ARTEMIS

HOW TO EXPLORE EUROPA

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Stone Aerospace
Schmidt Ocean Institute Research Planning Workshop 2015

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Mapping Wakulla Springs

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DEPTHX

Full 3-D Mapping of 4 cenotes

Autonomous core samples from Cenote Zacaton:
4 new phyla of bacteria discovered

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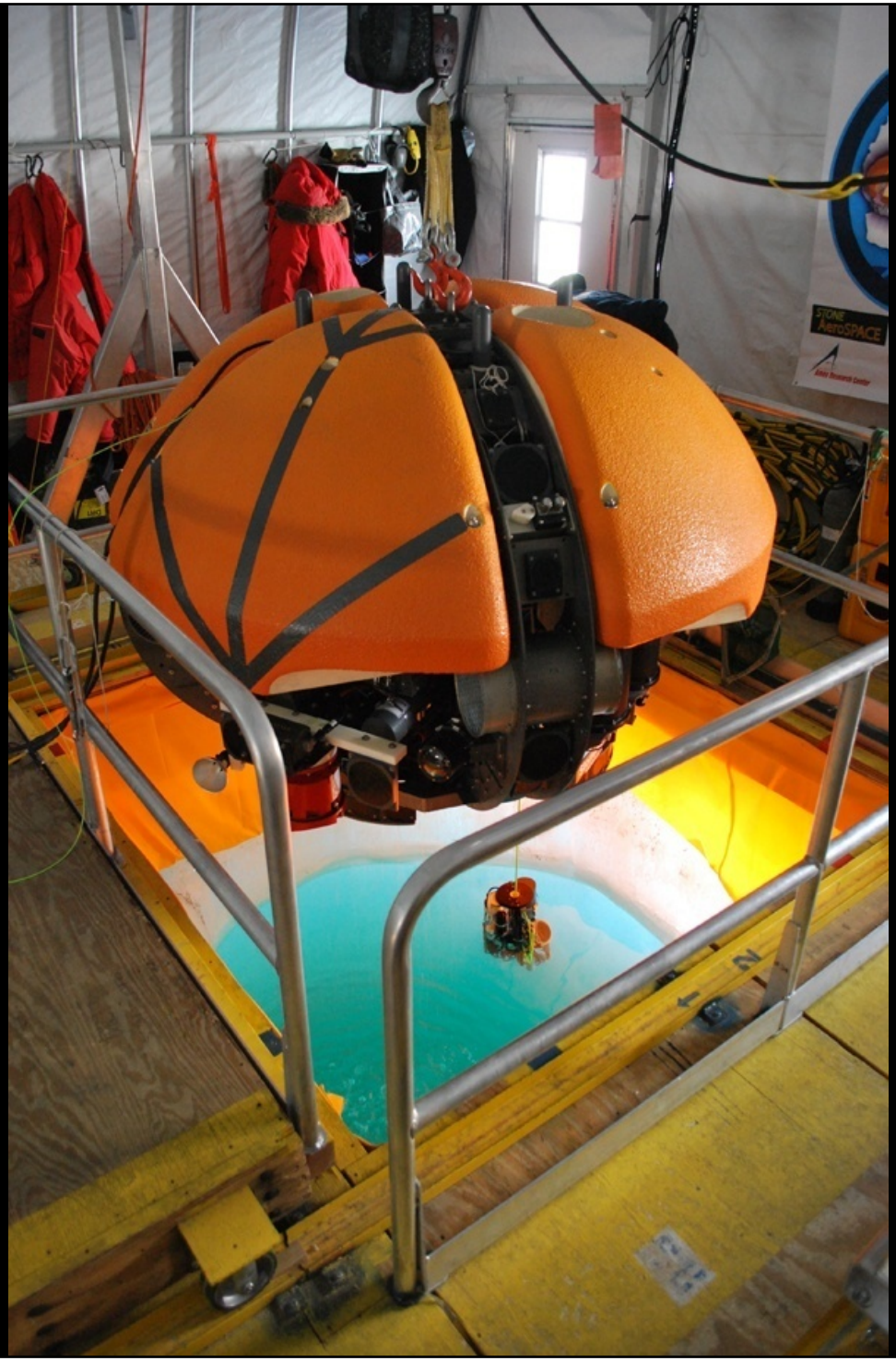

ENDURANCE

Environmentally Non-Disturbing Under-ice Robotic ANtarctiC Explorer

Lake Bonney, Antarctica 2008-2009

Full biogeochemical profiling

3D mapping

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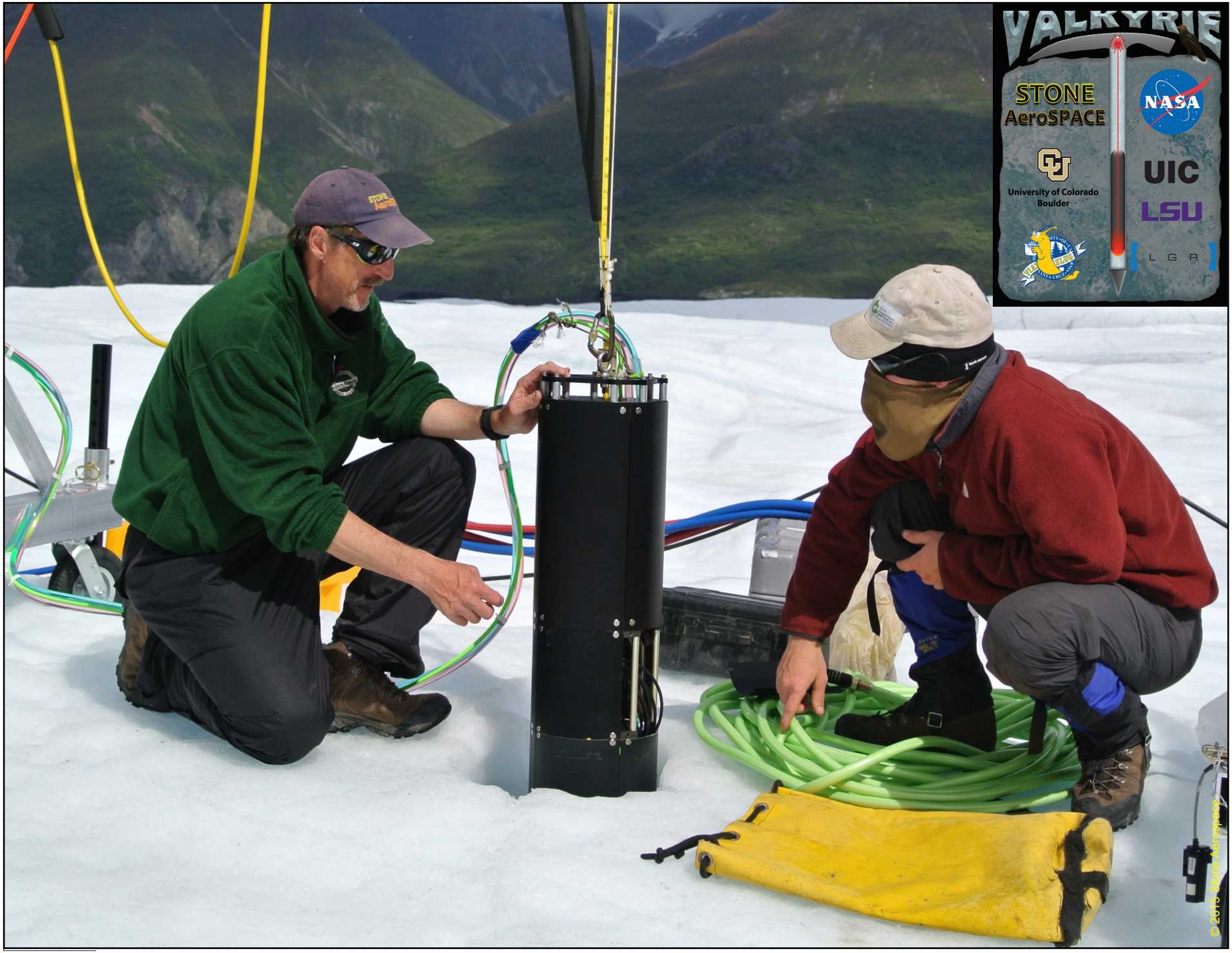
VALKYRIE
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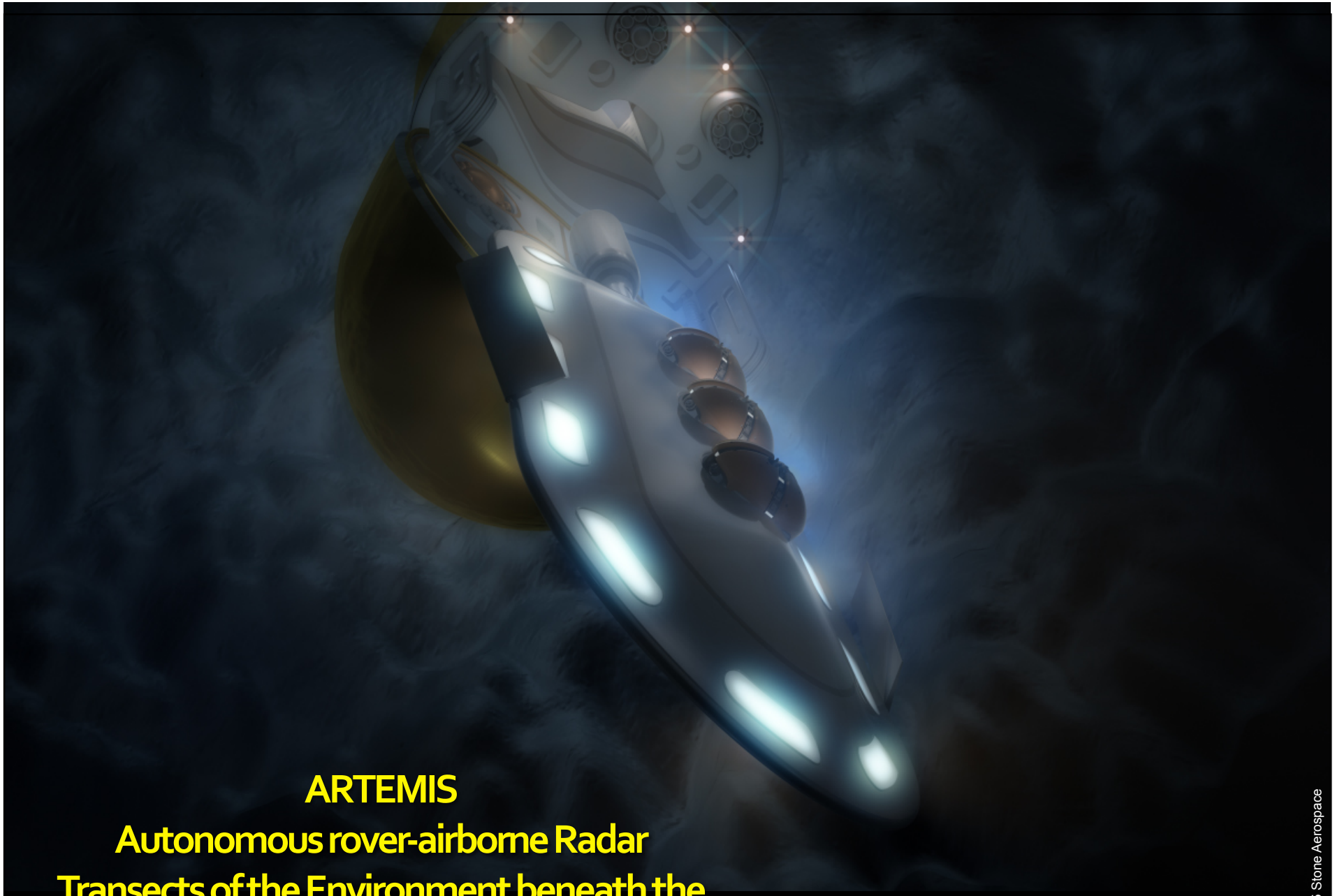

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Autonomous rover-airborne Radar Transects of the Environment beneath the McMurdo Ice Shelf

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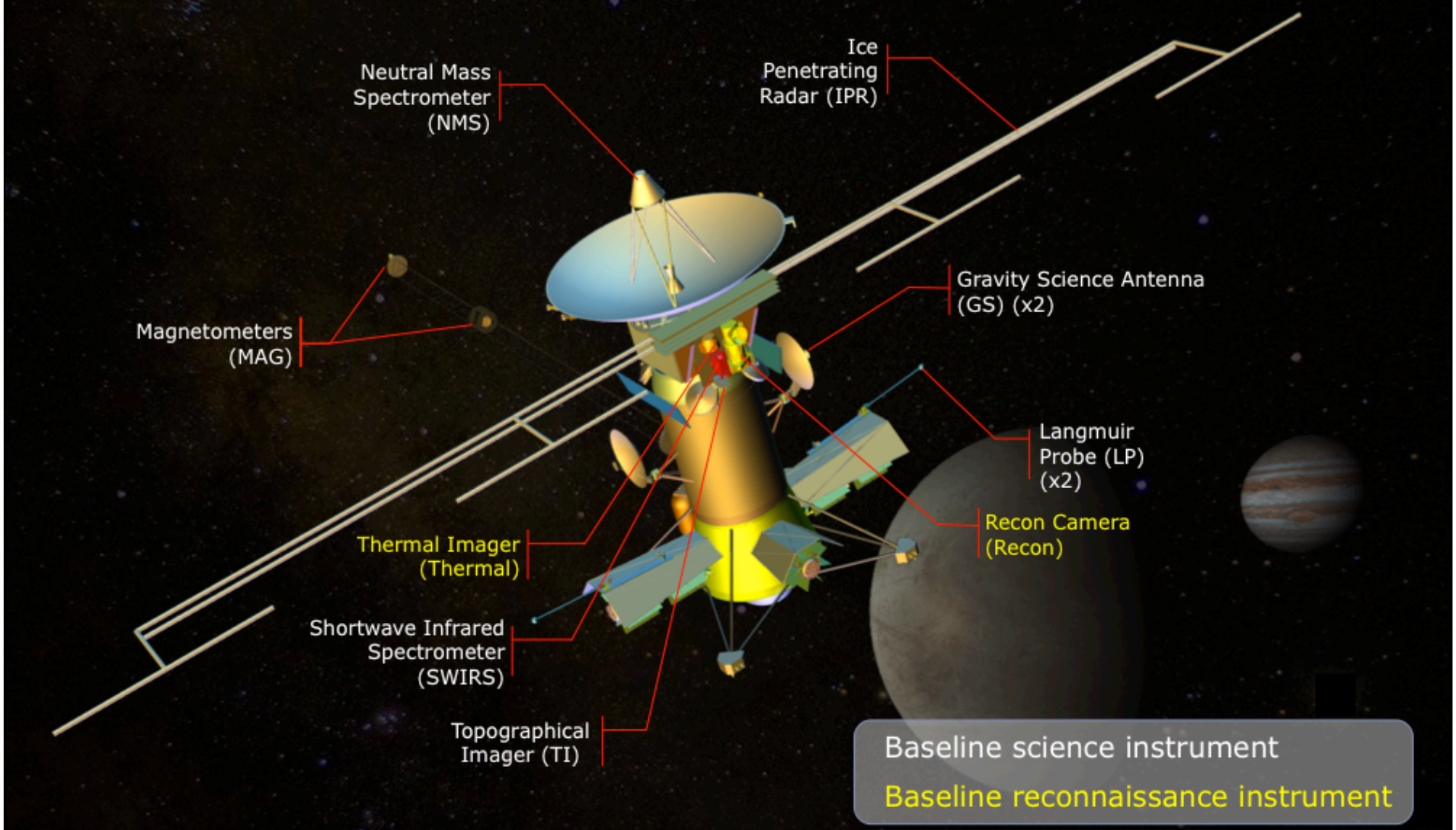
Europa Clipper Model Payload



Baseline science instrument

Baseline reconnaissance instrument

Pre-Decisional — For Planning and Discussion Purposes Only.

2015 Mission Objectives

- Calibrate the Europa Mission Ice Penetrating Radar by providing ground truth sub-ice bathymetry data.

- Test novel sensors for microbial life detection in ice (and to make autonomous sample collections when triggered by such sensors).

- Explore and map under the Ross Ice Shelf (MIS locality) and build detailed bathymetric (both up-look and down-look) maps and current profiles.

- Test long-range sub-ice autonomous vehicle systems (including rendezvous and docking) for a Europa lander

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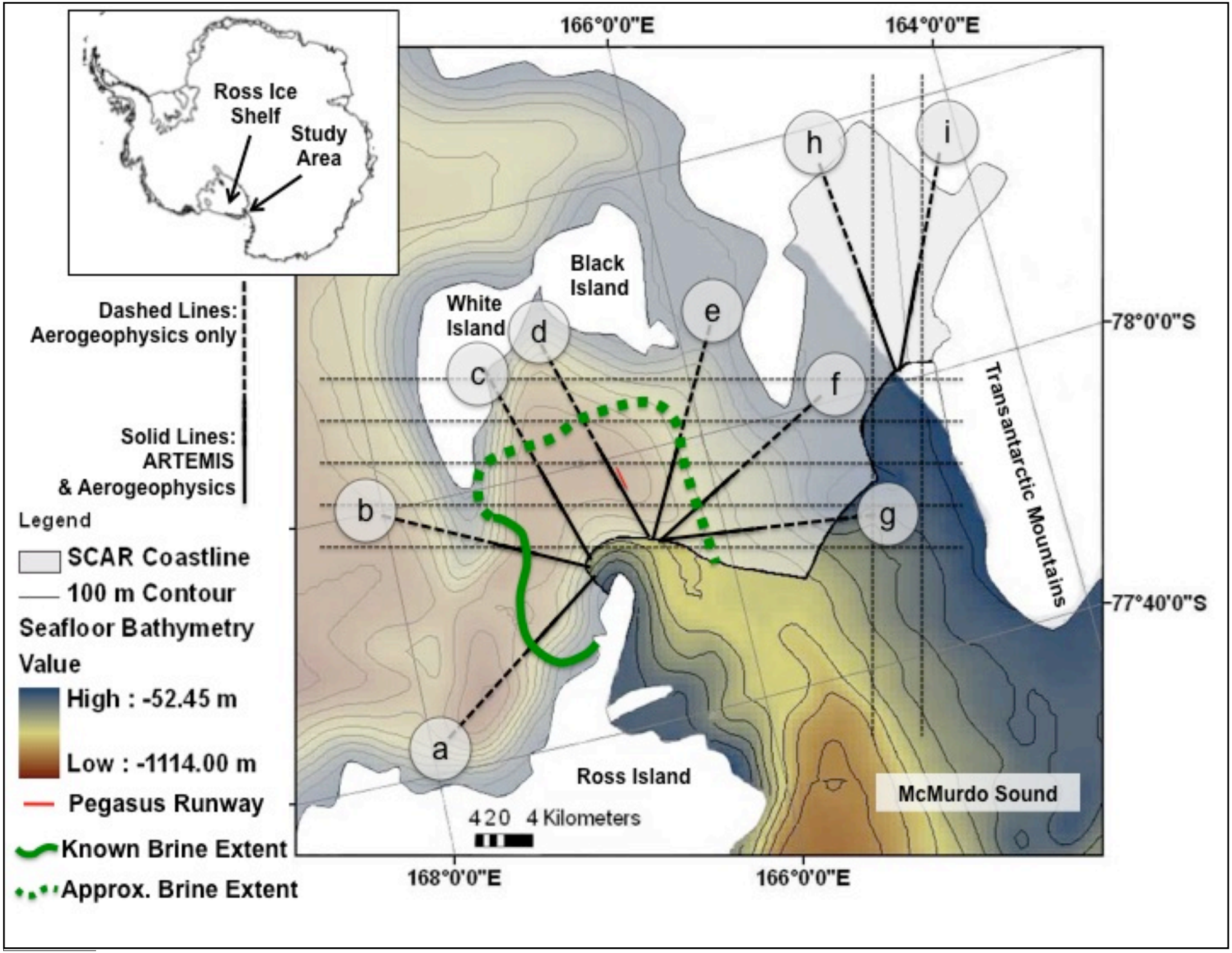
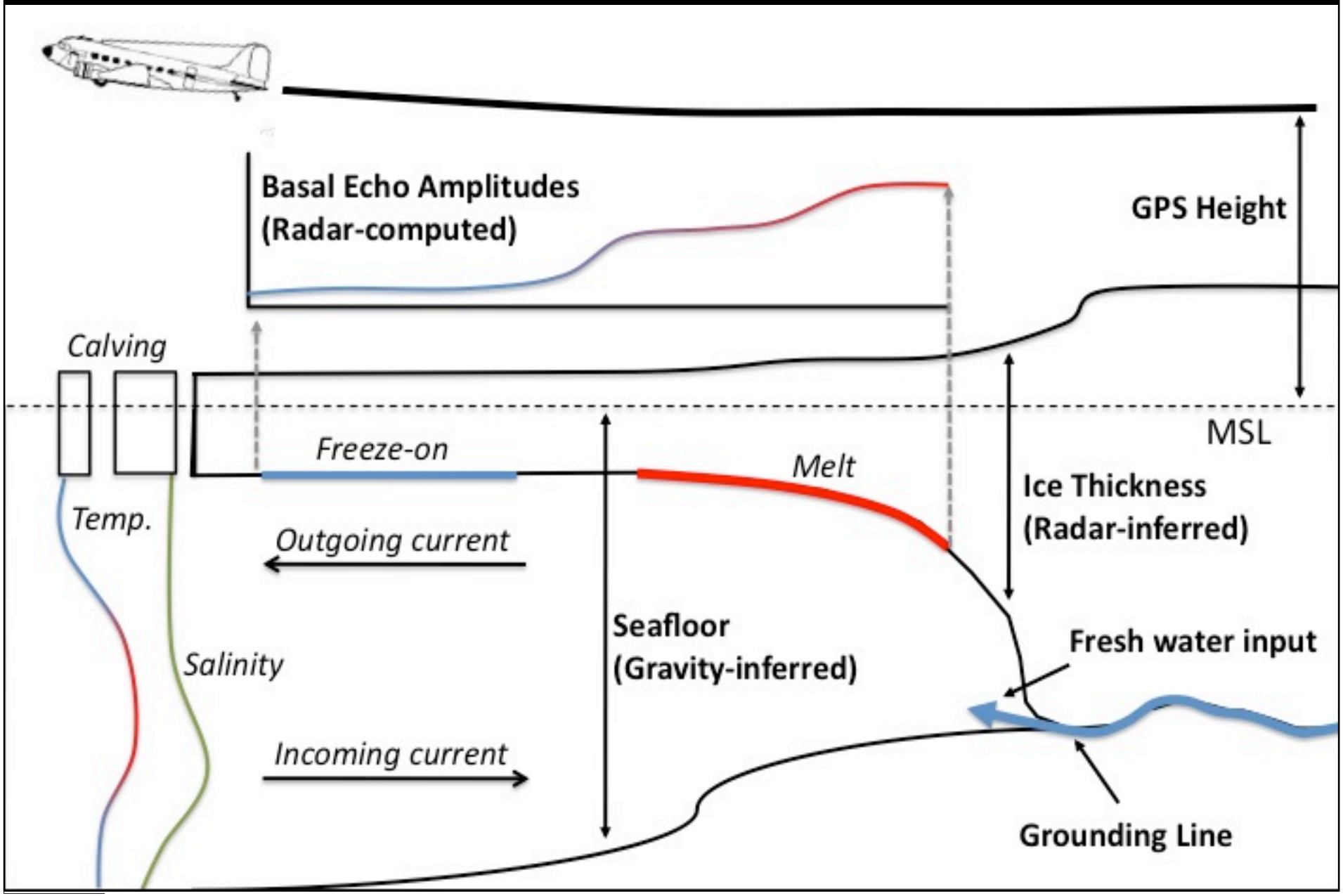
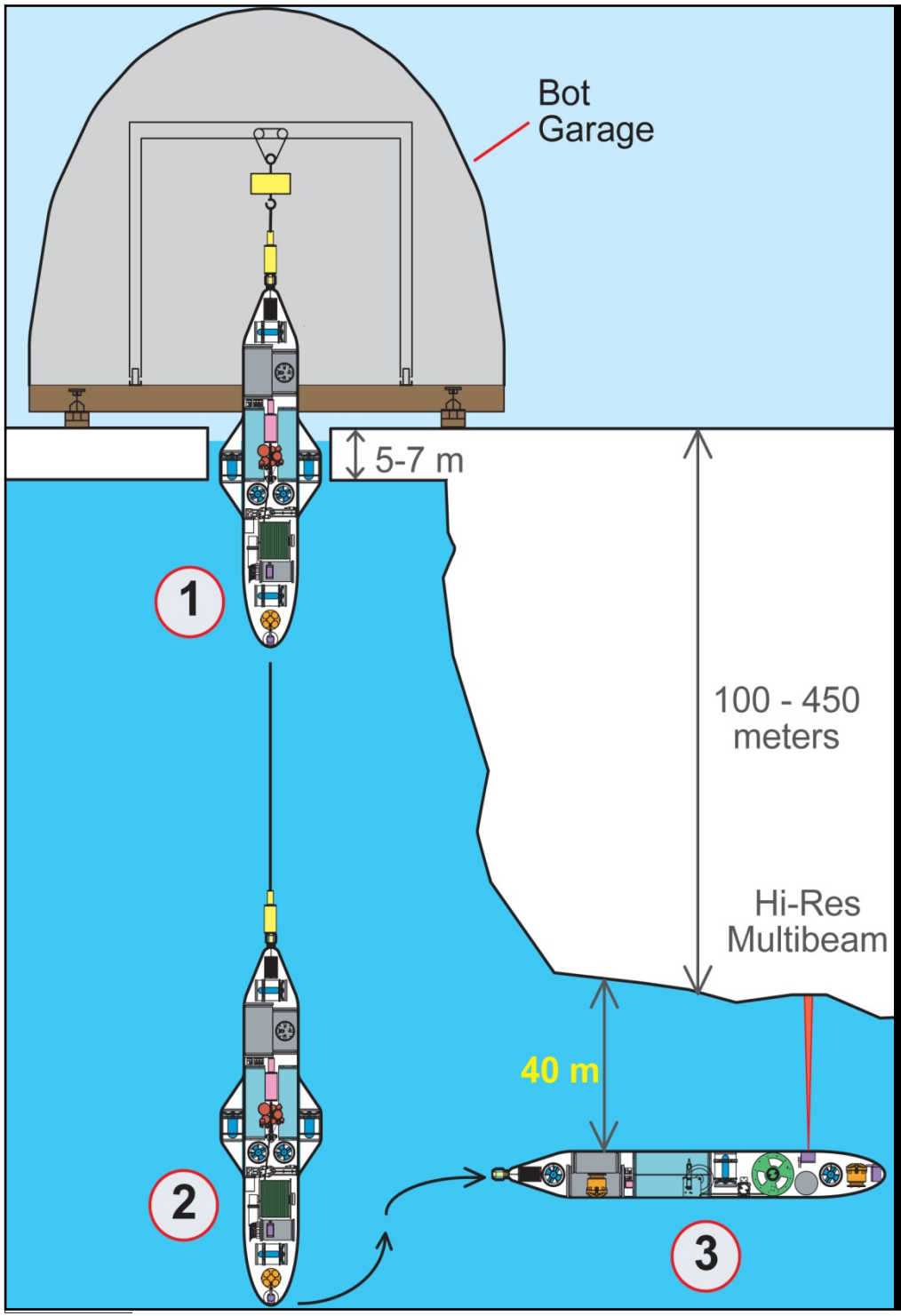

Ross Ice Shelf
Study Area
Dashed Lines: Aerogeophysics only
Solid Lines: ARTEMIS & Aerogeophysics
Legend
SCAR Coastline
100 m Contour
Seafloor Bathymetry Value
High : -52.45 m
Low : -1114.00 m
Pegasus Runway
Known Brine Extent
Approx. Brine Extent
166°0'0"E
164°0'0"E
78°0'0"S
77°40'0"S
168°0'0"E
166°0'0"E
Black Island
White Island
Ross Island
McMurdo Sound
Transantarctic Mountains
a
b
c
d
e
f
g
h
i
4 2 0 4 Kilometers

ARTEMIS Mission Overview





ARTEMIS CONOPS

- Down-hole deployment from a 1.2 m diameter drilled access shaft through sea ice.
- Vehicle then drops 40 m and scans at constant standoff from the underside of the ice shelf.
- Main Mission: Up-look and down-look bathymetric mapping, video imagery, water biogeochemistry.

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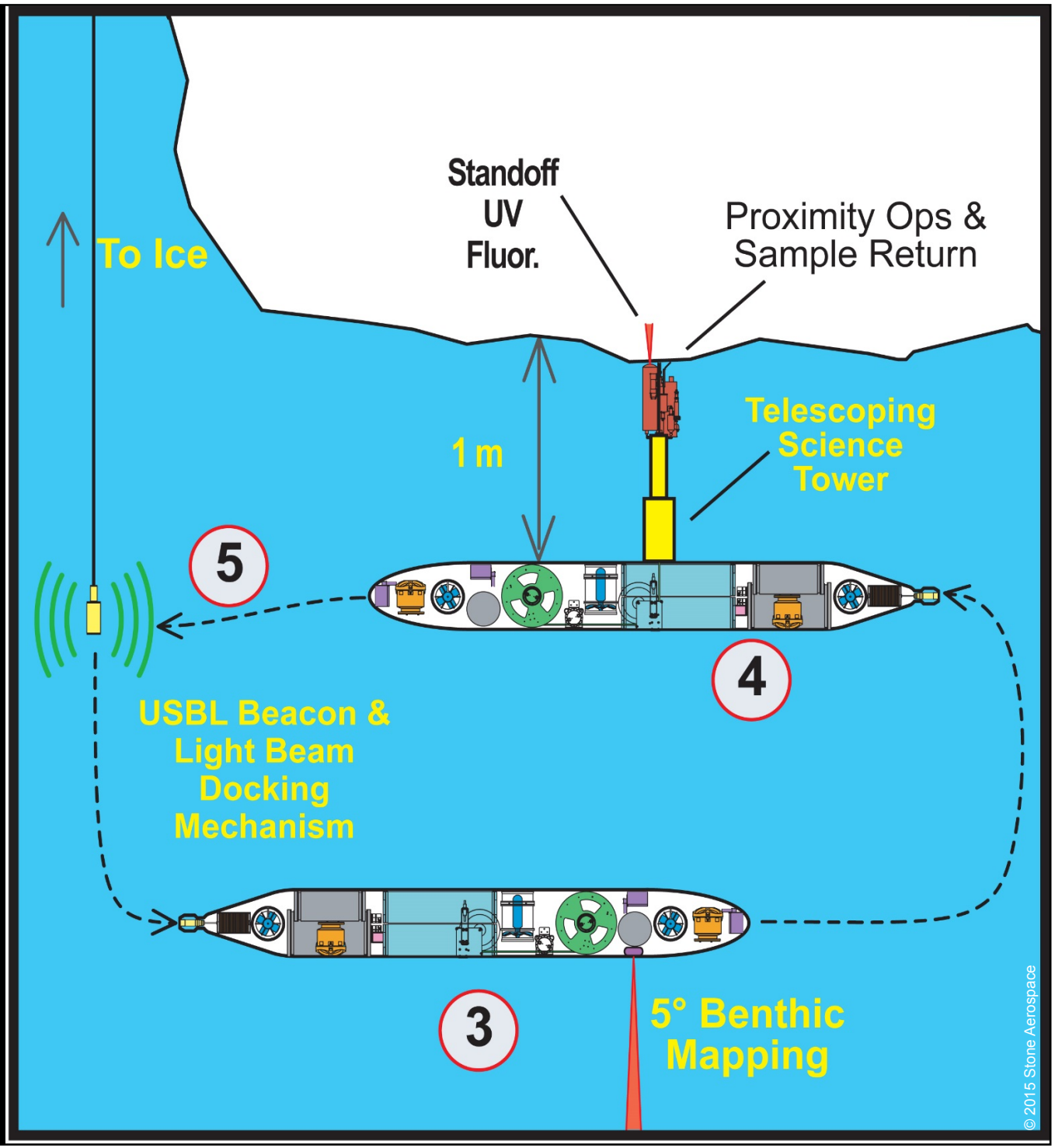
ARTEMIS PROXOPS:

Extend Science Tower Sonde at 50m standoff

Rise up peforming water chemistry "cast"

Conduct ice contact fluorescence measurements

Collect water samples



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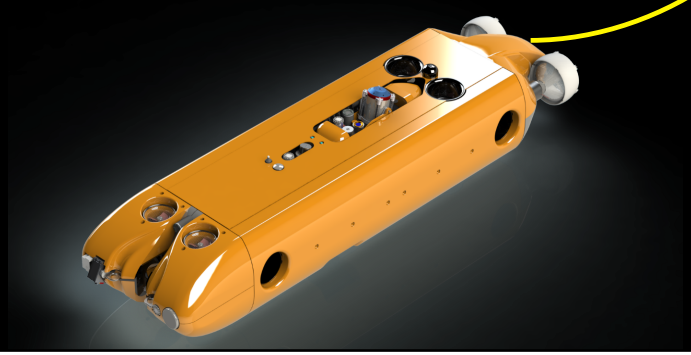
Supervised Autonomy

Enables incremental development of advanced capabilities

Allows Science Team to observe the mission in real-time and to interact with the vehicle if something unusual is discovered



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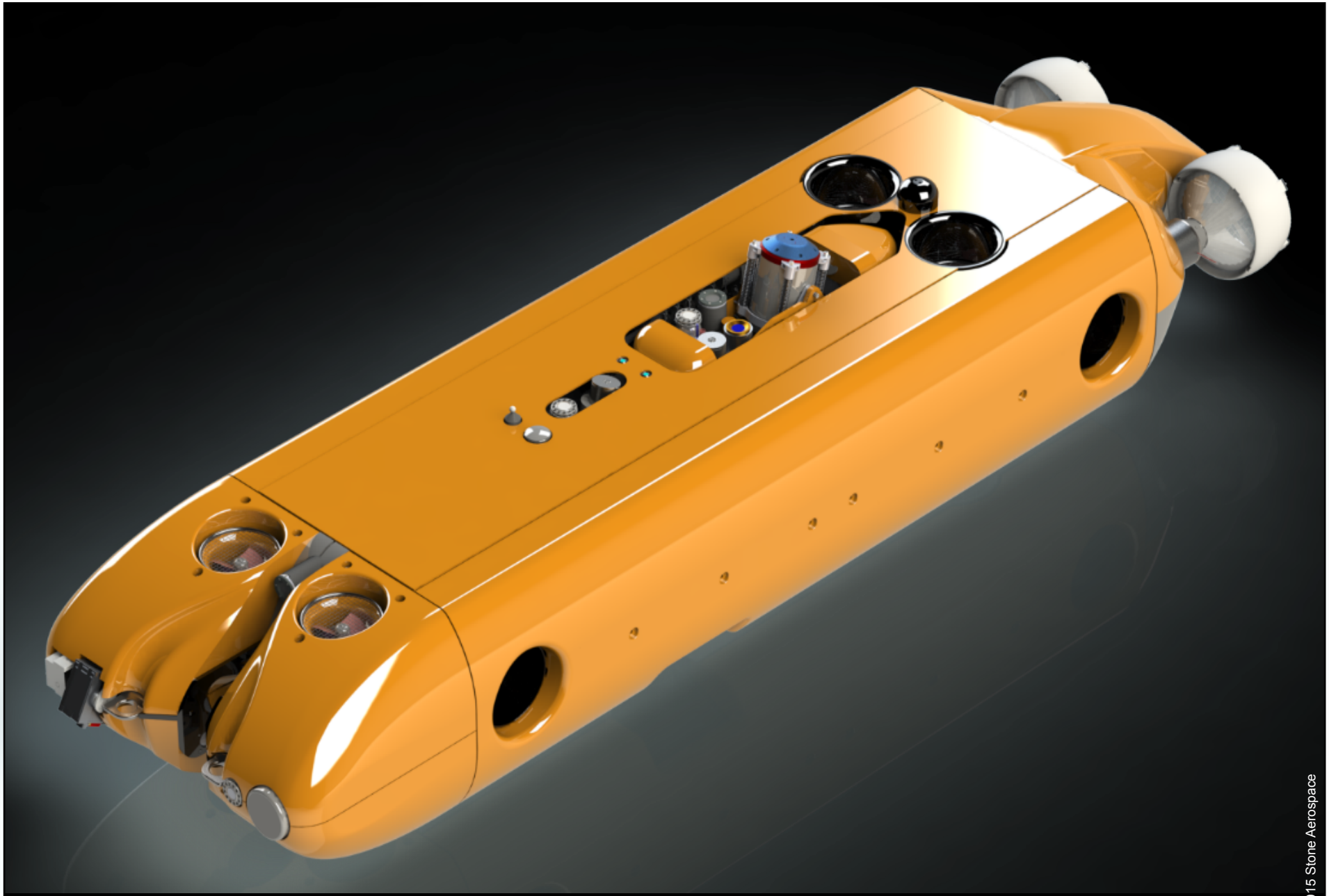

Cruise & Mapping Configuration

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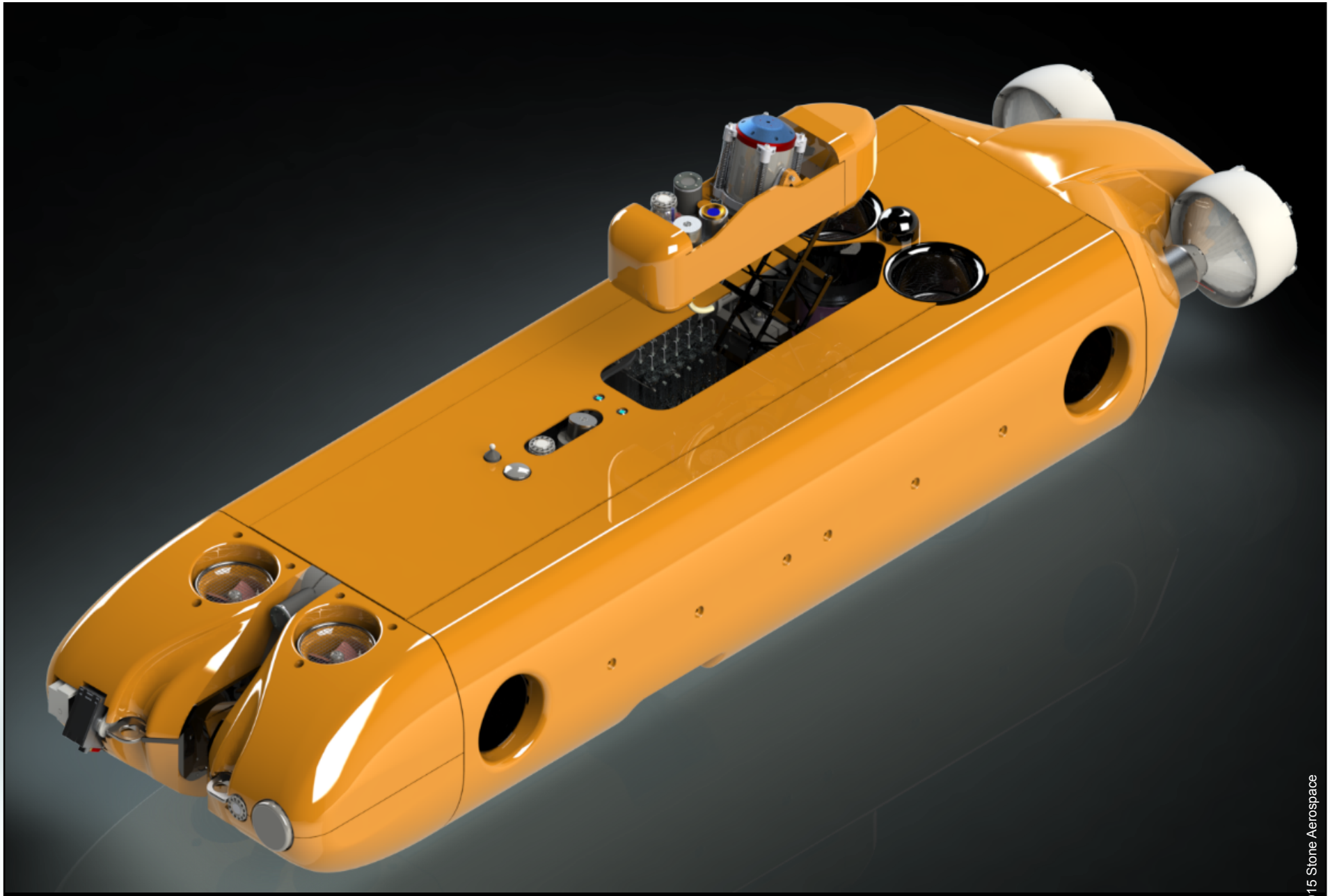

Proxops & Protein Fluorescence Sensing

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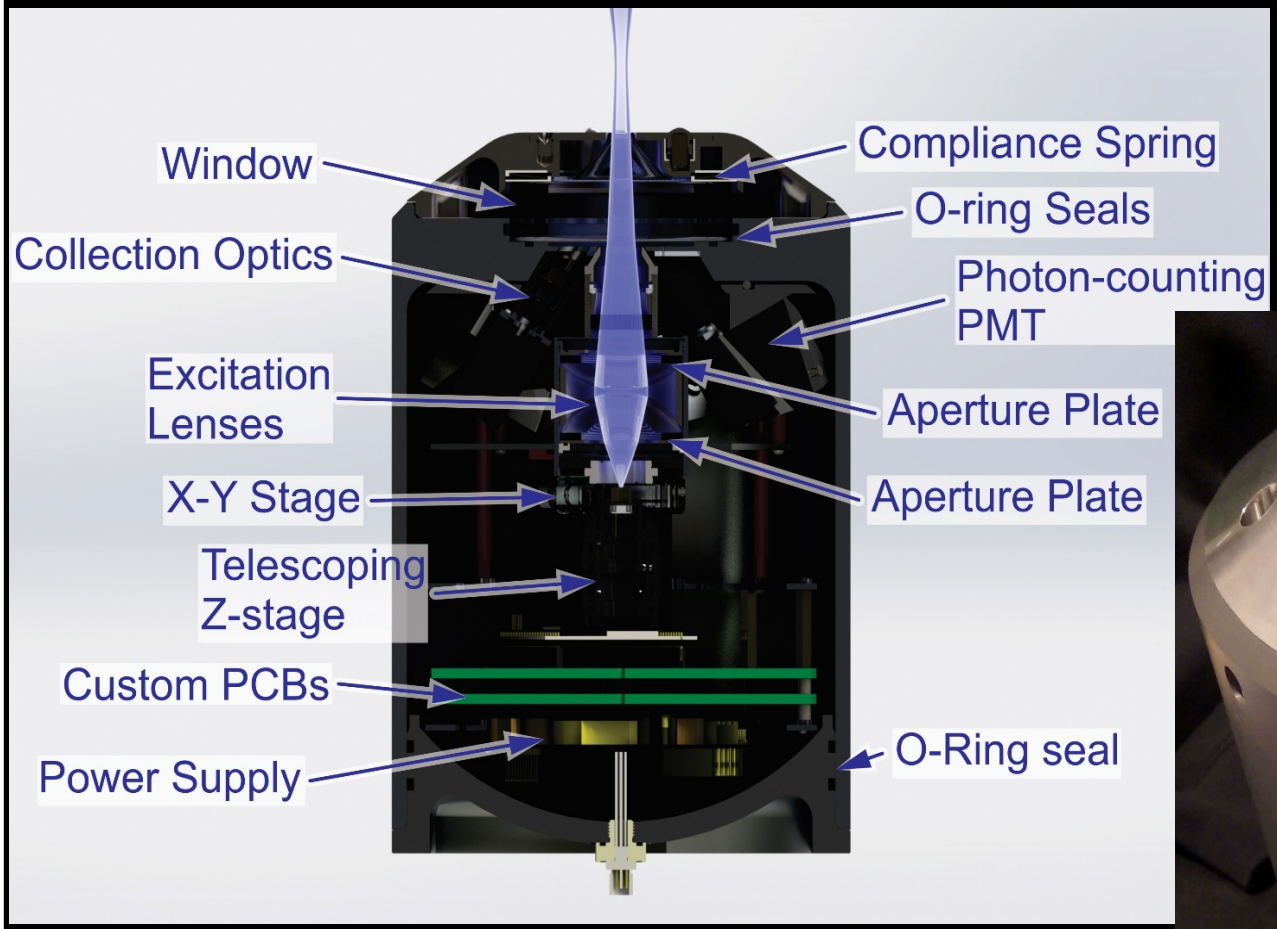
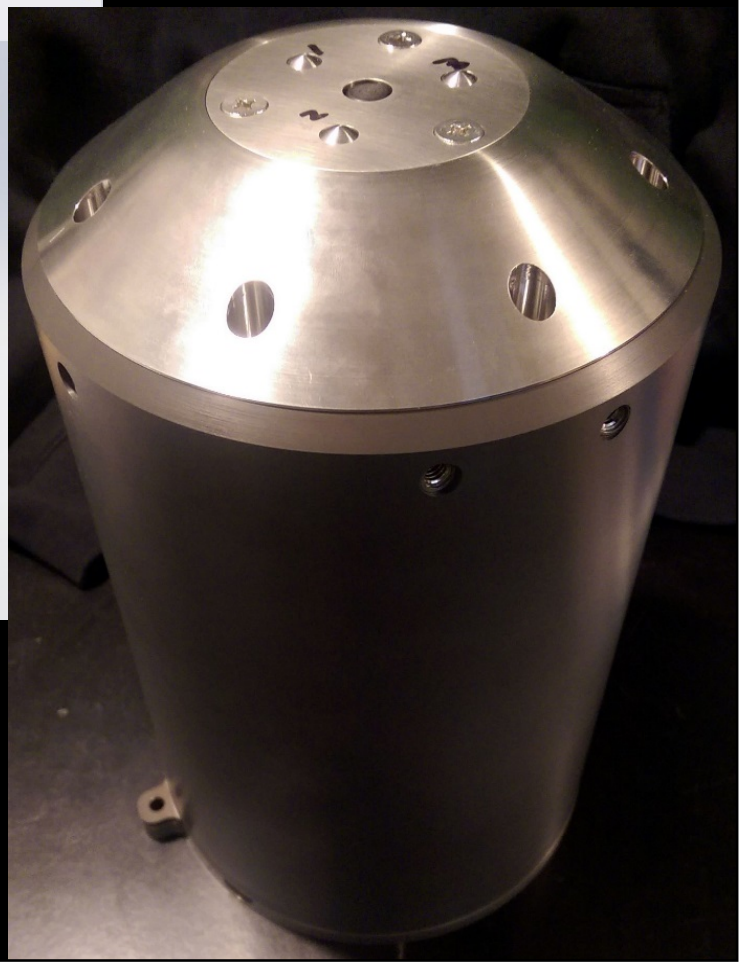
Protein Fluorescence Spectrometer (PFS)



Primary Astrobiology Science Sensor



Custom design with Deep UV laser and PMTs to scan into the ice for microbial communities

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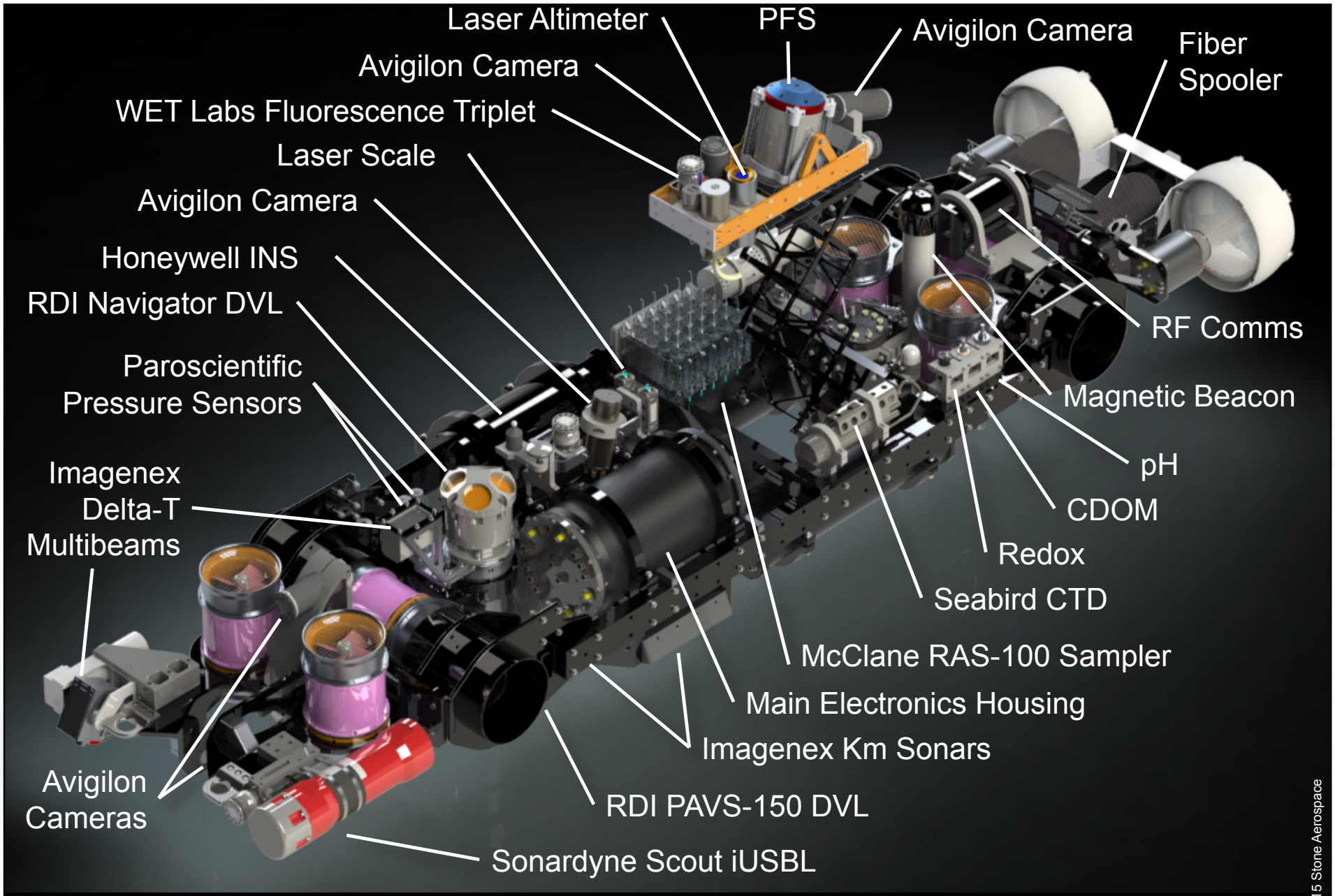

It's What's Under the Hood that Counts

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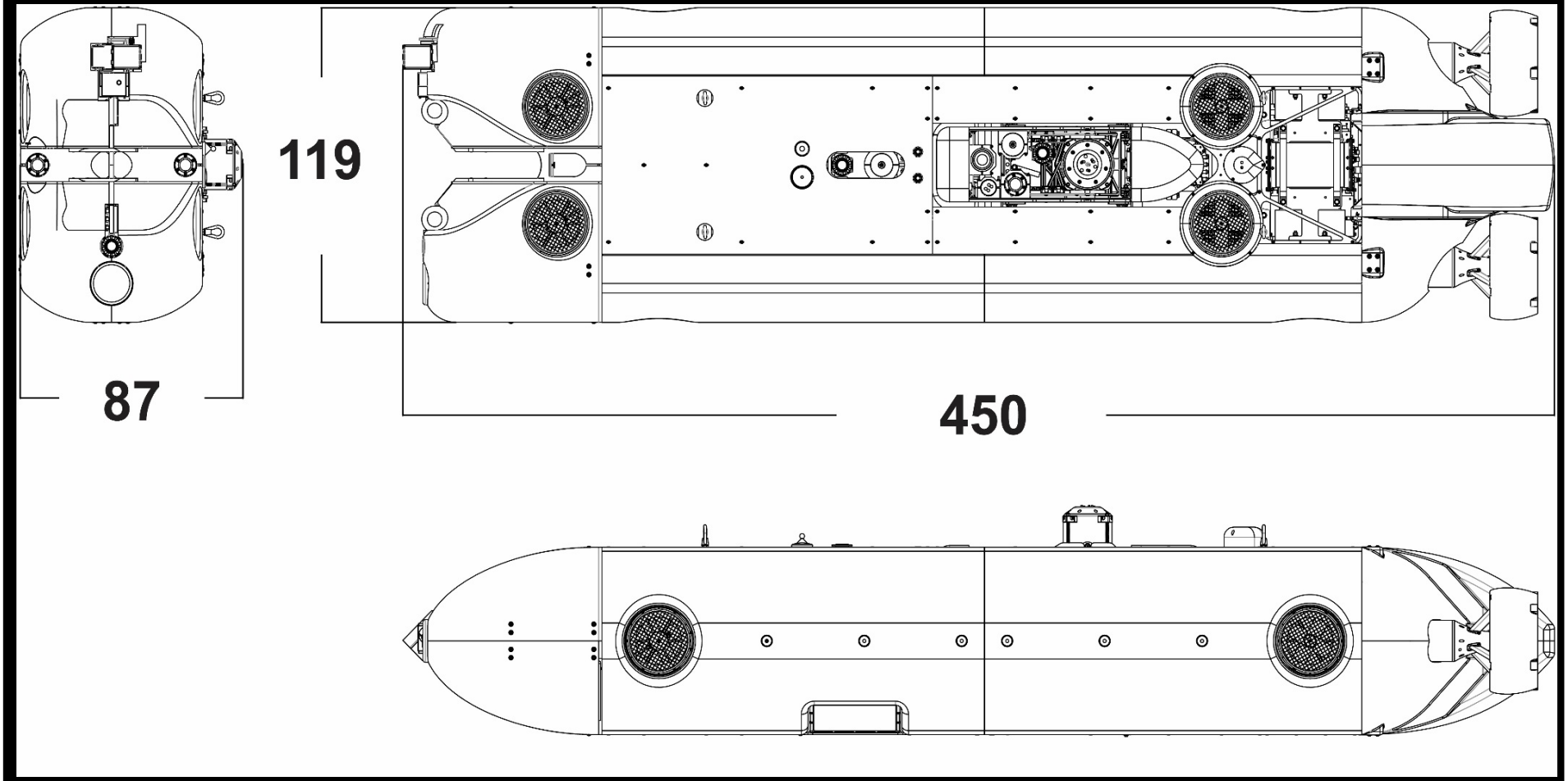
ARTEMIS: Dimensions



Weight in Air: 1,300 kg

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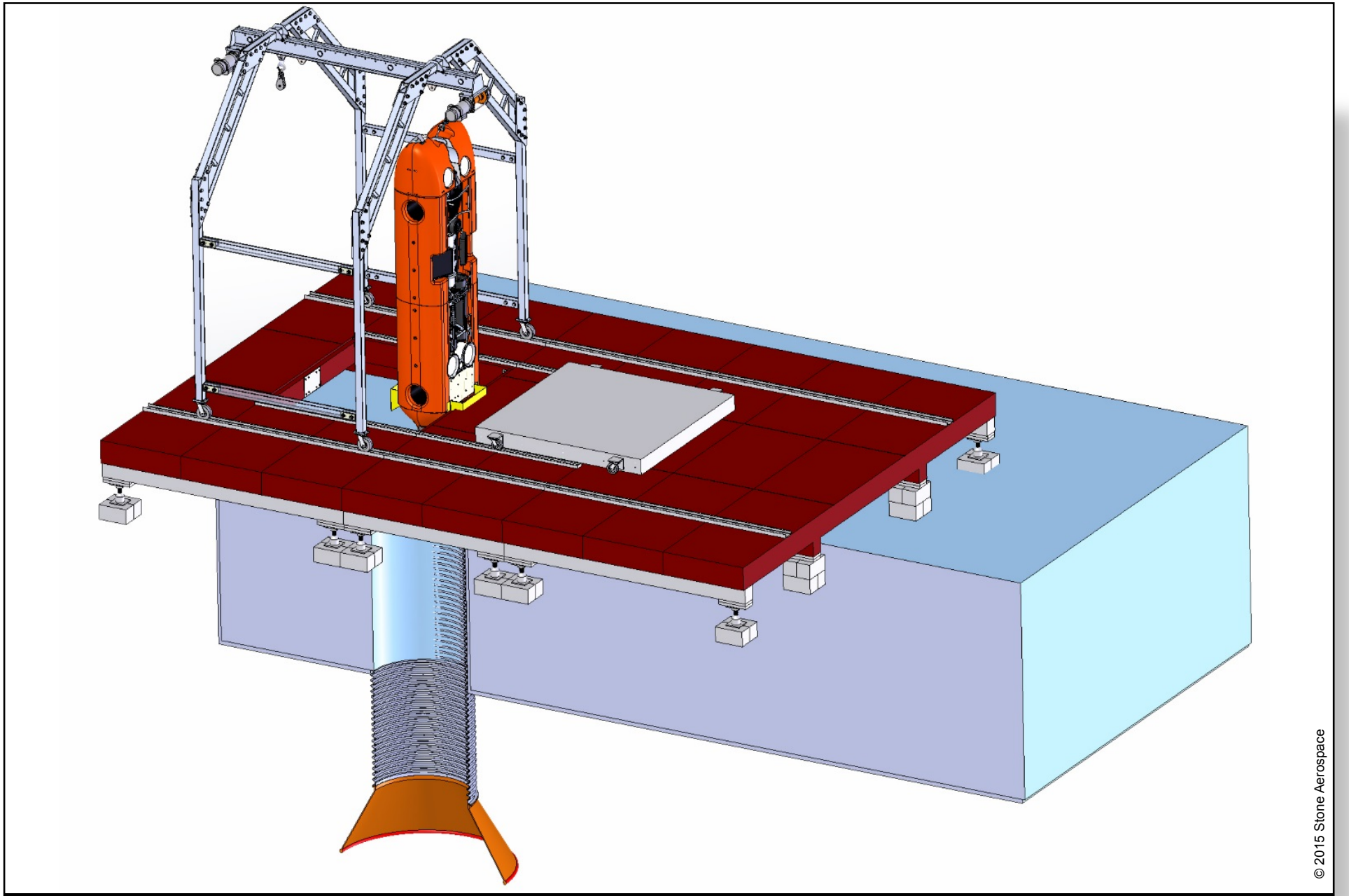

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Launch and Recovery

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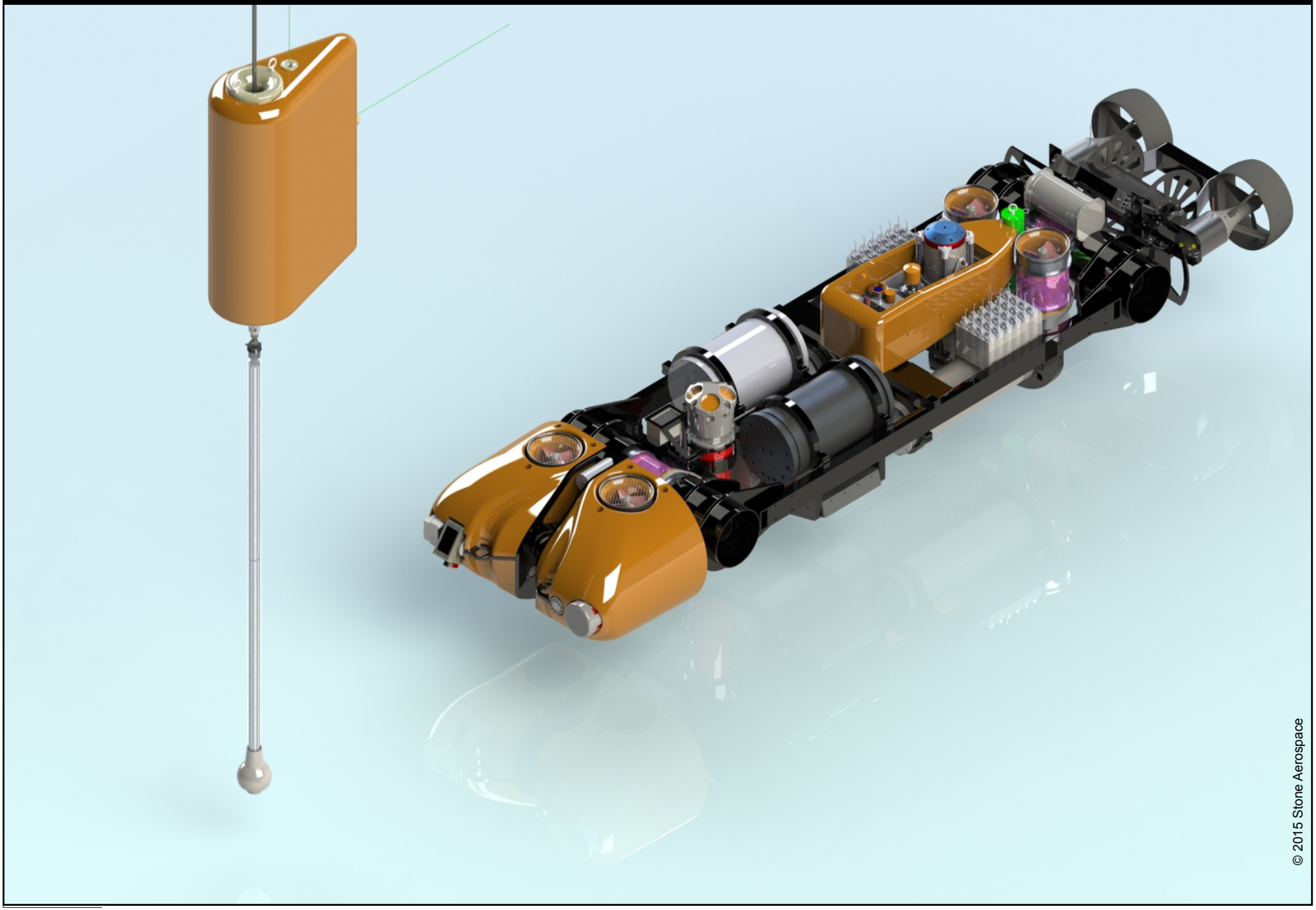
Docking Sequence



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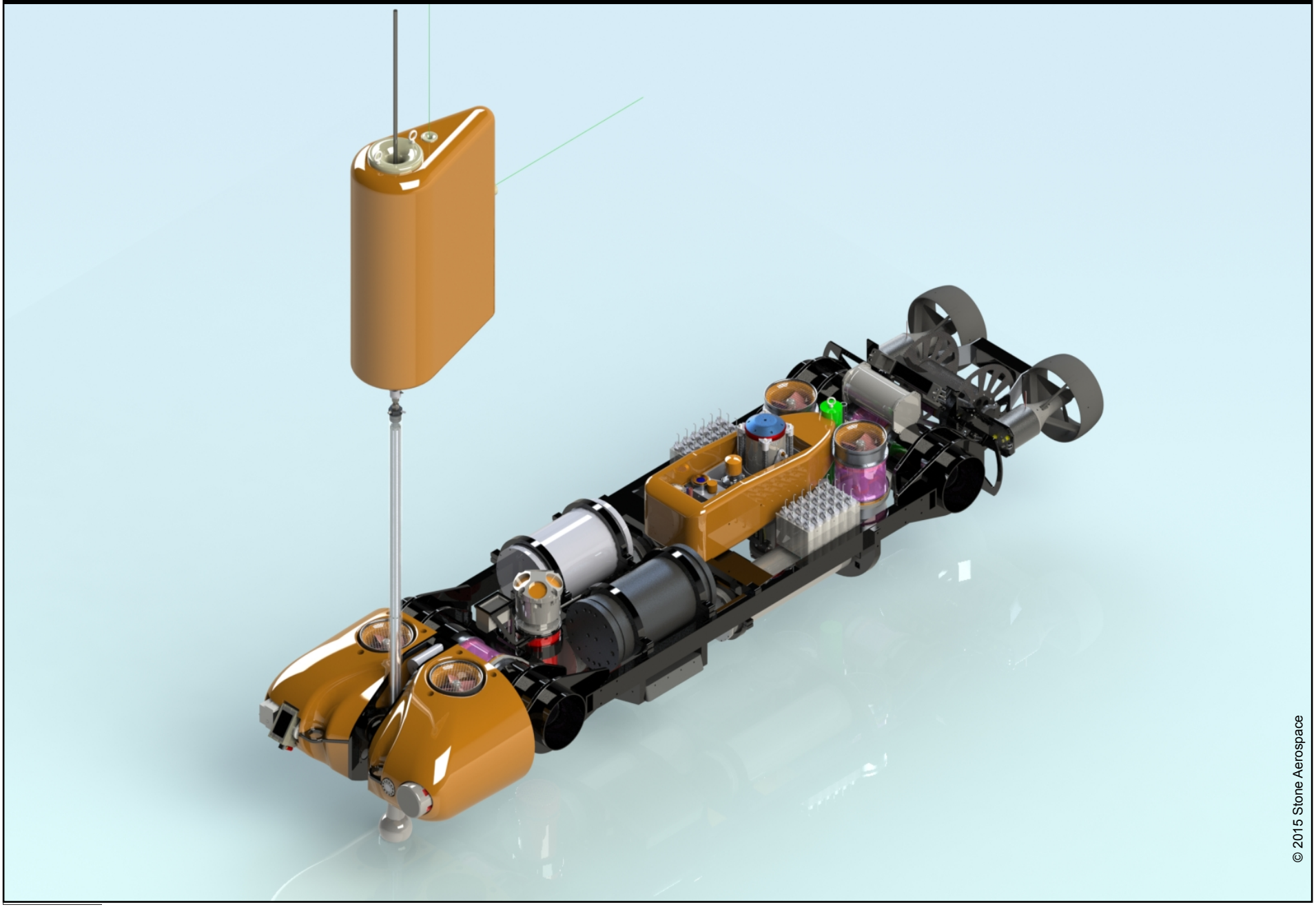
Docking Sequence



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Docking Sequence

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ARTEMIS Vehicle

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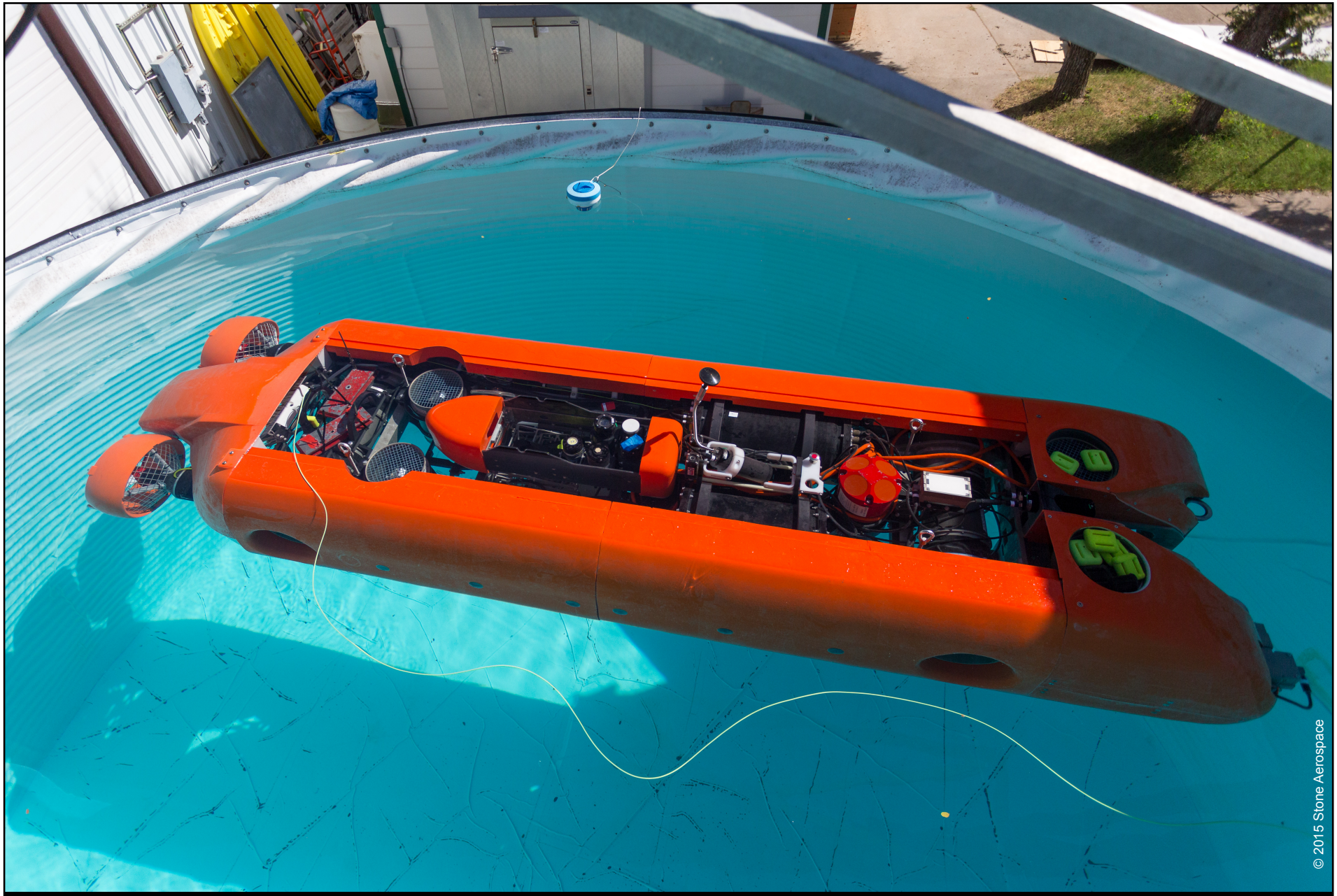

Ballasting in Saltwater Tank

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First Lake Tests

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Acknowledgements

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Peter Kimball	Mark Scully	Jason Kapit
Keith Huffstutler	Chad Kassem	Loral O'Hara
Justin Smith	Ricky Lenhart	Brian Pease
John Harman	Evan Clark	Pamela Minor
Bill Storage	Joshua Moore	Bill Stone

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