
2013-2022
NTNU Centre for Autonomous Marine Operations and Systems
Norwegian Centre of Excellence
2016-10-26
AMOS

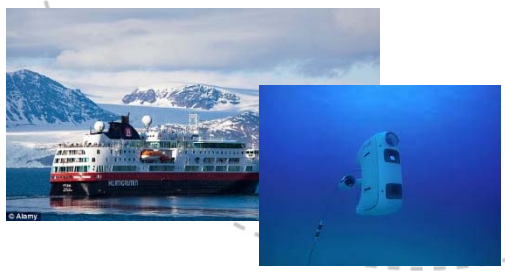
Ocean Space - The blue economy

Shipping

Ocean Science and Management

Marine mining

Tourism and consumer market

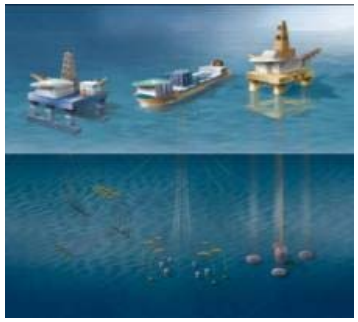


Offshore renewable energy

SUPER CLUSTER

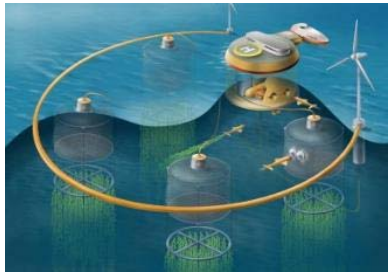
Fisheries

Coastal infrastructure



Oil & gas in deeper water…

…. and in Arctic areas



Aquaculture and biological production

UN sustainable development:
17 goals for 2030 to transform our world

- In September 2015, a new sustainability agenda set goals to **end poverty**, **protect the planet**, and **ensure prosperity for all**
- Each goal has specific targets to be achieved over the next 15 years
- For the goals to be reached, everyone needs to participate: governments, the private sector, civil society and people like you

SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD

Source: http://www.un.org/sustainabledevelopment/sustainable-development-goals/

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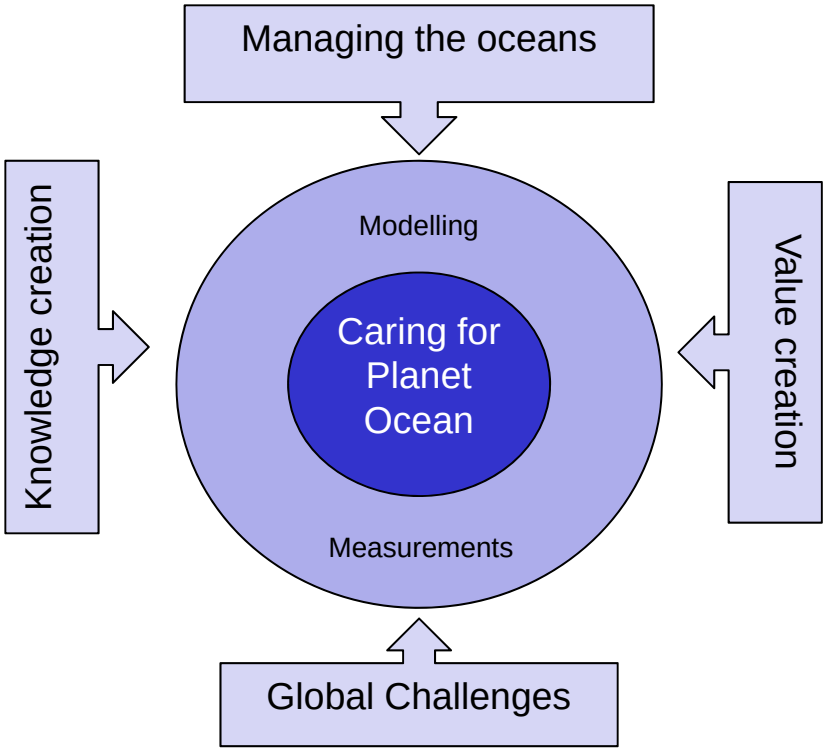
Sustainability by a holistic approach

"If you can measure you can manage":
Politics, regulations, social acceptance, ethics, accept criteria, standards, certification

- Education
- Research
- Knowledge
- Visualization ("seeing is believing")



- Shipping
- New transport routes in the Arctic
- Fisheries and aquaculture
- Oil and gas
- Marine minerals
- Offshore renewable energy
- Bio prospecting
- Tourism

The humanity is facing increasing global challenges such as global warming, deteriorating ecosystems, population explosion and lack of energy, food, water and minerals

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NTNU AMOS Facts and Figures (Phase 1: 2013-2017)

Personnel by October 2016:

6 Key scientists/professors
2 Scientific advisors/professors
10 Adjunct professors
13 Affiliated professors
9 Post Docs/researchers
5 visiting profs./researchers
87 PhD candidates
2 administrative staff
2 + lab engineers
3 Spin off companies

Partners and collaborators:

Partners: The Research Council of Norway, NTNU, Statoil, DNV·GL, MARINTEK SINTEF, SINTEF

International collaborators from: Denmark, Sweden, Portugal, Italy, Croatia, USA, Australia, Ukraine, the Netherlands

National collaborators: University of Tromsø, UNIS, UNIK, Kongsberg Maritime, Rolls-Royce Marine, FMC, Ecotone, Maritime Robotics, FFI, NGU, Ulstein Group, Eelume, NORUT, Marine Technologies, Akvaplan Niva, …

Budget (10 years): 800+ MNOK (~95 MEUR)

Norwegian Centre of Excellence

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NTNU AMOS Facts and figures (2013-2015)

	2013	2014	2015	Accum.
Cost (direct and indirect) - MNOK	24	40,7	70,6	135,3
Graduated PhD AMOS +CeSOS/AMOS SUM	-	5 + 8	5 + 4	10 +12 =22
Graduated MSc	38	88	63	189
Books	-	2	-	2
Journal papers	14	61	95	170
Book chapters	2	2	3	7
Conference papers	60	120	151	321
Keynotes and plenaries	2	12	11	25
Other dissemination (Media, talks)	31	55	73	159
Start-up companies	0	1	2	3

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Future ambition: Key Performance Indicators (KPI)

KPI 2013-2022	Application goals	Stretch targets (2013)	Status 2013-2015
PhDs (3 man years)	60	100	81
Postdocs (2 man years)	15	20	5
New professors	4	4	3
Adjunct professors	4	6	11
Affiliated professors	-	10	13
MSc	200	300	189
Conference papers	600	800	322
Journal papers incl. book chapters	400	500	170
Textbooks	-	6	2
Research	600 MNOK	1 Billion	800 MNOK

NTNU AMOS targets research projects up to NOK 1 Billion in the period of 2013-2022

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International Collaborators

- Universities and research organizations

1. University of Newcastle, Australia
2. Technical University of Denmark
3. University of Zagreb, Croatia
4. University of Rijeka, Croatia
5. CNR-INSEAN, Italy
6. Universita` di Cassino e Lazio Meridionale, Cassino, Italy
7. Eindhoven University of Technology, Netherlands
8. Instituto Superior Técnico, Portugal
9. University of Porto, Portugal
10. National University of Singapore
11. University of Linköping, Sweden
12. National Academy of Science of Ukraine, Ukraine
13. University of California Berkeley, USA
14. University of California Santa Barbara, USA
15. University of Delaware, USA
16. Woods Hole Oceanographic Institution, USA
17. Jet Propulsion Laboratory, NASA, USA

Industrial collaborators

- when acting as partner in associated projects

1. Akvaplan Niva
2. Blueye
3. Ecotone
4. Eelume
5. FMC Technologies
6. Kongsberg Maritime
7. Marine Technologies
8. Maritime Robotics
9. NGU
10. NORBIT
11. NORUT
12. Norwegian Defence Research Establishment (FFI)
13. Rolls-Royce Marine
14. UNIS: The University Centre in Svalbard
15. University of Tromsø, The Arctic University of Norway
16. Ulstein Group

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PHOTO GALLERY

Key Scientists


Prof. Asgeir J. Sørensen, Director


Prof. Thor I. Fossen, Co-director


Prof. Jørgen Amdahl


Prof. Marilena Greco


Prof. Tor Arne Johansen


Prof. Kristin Y. Pettersen

Post-docs


Dr Konstantin Amelin


Dr Andrea Cristofaro


Dr Ekaterina Kim

Adjunct professors and adjunct associate professors


Adj. ass. prof. Erin E. Bachynski


Prof. Mogens Blanke


Adj. prof. Arne Fredheim


Adj. ass. prof. Martin Føre


Adj. ass. prof. Vahid Hassani


Prof. Jørgen Juncher Jensen


Adj. prof. Claudio Lugni


Adj. ass. prof. Ulrik Dam Nielsen


Adj. ass. prof. Nadezda Sokolova


Adj. ass. prof. Rune Storvold

Affiliated scientists


Ass. prof. Jo Arve Alfredsen


Dr Morten Breivik


Ass. prof. Edmund Brekke


Prof. Zhen Gao


Prof. Lars S. Imsland


Prof. Geir Johnsen


Prof. Trygve Kristiansen


Dr Pål Liljebäck


Prof. Martin Ludvigsen


Dr Konstantinos Michailidis


Prof. Ingrid Schjølberg


Prof. Roger Skjetne


Prof. Oleksandr Tymokha


Prof. Ingrid B. Utne

Senior scientific advisers

Prof. Odd M. Faltinsen

Prof. Torgeir Moan

Administration

Annika Brennvåg

Sigrid Bakken Wold

2016

PhD candidates

NTNU AMOS Values

Excellent – generous - courageous

Fremragende – raus – modig

Motto:
“A lively scientific heart giving sustainable value to society.”

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Safer, smarter and greener

How to design and operate hybrid power plants and propulsion systems on offshore ships using LNG, batteries and diesel engines reducing energy consumption and emissions by a fraction with 70-80% reduction of todays solutions?

How to contribute to standards, rules and regulations by class, authorities and industry that enables the next generation of safer, smarter and greener ships with the next level of autonomy?

How to contribute to develop Trondheim's fjord and close by area to be the leading test arena for autonomous marine operations and systems?

New industrial era by Autonomous Unmanned Vehicle Systems

How to develop autonomous sensors and sensors platforms – small satellites, unmanned aerial vehicles, unmanned ships and underwater vehicles, buoys - in air, sea surface and underwater for ocean mapping and monitoring?

How to reduce use of surface vessels with 80% in offshore oil and gas operations?

How to ramp up mapping and monitoring coverage 10 times with a cost of 1/10?

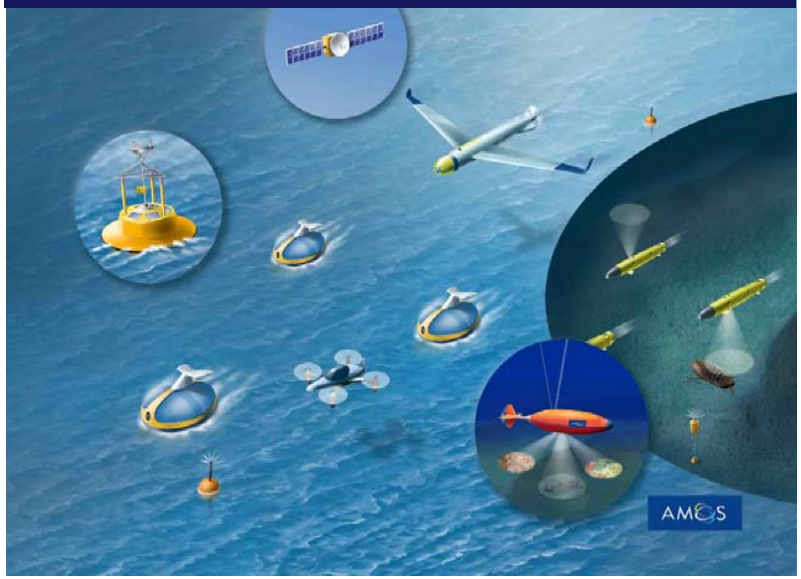
How to enable Norwegian public management agencies to pilot and invest in new sensor and technology platforms

AMOS

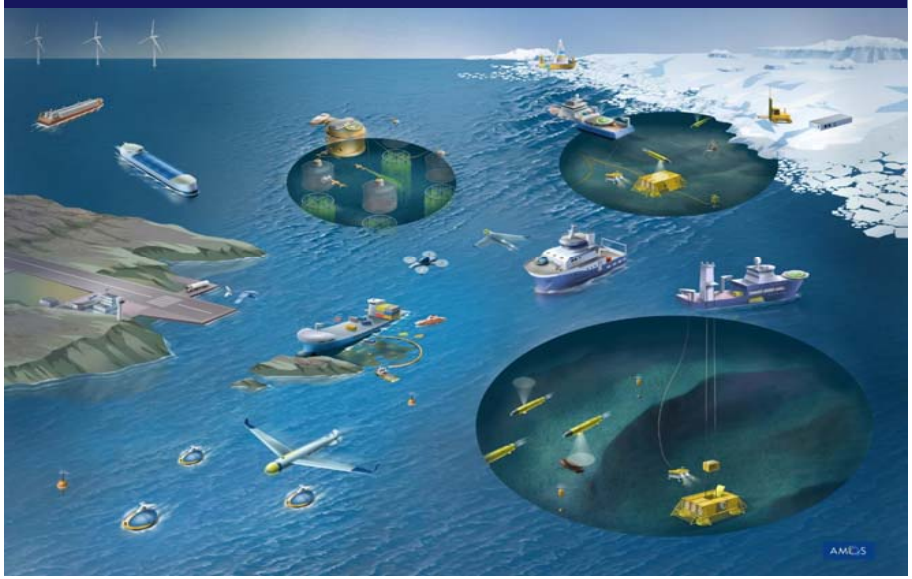
NTNU AMOS Research Areas

Ocean space: The blue economy

Autonomous unmanned vehicles and operations



Smarter, safer and greener marine operations and systems



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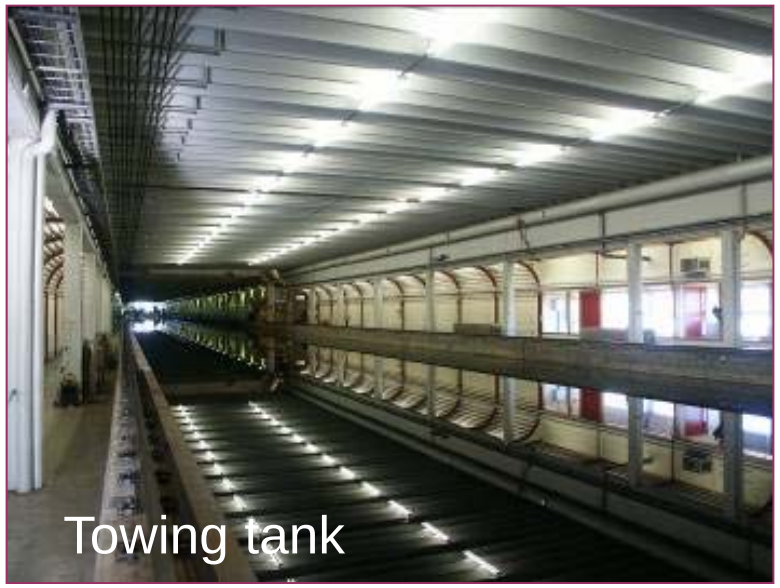
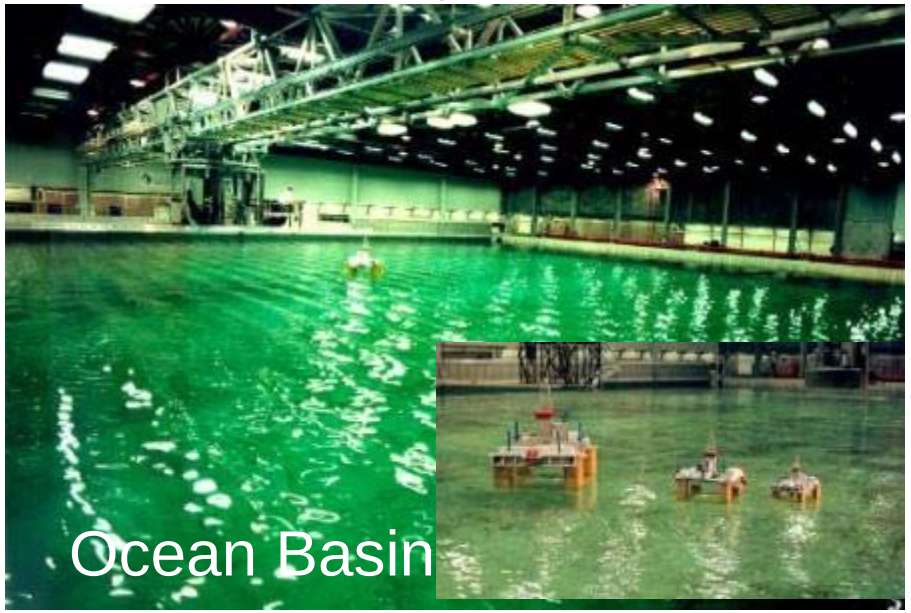
Hydrodynamic Laboratories


Towing tank


Ocean Basin


Marine Cybernetics Laboratory


Research vessel ”Gunnerus”

Other specialized experimental facilities (e.g. for sloshing tests)

NTNU AUR-Lab and UAV-Lab: Integrated technology platform for ocean space research

Air:

Penguin B fixed-wing UAV
X8 fixed-wing UAV
Hexa-copters

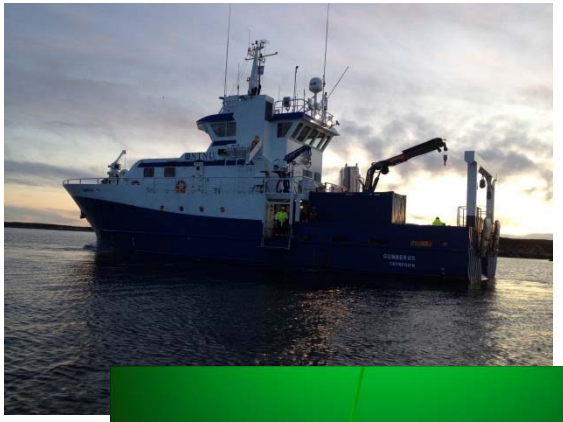
Sea surface:

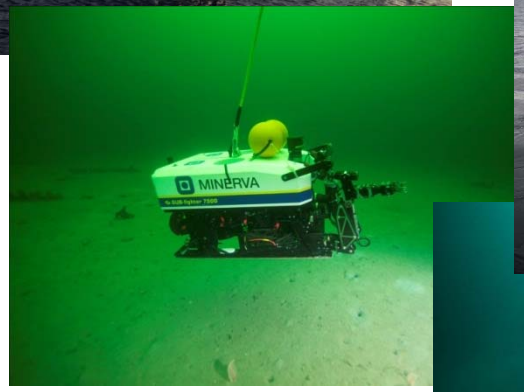
Manned vessel – Gunnerus
Unmanned vessel – Jetyak

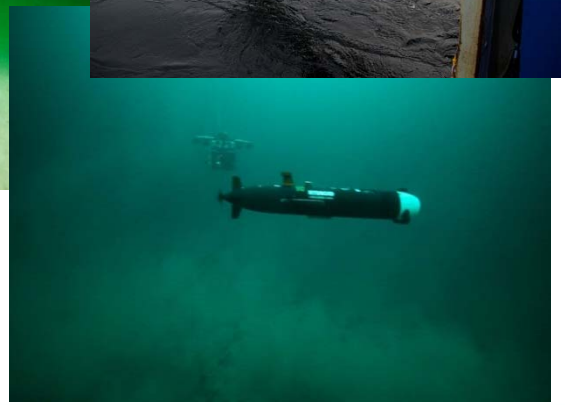
Underwater:

ROV Minerva
ROV 30k
ROV SEABOTIX
AUV Remus 100
HUGIN HUS
2 LAUVs




30 September 2016

Test site opens for unmanned vessels

The Trondheim Fjord in Norway will be the world's first technological playground for pilotless vehicles that move below, on and above the water's surface.

Norwegian authorities, industry, research and universities are behind this

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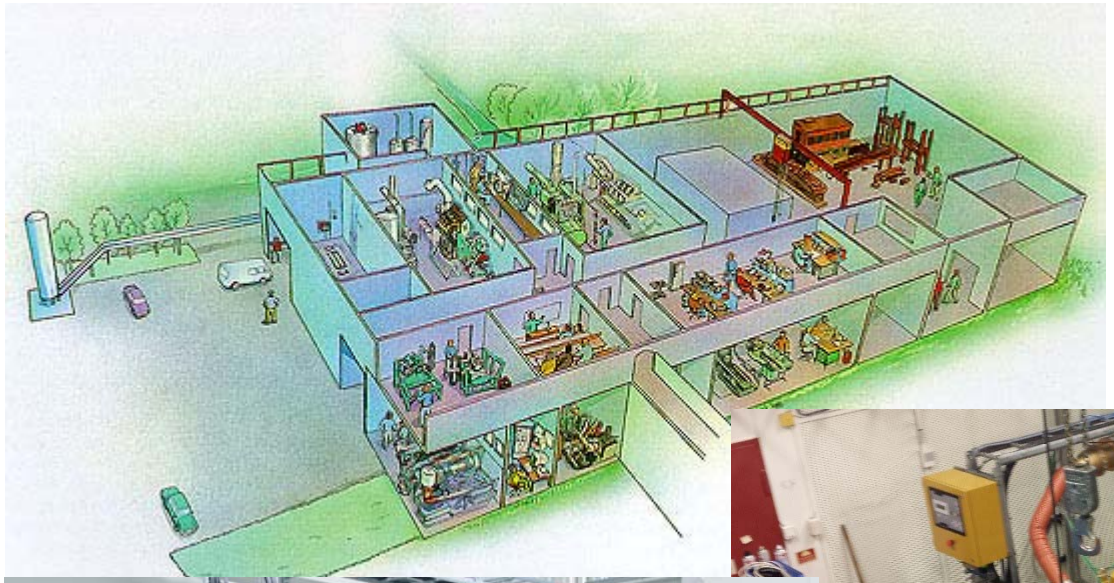
Marine Machinery and Hybrid Power Laboratories



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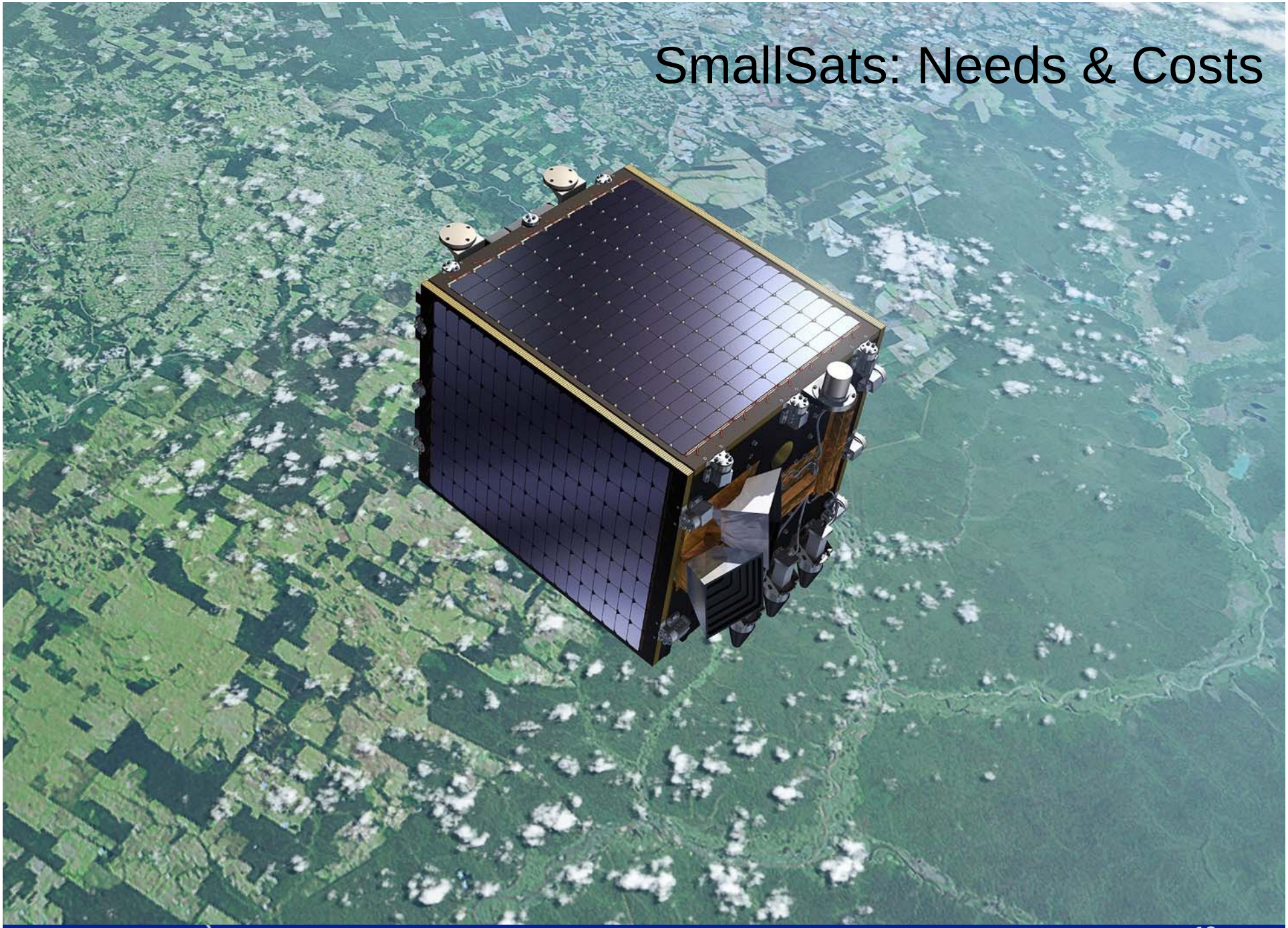
SmallSats: Needs & Costs



Why SmallSats?

- Norway is ocean-facing
- At the bleeding-edge of observing climate change
- Harsh open water conditions
- Substantial needs in security for the homeland

- Cost-effective means to continuously observe and monitor necessary
- Implications to
    1. science
    2. fisheries and commercial entities
    3. maritime security including pollution (natural/anthropogenic)
    4. STEM and pedagogical outreach for generating new skills

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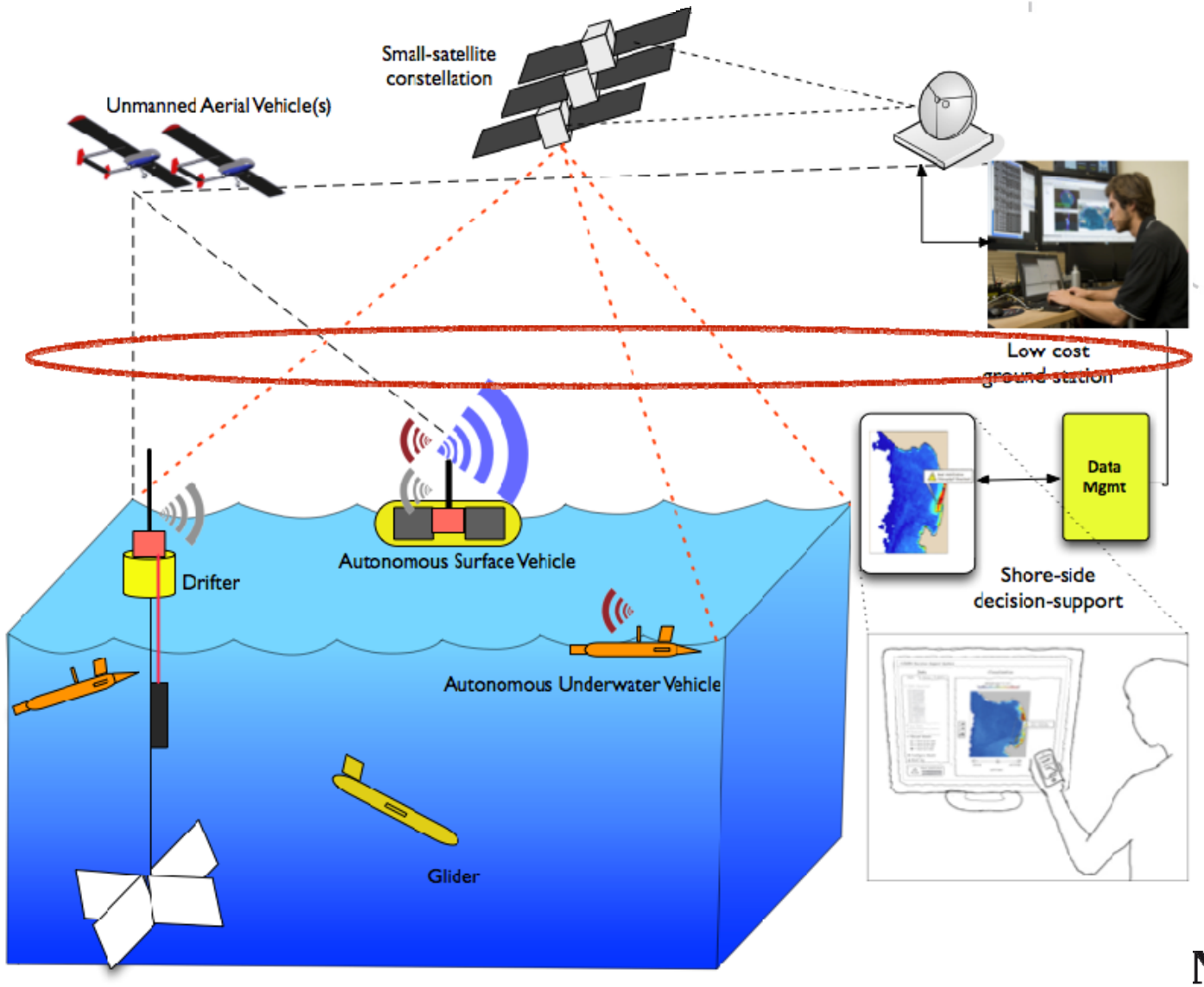
Autonomous vehicles in network



Coordinated co-temporal observations from diverse platforms

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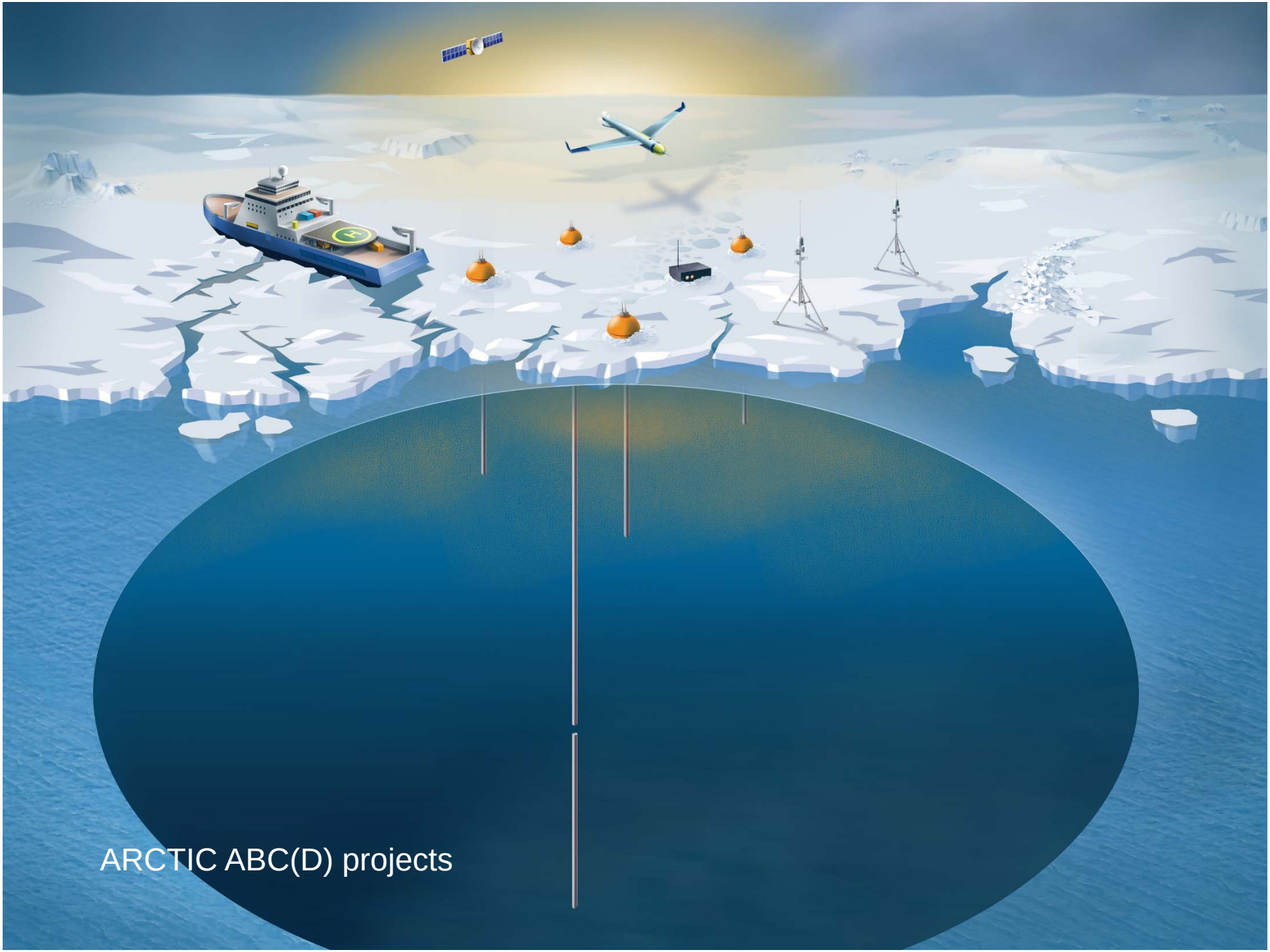
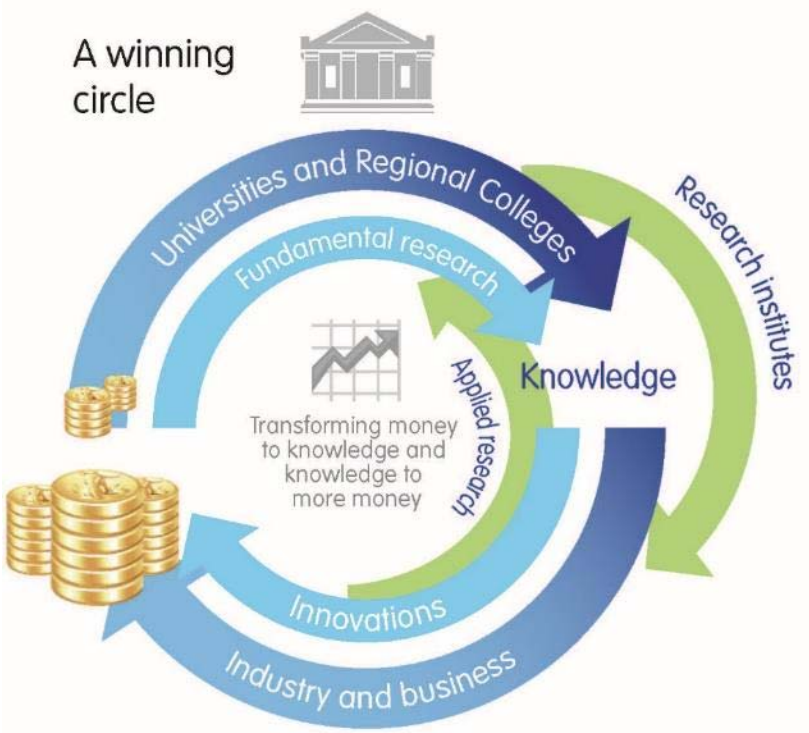
NTNU AMOS has together with UiT, UNIS, NORUT become a key national player in Arctic research

ARCTIC ABC(D) projects


ARCTIC ABC(D) projects

NTNU AMOS creates innovations for

- Industry partners and collaborators
- Universities and research institutes
- Governmental agencies
- New industry – company spinoffs



New method, product or process that are **valuable** and **taken in use**

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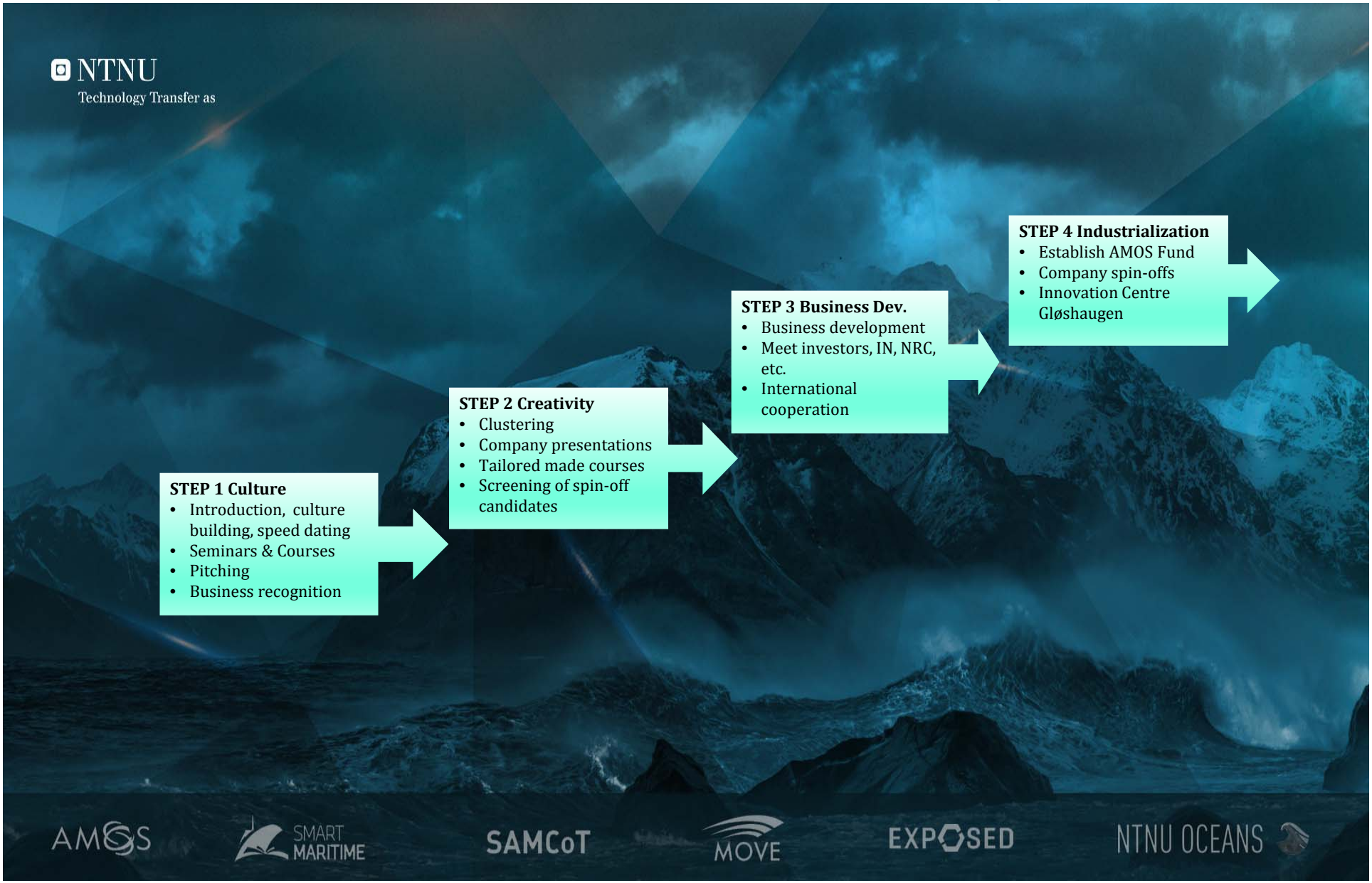
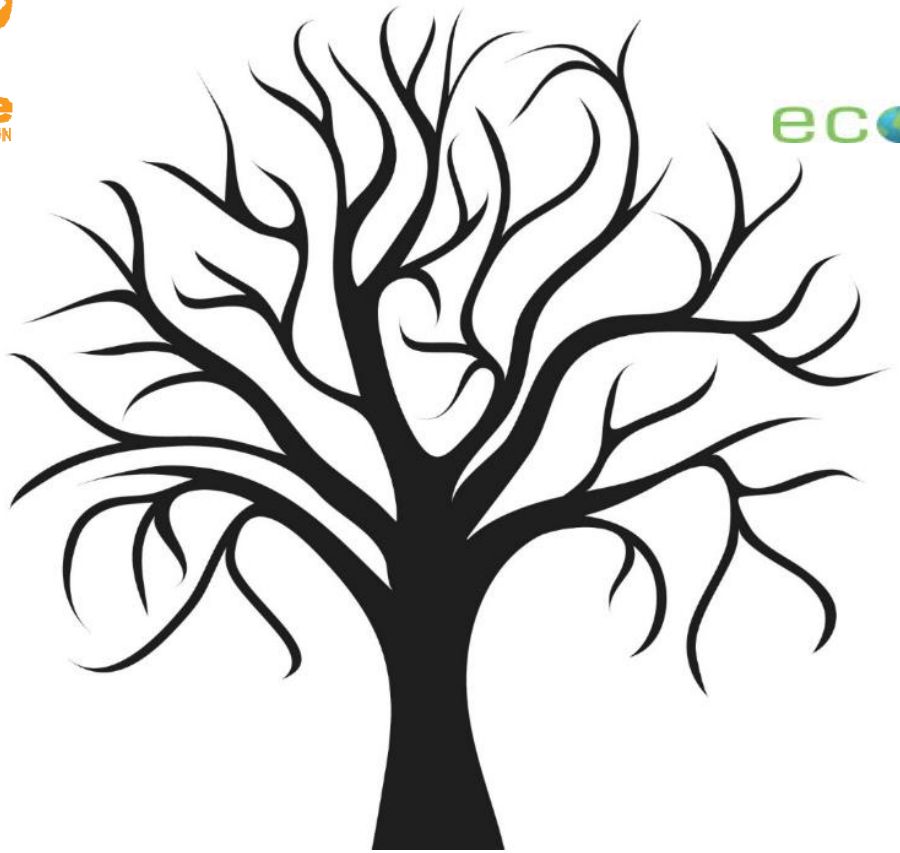
OCEAN SCHOOL OF INNOVATION



NTNU
Technology Transfer as

Creating value from research results and good ideas

NTNU Research Centre of Excellence Spin-offs
(CeSOS, NTNU AMOS)



Eelume
SUBSEA INTERVENTION

BluEye

ecotone

Norwegian Subsea

MARINE CYBERNETICS
a DNV GL company