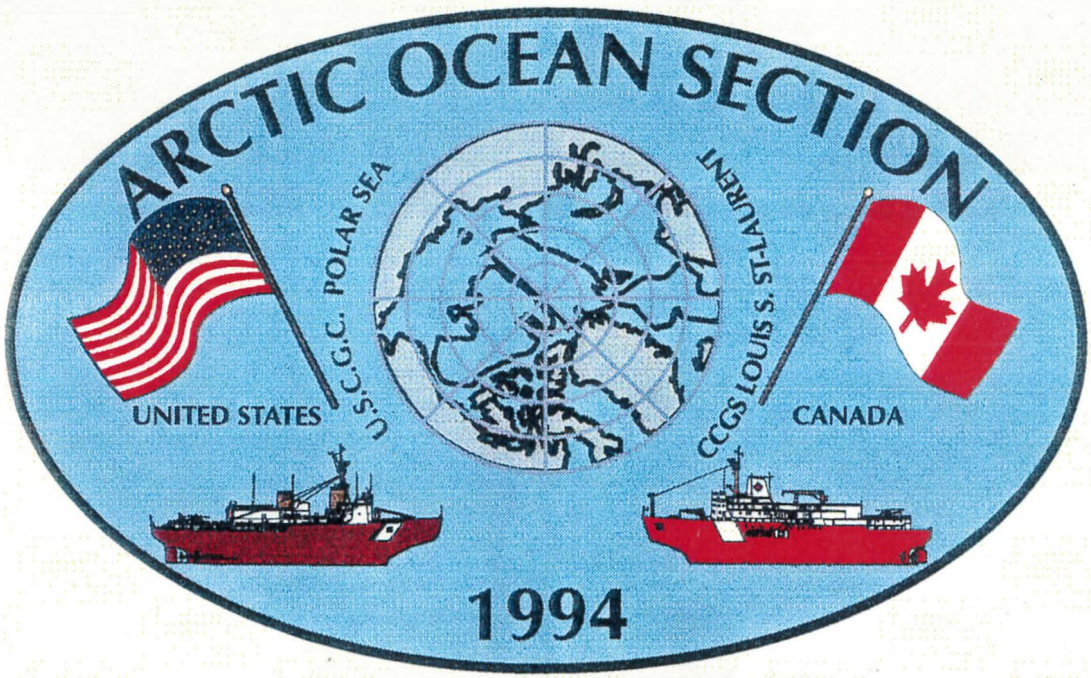
CCGS LOUIS S. ST-LAURENT
ARCTIC OCEAN SECTION '94



NORTH POLE
22 AUGUST 1994

TRANSARCTIC CROSSING
25 JULY - 30 AUGUST 1994

HISTORY OF CANADA/U.S. 1994 ARCTIC OCEAN SECTION

IN 1990-1991, the scientific communities of the United States and Canada, represented in the U.S. by the National Oceanographic and Atmospheric Administration (NOAA), and in Canada, by the Institute of Ocean Sciences, a branch of the Department of Fisheries & Oceans (DFO), asked the U.S. and Canadian Coast Guards to provide icebreakers to support a joint scientific environmental Arctic research program.

The expedition involving CCGS LOUIS S ST-LAURENT and USCGC POLAR SEA was planned to conduct an unprecedented multidisciplinary scientific study beginning in Nome, AK on July 24th and Ending in Barrow, AK in late September.

Recent scientific findings suggest that all aspects of global change are amplified in the Arctic. Until now, the absence of basic shipborne measurements of the world's least studied ocean has made it impossible to understand the processes which drive global climate change. This summer's expedition was the cumulation of four years of joint planning by agencies in Canada and the U.S. including the U.S. and Canadian Coast Guards, Canadian Department of Fisheries & Oceans, Indian & Native Affairs and Environment Canada, the U.S. National Science Foundation, Office of naval Research and the U.S. Geological Survey. Researchers from more than 20 institutions participated in the expedition.

Professor Knut Aagaard, of the University of Washington in Seattle, WA was the expedition leader and Chief Scientist. Dr. Ed Carmack, of the Institute of Ocean Sciences in Sidney, B.C. and Dr. Arthur Granz of the U.S. Geological Survey in Menlo Park, CA, were senior scientists aboard the CCGS LOUIS S ST-LAURENT and USCGC POLAR SEA respectively. Their Arctic research team included:

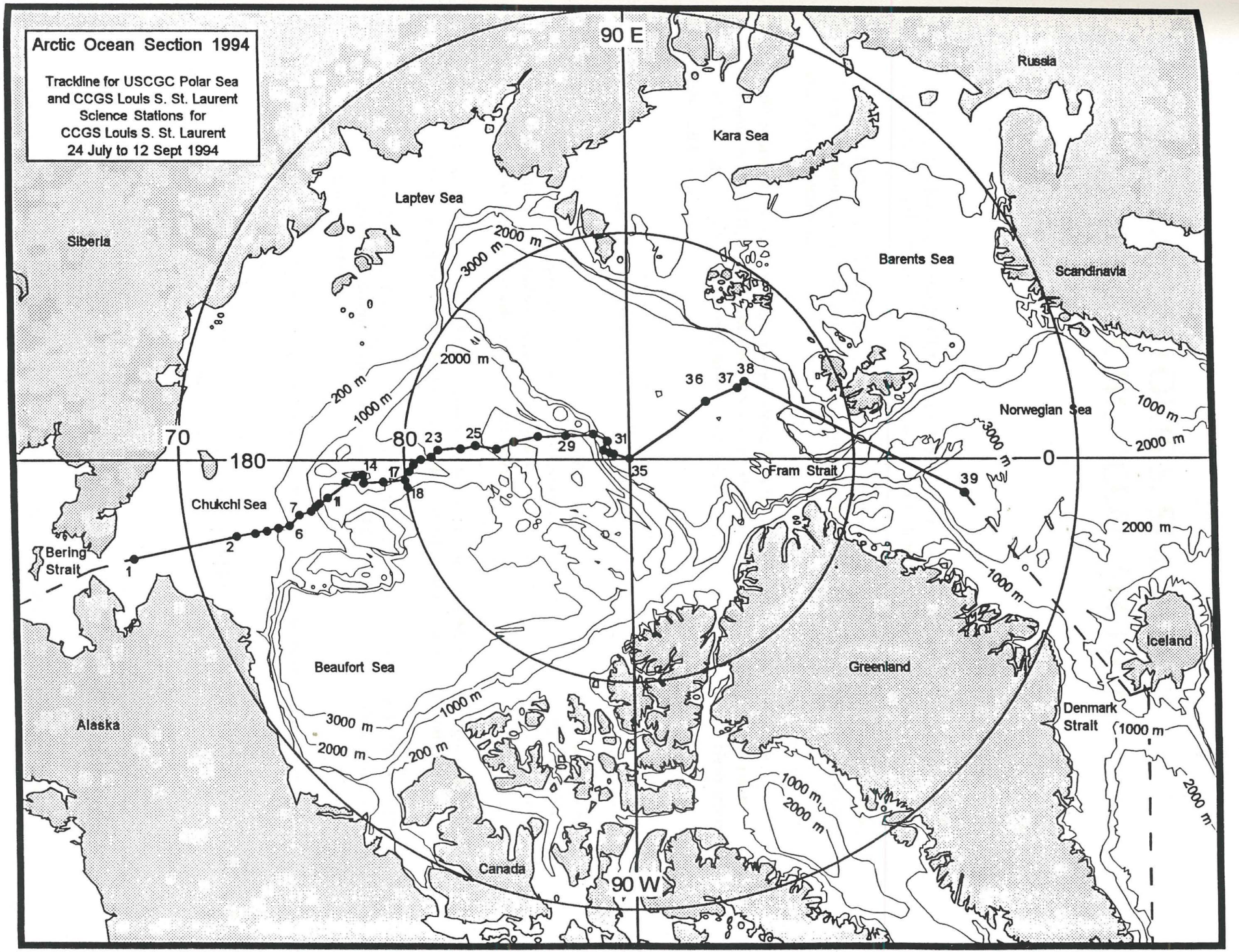
* Oceanographers, ice physicists and atmospheric scientists who collected measurements they will use to understand how the world's heat budget is affected as Arctic ice freezes and melts.

* Geologists who collected sediment cores from the seafloor to complete a climatic history of the Arctic covering 2.6 million years. This data will aid the scientists in distinguishing between the changes that are part of the Arctic's ongoing climate cycle and those caused by humans.

* Biologists who measured the primary production by phytoplankton, tiny marine plants which remove carbon dioxide from surface waters by photosynthesis. Understanding the rates of carbon cycling by phytoplankton, zooplankton and bacteria will help scientists understand how much carbon dioxide, one of the "greenhouse gases", is absorbed and released by the Arctic Ocean.

Contaminants were another focus of the study. the great rivers of the Eurasian continent which flow north to the Arctic, carry enormous amounts of agricultural and industrial wastes, including heavy metals, PCBs and other chlorinated organics. New ice scrapings along the Russian shelf is thought to create a sandwich of ice, sediments and contaminants. It is important to find out how much of the contaminated sediment sloughs off as the ice moves through the Arctic and how much is carried across the Arctic Ocean to the shores of North America and the Atlantic.

The expedition was named the Canadian/U.S. 1994 Arctic Ocean Section. the term "Section" refers to the cross section of the ocean from the sea surface to sea floor which was sampled as the ships cut across basins and ridges. The Canadian Basin is the only ocean basin in the world for which no ocean section has been completed. One of the aims of the project was to produce a map of basic measurements comparable to those compiled for the rest of the world's oceans


Arctic Ocean Section 1994
Trackline for USCGC Polar Sea
and CCGS Louis S. St. Laurent
Science Stations for
CCGS Louis S. St. Laurent
24 July to 12 Sept 1994
90 E
Russia
Kara Sea
Laptev Sea
Siberia
Barents Sea
Scandinavia
Norwegian Sea
Fram Strait
Chukchi Sea
Bering Strait
Beaufort Sea
Alaska
Canada
Greenland
Iceland
Denmark Strait
90 W
70
80
180
0
2000 m
3000 m
1000 m
200 m
1 2 6 7 11 14 17 18 23 25 29 31 35 36 37 38 39

C.C.G.S. LOUIS S. ST-LAURENT
1994 ARCTIC OCEAN SECTION

-1600 local , Thursday, June 2, CCGS Louis S St. Laurent departed Dartmouth N.S. for Victoria B.C. via the Panama Canal with one Port of Call in San Diego,California.

-1330 to 1430 Sunday, June 05, a Fire and Boat Drill was conducted and all Crew members with a fire fighting exercise, extinguisher demonstration and a briefing on lifeboat launching and survival techniques.

-2000 Monday, June 06, vessel entered Mona Passage between Puerto Rico and the Dominican Republic in Position 19° 13'N 67° 28'W. Sea temperature had gradually risen from 12°C off Nova Scotia to 30°C in the Mona Passage and air temperatures had risen from about 20°C to 30°C.

-0400 Tuesday, June 07, vessel enter the Caribbean Sea in Position 17° 24'N 68° 31'W and transitted towards the Panama Canal.

-0800 Thursday, June 08, the LSSL entered the Port of Cristobal and after a brief anchorage commenced transit of the Panama Canal. One Seaman departed the vessel with the Ships Agent in Cristobal for health reasons. Two pilots were taken for the transit of the canal and disembarked at the Pacific side of the Canal at 2000.

-2000 Thursday, June 08, the LSSL commenced transit from Panama to San Diego, California via the coastal route. Sea and air temperatures remained steady at approximately 30°C.

-2000 Thursday, June 16, the ship enter the California current in position 24° 14'N 112° 51'W and the Sea temperature dropped to approximately 14°C and the air temperature dropped to a high of 20°C during the day.

-1030 Saturday, June 18, LSSL entered San Diego Harbour with one pilot and docked at the Broadway Pier.

-1300 to 1600 Sunday, June 19, LSSL hosted an open house for the public of San Diego with approximately 1000 people visiting the ship.

-Monday and Tuesday June 20 and 21, the Scripps Institute loading and installed 20 000 pounds of scientific equipment. Monday afternoon the Scripps Institute hosted a tour of their facilities and a cocktail party for the Ships Crew.

-1900 Tuesday, June 21, departed San Diego for Victoria, one Pilot taken aboard for the departure.

-0600 Saturday, June 25, entered the Strait of Juan De Fuca. Sea temperature rose from 14°C to about 19°C while enroute to Victoria and the Air temperature remained constant at about 19°C.

-1030 Saturday, June 25, a CG helicopter landed on the vessel with CG representatives and Canadian Customs Officials to clear the LSSL into Canada. At 1230 the Helicopter returned to the ship with local media to cover our arrival.

-1410 Saturday, June 25, the ship docked at berth B Ogden Pt. in Victoria with the assistance of one Pilot. At 1430 the ship was secured alongside and the media personnel departed the ship.

-Saturday June 25 to Sunday July 17, the CCGS Louis S. St-Laurent was docked at berth B Ogden Pt. in Victoria loading stores and the remainder of the scientific equipment.

-0630 Sunday July 17, the vessel shifted to berth A at Ogden Pt where the USCGC Polar Sea and CCGS Louis S. St-Laurent held dedication ceremonies and an open house.

-1000 Sunday July 17, dedication ceremonies were conducted on the helicopter deck with many distinguished guests and personnel from the Polar Sea, scientific community, and local officials.

-2035 Sunday July 17, one Pilot boarded vessel and the LSSL and the USCGC Polar Sea departed Ogden Pt. proceeding towards Nome Alaska .

-1200 Friday July 22, both the Louis S. St-Laurent and Polar Sea passed through Unimak Pass enroute Nome Alaska.

-0915 Sunday July 24, anchored off of Nome Alaska to load scientific personnel aboard the LSSL and Polar Sea. During this time, crew members were taken ashore to call home.

-2113 Sunday July 24, departed anchorage to proceed towards the Bering Strait enroute the Arctic.

-0859 Monday July 25, a Fire and Boat drill was conducted and all crew members including scientific personnel were mustered at their stations and briefed on lifeboat launching and firefighting duties.

-1715 Monday July 25, the CCGS Louis S. St- Laurent crossed the Arctic Circle and ceremonies were held shortly afterwards.

-2136 Monday July 25, reached the first scientific station and began 1994 Arctic Ocean Section scientific experiments.

-0352 Monday August 22, the CCGS Louis S. St-Laurent and USCGC Polar Sea reached the North Pole making us the first Canadian surface vessel to reach the pole and also completed it in the most difficult direction via the Arctic Ocean. Many pictures were taken as well as the erecting of a north pole to commemorate our landing.

-0824 Tuesday August 23, departed the North Pole proceeding towards position of Russian Nuclear Icebreaker YAMAL.

-1430 Tuesday August 23, arrived at Yamal position and an open house was held for all crews of CCGS Louis S. St- Laurent, USCGC Polar Sea, and Yamal. This included a barbecue held on the ice by the Yamal for all personnel.

-2237 Tuesday August 23, three vessels proceed out of the arctic towards the east with the Yamal breaking a track for the Polar Sea (due to propeller damage).

-0856 Thursday August 25, the Yamal departed company and continued on her way to Ramansk.

-0927 Thursday August 25, arrived on station 36 to conduct scientific data collection.

-0931 Sunday August 28, fire and boat drill was conducted for all crew and scientific personnel. All persons mustered at stations with briefings of firefighting and lifesaving techniques conducted.

-0800 Tuesday August 30, reached ice edge, proceeding towards Iceland with Polar Sea.

-2006 Wednesday August 31, stopped on final station 38 to collect data followed by departure towards Keflavik Iceland.

-1306 Thursday September 01, informed by Ottawa that the 1994 Arctic Ocean Section Expedition ended due to damage to Polar Sea.

-0815 Saturday September 3, anchored off Keflavic Iceland with Polar Sea. Scientific personnel from Polar Sea flown ashore by helicopter for flights home.

-1153 Saturday September 3, departed Keflavic Iceland enroute Dartmouth.

-0900 Friday September 9, CCGS Louis S. St-Laurent and USCGC Polar Sea met outside Halifax Harbour by CCGS Mary Hichens and Halifax Firetug. Both vessels escorted into harbour to the sounding of many ships whistles in recognition of accomplishments. Many media personnel, dignitaries and customs officials flown out to LSSL.

-1021 Friday September 9, CCGS Louis S. St. Laurent secured berth #6 and #7 at Dartmouth C.G. Base. Many friends and families on dock to greet ships crew.

-1300 Friday September 9, all crew members and scientific personnel piped to pollution shed for ceremonies to recognize accomplishments of all onboard. Many plaques and letters presented to Capt. Grandy for CCGS Louis S. St-Laurent. All members of ships crew and scientific personnel presented with Commissioners Commendation Award.

VOYAGE SUMMARY

DAYS AT SEA..... 76
DISTANCE STEAMED..... 14960 Nmiles
TOTAL STEAMING TIME..... 48 days 16 hours 06 mins.
SCIENTIFIC SURVEY..... 264.8 hours
FUEL CONSUMED..... 3107.22 m^3
AVGAS CONSUMED..... 17040 lts.

DEPARTED VICTORIA,B.C. WITH 4683.21 m^3 OF FUEL.
ARRIVED DARTMOUTH,N.S. WITH 2516.42 m^3 OF FUEL.
VESSEL CONSUMED ONLY 46.3 % OF TOTAL FUEL CARRIED.

KEY SATELLITE-BASED SYSTEMS FOR ICE INFORMATION & COMMUNICATIONS ONBOARD USCGC POLAR SEA

TERASCAN: This system provided real-time images from both the National Oceanographic & Aeronautic Administration (NOAA) satellite and the Defense Meteorological Satellite Program (DMPS) Special Sensor Microwave Imager (SSMI) of total ice and multi-year ice concentrations for planning purposes.

Daily briefs of current and prospective ice conditions based on SSMI interpretation were instrumental in adjusting the research track of both icebreakers during the first half of AOS 94. Processed SSMI images indicating the shortest distance to the ice edge drove the decision - making process that led to both icebreakers departing the Pole towards the Greenland Sea. Additional ice edge information was extracted from processed SSMI data late in the cruise resulting in the last scientific station being conducted within a few miles of the acual ice edge. During the cruise, helicopter reconnaissance flights and around the clock ice observations from the pilot house of both ships provided "ground truthing" or confirmation of the remotely sensed images.

During the course of the expedition, ARGOS transmitters were attached to two female polar bears with cubs. Using ARGOS receivers on the NOAA satellite, the transmitters allowed the first ever real-time tracking of polar bears in the wild. After several weeks had passed, the movements of the bears were merged with the SSMI total ice imagery allowing the polar bear researchers to study the bears' migration habits in relation to ice concentrations.

NOAA satellite imagery was also used in conjunction with SSMI data to estimate the intensity of approaching weather systems by giving an early look at the amount of water and water vapour available to the system.

Lincoln Experimental Satellite (LES-9/MALABAR): This satellite enabled POLAR SEA to access the Internet E-mail service through out the expedition. Messages were prepared as text files on computers onboard the ship . When the Air Force's Lincoln Experimental Satellite (LES-9) was within range of the ship's UHF satellite antennas, a real-time connection was established with a DECVAX Minicomputer operated by the University of Miami in Malabar, FL. Once received, it was processed and routed through the Internet and finally to the Coast Guard's mail centre for distribution.

The LES-9's unusual geosynchronous orbit , inclined 17 degrees above the equator, provided up to 6 hours of connection time daily. The link allowed the science party and the

crew of the POLAR SEA to maintain contact with their home offices, share preliminary results, and trouble-shoot equipment problems. The ability to maintain contact with the rest of the world even at the North Pole contributed significantly to the success of this expedition.

At the North Pole, an E-mail message was sent to the U.S research station at the South Pole, Antarctica. This was hailed by *Newsweek* magazine as the" longest E-mail in history".

Even personnel aboard LOUIS S. ST-LAURENT could access the Internet by using the VHF-FM data link installed specifically for direct communications between the two ships. This link was critical when expedition crossed 80 North and travelled outside of the usable range of the International Maritime Satellite (INMARSAT). Special thanks to ATS satellite operations control centre in Malamar, FL, and especially to station manager, Paul Eden.

CREWLIST

Commanding Officer P. Grandy

DECK DEPARTMENT

POSITION	NAME	POSITION	NAME
Chief Officer	M. Hemeon	Leading Seaman	K. Baker
Fi rst Officer	W. Turner	Seaman	R. Amamio
Second Officer	S. Baxter	Seaman	A. Jarvis
Third Officer	T. Lafford	Seaman	A. Sears
Bosun	A. Welcher	Seaman	K. Gouthro
Carpenter	P. Walker	Seaman	W. Wallace
Leading Seaman	D. Hiltz	Seaman	A. Larkin
Leading Seaman	L. Drake		

ENGINEERING DEPARTMENT

POSITION	NAME	POSITION	NAME
Chief Engineer	M. Cusak	Eng. Tech.	S. Baxter
Senior Engineer	N. Hawksworth	Eng. Tech.	W. Fagan
SR. Elec. Officer	P. Seaboyer	Electrcian	E. Ginter
JR. Elec. Officer	W. Falconer	Oiler	P. Macpherson
First Engineer	M. Frogley	Oiler	R. Boucher
Second Engineer	M. Turner	Oiler	G. Ritchie
Third Engineer	D. Baker	Oiler	G. Engler
Sup. Engineer	D. Arkerman	Oiler	T. Hann
Electrician	C. Wood	Oiler	S. Gagnon
Eng. Supervisor	D. Baur	Oiler	W. Langille
Eng. Tech.	W. Ryan	Oiler	A. Myers
Eng. Tech.	K. Pettipas		

LOGISTICS DEPARTMENT

POSITION	NAME	POSITION	NAME
Logistics Officer	J. Purdy	Steward	G. Sullivan
Logistics Officer	E. Campbell	Steward	G. Garrett
Chief Cook	R. Turner	Steward	J. Bourdon
Sr. Storekeeper	D. Wallingham	Steward	L. Higgins
Storekeeper	R. Strickland	Steward	R. Bowley
Clerk	A. Macdonald	Steward	M. Lewis
Cook	S. Oliver	Steward	R. Schoots
Cook	D. Jones	Steward	T. Beaver
Steward	G. Weldon		

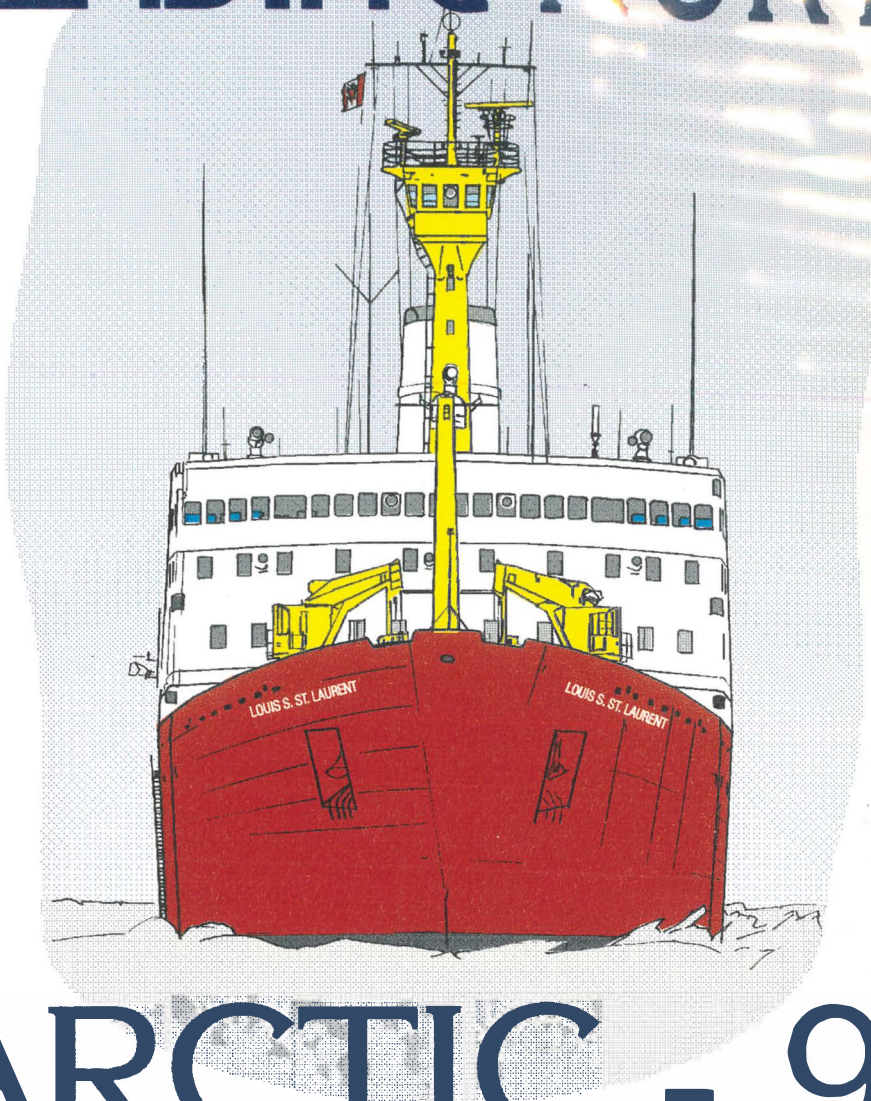
ADDITIONAL CREW

POSITION	NAME	POSITION	NAME
Radio Operator	G. Stoodley	Helicopter Pilot	R. Hempill
SEW	R. Brown	Helicopter Eng.	P. Gammon
Ice Observer	A. Kodz	Nurse	C. Lee
Helicopter Pilot	Y. Giroux		

SCIENTIFIC PERSONNEL

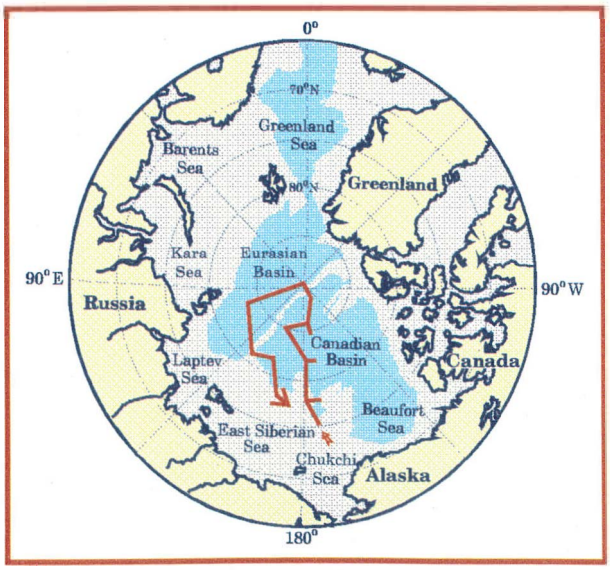
POSITION	NAME	POSITION	NAME
Scientist	E. Carmack	Scientist	K. Asmus
Scientist	K. Aagaard	Scientist	J. St. John
Scientist	D. Sieberg	Scientist	C. Garrity
Scientist	R. Nelson	Scientist	C. Measures
Scientist	M. Hingston	Research Ass.	O. Iqaluq
Scientist	R. Williams	Scientist	D. Muus
Scientist	E. Jones	Research Ass.	I. Amagoalik
Scientist	J. Swift	Scientist	M. Williams
Scientist	R. Macdonald	Scientist	J. Schmitt
Scientist	M. Ramsay	Scientist	K. Ellis
Scientist	S. Farley	Scientist	R. Pearson
Scientist	B. Ekwurzel	Scientist	F. Zemlyak
Scientist	J. Barwell-Clarke	Scientist	R. Ritch
Scientist	L. Adamson	Scientist	L. Jantunen
Scientist	R. Perkins	Artist	S. Drabbit
Scientist	F. Mclaughlin	Artist	C. Walker
Scientist	D. Tuelle	Vidiegrapher	S. Nitosolawski
Scientist	J. Elliott	Writer	W. Grady
Scientist	D. Paton		

HEADING NORTH



ARCTIC - 94

1994 CANADA / US ARCTIC OCEAN SECTION



OBJECTIVES

To carry out the first Scientific Crossing of the Canadian Basin.

To understand the role of the Arctic in Global Change.

To develop and demonstrate new capabilities in Polar Navigation, Communication and Technology.