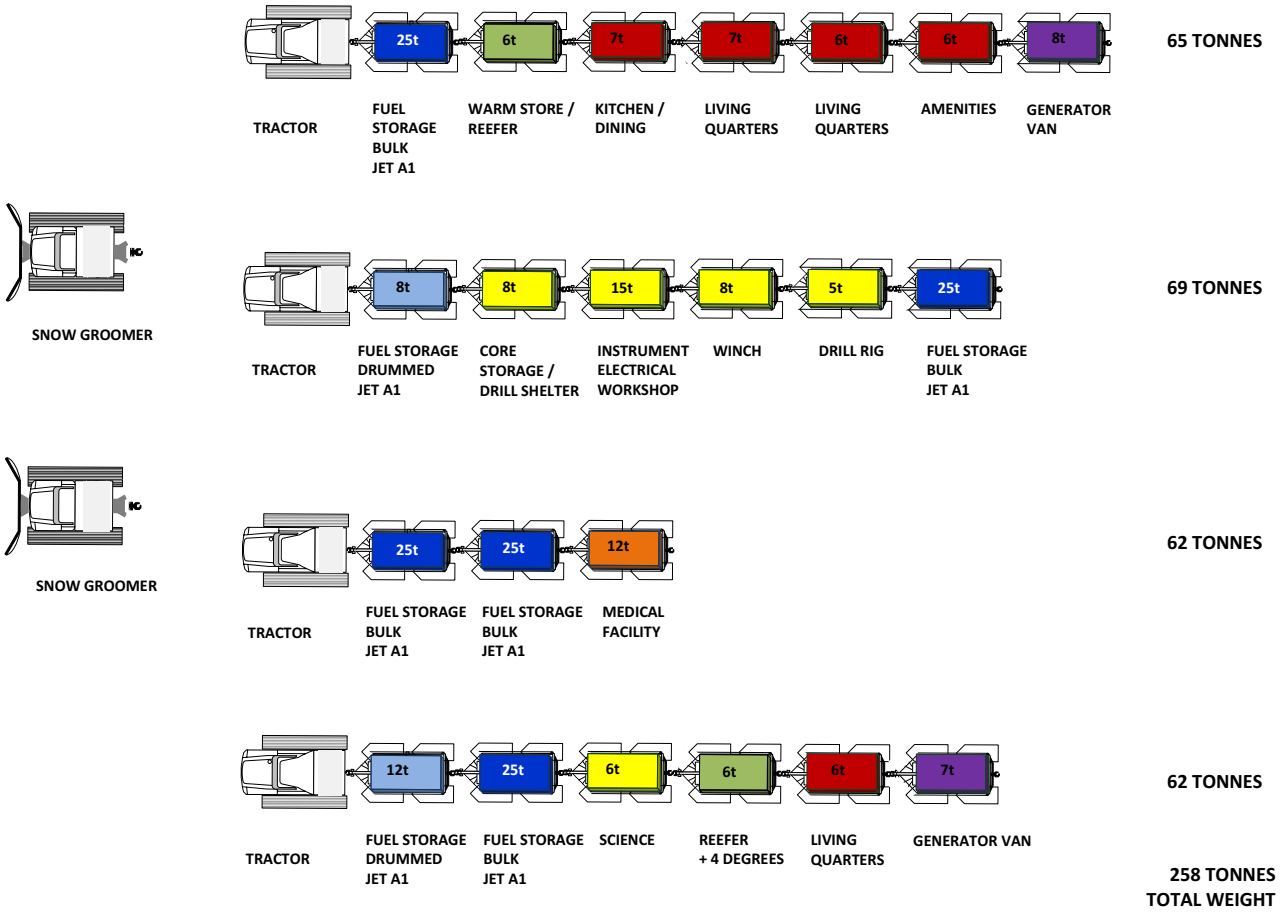
- Provides potential expanded shoulders of Summer and also dedicated winter access = flexibility for beds on station

Re-Establishing AAp Traverse and establishing an inland station Capability

Key Capabilities
• Traverse capability catering for 8-12 personnel that can operate to ranges beyond 1000km inland to sites of scientific interest within east Antarctica
• Traverse to be capable of being configured for both a supply and science capability. Designed for 320T pull capacity.
• Traverse to consist of four prime movers (minimum) and two snow groomers
• An inland mobile station capable of supporting 12-16 personnel over multiple summer seasons
• Be capable of sustaining operations ‘in locations’ for consecutive seasons
• Prepare field landing areas providing aviation link between inland station and Australia’s research stations
• 20 year capability – to meet future demands

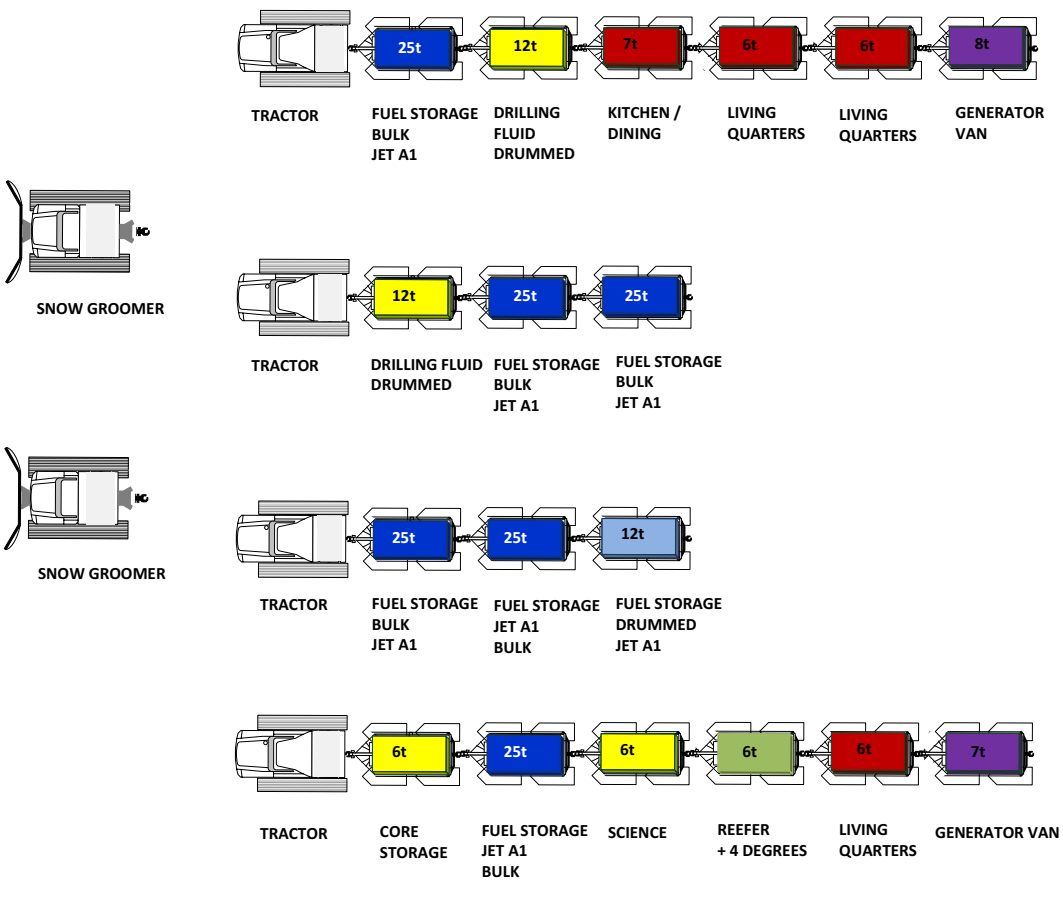
OVERLAND TRAVERSE DIAGRAMMATIC LAYOUT

TRAVERSE 1



OVERLAND TRAVERSE DIAGRAMMATIC LAYOUT

TRAVERSE 2



64 TONNES

62 TONNES

62 TONNES

56 TONNES

244 TONNES TOTAL WEIGHT

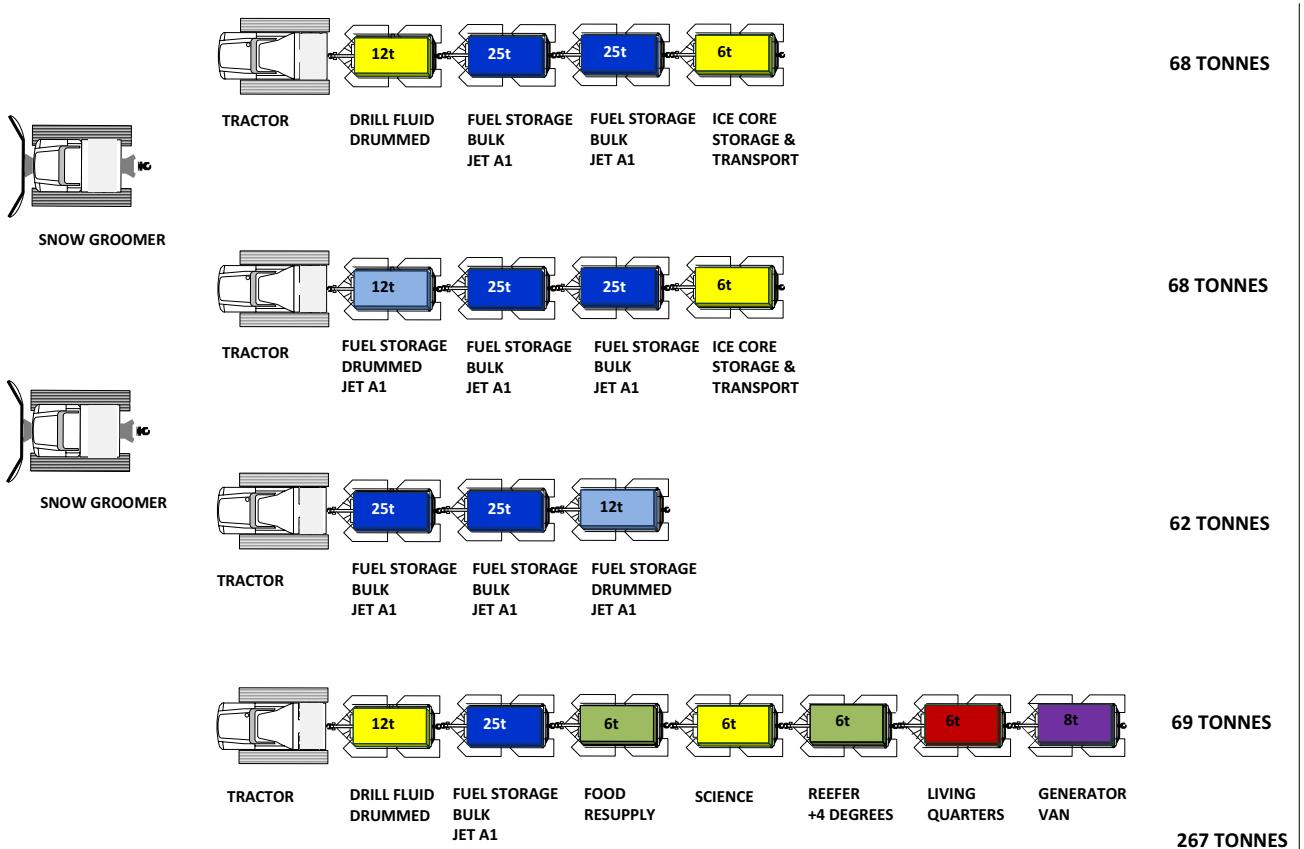
LEGEND:

- DRUMMED FUEL
- BULK FUEL
- SCIENCE / MYIC
- LIVING / AMENITIES
- WARM STORE / REEFERS
- MEDICAL
- GENERATOR

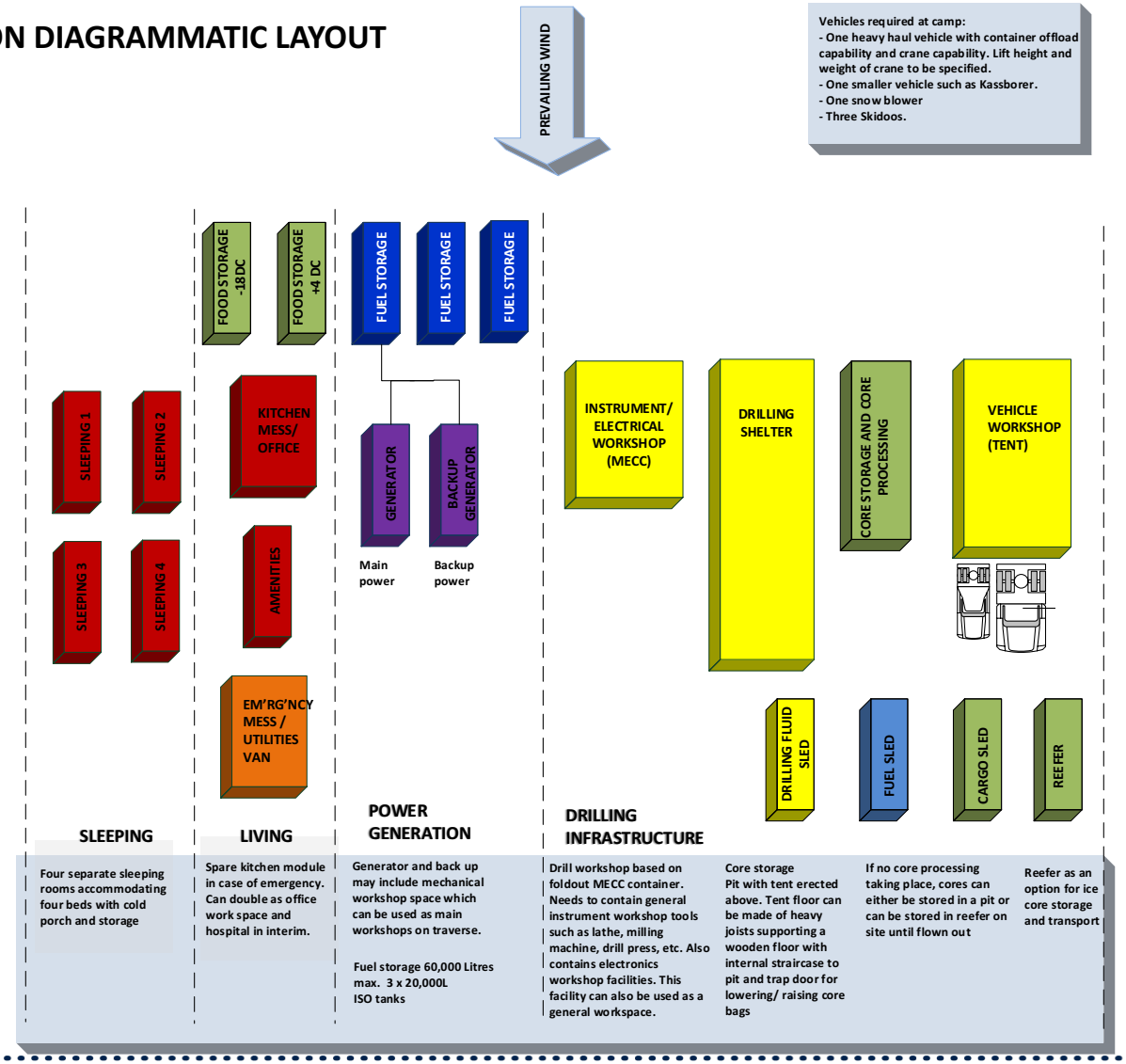
Groom traverse route and prepare skiway

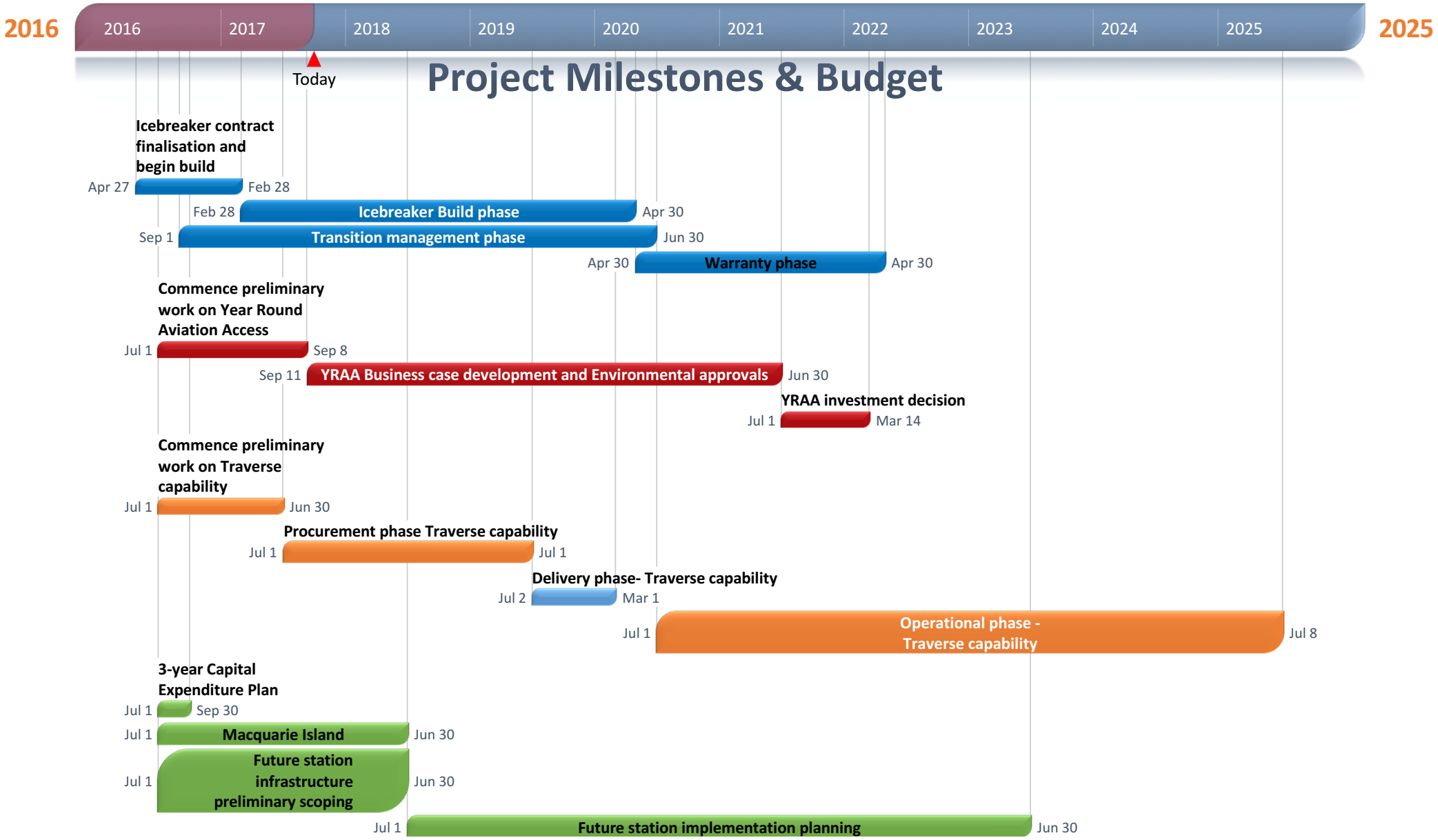
OVERLAND TRAVERSE DIAGRAMMATIC LAYOUT

TRAVERSE SUSTAIN & RESUPPLY



INLAND STATION DIAGRAMMATIC LAYOUT




2016
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2025
Today
Project Milestones & Budget
Icebreaker contract finalisation and begin build
Apr 27
Feb 28
Feb 28
Icebreaker Build phase
Apr 30
Sep 1
Transition management phase
Jun 30
Apr 30
Warranty phase
Apr 30
Commence preliminary work on Year Round Aviation Access
Jul 1
Sep 8
Sep 11
YRAA Business case development and Environmental approvals
Jun 30
YRAA investment decision
Jul 1
Mar 14
Commence preliminary work on Traverse capability
Jul 1
Jun 30
Procurement phase Traverse capability
Jul 1
Jul 1
Delivery phase- Traverse capability
Jul 2
Mar 1
Jul 1
Operational phase - Traverse capability
Jul 8
3-year Capital Expenditure Plan
Jul 1
Sep 30
Jul 1
Macquarie Island
Jun 30
Jul 1
Future station infrastructure preliminary scoping
Jun 30
Jul 1
Future station implementation planning
Jun 30

MYIC Project

Why are we looking for a Million Year Ice Core?

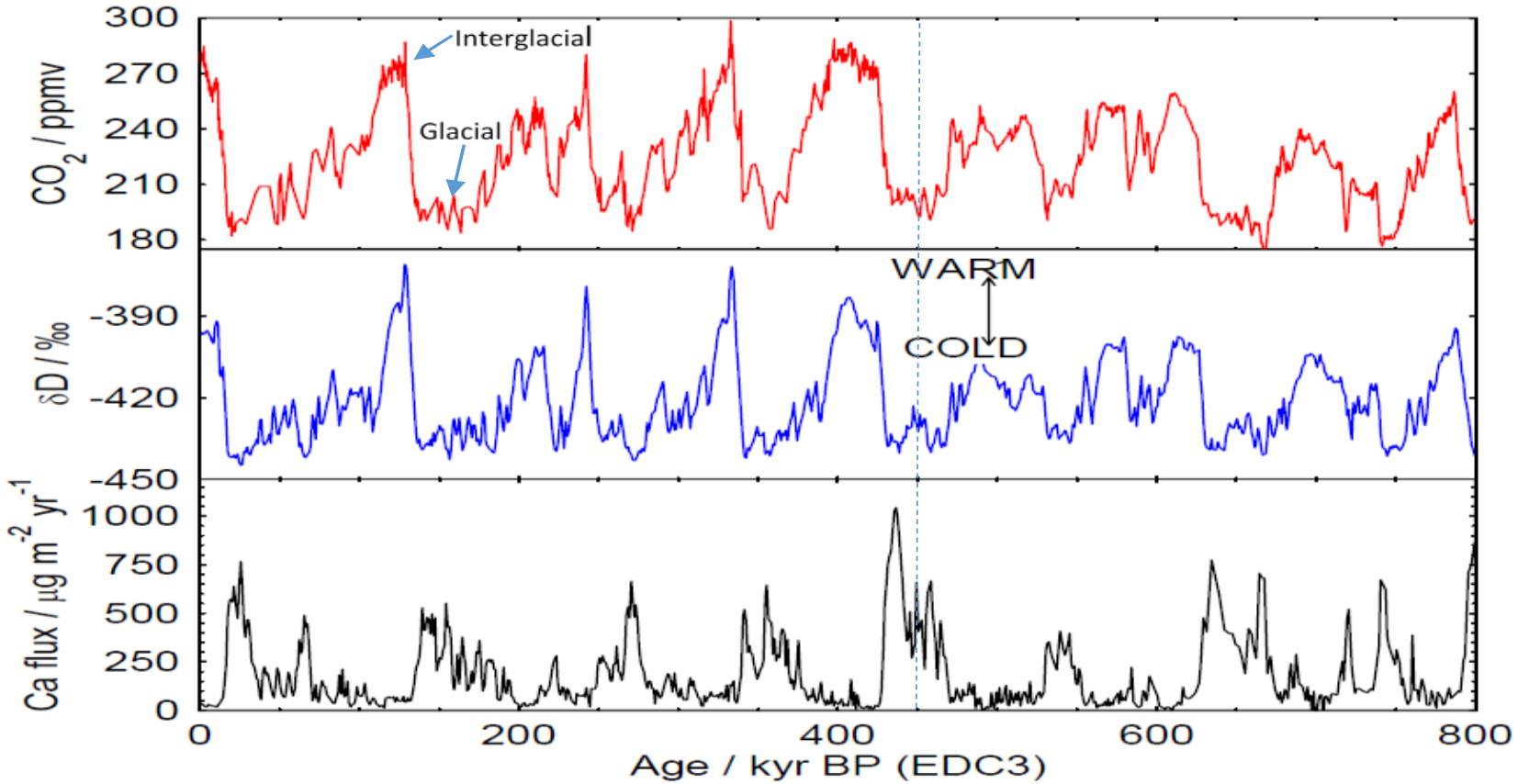


Figure 1: Records of CO2, deuterium (temperature proxy) and calcium flux (dust) found in ice cores

Reproduced from "International Partnerships in Ice Core Sciences (IPICS)"
"The oldest ice core: A 1.5 million year record of climate and greenhouse gases from Antarctica."
"Science and outline implementation plan, as approved by IPICS SC: 1st June 2008"

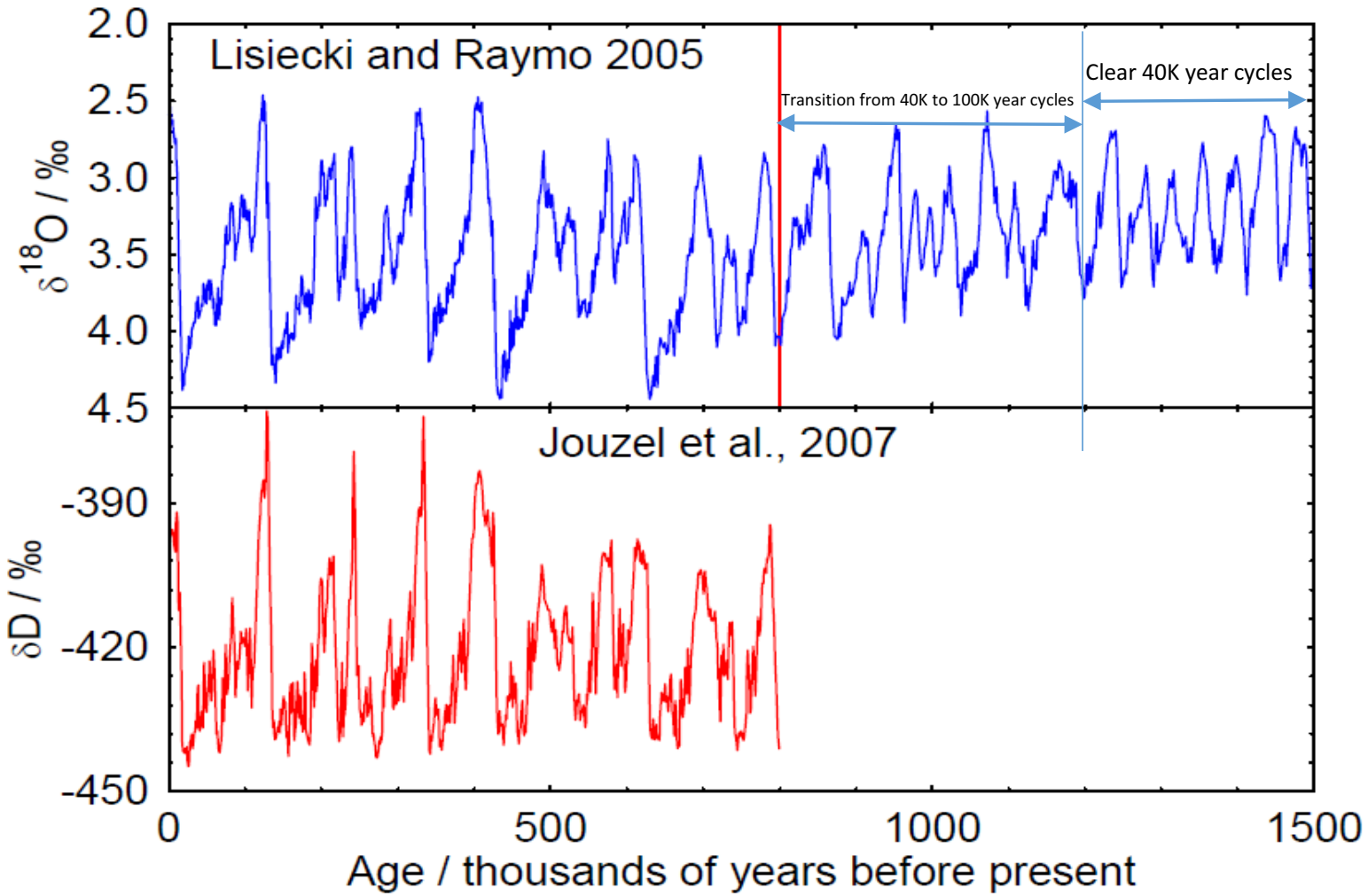


Figure 1: Marine record (blue) showing climate back to 1.5M years ago and the ice record (red) from EPICA (Dome C)

Reproduced from "International Partnerships in Ice Core Sciences (IPICS)"
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Where Do We Find A Million Year Ice Core

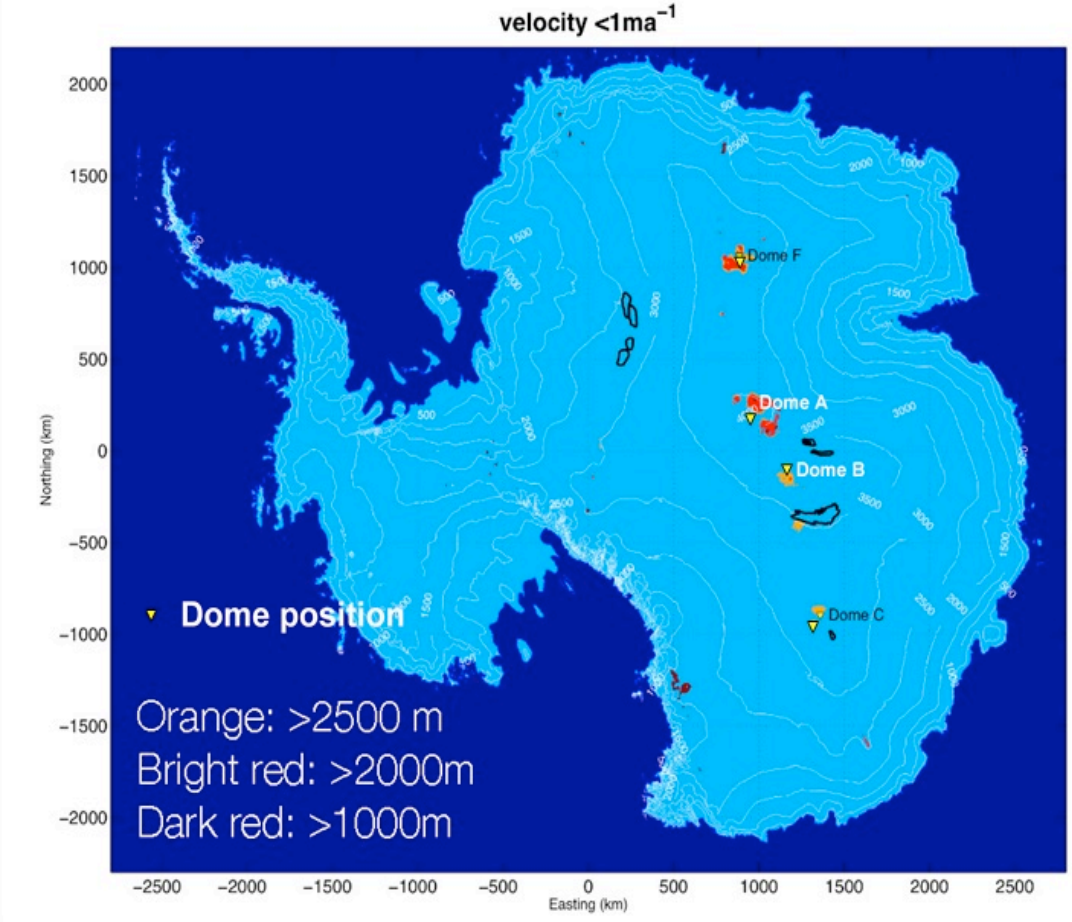


Figure 1: Potential "Oldest-Ice" study areas, where horizontal flow is <1 m a-1, mean ice thickness larger than 1000m and the bottom temperature below -5C (Pattyn, 2013 WS IPICS oldest ice)

Likely Drilling Region

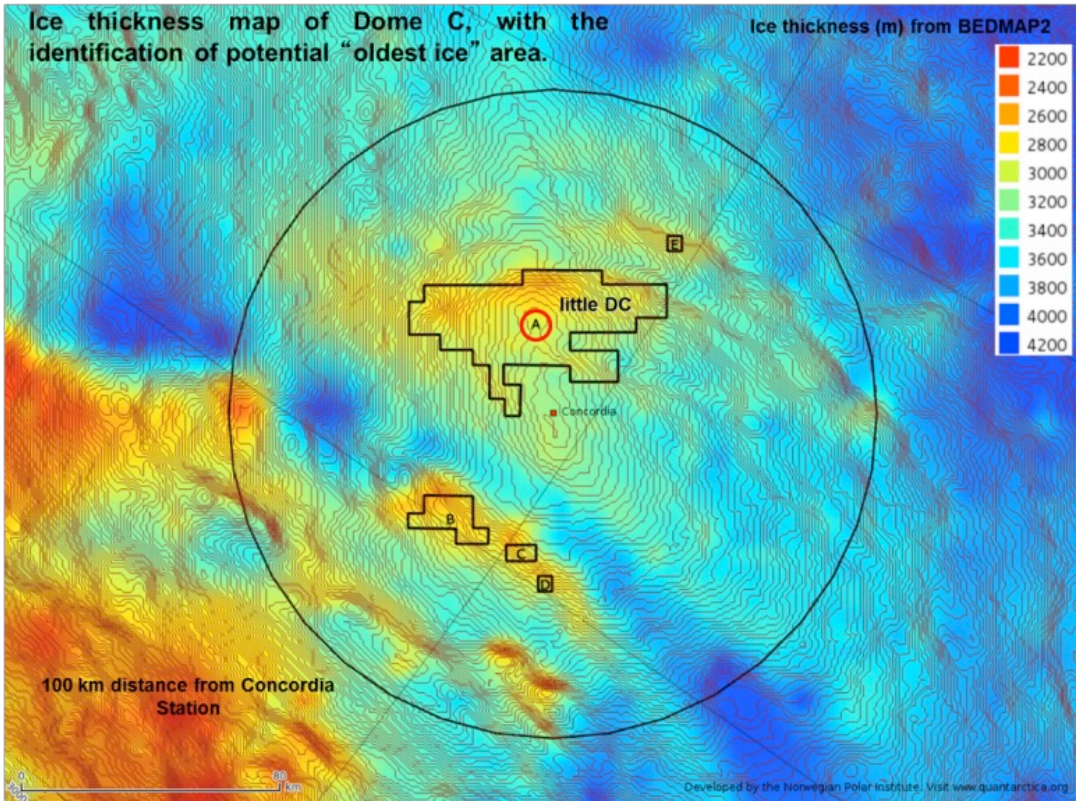
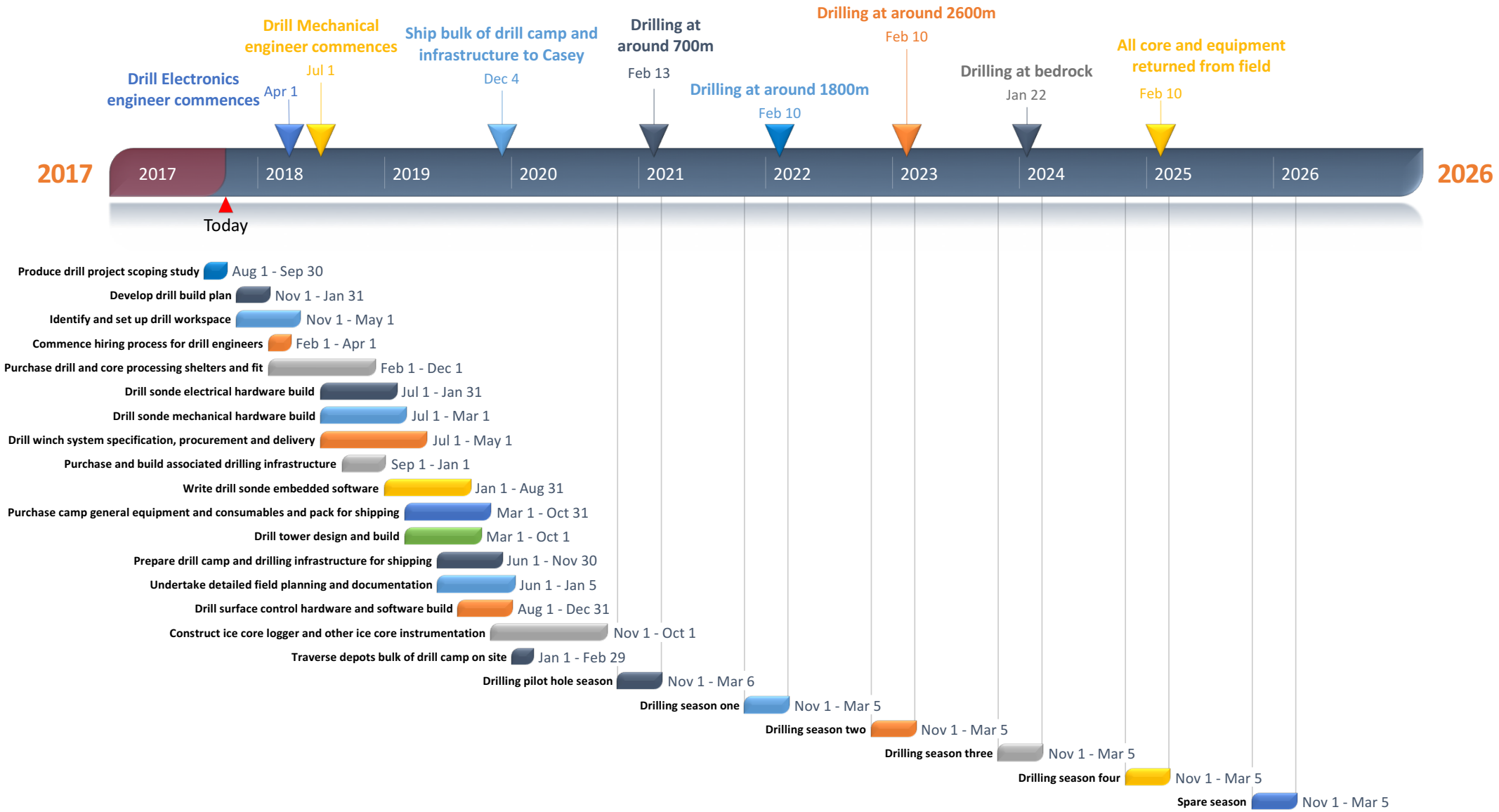


Figure 1: Ice thickness map of Dome C with potential oldest ice areas marked and labelled A, B, C and D.


Drill Electronics engineer commences
Apr 1
Drill Mechanical engineer commences
Jul 1
Ship bulk of drill camp and infrastructure to Casey
Dec 4
Drilling at around 700m
Feb 13
Drilling at around 1800m
Feb 10
Drilling at around 2600m
Feb 10
Drilling at bedrock
Jan 22
All core and equipment returned from field
Feb 10
2017
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2026
Today
Produce drill project scoping study Aug 1 - Sep 30
Develop drill build plan Nov 1 - Jan 31
Identify and set up drill workspace Nov 1 - May 1
Commence hiring process for drill engineers Feb 1 - Apr 1
Purchase drill and core processing shelters and fit Feb 1 - Dec 1
Drill sonde electrical hardware build Jul 1 - Jan 31
Drill sonde mechanical hardware build Jul 1 - Mar 1
Drill winch system specification, procurement and delivery Jul 1 - May 1
Purchase and build associated drilling infrastructure Sep 1 - Jan 1
Write drill sonde embedded software Jan 1 - Aug 31
Purchase camp general equipment and consumables and pack for shipping Mar 1 - Oct 31
Drill tower design and build Mar 1 - Oct 1
Prepare drill camp and drilling infrastructure for shipping Jun 1 - Nov 30
Undertake detailed field planning and documentation Jun 1 - Jan 5
Drill surface control hardware and software build Aug 1 - Dec 31
Construct ice core logger and other ice core instrumentation Nov 1 - Oct 1
Traverse depots bulk of drill camp on site Jan 1 - Feb 29
Drilling pilot hole season Nov 1 - Mar 6
Drilling season one Nov 1 - Mar 5
Drilling season two Nov 1 - Mar 5
Drilling season three Nov 1 - Mar 5
Drilling season four Nov 1 - Mar 5
Spare season Nov 1 - Mar 5