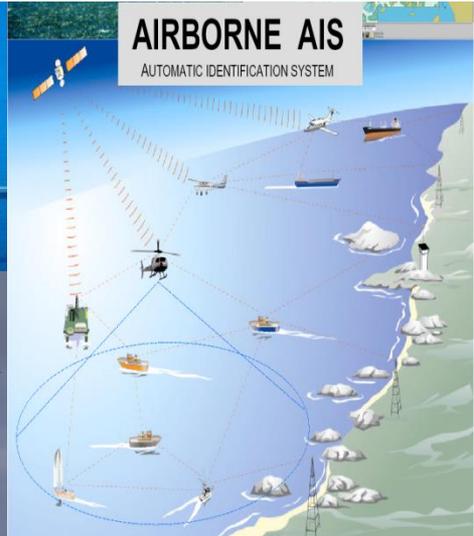
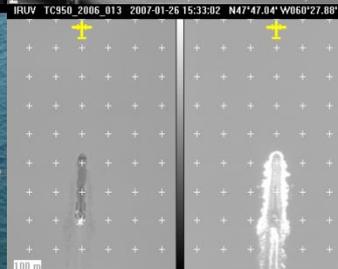
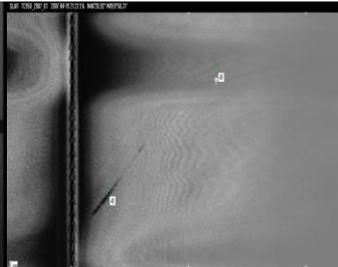


Surveillance and Reconnaissance

Optimizing the use of Transport Canada's Assets to Gain Public Confidence and Interdepartmental Recognition

Presented by:
Kim Pearce MSc.
Senior Technologist – Marine Aerial Reconnaissance Team
Environment Canada
May 21, 2015



Surveillance of Sea Surface Activities

- In Canada, Transport Canada works collaboratively with other departments to enforce the different mandates to **protect the marine environment, enhance marine safety and security, and support economic development** for the benefit of coastal communities and all Canadians



Environnement
Canada

Environment
Canada



Fisheries and Oceans
Canada

Pêches et Océans
Canada



National
Defence

Défense
nationale



Royal Canadian
Mounted Police

Gendarmerie royale
du Canada



Canadian Coast Guard
Garde côtière canadienne

Why does TC Conduct Surveillance?

- Accidental or intentional discharges of oil
- Steady increase in commercial shipping
- Identification of vessels in marine protected areas
- Our department's role in maritime security
- Ensure public confidence in Canada's Transportation System



Background / Milestones

- 1968 – Pollution Patrols commenced over the Great Lakes
- 1991 – NASP was created and expanded to the East and West
- 2003 – Program transferred to Transport Canada
- 2005 – Arctic Patrols began in Partnership with EC Ice Service (Dash 7)
- **2006 – First Dash 8 Commissioned with MSS6000 (East Coast)**
- 2008 – Second Dash 8 Commissioned with MSS6000 (West Coast)
- 2009 – Dash 7 Modernization project was completed with MSS6000
- **2010 – 11 weeks in Houma, LA responding to DWH Incident**
- 2013 – World Class Tanker Safety System (WCTSS)
 - Secured sufficient permanent funding

Program Enhancements – WCTSS

- Long Term Funding - \$47M over 5 years and \$10.7M ongoing
- Additional Hours – maximized utilization of the assets
- Human Resources - staff
- Equipment upgrades and additional spares
- Satellite Communications System upgrades



Program Resources

3 **DEDICATED** TC Aircraft

- 3 teams that cover Canada's 3 Oceans
- ~ 40 People across Canada

+ Access to 4 Contracted Private Industry aircraft

- Provincial Airlines (PAL)
- Surveillance in Newfoundland and Labrador

~ \$9M – budget for 2014/15 (including cost recoveries)





- Legend**
- ★ Vancouver (NASP Primary Base)
 - ★ Moncton (NASP Primary Base)
 - ★ Ottawa (NASP Primary Base)
 - ★ Iqaluit (NASP Secondary Base)
 - ★ St. John's (PAL Primary Base)
 - Canadian Exclusive Economic Zone

NASP Statistics

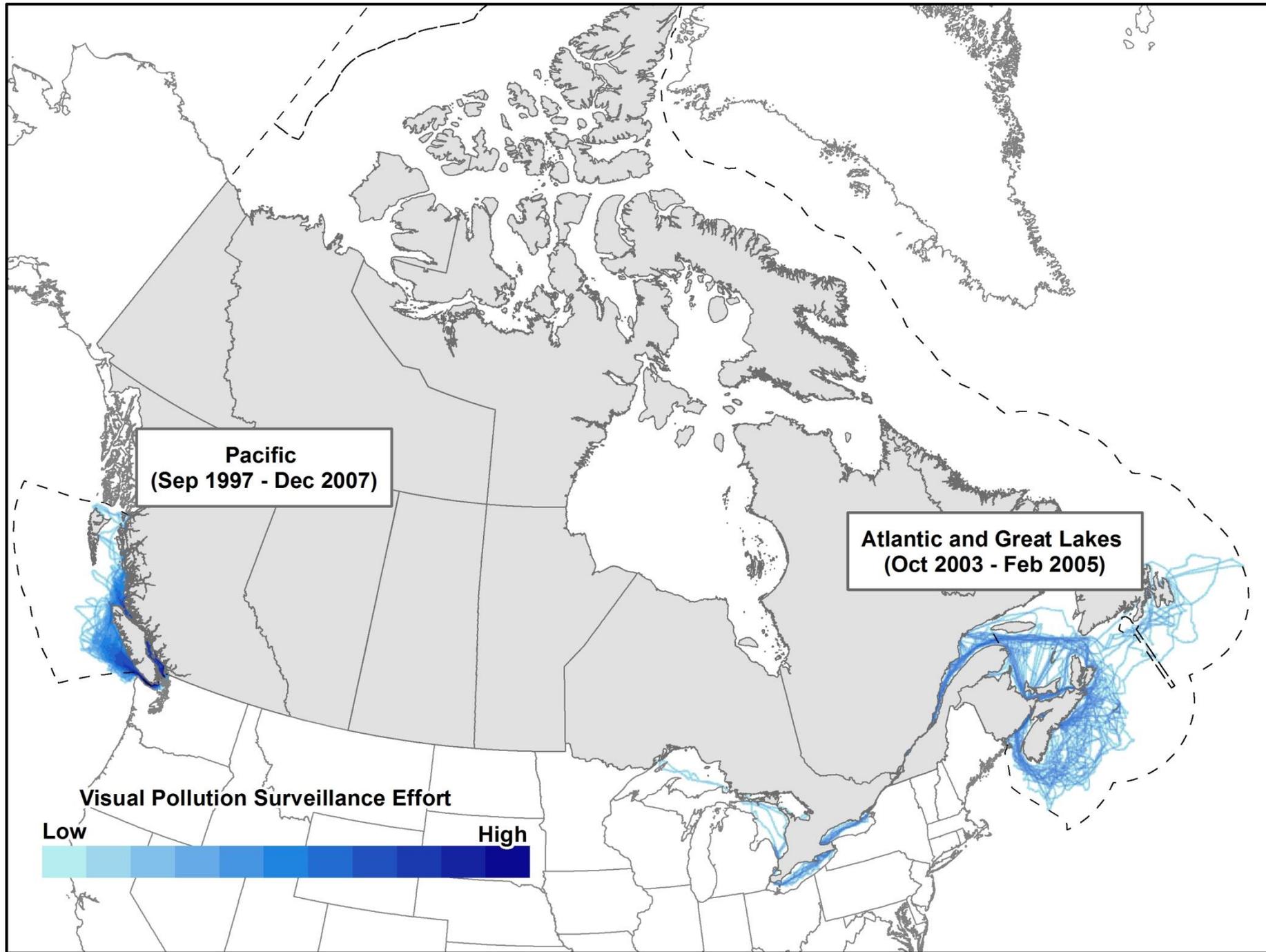
Fiscal Year	Patrol Hours	PAL Hours	TC Hours	Vessel Over-flights (VOF)	Pollution Sightings	Oil Volume (litres)
2007/2008	2,578	587	1,991	13,038	151	3,130
2008/2009	2,340	561	1,779	9,947	183	2,863
2009/2010	2,274	611	1,663	11,262	109	8,111
2010/2011	2,506	898	1,855	12,365	84	9,296
2011/2012	2,063	501	1,562	12,032	135	1,014
2012/2013	1,814	119	1,695	9,855	97	7,813
2013/2014	3,877	669	3,208	19,989	214*	4,453
2014/2015	3,842	837	3,005	19,551	322	3,173

Surveillance Tools Used Prior to 2006-2007

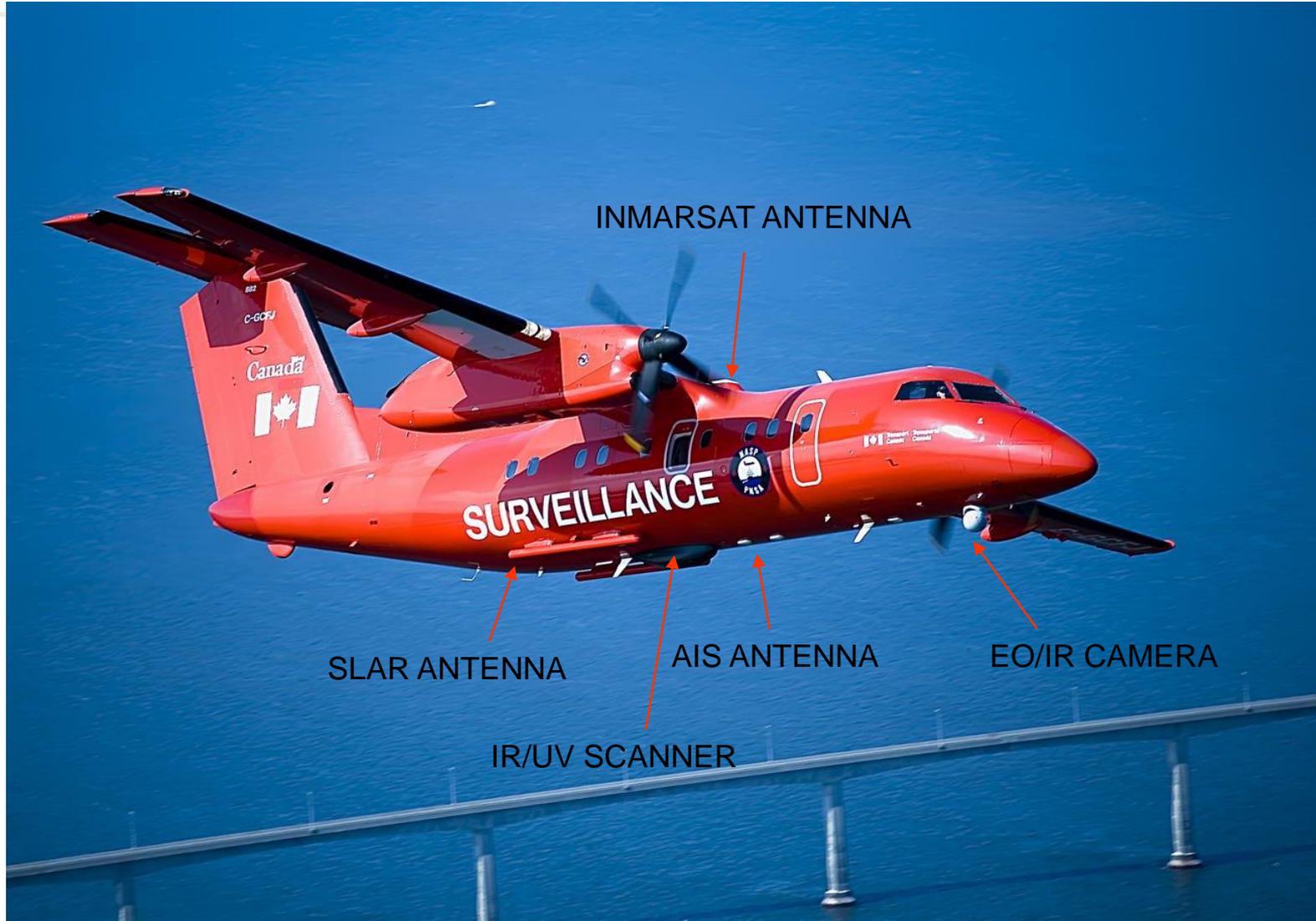
Comprised of:

- Naked Eye
- Digital Still & Video Camera Systems
- Expert Witness Testimony



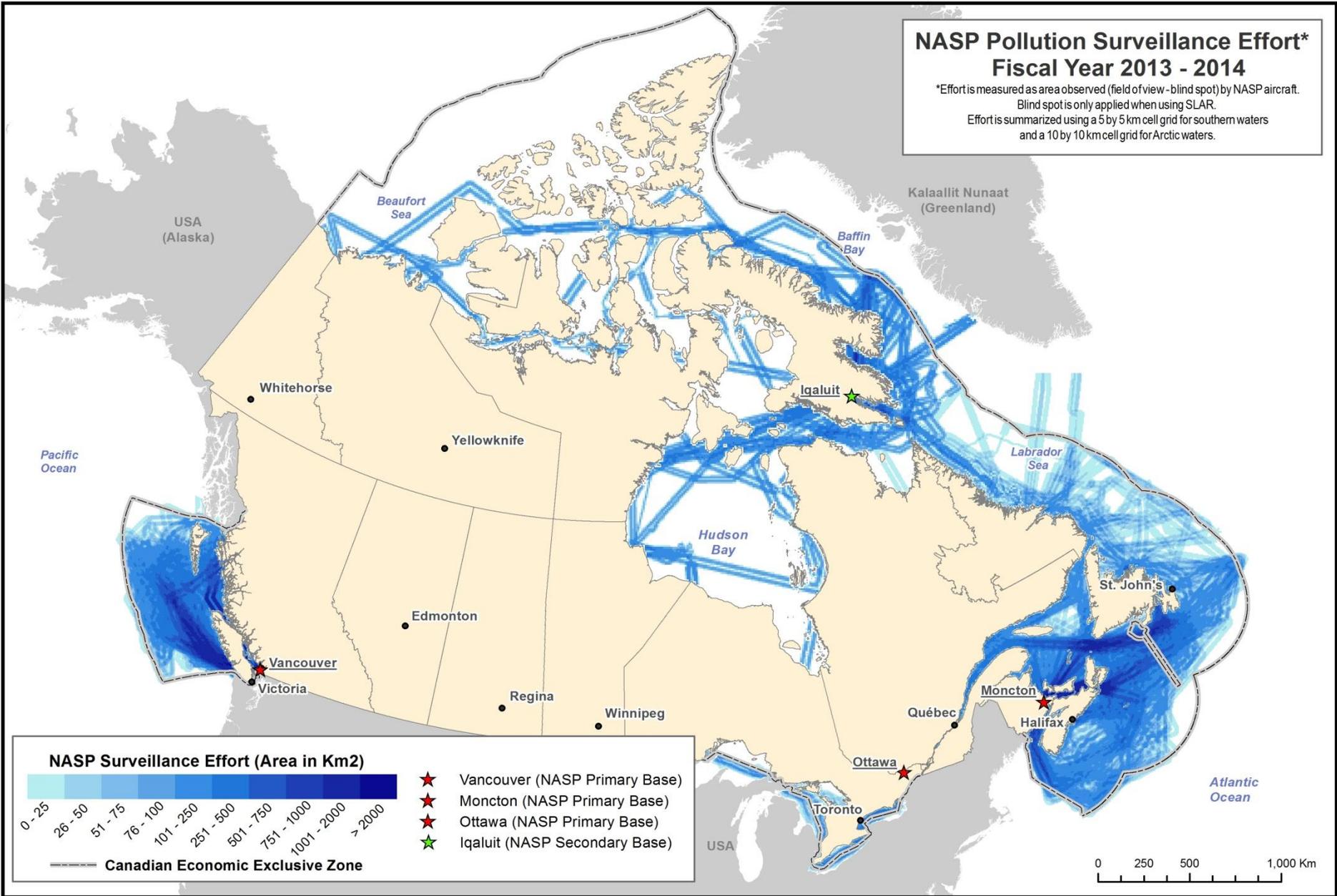


NASP Surveillance System After 2007

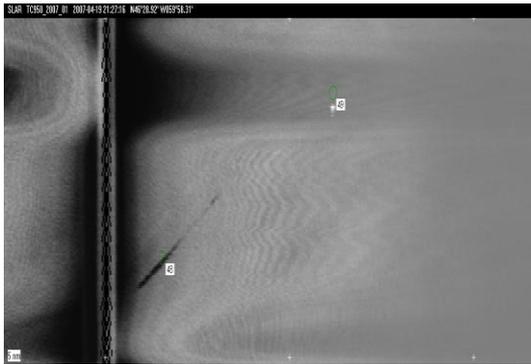


NASP Pollution Surveillance Effort* Fiscal Year 2013 - 2014

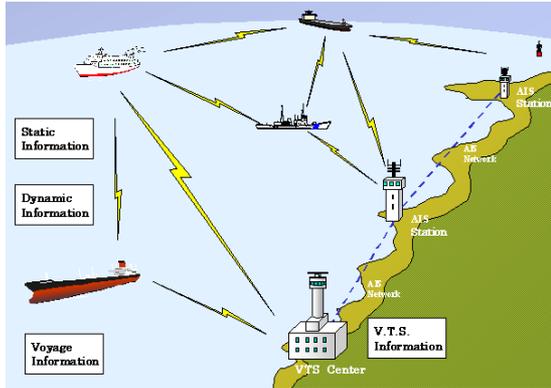
*Effort is measured as area observed (field of view - blind spot) by NASP aircraft.
Blind spot is only applied when using SLAR.
Effort is summarized using a 5 by 5 km cell grid for southern waters
and a 10 by 10 km cell grid for Arctic waters.



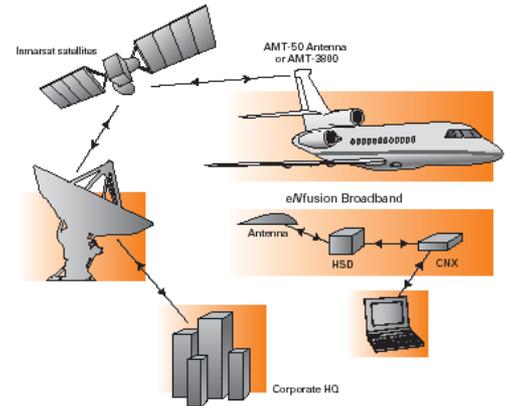
MSS6000 Sensors / Components



SLAR



AIS



SATCOM



EO/IR



IR/UV



Cameras



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ROSCHEID FAX
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IN EMERGENCY
STOP MFD-13 (if time permits)
EMERGENCY SHUT OFF SWITCH

ROSCHEID FAX
7 COL AUTO

Digital Still & Video Camera Systems

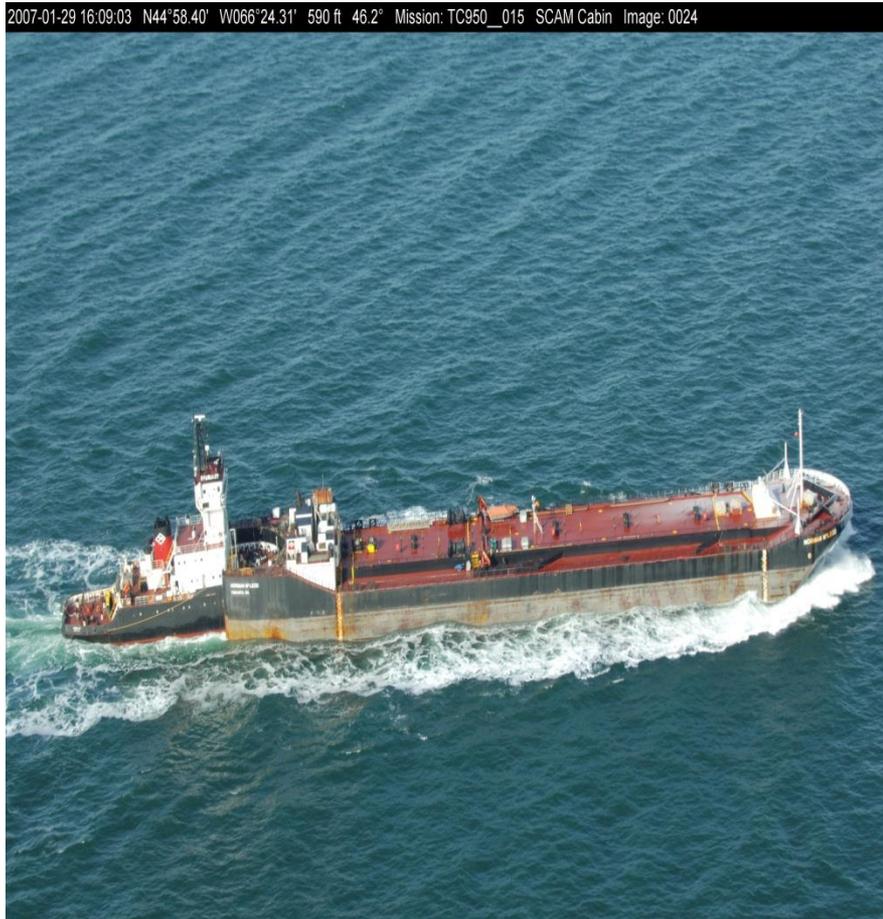


Photo Annotation:

- Date: 2007-01-29
- Time: 16:09:03
- Latitude: N44° 58.40
- Longitude: W066° 24.31
- Altitude: 590 ft
- Heading: 46.2°
- Mission #: TC950_015
- Image #: 0024





Pollution at Sea



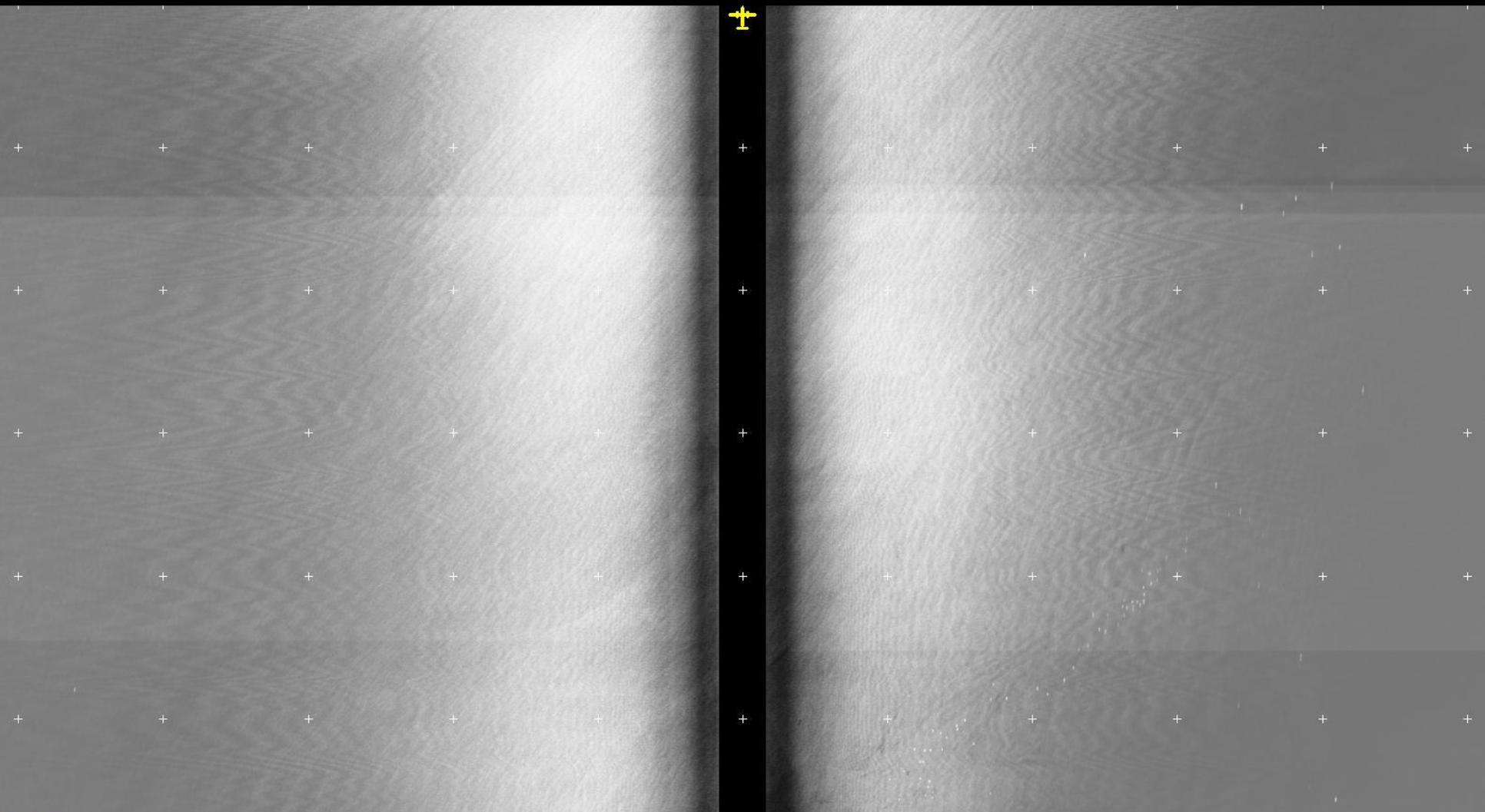






Good SLAR image

MSS 6000 Mission: TC951-2008-108 SLAR
Top center: 2008-09-03 23:14:24 N48°29.15' W126°21.60' 276° 10488 ft 219.0 kts
Left Gain: 92% Left STC: Low Right Gain: 92% Right STC: Low Antenna: Both
Aircraft: 2008-09-03 23:14:24 N48°29.15' W126°21.65' 276° 10488 ft 219.0 kts

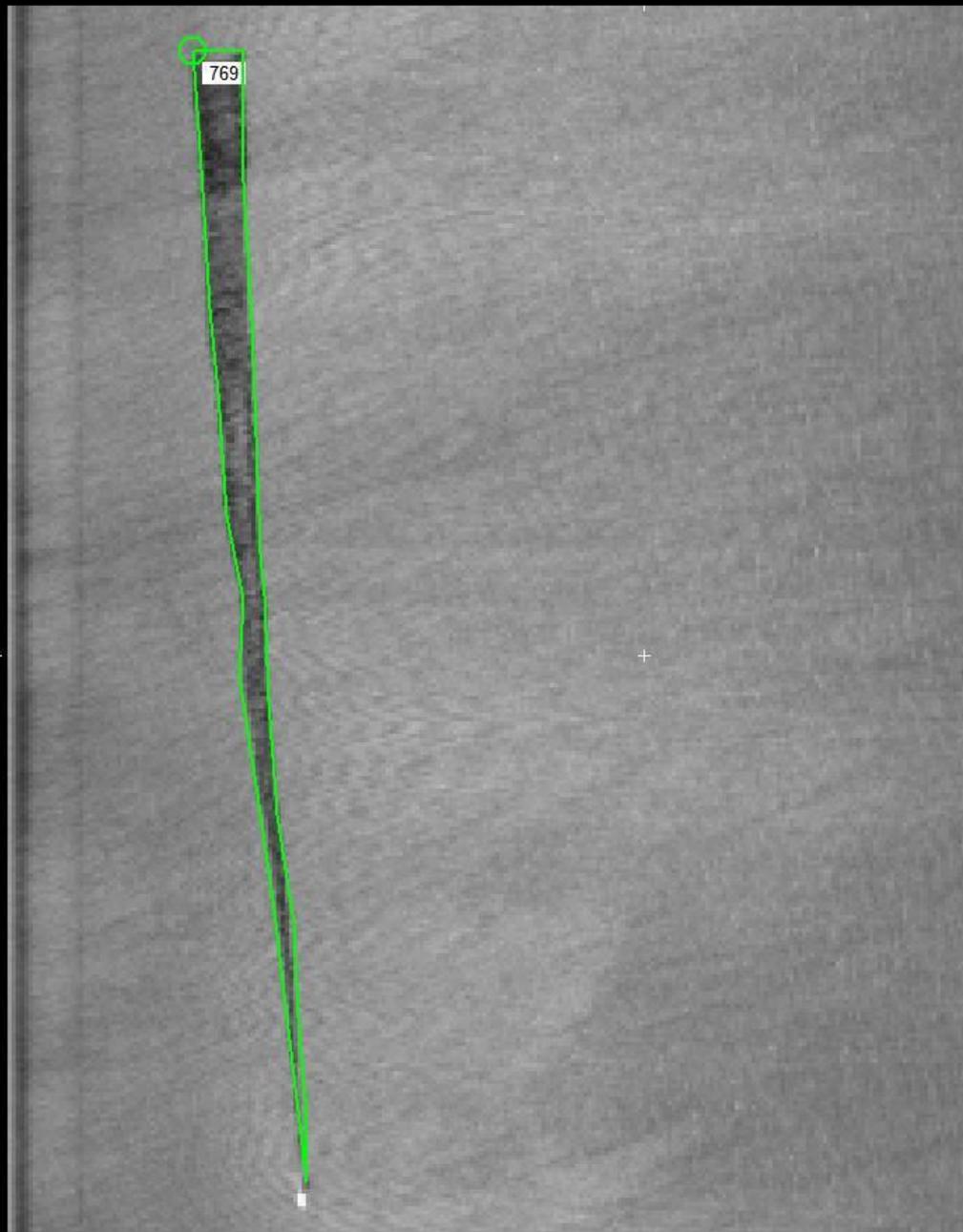
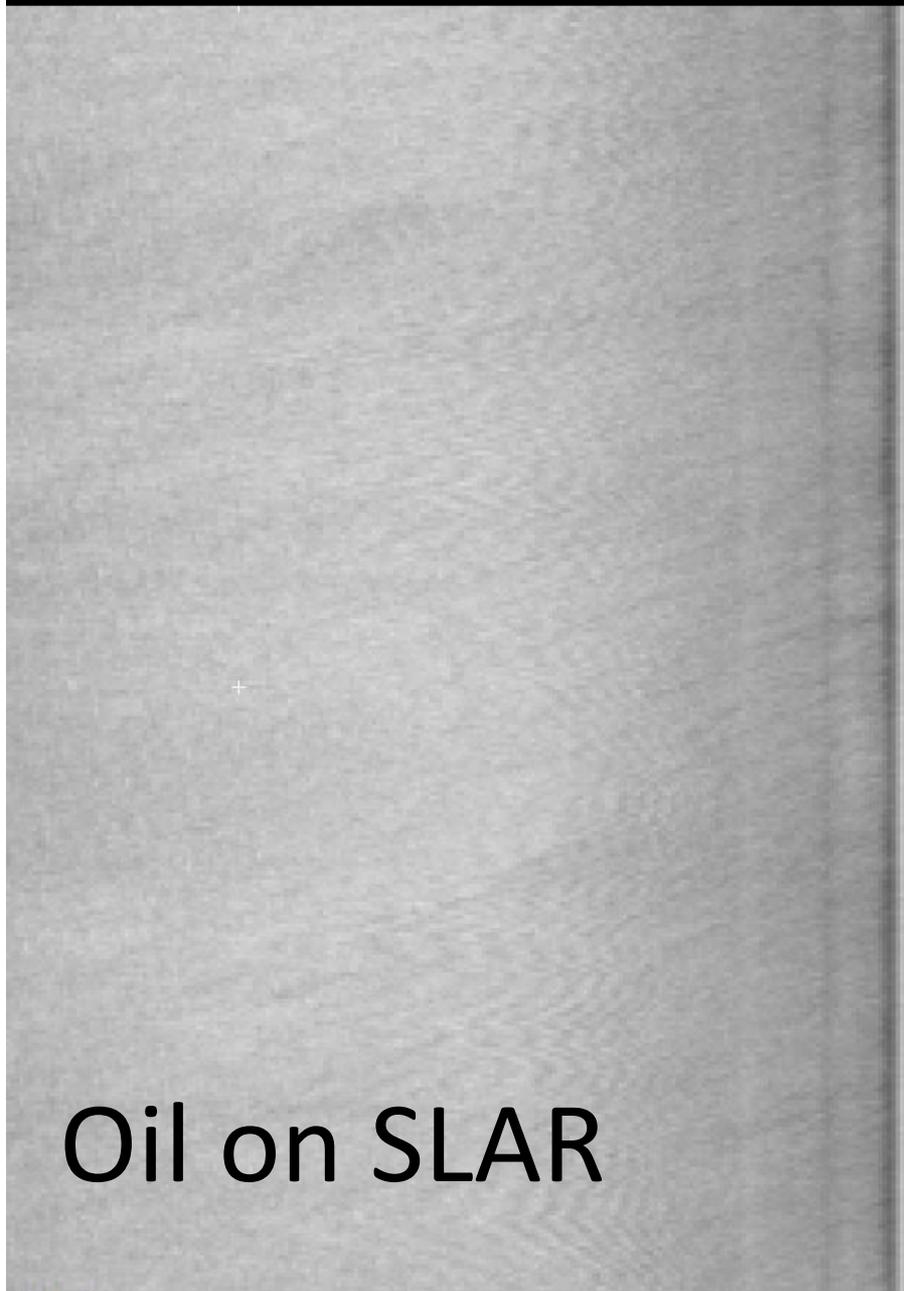


SLAR Imagery

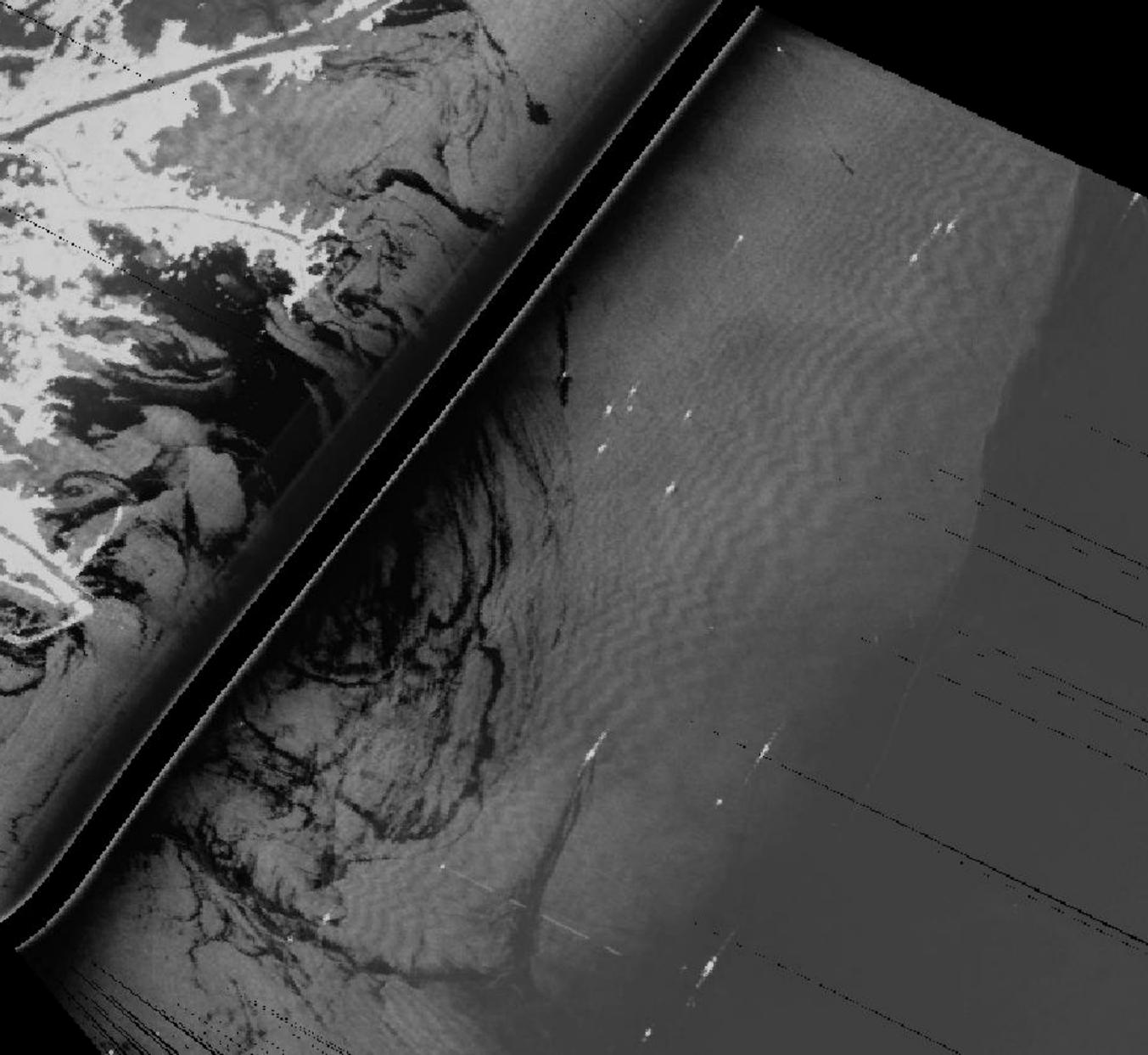
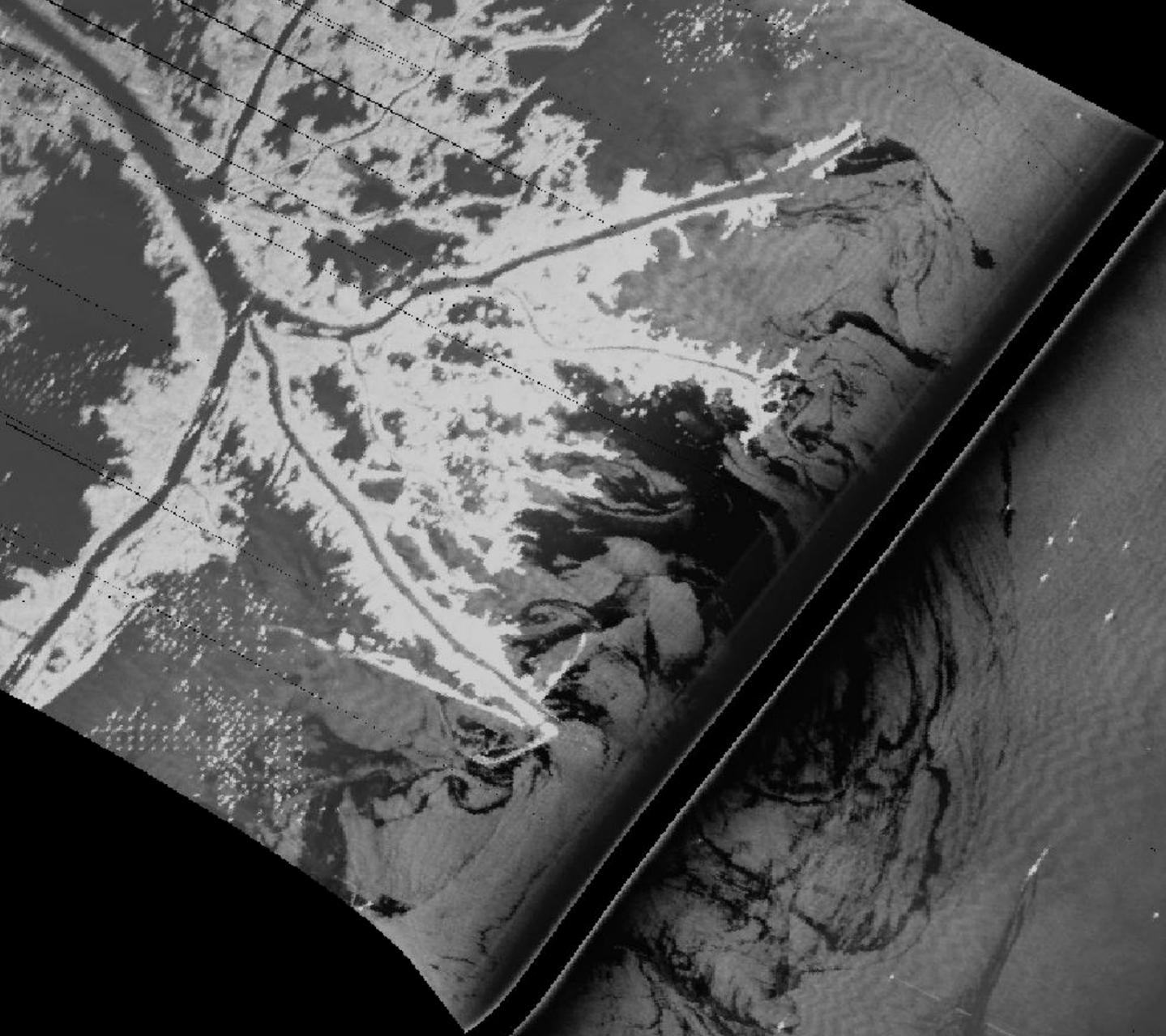
MSS 6000 Mission: TC951-2010-038 SLAR
Top center: 2010-07-29 18:45:37 N48°31.20' W129°50.06' 89° 1492 ft 217.5 kts
Left Gain: 85% Left STC: Medium Right Gain: 85% Right STC: Medium Antenna: Both
Aircraft: 2010-07-29 20:07:05 N48°38.17' W129°09.04' 75° 5488 ft 222.5 kts

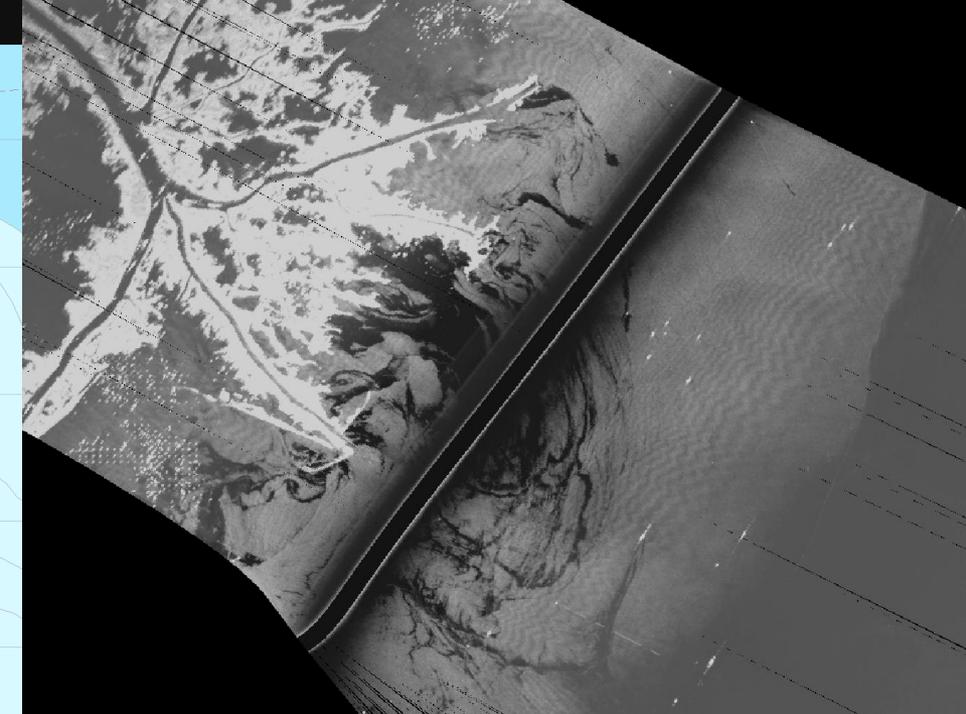
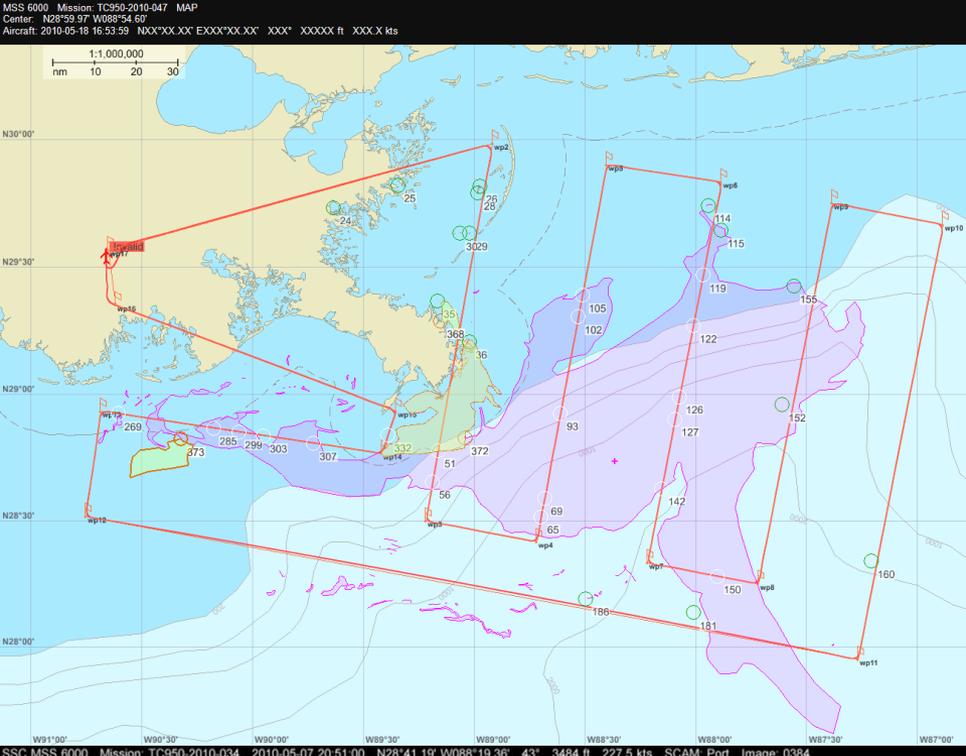


MSS 6000 Mission: TC951-2010-038 SLAR
Top center: 2010-07-29 18:45:10 N48°31.38' W129°52.48' 90° 1496 ft 216.6 kts
Left Gain: 85% Left STC: Medium Right Gain: 85% Right STC: Medium Antenna: Both
Aircraft: 2010-07-29 20:11:15 N48°41.24' W128°45.95' 76° 5488 ft 226.1 kts



Oil on SLAR





NASP support of DWH 2010

April 30, 2010 – The NASP was requested to assist USCG and BP

May 1, 2010 – The NASP deployed to Houma for **11** weeks and flew **297** hours in support of the response

July 15, 2010 – Arranged for Icelandic Coast Guard to replace Transport Canada Dash 8

NASP 1st operation with heavy oil identification using the SLAR. Many lessons learned which will benefit future sorties

EO/IR (MX-15) Integrated with MSS-6000



MX-15 - 4 sensors

- Infrared Camera w/ high magnification 4 step zoom
- Colour Daylight Camera with continuous Zoom Lens (EOW)
- Dual Channel Spotter Lens – Fixed focal length (Daylight Camera & Low Light Camera) (EON)
- Laser illuminated Night Spotter (Illuminates the target in total darkness)



Mission: TC951 2008_066 TC951

EO/IR: N49°37.57' W124°05.10'

Video: 2008-05-26 18:32:48 N49°37.28' W124°05.31' 104° 826 ft 145.3 kts EO/IR

POSTPROCESS



Mission: TC951 2008 070 TC951

EO/IR: N49°50.05' W124°31.73'

Video: 2008-05-31 14:26:23 N49°49.59' W124°31.14' 326° 1056 ft 142.8 kts EO/IR

Aircraft: 2008-05-31 14:37:53 N49°59.77' W124°47.95' 282° 1286 ft 180.5 kts



NO ANNOTATION

Aircraft: 2008-06-01 19:04:52 N48°30.22' W124°54.86' 258° 997 ft 183.1 kts



Mission: TC951 2008 074 TC951

EO/IR: N48°53.69' W125°20.29'

Video: 2008-06-04 19:05:47 N48°53.42' W125°19.28' 14° 1558 ft 165.0 kts EO/IR

Aircraft: 2008-06-04 19:05:48 N48°53.44' W125°19.27' 12° 1558 ft 165.0 kts



10/24/02 MAN 1000 FUL AUTO 2389
16:46:22 -2%

-10
-15
-20



5 70 75 80 85 MAN NONE

ACFT 37:27:22N 76:44:11W 928 0 INS STATE HEADING TGT

Video: 2014-09-28 21:03:56 N49°55.47' W125°37.99' 63° 5892 ft 244.3 kts EO/IR
EO/IR: N50°01.14' W125°12.21'
Aircraft: 2014-09-28 21:03:56 N49°55.47' W125°37.98' 63° 5892 ft 244.3 kts

12SE2014 AUTO 50W 7:00
17:33:31
UTC+0.0

←N
-02
-03
-04

LI:DISARM
LI:LOW
ACFT :6 27 28 29 30 3
49:59:23N 155° 093° TGT LOS
126:08:37W 8707FT 0FT 1.7NM 126:07:04W

28SE2014 AUTO 675 AUTO ∞
21:03:57 DFLT AUTO
UTC+0.0

01-
00-
-01-

LI:DISARM
LI:LOW
ACFT 4 35 00 01 02 03 TGT LOS
49:59:28N 065° 271° 50:01:03N
125:00:00W 6031FT 0FT 17.6NM 125:12:12W

12SE2014 AUTO 50W 7:00 AUTO ∞
17:33:27 DFLT AUTO
UTC+0.0

←N
-02
-03
-04

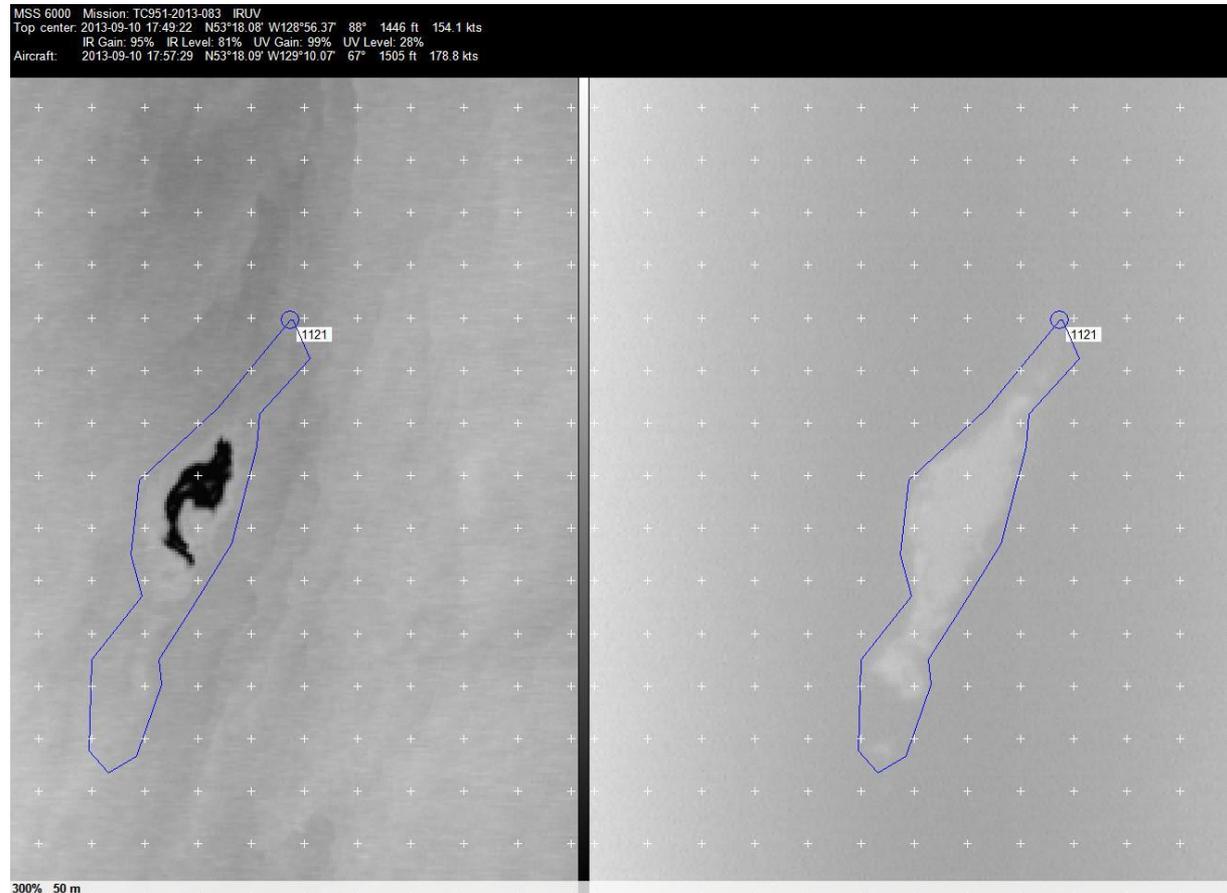
LI:DISARM
LI:LOW
ACFT 26 27 28 29 30 TGT LOS
49:59:35N 167° 100° 49:59:25N
126:08:42W 8709FT 0FT 1.7NM 126:07:18W

IR/UV Line Scanner

IR

UV

- Detects total extent of oil on surface (UV) and the thicker parts of the oil (IR)
- Data are georeferenced
- Used to map spatial extent of oil spills and get area of coverage
- Draw polygon around the oil
- Assists in determining and mapping where are the heaviest concentrations of oil

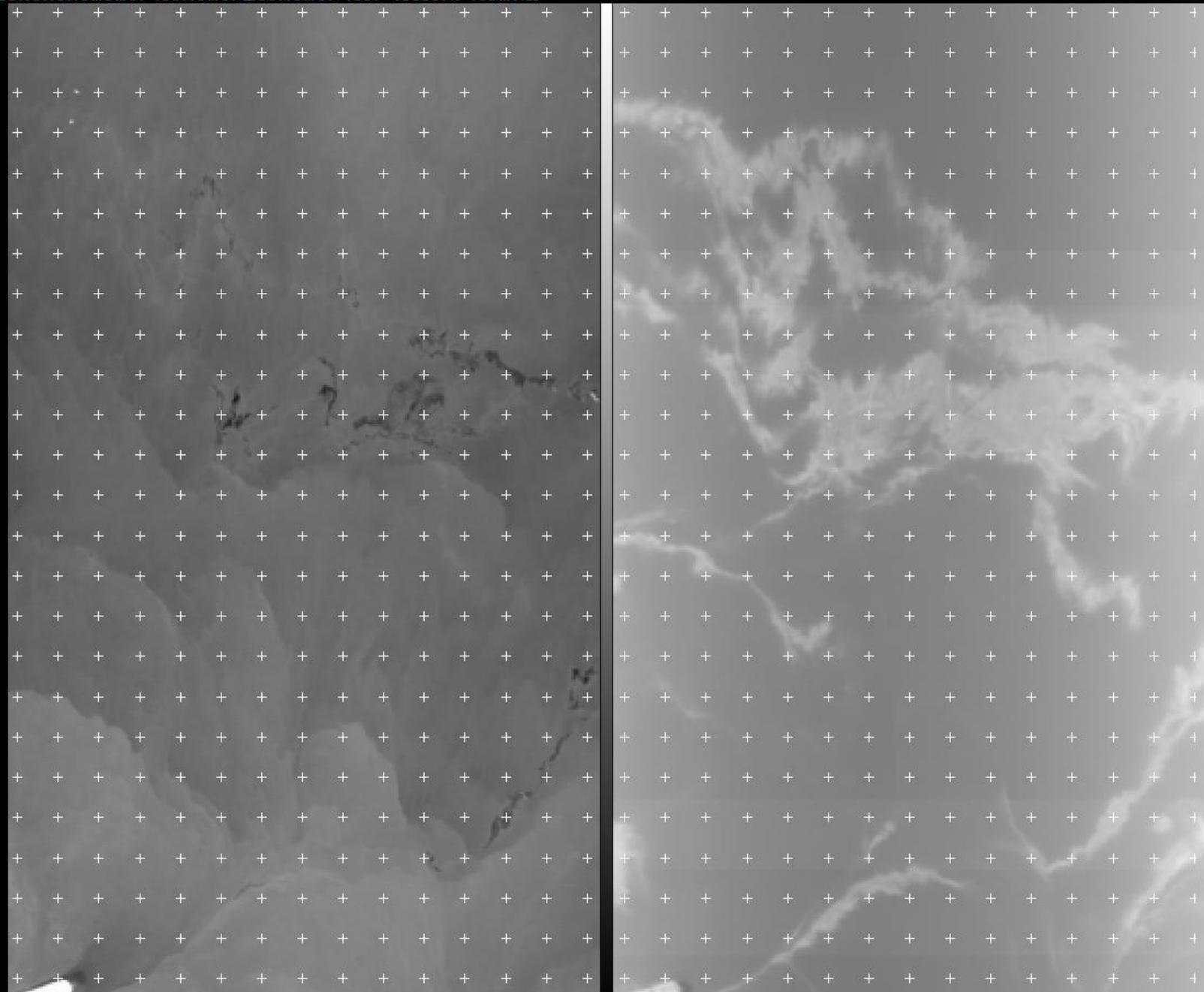




MSS 0000 Mission: 2015-04-09 17:43:41 N49°18.65' W123°13.91' 271° 2972 ft 151.6 kts

IRG: 33% IRL: 16% UVG: 38% UVL: 6% Ctr: 50% Brt: 50%

Aircraft: XXXX-XX-XX XX:XX:XX NXX°XX.XX' EXXX°XX.XX' XXX° XXXXX ft XXX.X kts





N49°20'

N49°18'

N49°17'



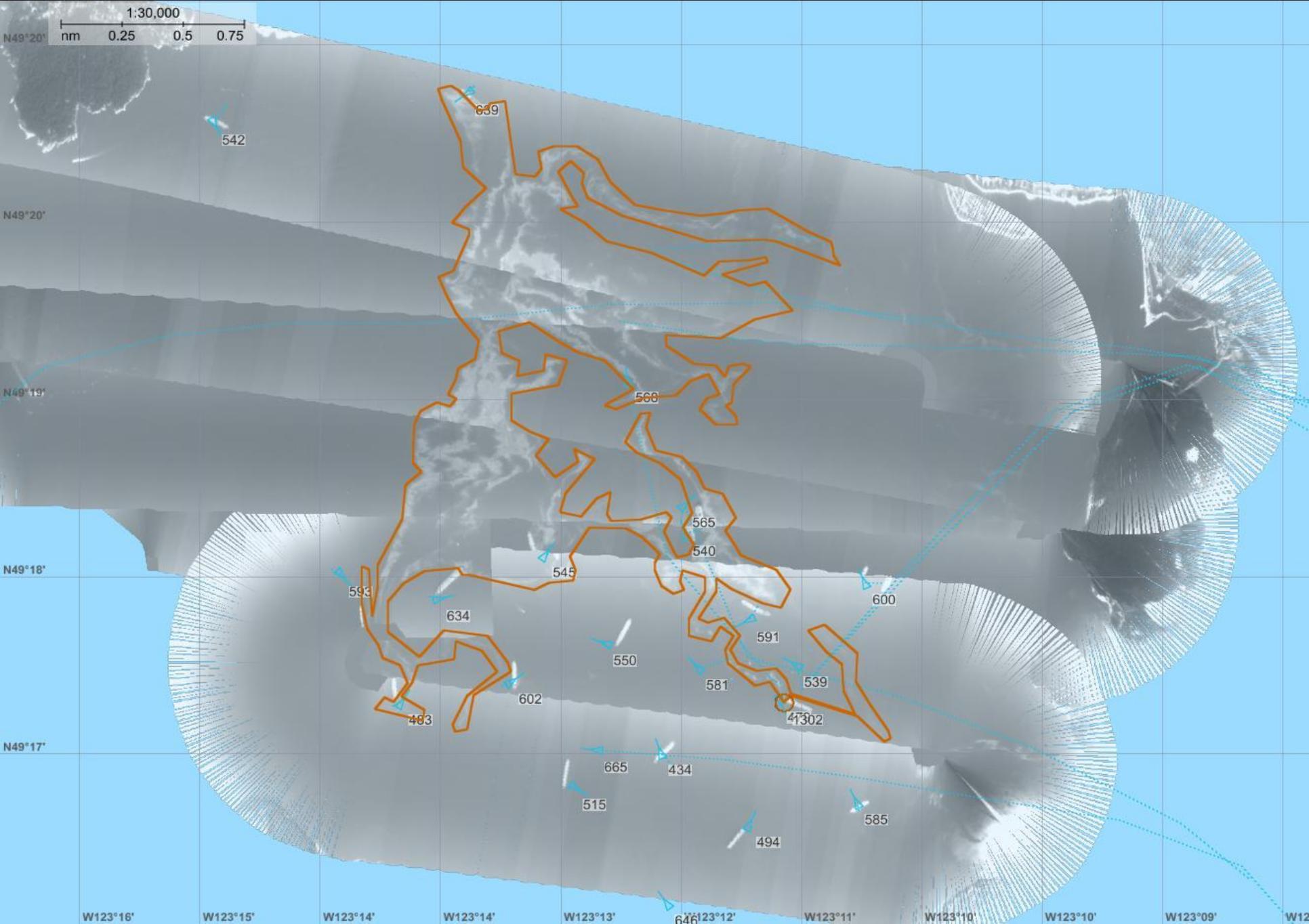
Trans-C

Taylor Way

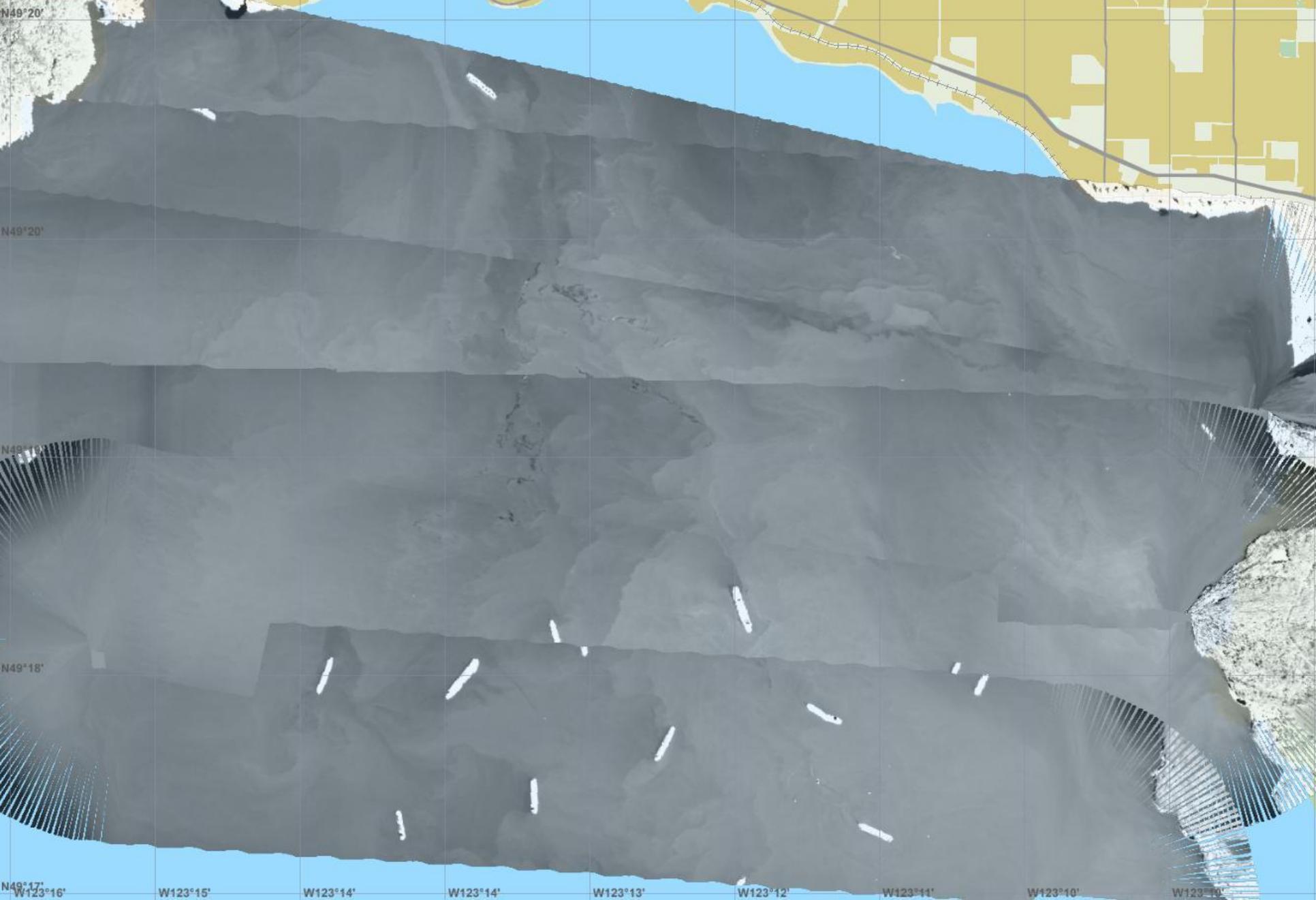
Mariner Drive

Mariner Bridge

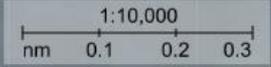
Stanley Park Causeway



Center: XXXX-XX-XX XX:XX:XX NXX°XX.XX' EXXX°XX.XX' XXX° XXXXX ft XXX.X kts



Center: N49°18.94' W123°12.53'
Aircraft: XXXX-XX-XX XX:XX:XX NXX°XX.XX' EXXX°XX.XX' XXX° XXXXX ft XXX.X kts



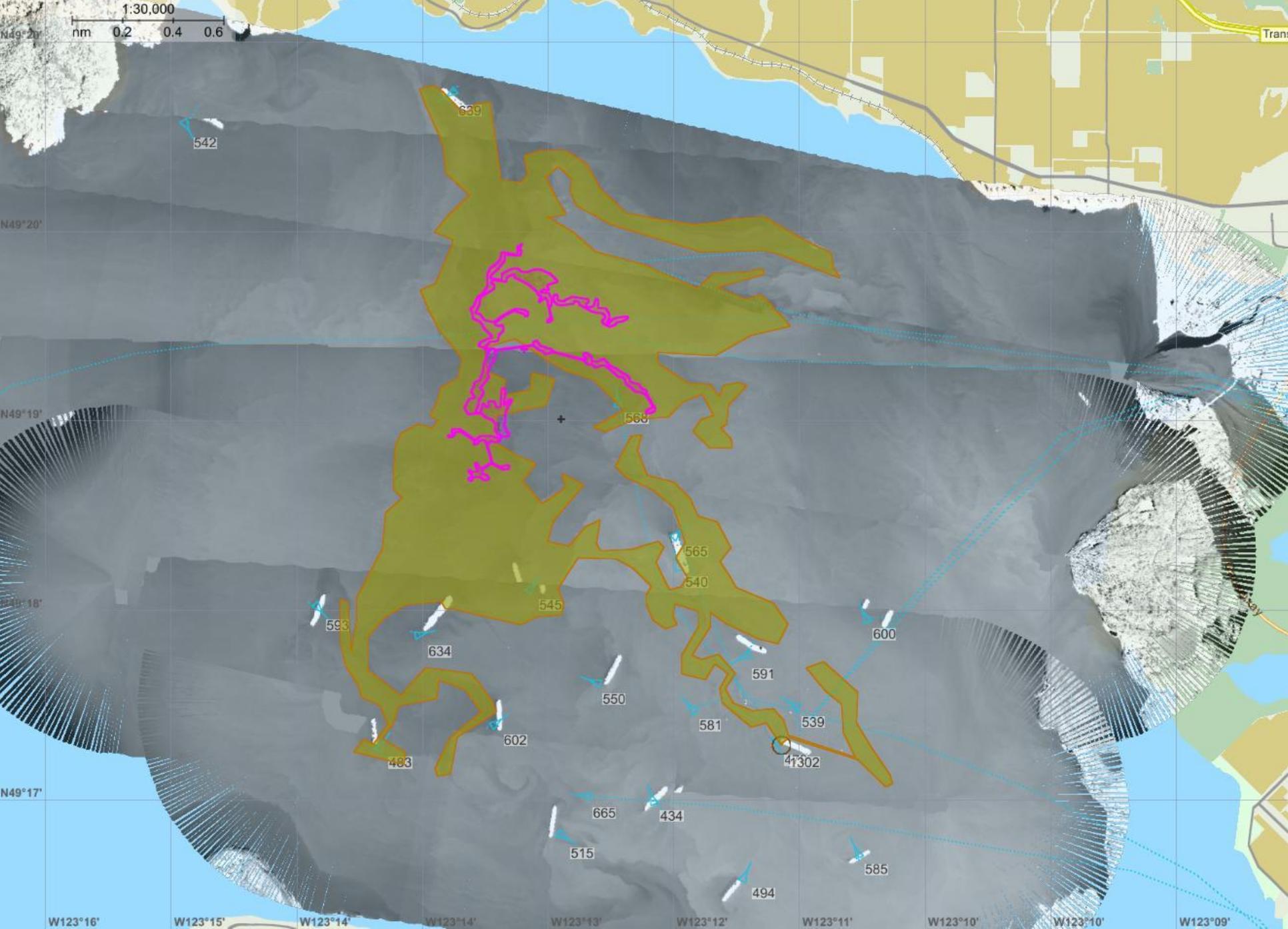
N49°20'

N49°19'

N49°19'

N49°18'

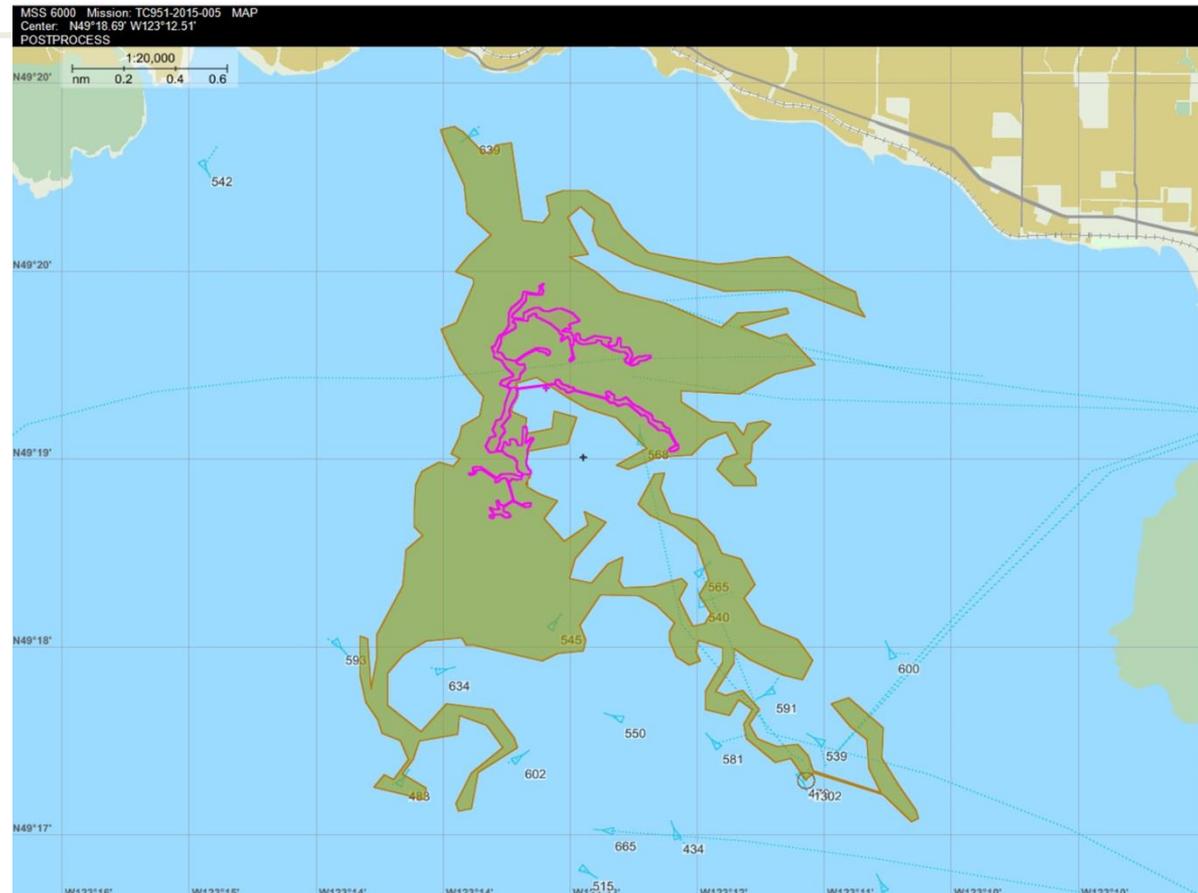
W123°14' W123°14' W123°14' W123°14' W123°14' W123°14' W123°14' W123°14' W123°14'



Automatic Identification System (AIS) & Moving Map Display

AIS

- Maritime Domain Awareness
- Vessel Voyage and Identity Information
- Data sent to MSOCs
 - In flight – every 15 minutes
 - Post flight



MAP DISPLAY

- Drawing features (Polygons around slicks)
- Accurate Area Calculations = Better Estimation of Oil Quantity

Satellite Communication System

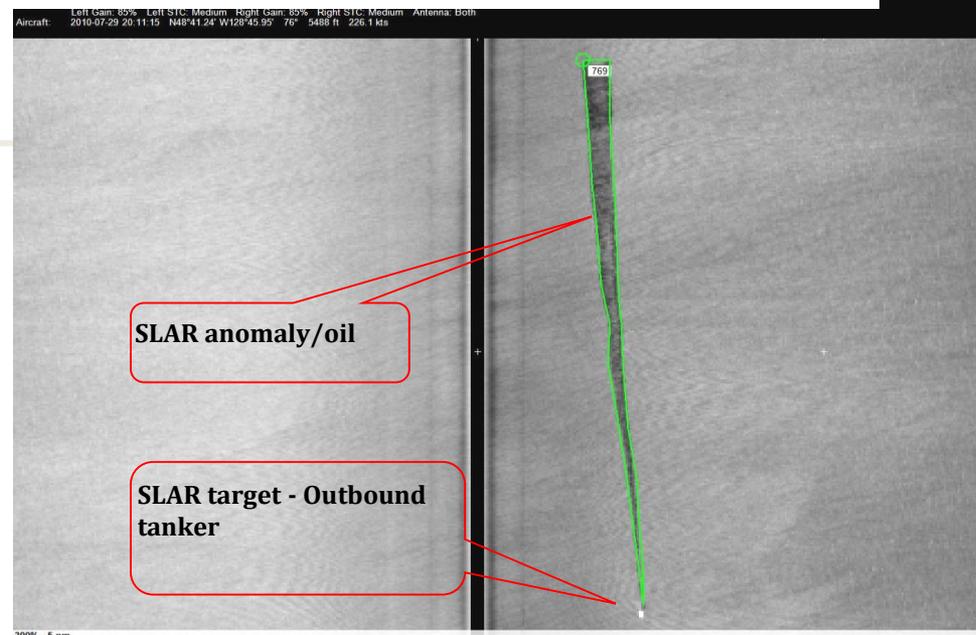
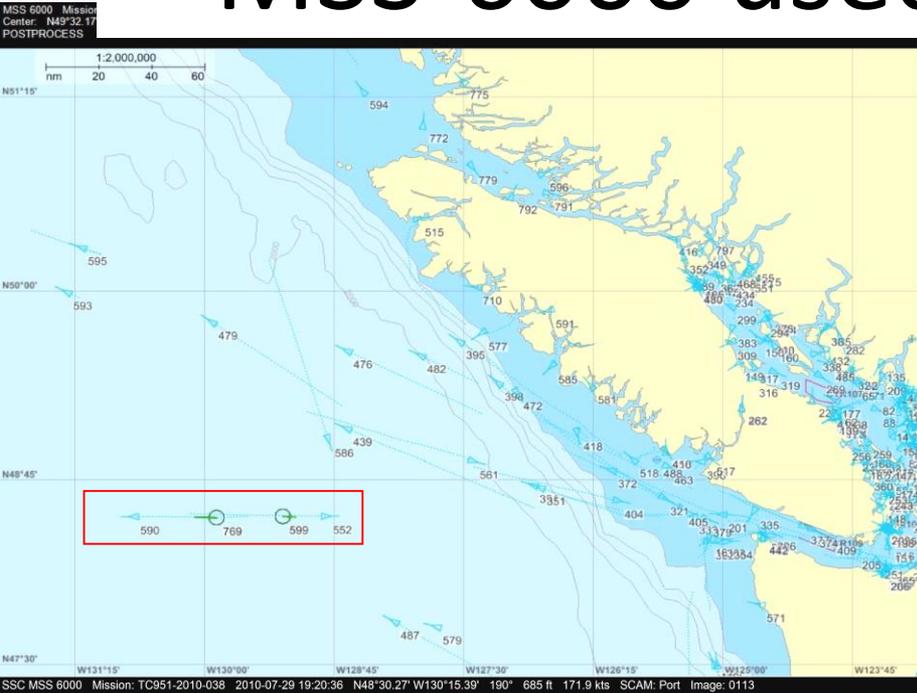
Swift broadband (SBB) technology:

•Continuous connection throughout every mission allows:

- Regular transmission of AIS information
- Continuous flight following
- Live streaming video capability
- Transmission of target information
- “Office Operable” while airborne
- Recently upgraded to Xtreme Service ~ 480 kbs/sec
- Improvements since DWH Response



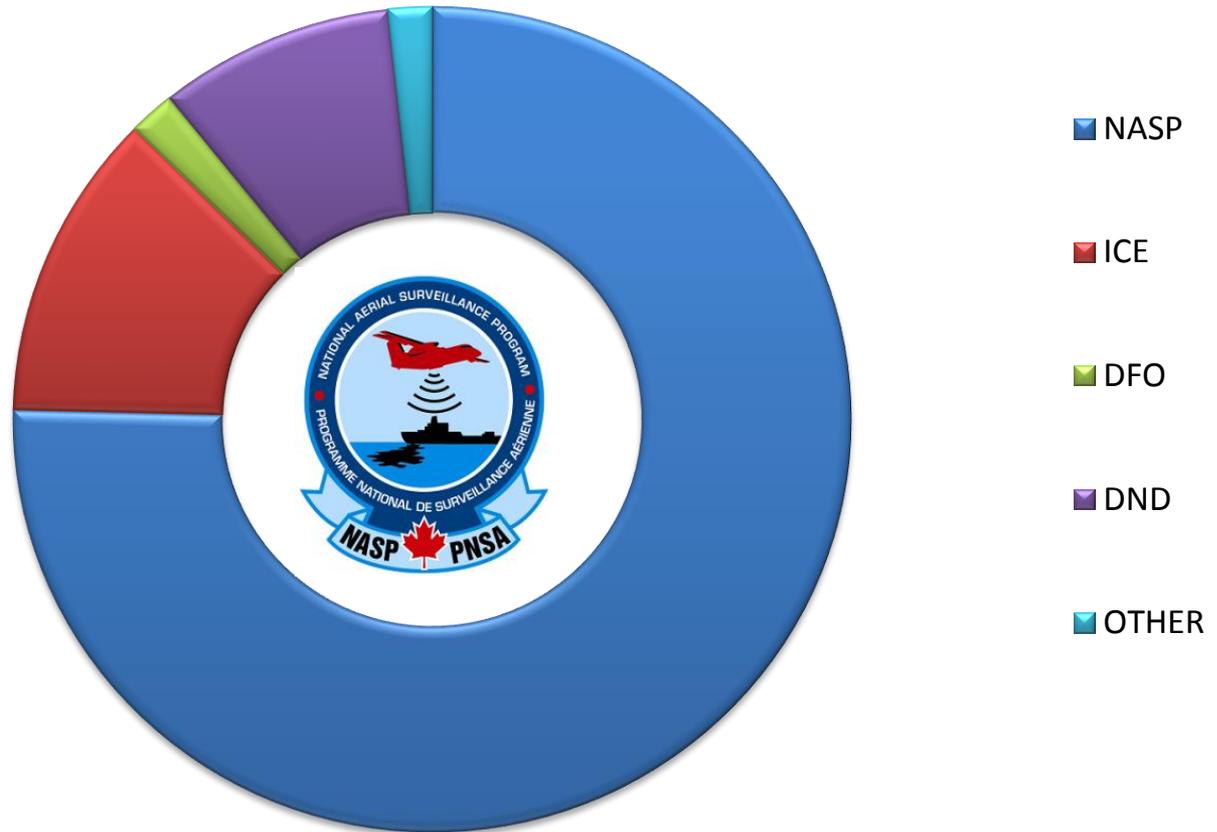
MSS-6000 used for Prosecution



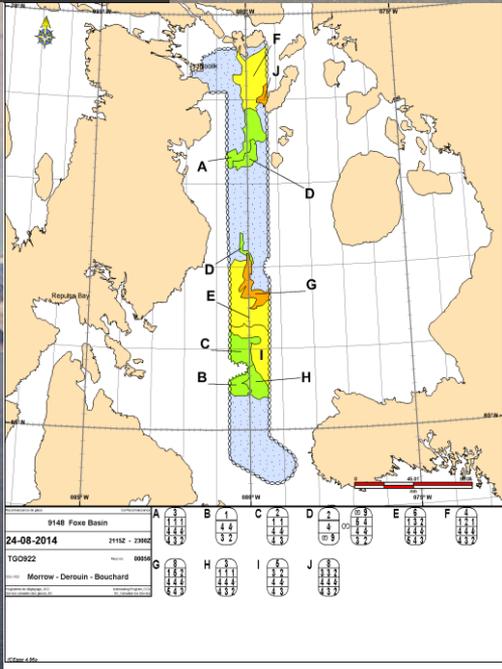
NASP Activities



NASP Mission Purpose Hours Fiscal Year 2013-2014



Ice Reconnaissance



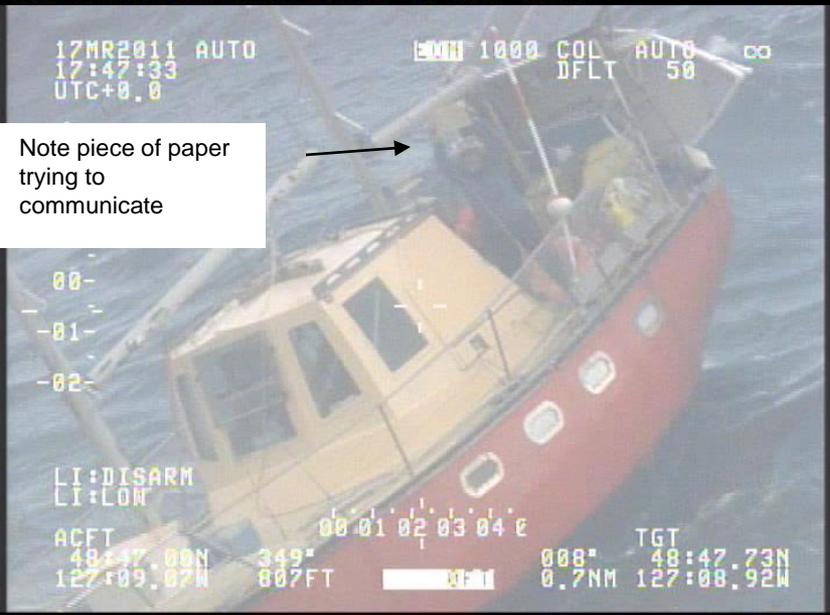
SAR/SAA

SSC MSS 6000 Mission: TC951-2010-083 VIDEO
 Video: 2011-03-17 17:40:43 N48°48.97' W127°09.69' 147° 725 ft 122.9 kts EO/IR
 EO/IR: N48°47.57' W127°08.79'
 Aircraft: 2011-03-17 18:21:13 N49°14.08' W127°26.83' 157° 16073 ft 228.3 kts

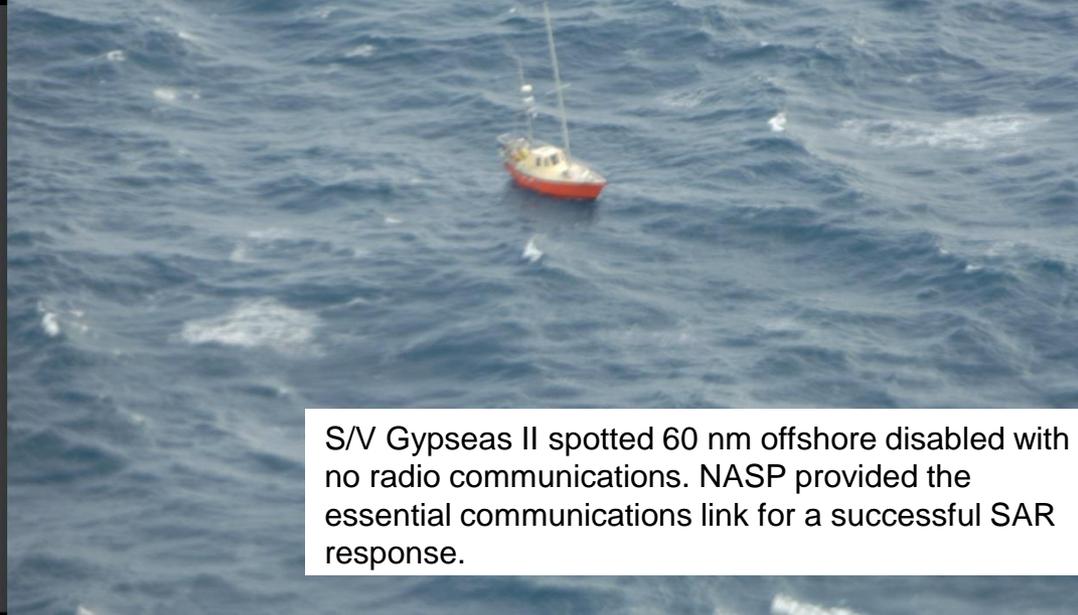


SSC MSS 6000 Mission: TC951-2010-083 VIDEO
 Video: 2011-03-17 17:47:25 N48°46.82' W127°08.97' 332° 790 ft 183.3 kts EO/IR
 EO/IR: N48°47.71' W127°08.91'
 Aircraft: 2011-03-17 18:24:04 N49°05.20' W127°20.08' 156° 8704 ft 195.9 kts

SSC MSS 6000 Mission: TC951-2010-083 2011-03-17 17:43:40 N48°47.44' W127°09.26' 323° 754 ft 186.8 kts SCAM: Port Image: 0016

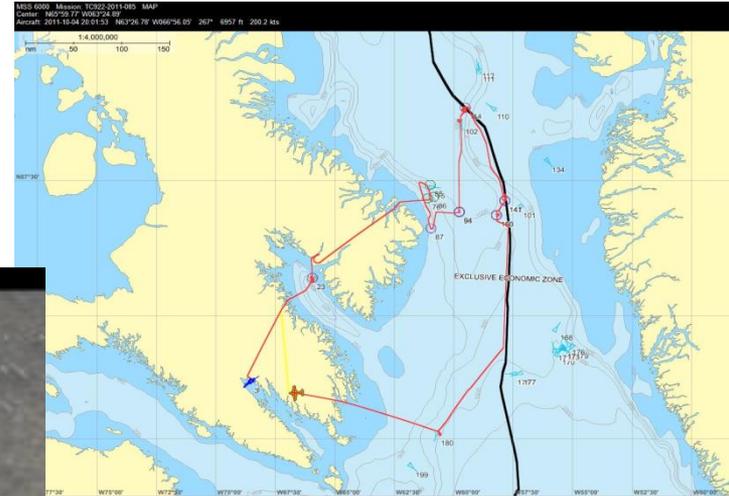


Note piece of paper trying to communicate



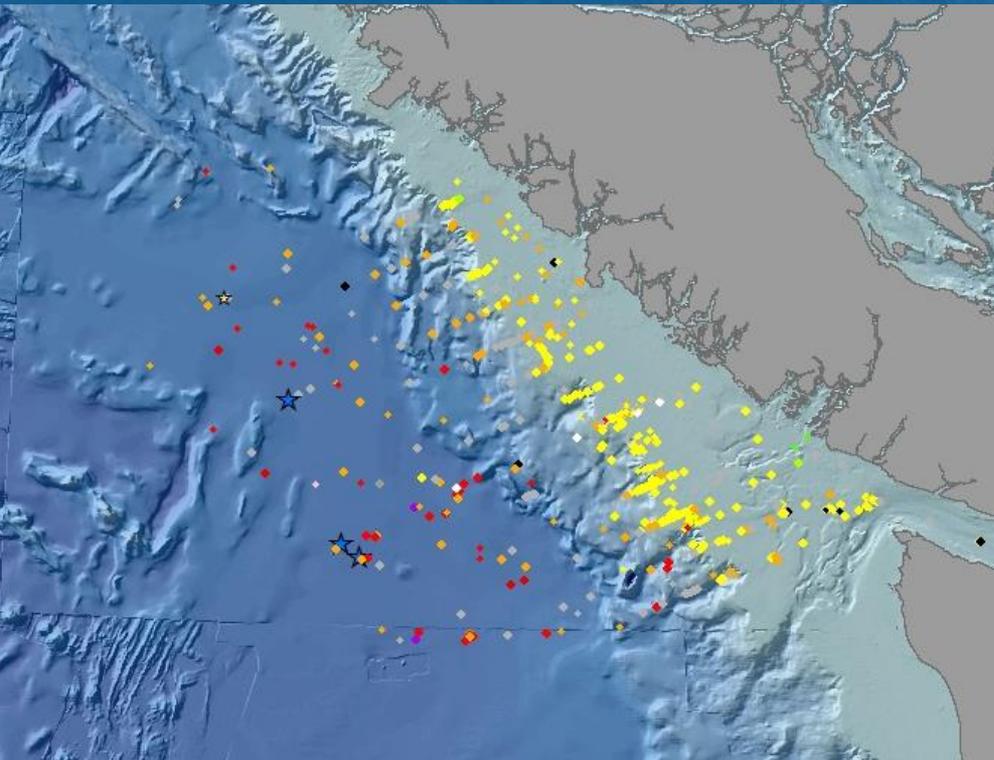
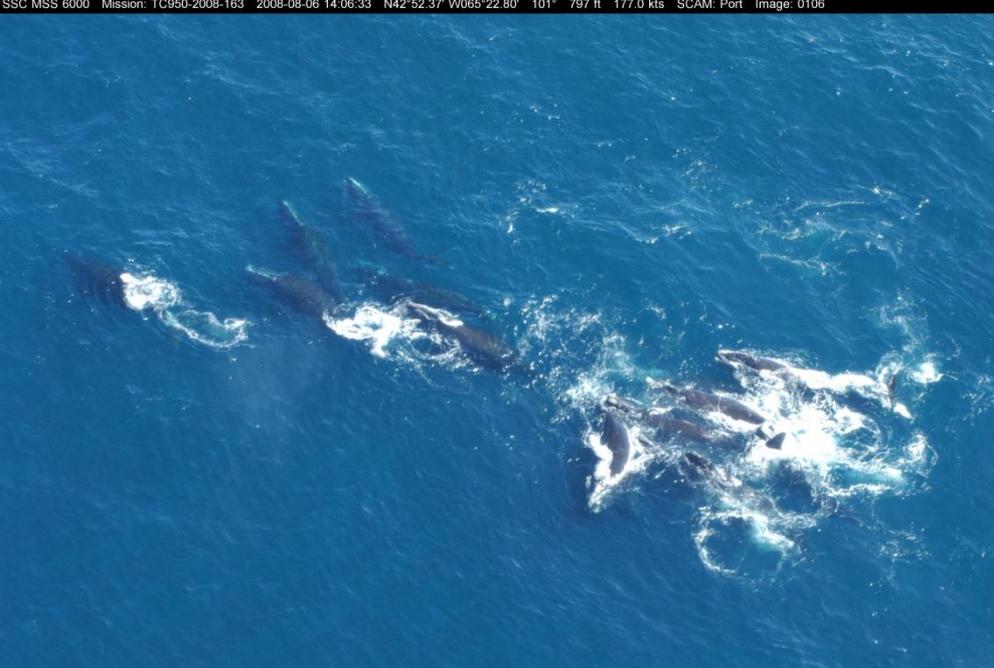
S/V Gypseas II spotted 60 nm offshore disabled with no radio communications. NASP provided the essential communications link for a successful SAR response.

Fisheries Patrol



Wildlife Monitoring





Dedicated Marine Mammal Surveys (Sept 2012 to Feb 2014)

Whale Researches on board conducting transects to determine populations and

- Red = fin whale
- Orange = large unidentified whale or like fin whale or unidentified baleen whale
- Yellow = humpback
- Blue stars = blue whale**
- Smaller yellow star = baird's beaked whale
- Purple = sperm whale
- Grey = Risso's dolphin, pacific white sided dolphin, northern right whale dolphin and all other dolphin/porpoise
- Black - killer whale
- Lime green = grey whale
- White = Cuvier's beaked whale

Science – Monitoring of Ice Flows in the Beaufort Sea

2007-04-02 20:34:26 N73°21.55' W145°15.75' 583 ft Mission: TC950_2007_055 SCAM Cabin Image: 0012



Environmental Enforcement Support



The Integrated Satellite Tracking of Pollution (ISTOP) Program



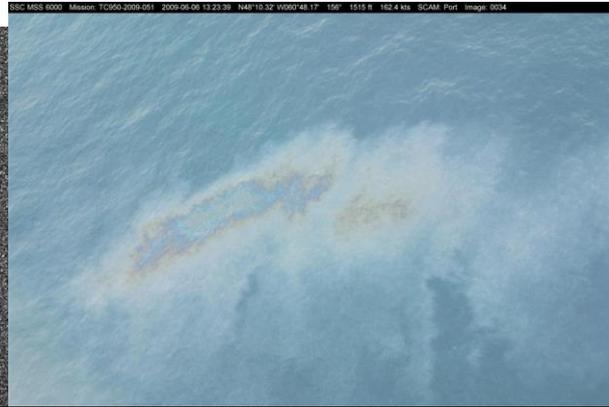
- Earth observation satellites (RADARSAT) to detect and monitor oil spills
- Created daily in near real time by the Canadian Ice Service
- Task aircraft to investigate potential pollution

June 6, 2009 Incident

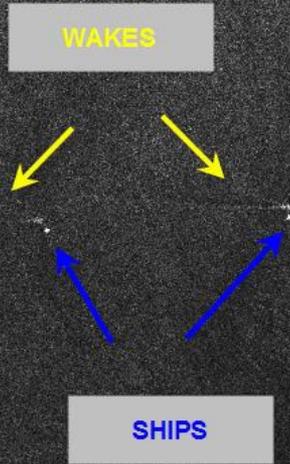
CATEGORY 1B

ISTOP detected a 5 km long anomaly in the Gulf of St. Lawrence

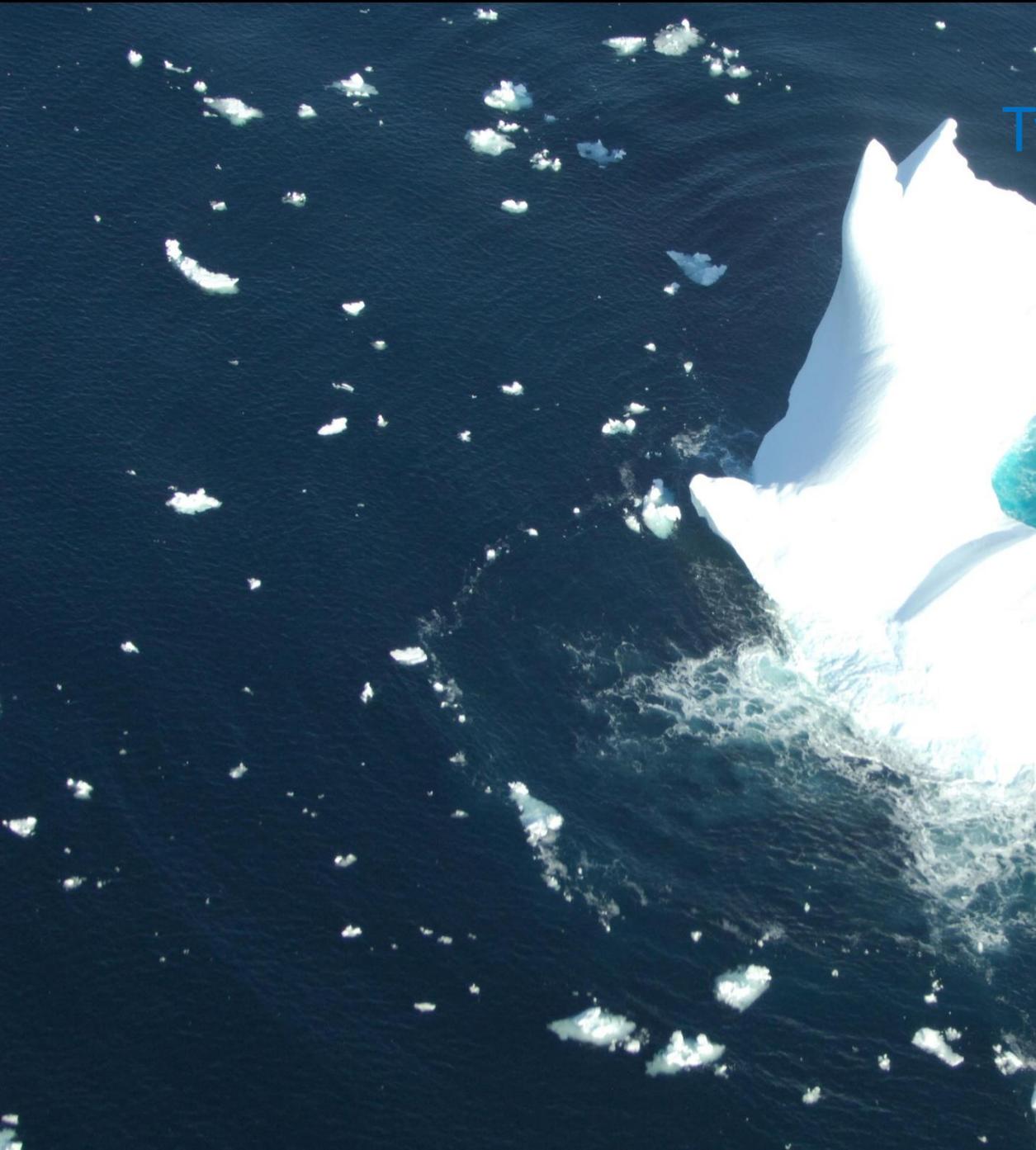
36 litre spill confirmed by the aircraft



SSC MSS 6000 Mission: TC950-2009-051 2009-06-06 15:57:47 N49°23.19' W065°44.15' 207° 1007 ft 168.5 kts SCAM: Port Image: 0070



Visual photos of the June 6, 2009 oil spill taken from the DASH 8 aircraft.



Filter>> Targets [623]

Id	C	Time	Lat	Long
⊕ 597	AV	18:00	N47°44'	W128°03'
⊕ 598	AV	18:38	N50°08'	W128°04'
⊕ 599	AV	18:02	N48°30'	W128°48'
⊕ 601	AV	17:46	N47°40'	W125°17'
⊕ 605	AV	17:45	N47°23'	W124°48'
⊕ 606	AV	20:08	N49°44'	W124°23'
⊕ 607	AV	17:44	N47°43'	W122°25'
⊕ 608	AV	20:00	N49°55'	W124°41'
⊕ 609	AV	18:50	N50°48'	W127°08'
⊕ 610	AV	18:54	N50°44'	W127°07'
⊕ 611	AV	18:01	N49°53'	W126°50'
⊕ 612	AV	19:59	N49°52'	W124°33'
⊕ 613	AV	17:56	N47°57'	W129°06'
⊕ 614	AV	18:48	N50°57'	W127°29'
⊕ 615	AV	18:57	N50°35'	W127°00'
⊕ 616	AV	18:03	N49°04'	W129°52'
⊕ 617	AV	18:28	N49°52'	W124°34'

Property	Value
Category	AIS
Type	VESSEL
Date	2013-06-18
Time	18:03:17
Latitude	N49°03.56'
Longitude	W129°52.36'
Course	306°
Speed	11.7 kts
Vessel type	AIS Ship
Name	ALPHA EFFORT
Call sign	SVYL
IMO	9189081
Port of call	
Destination	CHINA SHANGHAI
ETA	-
Ship/cargo type	70 Cargo ship
Length/width	225 m/32 m
True heading	305.0°
ROT	0.0°/min
Max. draught	13.8 m
Nav. status	UNDER WAY

Comment

Cursor

Object 616
N49°03.56' W129°52.36'

Support During Emergency Response Situations



May include events such as:

- **Public Safety**
- **Ships stuck in ice**
- **Marine Casualties**
- **Floods**
- **Support to OGDs**
- **Response to Pollution Incidents**



The MX-15 camera and the live streaming video were vital with this operation

Future Initiatives

- 2nd MSS6000 User consoles for all three aircraft increase data input and team operations
- International Survey on Program Resources, Training, and Exercising
- Arctic Hangar – seek funding
- Manned verses Unmanned –
Follow the evolution of the UAS
- Replacement of aging fleet
- Upgrade sensors and MSS-7000



Conclusion

- TC - NASP will continue to observe, analyze, record and report marine pollution and sea based activities
- Equipment capabilities teamed with trained professionals
- Public confidence and perception is a key driving factor
- Copious amounts of data is now available due to advancements in technology – TC should use this to our advantage
- Streaming video capability is a great tool for situational awareness
- This program greatly enhances COP during incidents

Thank You



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Team (MART)

Environment Canada

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Office: (604) 666-3927

Cell: (604) 787-2046



Tasking of NASP Assets

All Taskings should be initiated through the TC SitCen

1-888-857-4003 or 613-995-9737

The client is required to provide:

- Purpose of the tasking (e.g. oil spill, Search and Rescue, etc.)
- Is the tasking Urgent or Non-Urgent?
- Name
- Cell Phone Number
- Office Phone Number
- His/her department / organization
- Which aircraft is required
- Where the client is located (which Region)
- For which day & time the aircraft required