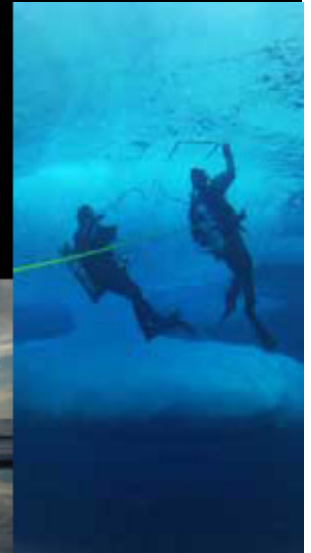


OCRT  
2016

**Arctic - COLORS**  
*Coastal Land Ocean Interactions*



## ***ARCTIC-COLORS implementation strategy***



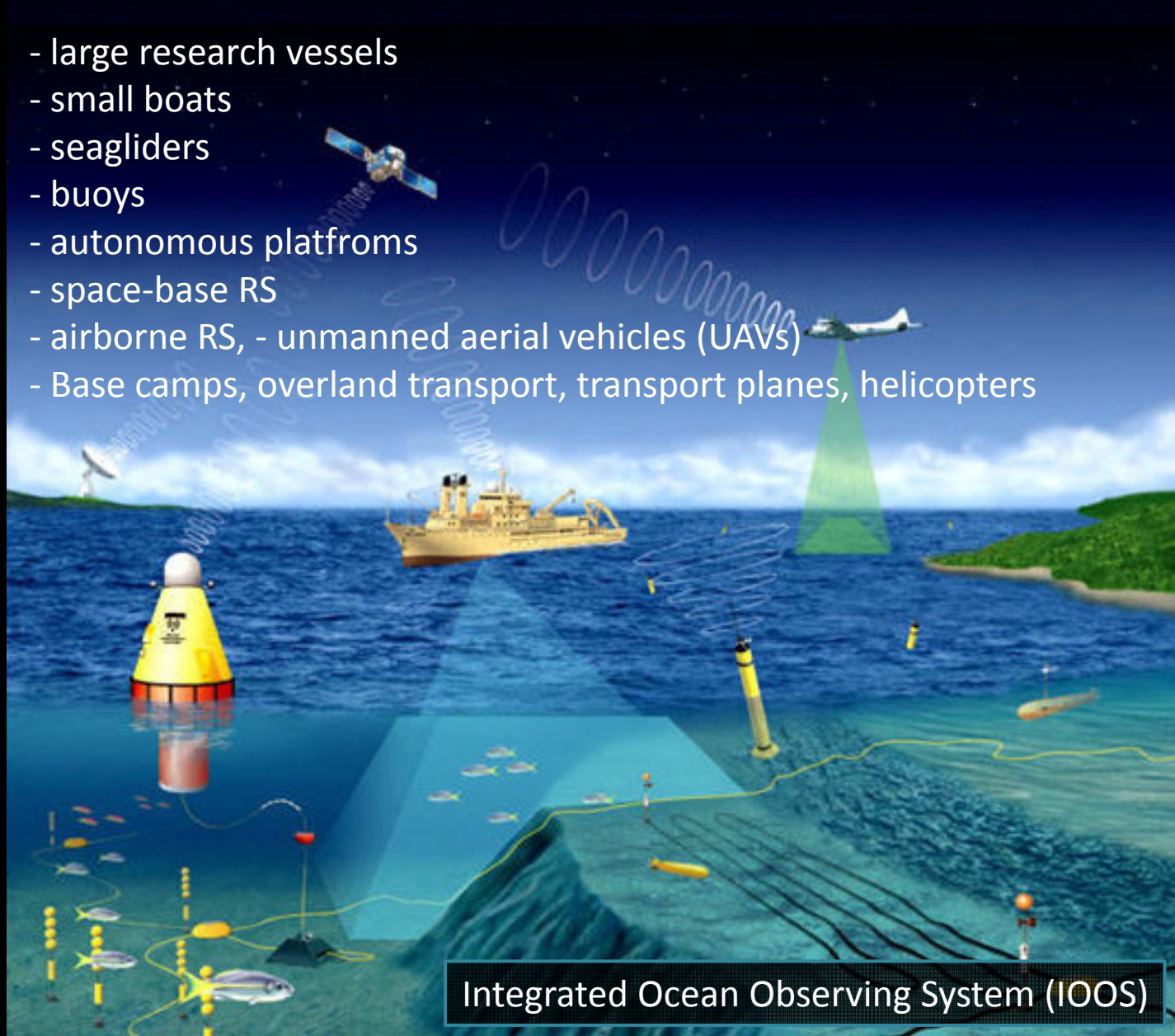
- High level considerations
- Implementation schedule discussion
- Jump starting Arctic Colors
- Sampling campaign logistics on land and water
- Other

# Consideration 1: many assets to coordinate and fund Arctic - COLORS

*Coastal Land Ocean Interactions*



- large research vessels
- small boats
- seagliders
- buoys
- autonomous platforms
- space-base RS
- airborne RS, - unmanned aerial vehicles (UAVs)
- Base camps, overland transport, transport planes, helicopters



Integrated Ocean Observing System (IOOS)



# Integrative Observational Approach

Arctic - COLORS  
*Coastal Land Ocean Interactions*



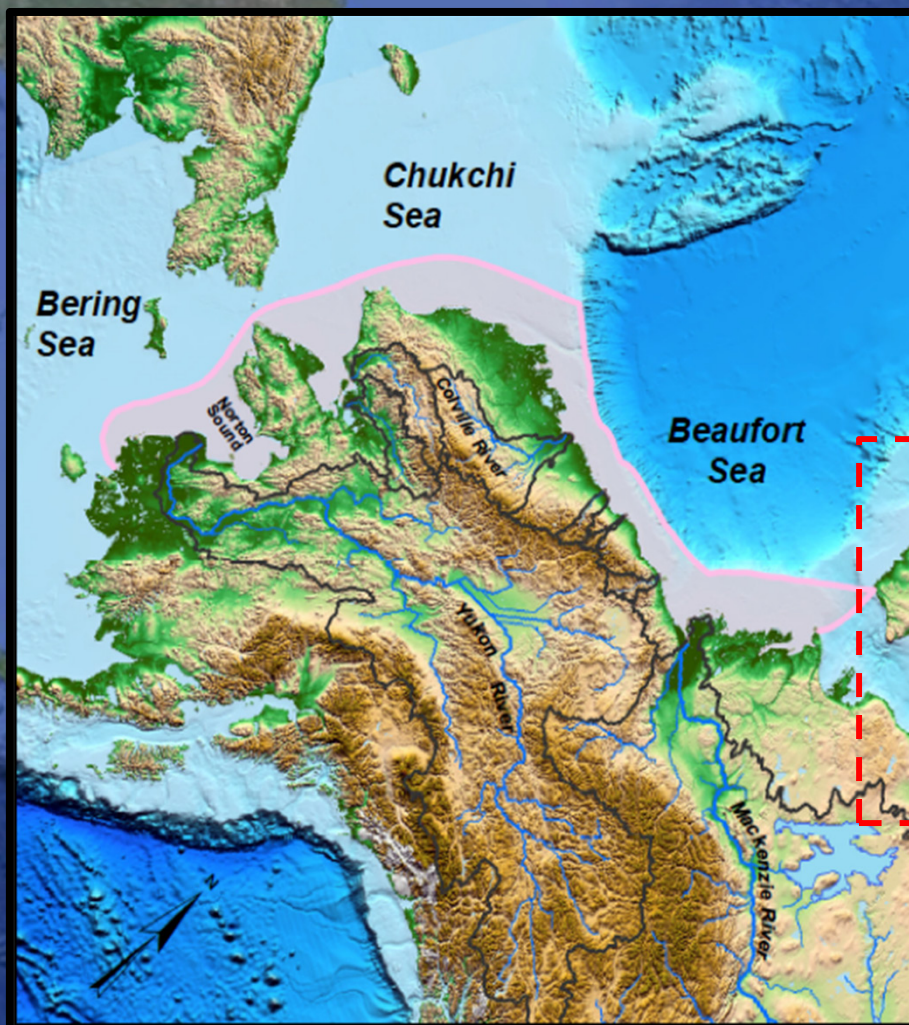
- **Not a traditional oceanographic campaign with a few major cruises**
- Diverse array of measurement approaches proven to be effective in the Arctic for **year-round measurements and sampling**
  - Ice camps, ATVs, sleds (lower river, delta, landfast ice regions)
  - Small boats and small ships (lower river to nearshore seas)
  - Medium and large icebreakers (nearshore to outer shelf seas)
    - Deployable small vessels for shallow-water and near ice work
  - Helicopter-enabled sampling
  - Moorings, floats, buoys, gliders and other autonomous vehicles
  - Airborne and satellite remote sensing

Benthic Community Dynamics

Float



## Consideration 2: large spatial extent



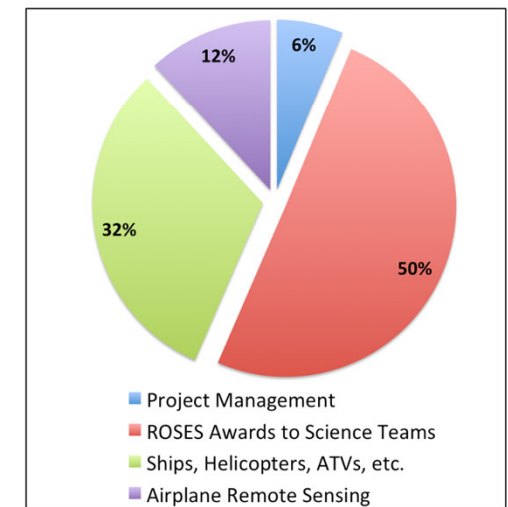
*Victoria and Banks  
Islands in the Canadian  
Archipelago - CHARS*  
(CHARS: Canadian High  
Arctic Research Station)  
Polar Knowledge Canada  
Program



## Consideration 3: Budget - PI Leadership will be key

Table 5.1. Summary of Costs for Arctic-COLORS. See § 8.1 for details.

Category	Cost (\$K)
ROSES Awards to Science Teams <i>(Pre-Arctic-COLORS, Field Campaign and Modeling, and Synthesis)</i>	40,050
Ships, Helicopters, All-Terrain Vehicles	25,173
Airplane Remote Sensing	9,480
Project Management	5,000
<b>TOTAL Costs of Arctic-COLORS</b>	<b>79,703</b>



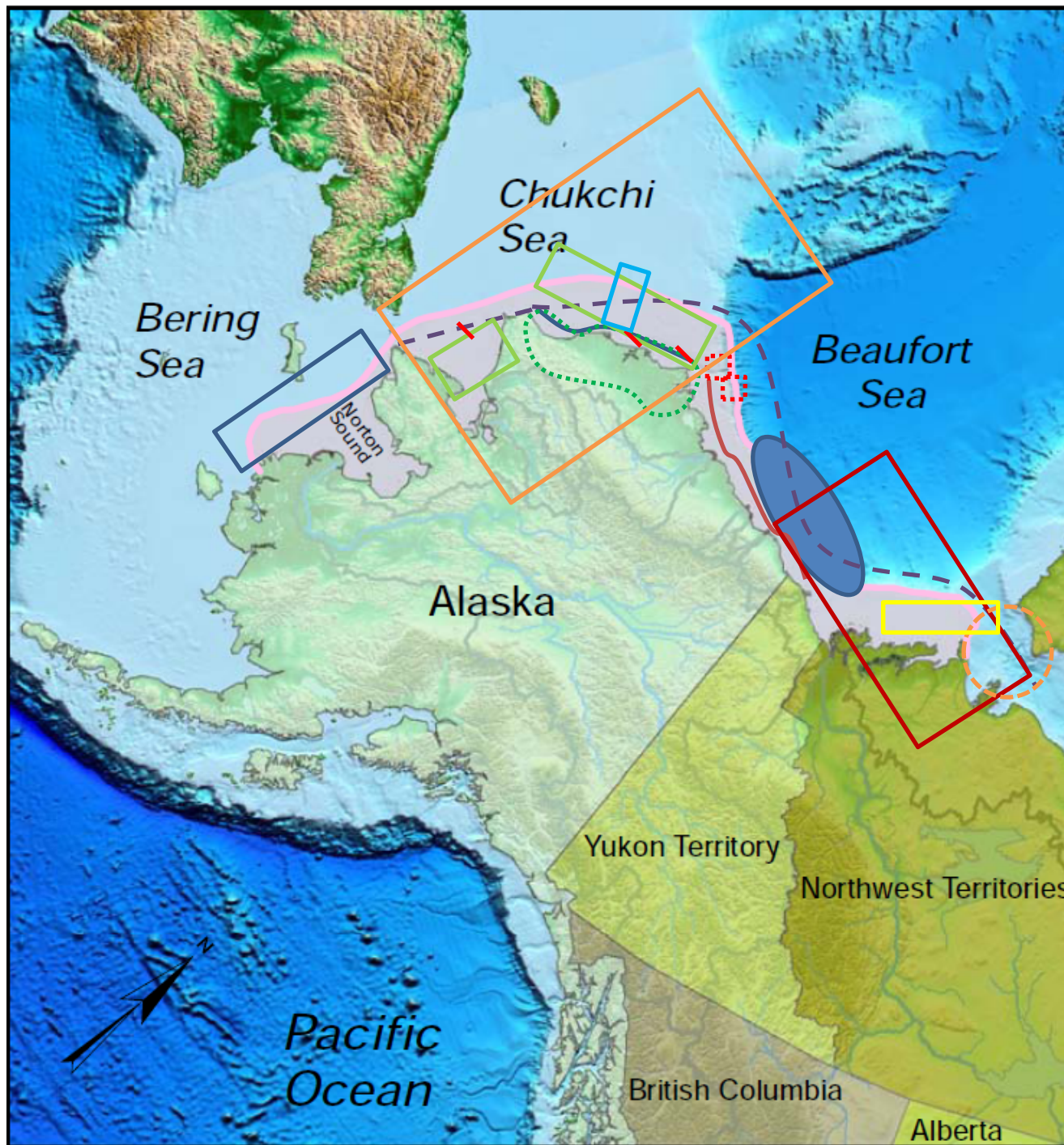
## Slide 5

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**1**

Joe Salisbury, 7/22/2016





## Consideration 4: Upcoming and ongoing Arctic research in the Arctic Colors Neighborhood

- AIDJEX
- (c)ANIMIDA (1999-07)
- BEST
- C3O (2009)
- CASES (2002-04)
- CFL
- COMIDA
- CSESP (2008- )
- ICESCAPE
- Malina
- SBI (2000-08)
- SNACS (2005-06)
- 
- Current/New:
- ABoVE
- AKMAP (2010-12)
- AMBON
- DBO
- MARES

## Consideration 4: Upcoming and ongoing Arctic research in the Arctic Colors Neighborhood

Table 5.1 Timeline of Ongoing and Upcoming Arctic Observing Programs

Project	Region	2016	2018	2020	2022	2024	2026	2028
AMBON	Chukchi	...	→					
DBO	Bering, Chukchi and Beaufort shelves	...	→					
RUSALCA	Chukchi- E. Siberian Sea	...	→					
Beaufort Gyre	Beaufort	...	→					
MARES NOPP PARTNERSHIP	Coastal Beaufort	...	→					
Arctic-COLORS	Coastal zone between Mackenzie and Yukon R.		←→					
ABoVE	Canadian Arctic and Alaska boreal and tundra	←→						
NPRB	Chukchi	←→						
Sentinelle Nord		←→						



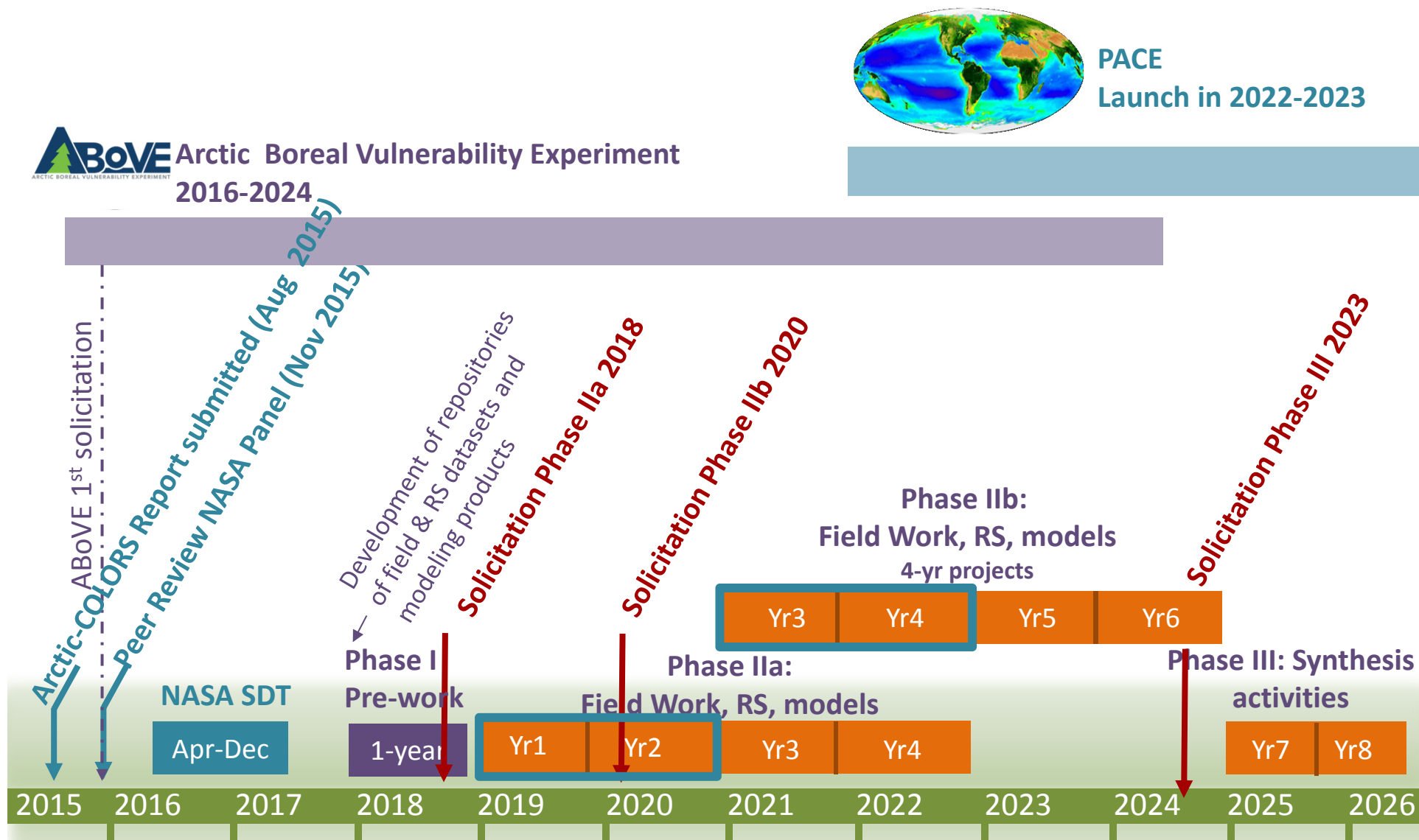


8-12 November 2015 • Portland, OR  
Grand Challenges in Coastal & Estuarine Science: Securing Our Future

**Arctic - COLORS**  
*Coastal Land Ocean Interactions*



## Former Notional Timeline for Arctic COLORS



# Notional Timeline

Arctic - COLORS  
*Coastal Land Ocean Interactions*

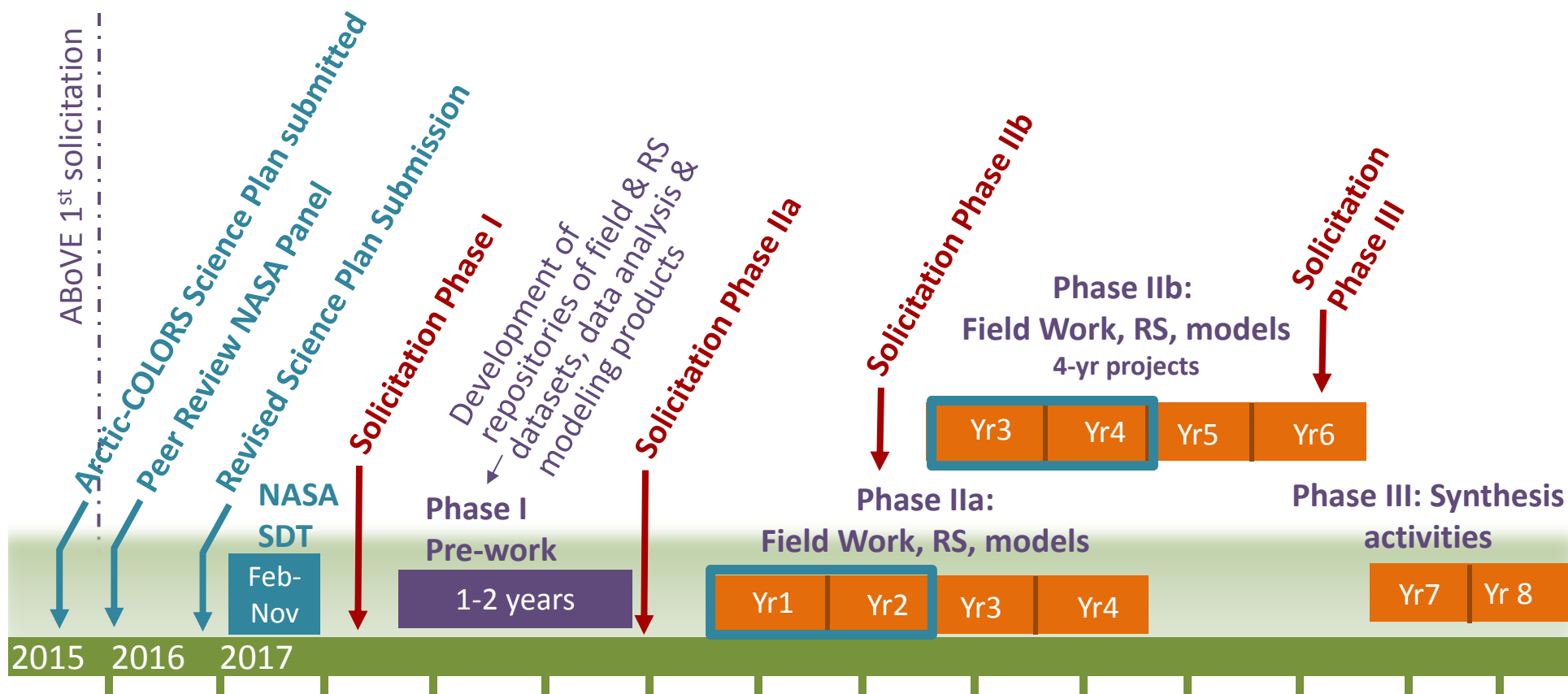


Launch  
in ~Aug. 2022



Arctic Boreal Vulnerability Experiment 2016-2024

Sentinel North (U. Laval, Canada) ~2017-2023





## Ships and boats

CCGS Amundsen



USCGC Healy



Northern Transportation Company



CCGS Louis St. Laurent



UNOLS Sikuliaq





Table 5.2. List of Potential Research Vessels and Costs for Consideration

Research Vessel	Details	Cost US K\$/day	Contact Information
<b>Private vessels</b>	32 ft (out of Barrow)	\$5.5	<p>Able coastal vessels are available at a lower cost than the larger ice-capable vessels</p> <p><a href="http://www.norsemanmaritime.com/">http://www.norsemanmaritime.com/</a></p> <p><a href="http://www.ntcl.com">http://www.ntcl.com</a></p> <p><a href="http://www.rvannikamarie.com/">http://www.rvannikamarie.com/</a></p> <p>Details on vessel, port and cost from C. Polashenski.</p>
	77 ft (out of Russian Mission)	\$8.8	
	132 ft (out of Prudhoe Bay)	\$28	
<b>USCGC Healy</b>	Berth space for 50 scientists	~\$50	<a href="http://www.uscg.mil/pacarea/cgcHealy/">http://www.uscg.mil/pacarea/cgcHealy/</a>
<b>UNOLS R/V Sikuliaq</b>	Berth space for ~25 scientists	~\$45	<p><a href="https://www.sikuliaq.alaska.edu/">https://www.sikuliaq.alaska.edu/</a></p> <p>Owned by the National Science Foundation and operated by the University of Alaska Fairbanks</p>
<b>CCGS Sir Wilfrid Laurier</b>			<a href="http://en.wikipedia.org/wiki/CCGS_Sir_Wilfrid_Laurier">http://en.wikipedia.org/wiki/CCGS_Sir_Wilfrid_Laurier</a>
<b>CCGS Louis S. St. Laurent</b>			<a href="http://en.wikipedia.org/wiki/CCGS_Louis_S._St-Laurent">http://en.wikipedia.org/wiki/CCGS_Louis_S._St-Laurent</a>
<b>CCGS Amundsen</b>		~\$60	<a href="http://www.amundsen.ulaval.ca/">http://www.amundsen.ulaval.ca/</a>
<b>I/B Oden</b>			<p><a href="http://en.wikipedia.org/wiki/Oden_(1988_icebreaker)">http://en.wikipedia.org/wiki/Oden_(1988_icebreaker)</a> and <a href="http://polar.se/en/om-oss/forskningsplattformar/fartyg/">http://polar.se/en/om-oss/forskningsplattformar/fartyg/</a></p> <p>Operated by the Swedish Polar Research Secretariat</p> <p><a href="http://www.sprs.org">http://www.sprs.org</a></p>
<b>RV Araon</b>			<p><a href="http://en.wikipedia.org/wiki/RV_Araon">http://en.wikipedia.org/wiki/RV_Araon</a> and <a href="http://eng.kopri.re.kr/home_e/contents/e_3400000/view.cms">http://eng.kopri.re.kr/home_e/contents/e_3400000/view.cms</a></p>



## **Other discussion topics**

**1. Logistics: what have we missed that may affect the budget or timing**

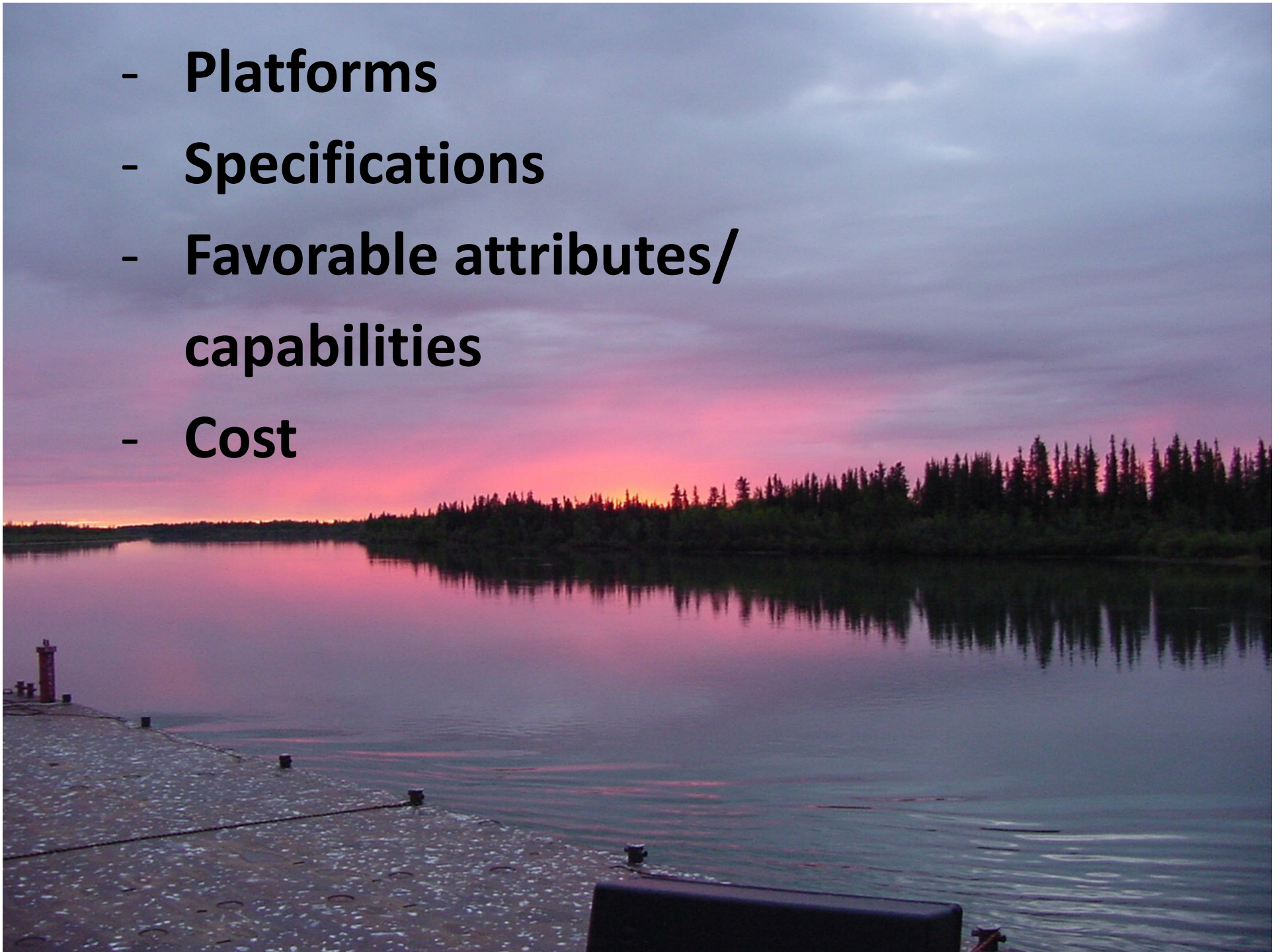








- **Platforms**
- **Specifications**
- **Favorable attributes/  
capabilities**
- **Cost**





# CCGS Amundsen







## Technical Characteristics

The Canadian research icebreaker CCGS *Amundsen* is a Class-1200 medium-size icebreaker based in Quebec City, Canada. The electric diesel engines of the CCGS *Amundsen*, which generate 11 155 kW, and the adjusted shape of the hull allows for navigation at 3 knots in more than 1 metre thick ice. The vessel was designed to have great autonomy at sea: it can travel 15 000 nautical miles at cruising speed without calling port. The CCGS *Amundsen* is an efficient, versatile and cost-effective ship to conduct scientific research of international calibre in the Canadian Arctic.

- |  |   |
|--|---|
| ☞ Name: CCGS <i>Amundsen</i> (formerly the CCGS <i>Sir John Franklin</i> ) | ☞ Crew: 30 to 40                              |
| ☞ Year built: 1979 (Burrard dry dock, B.C.)                                | ☞ Science berths: 43                          |
| ☞ Year retrofit: 2002-2003 (Les Méchins dry dock, QC)                      | ☞ Deck cranes: 4                              |
| ☞ Ice class: Arctic class 3  | ☞ Helideck/hangar: Yes                        |
| ☞ Overall length (m): 98.33  | ☞ Helicopter: BO 105                          |
| ☞ Breadth (m): 19.51   | ☞ Hydraulic A-frames: 2                       |
| ☞ Draft (m): 7.18  | ☞ Scientific winches: 5                       |
| ☞ Displacement (t): 5 911  | ☞ Acoustic well: Yes                          |
| ☞ Power (kW): 11 155   | ☞ Internal moon pool: Yes                     |
| ☞ Propulsion: 6 diesel electric generators 2950 hp (18 000 hp diesel)      | ☞ Dynamic positioning system: Yes             |
| ☞ Shaft horsepower: 13 960 hp (15 000 hp with overload)                    | ☞ Launches/barge: 3                           |
| ☞ Cruise range (nm): 15 000 @ 14 knots                                     | ☞ Internal communications network             |
| ☞ Maximum speed: 16.5 knots  | ☞ Internet access: Yes (E-mail at sea system) |
| ☞ Maximum capacity: 83 persons   | ☞ NOAA SCS server system                      |





~\$60k/day, but no transit costs if any ongoing work in the Western Arctic

Scheduling: 9 months out minimum, typically 1 year works if you can be flexible

Available in 2017, with some mooring work scheduled in the Beaufort

Laval is applying for Canadian Gov funds to reduce cost of research on the Amundsen

Keith Lévesque <[Keith.Levesque@arcticnet.ulaval.ca](mailto:Keith.Levesque@arcticnet.ulaval.ca)>



CCGS Louis St. Laurent

## ▼ Vessel Specifications

**Length:** 119.6 m

**Breadth:** 24.4 m

**Draft:** 9.9 m

**Freeboard:** 6.4 m

**Gross Tonnage:** 11345.0 t

**Net Tonnage:** 3403.0 t

**Cruising Range:** 23000 nm

**Endurance:** 205 d

**Cruising Speed:** 16.0 kts

**Maximum Speed:** 20.0 kts

**Fresh Water:** 200.00 m<sup>3</sup>

**Fuel Capacity:** 3500.00 m<sup>3</sup>

**Fuel Consumption:** 24.00 m<sup>3</sup>/d



## CCGS St. Laurent

- Large helipad
- Can break more ice (get us there earlier, stay later)
- More endurance
- Expensive (\$95k/day (Can))
- 10m draft, more difficulties close to shore
- Administrative issues



# USCGC Healy





## CGC Healy Ship's Characteristics

Length, Overall	420'0" (128 meters)
Beam, Maximum	82'0" (25 meters)
Draft, Full Load	29'3" (8.9 meters)
Displacement, Full Load	16,000 LT
Propulsion	Diesel Electric, AC/AC Cycloconverter
Generating Plant	4 Sultzer 12Z AU40S
Drive Motors	2 AC Synchronous, 11.2 MW
Shaft Horsepower	30,000 Max HP
Propellers	2 Fixed Pitch, 4 Bladed
Auxiliary Generator	EMD 16-645F7B, 2400kW
Fuel Capacity	1,220,915 GAL (4,621,000 liters)
Cruising Speed	12 knots @ 105 RPM
Max Speed	17 knots @ 147 RPM
Icebreaking Capability	4.5 ft @ 3 knots (continuous) 8 ft (2.44 m) Backing and Ramming
Science Labs	Main, Bio-Chemical, Electronics, Meteorological, Photography
Accommodations	19 Officer, 12 CPO, 54 Enlisted, 35 Scientists, 15 Surge, 2 Visitors





## USCG Healy

- Familiarity (used during ICESCAPES)
- \$60k+/day (not verified, may be more)
- Break ~3m ice if necessary
- Long endurance
- 9+m draft, more difficulties close to shore
- Administrative issues



# UNOLS Sikuliaq





# R/V SIKULIAQ Characteristics

## General Characteristics

Length, Overall	LOA	261 feet
Length, Design Waterline	LWL	237 feet 0 inches
Beam, Max across reamer	Bmax	52 feet
Beam, Max across hull amidship	Bmidship	48 feet
Depth, Keel to Main Deck	D	28 feet
Draft, Design Waterline	TDWL	18 feet 9 inches
Freeboard, Design Waterline	FDWL	8 feet 9 inches
Displacement at Design Waterline		3,665 long tons
Propulsion Power	P	5,750 BHP

## Performance

Endurance	45 days	
Endurance, Hotel Only	60 days	
Range	11 knots	9,000 NM preliminary
Cruise Speed	transit speed	11 knots
Max Speed, Calm Open Water	Vcalm	14.2 knots
Max Speed, 4 M Sea (13.1 ft)	Vss 5	12.3 knots
Level Ice at 2 knots	Ice thickness	3 feet

# Sikuliaq Specs

## Capacities and Working Areas

Science Berths	24
Crew Berths	20 crew plus 2 marine technicians
Science deadweight	100 long tons
Aft Deck 20' ISO Van Services and Twist Lock	3 Fixed locations
Fwd Deck 10' ISO Van Services and Twist Lock	1 Fixed location
Science storage	8,000 cubic feet
Science Labs	2250 square feet
Deck Working Area	4360 square feet

## Consumables

Diesel Fuel, at 95%	170,000 gallons
Fresh Water, at 100%	13,150 gallons
Water making capacity	6,000 gallons/day
Provisions	60 days
Holding capacity	24 hours

# UNOLS Sikuliaq

- Stationed at UAK (Tom W. knows a lot about it!)
- \$39-45/ day (US)
- Light duty icebreaker
- Comes in from the west, so may may be more amenable for shoulder seasons
- State of the art!
- Can serve as hotel
- Only 45 day endurance/ 60 hotel





# NTCL - Northern Transportation Company Limited

## Proud of our Heritage

From 1934 in "Waterways", Alberta to today on the East Coast of Canada, the Western Arctic, and in particular along the Mackenzie River, our roots, not just our name, show who we are and who we serve. Our relationship with the communities we reach each season strengthens both these roots and our responsibility to these customers. As we close in on our 80<sup>th</sup> sealift season, and reflect back on the progress of the North and the promise of the future, NTCL is more committed than ever to relationship building and helping the people and companies of the North succeed in all they do.

Providing innovative, efficient transportation alternatives and great customer service are the hallmarks of our capabilities today and will remain so for the future. Nearly 80 years has taught us a lot and building off what we have learned will help us continue to offer you the best service possible.

## NTCL Mission Statement

*"We proudly deliver northern solutions and opportunities in challenging environments"*

Translate to  
French,  
Inuktitut,  
Inuvialuktun

## Sailing Schedule

**The 2014 Shipping Schedule is now available:**

Latest Schedule Changes:

If you have not requested to be added to our email schedule distribution list please email [kw@ntcl.com](mailto:kw@ntcl.com) with the subject line please add me

**River Schedule 2014-09-26**

**The 2014 Shipping rates are now available:**

**New Flat Rates on Many Commodities!**

**2014 Cargo Rates – All Commodities**

**CONTACT US WITH YOUR LARGE CARGO NEEDS – WE CAN PROVIDE AN ESTIMATE TODAY!**

-

**All NTCL terminals are now open to accept cargo!**

**Driving directions to the Hay River terminal**

## News Articles

**Changes at NorTerra but business as usual for NTCL**  
Changes with NTCL's parent company NorTerra.

Follow this for ...

**NTCL is now on Facebook and LinkedIn!**

NTCL is now on Facebook and LinkedIn!

Like us ...

**New Contact Numbers for Hay River Terminal**

Please be advised – contact numbers for the ...

**[View all articles →](#)**

# Region/ towns served by NTCL





Vessel (click for details)	H.P.	Speed (knots)	O.A. Length	Moulded Breadth	Moulded Depth	Running Draft	Voyage Class	Limitation
<a href="#">M.V. Alex Gordon</a>	7200	15.5	205'	45'	18'2"	14'2"	Home Trade I	Arctic Class 2
<a href="#">M.V. Jm Kilabuk</a>	7200	15.5	205'	45'	18'2"	14'2"	Home Trade I	Arctic Class 2
<a href="#">M.V. Nunakput</a>	4300	12	167'6"	47'9"	10'6"	6'	Home Trade II	Western Arctic – Barrow to Taloyoak
<a href="#">M.V. Pisurayak Kootook</a>	4300	12	160'	40'	10'6"	6'6"	Home Trade II	Western Arctic – Barrow to Taloyoak
<a href="#">M.V. Pat Lyall</a>	4300	12	160'	40'	10'6"	6'6"	Home Trade II	Western Arctic – Barrow to Taloyoak
<a href="#">Vic Ingraham</a>	4500	12	154.6'	50'	9'6"	3'9"	Minor Water I	Great Slave Lake & Mackenzie River
<a href="#">M.V. Edgar</a>	5600	14	153'3'	52'1"	9'6"	3'9"	Home Trade III	Western Arctic – Up to 20 miles offshore
<a href="#">M.V. Henry Christoffersen</a>	4500	14	153'3'	52'1"	9'6"	3'9"	Home Trade III	Western Arctic – Up to 20 miles offshore
<a href="#">M.V. Kelly Ovayuak</a>	5600	14	148'3'	52'1"	9'6"	3'9"	Home Trade III	Western Arctic – Up to 20 miles offshore
<a href="#">M.V. Jock McNiven</a>	4500	14	148'3'	52'1"	9'6"	3'9"	Home Trade III	Western Arctic – Up to 20 miles offshore
<a href="#">M.V. Keewatin</a>	3375	12	126'6"	38'1"	12'1"	8'10"	Home Trade II	Hudson Bay
<a href="#">M.V. Marjory</a>	1100	10	81'1"	29'6"	7'9"	3'6"	Home Trade III	Western Arctic – Up to 20 miles offshore

## NTCL Vessel Specs







## **Northern Transportation Company**

- Extensive river and estuary work experience
- First Nation owned (possibility of contacts/ connections)
- Can accommodate ~12 scientists
- Willing to serve as a hotel or staging platform
- Lab space available/ specifics unknown
- Discussed cost of \$30k/day (Can)

- <http://www.alaskaair.com/content/route-map.aspx?lid =nav:planbook-routeMap>
- <http://www.flyravn.com/flying-with-ravn/route-map/>
- <http://www.flyairnorth.com/Experience/RouteMap.aspx>
- <http://www.canadiannorth.com/route-map-and-flight-schedule>
- <https://firstair.ca/book/routemap/>
- <http://www.fairweather.com/index.html>
- <http://cspolar.com/>
- [http://www.apl.washington.edu/people/profile.php?last\\_name=Heiberg&first\\_name=Andy](http://www.apl.washington.edu/people/profile.php?last_name=Heiberg&first_name=Andy)
- <http://www.uicprofessionalservices.com/ services/category/uic-science/arctic-science-logistics-support/>

**Equipment transport:** Air shipments are typically expensive and each team must budget accordingly. Typical transport rates into Alaskan villages vary between \$0.50/lb and \$1.5/lb, dimensional weight, for parcel size and shape objects, with considerably higher costs for large and irregular items. Large aircraft (e.g. 737 combi's) fly into Barrow, Kotzebue, Nome, and other larger towns in Alaska, enabling most parcels to be moved. However, aircraft size is typically limited to Cessna Caravans (208's) when flying into smaller villages, which substantially limits the maximum size of objects that can be moved to smaller villages. Northern Air Cargo provides jet freight service to larger communities such as Barrow, Nome, and Kotzebue. Several companies, including Northern Air Cargo and Evertts, specialize in bulk cargo, while RAVN and Alaska Airlines have priority parcel moving services. Services are typically available several times a week. Other transfer options include Arctic Air Alaska (<http://arcticairalaska.com>) and Air Arctic (<http://www.airarctic.com/fbo/>), which provide charter air services. Rental costs for vehicles are generally high in Arctic towns and villages. In smaller villages, obtaining a rental vehicle is quite difficult, as many towns do not have a dedicated business for renting equipment. In these instances, it is sometimes possible to rent personal vehicles and transport services. Several companies including Northern Transportation Company Limited (<http://www.ntcl.com>) also provide coastal and river shipping during ice-free periods in the Mackenzie River basin, which is a viable option for moving larger equipment to most small villages. If larger vessels are used, some cargo can be loaded at their homeports prior to the field season