Satellite based oil spill detection –early warning using multiple data sources

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Sometimes a bird’s eye view can provide a different perspective on things

”Early birds”

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The famed pigeon fleet that operated in Europe end of last century

”Birds” of today

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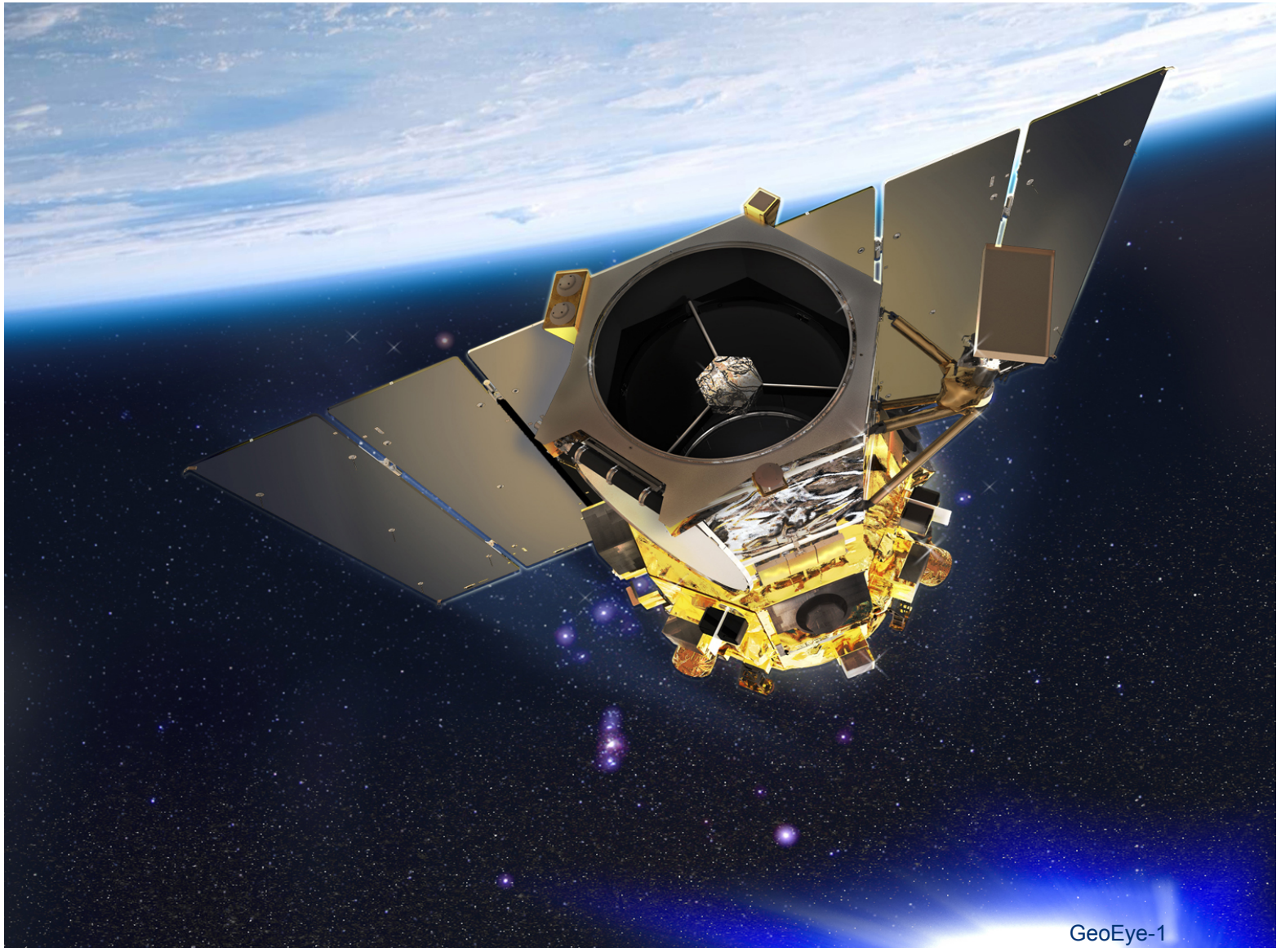

Kongsberg Satellite Services, KSAT

- Established in 1967
- Kongsberg Satellite Services since 2002
- World leading commercial satellite centre
- Providing products and services based on polar orbiting satellites
- Round the clock operations (24h/365d)

Up North..

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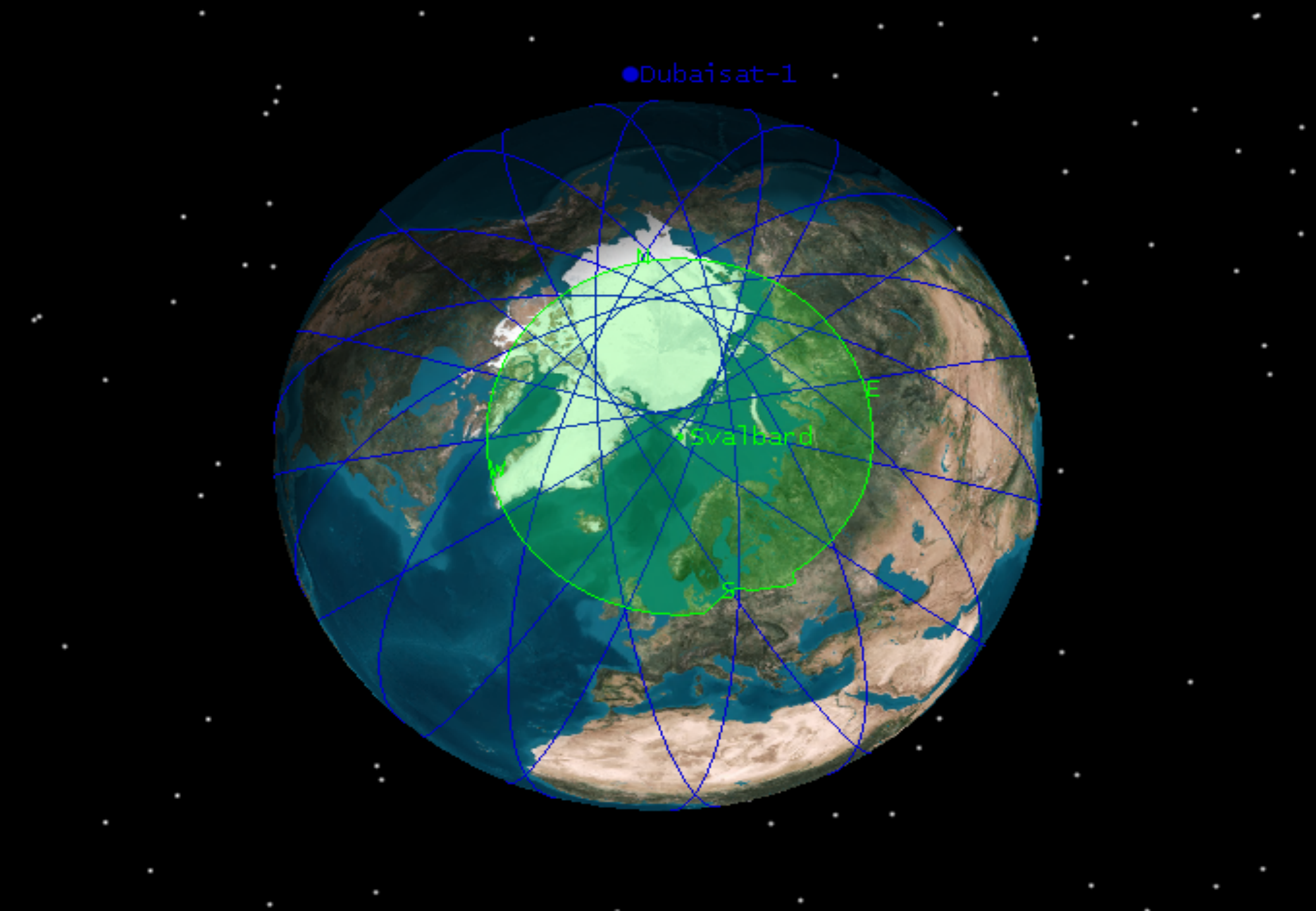
SvalSat, Earth station at 78´north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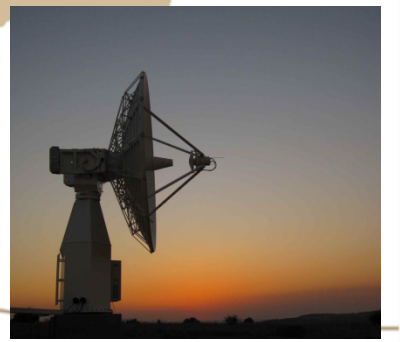
KSAT's Extended Polar and Mid-Latitude Network



Optical imgagery

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Synthetic Aperture Radar (SAR)

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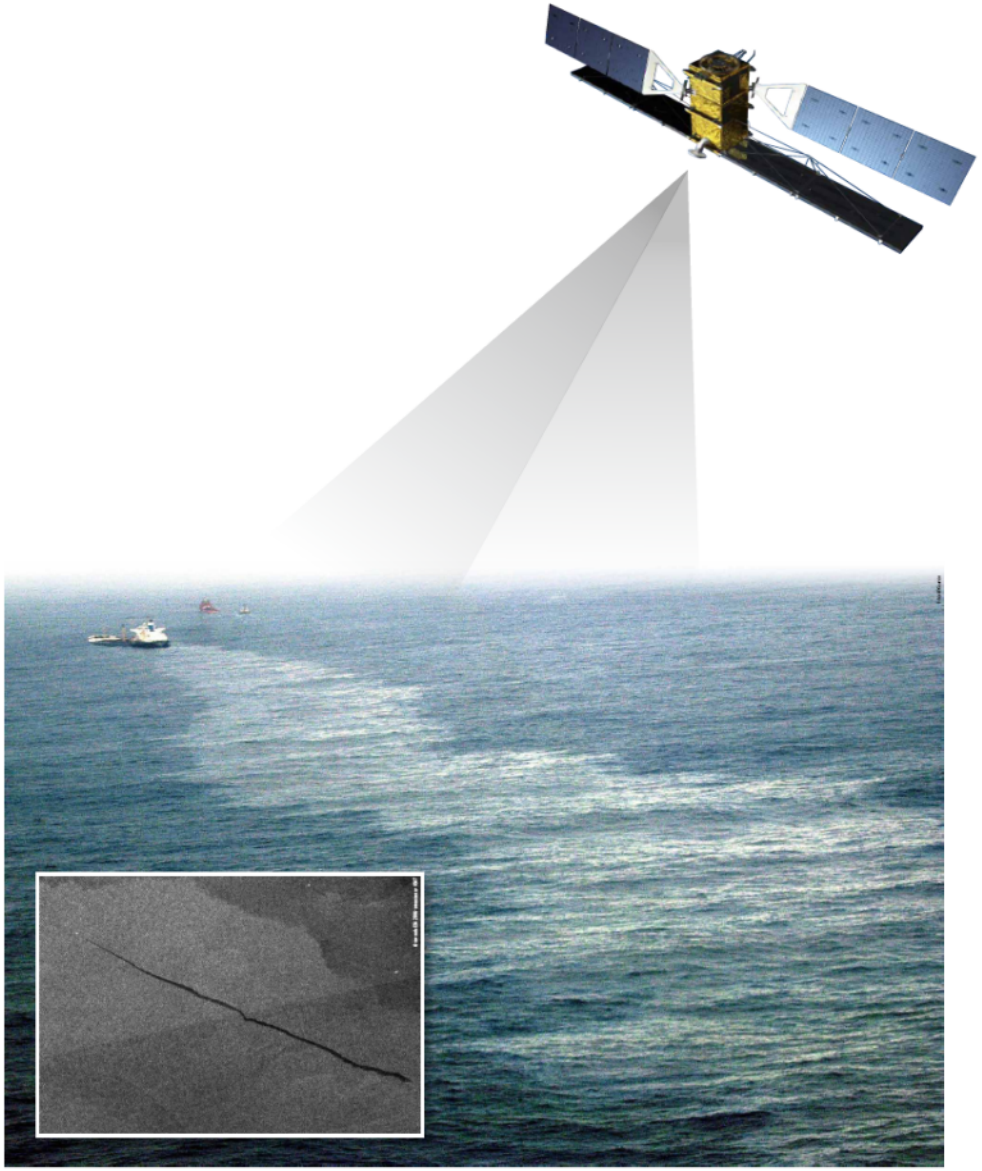
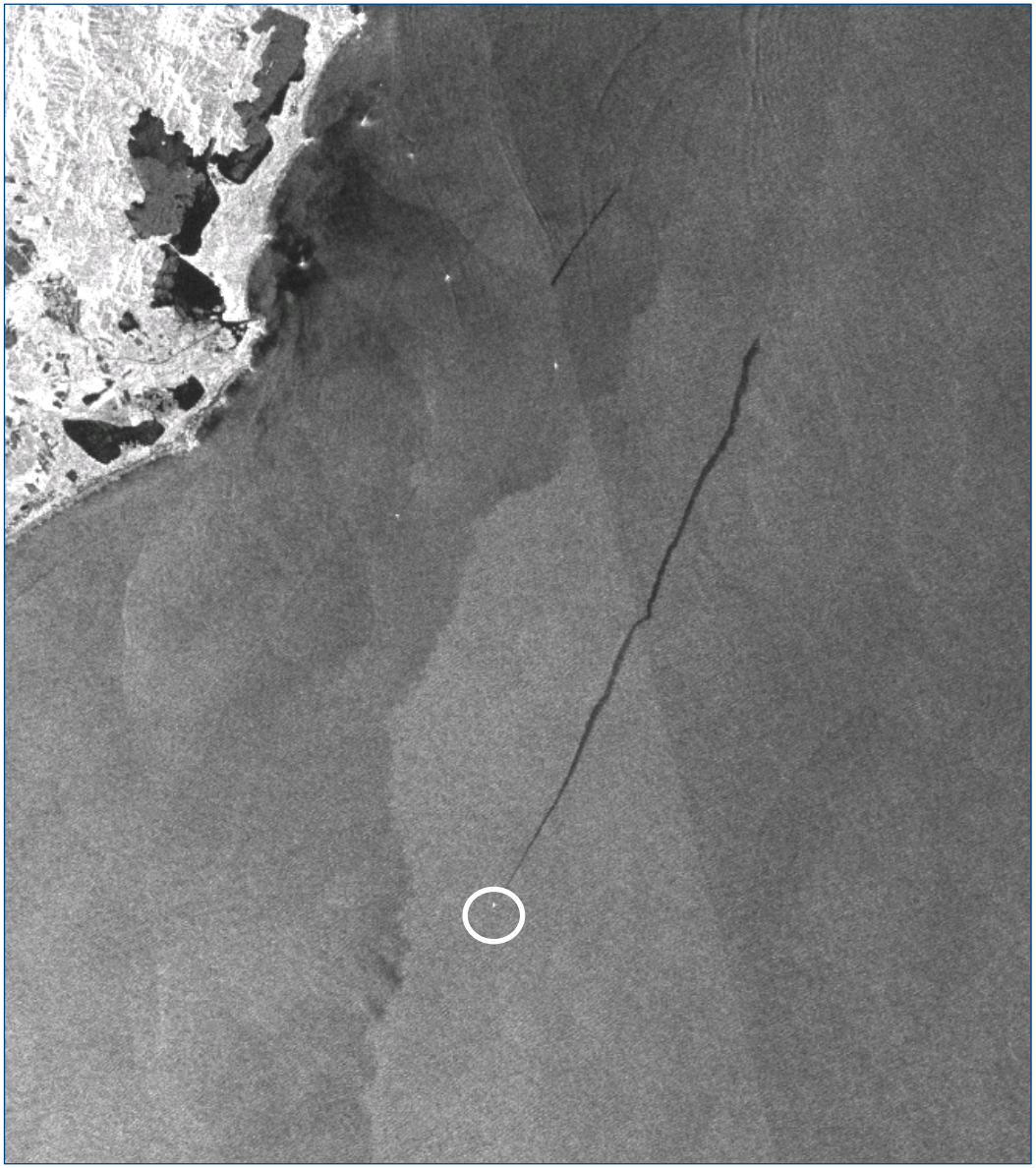
Why use radar from satellites to detect oil spills?

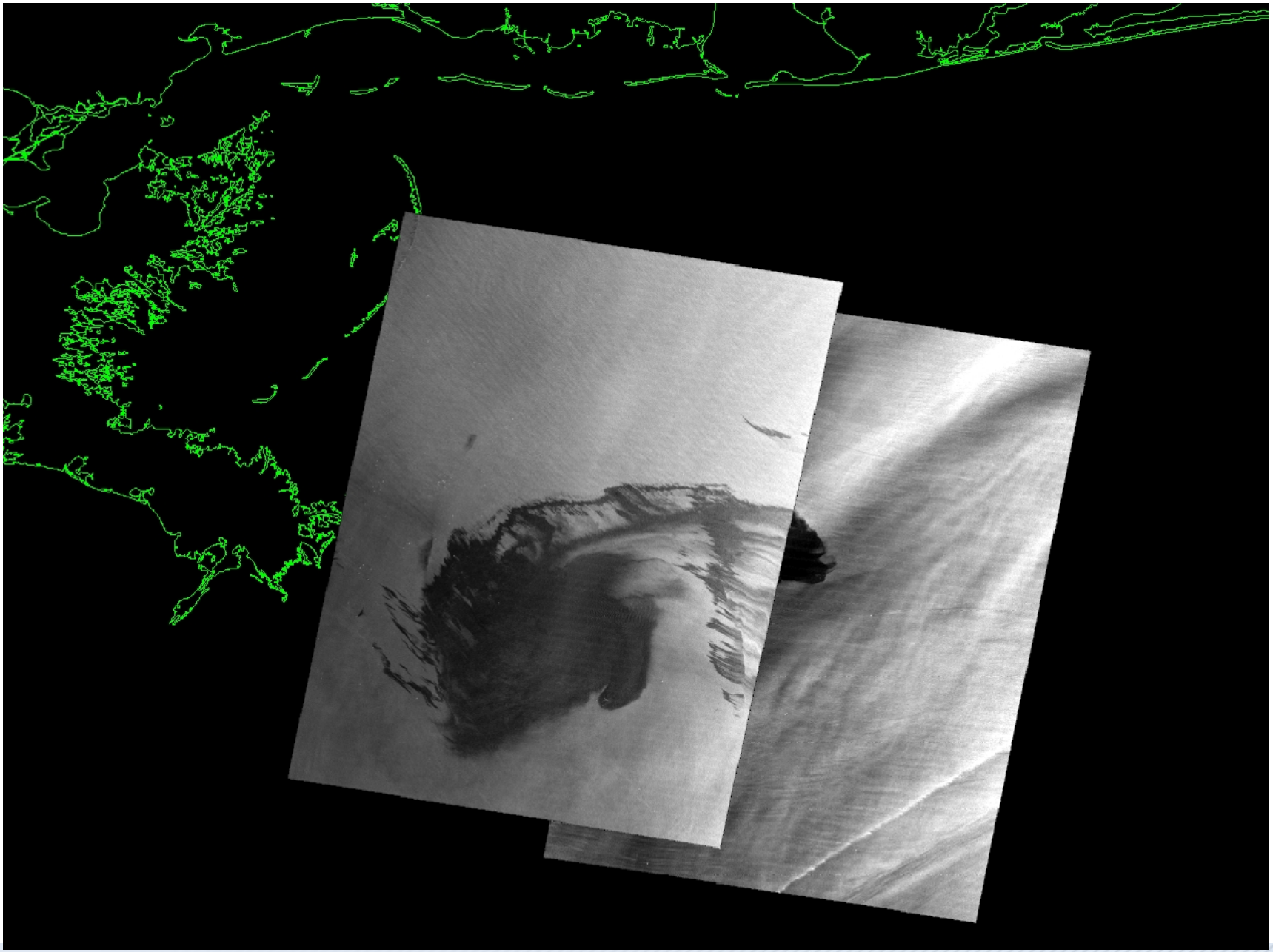


- Synthetic Aperture Radar (SAR)
- Active sensor
- Independent of daylight
- Sees through clouds and fog
- Large area coverage
- Excellent tool for detecting
  - Slicks
  - Vessels
  - Installations



©ESA processed by KSAT

Radarsat-2, © MacDonaldDettweiler



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KSAT NRT oil spill detection service

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- Early warning
- Multi user system; easy to expand to new areas
- Multi mission; multiple satellites (temporal coverage and reduncedancy)
- Agreed procedures for alerts
  - Confidence levels from predefined characteristics
  - Alert matrix, other informatrion, distance to installations, pipelines, shore, sensitive areas etc
- Easy ramp up; delivery of emergency or additional information through same channels
- NRT drift forecast and hindcast can be integrated

KSAT Near Real-time service chain

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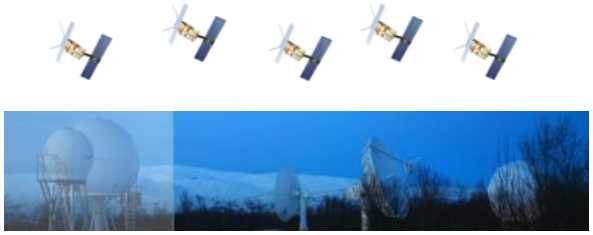
Satellite acquisition, multiple satellites



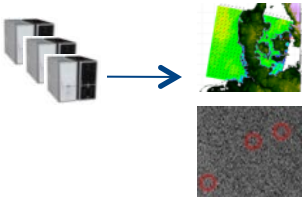
Automatic Identification System (AIS)

Sea-State

GIS -information

SAR Processing

VA Processing



Analysis and Notification

End user
Operations centre

Experienced operators is a crucial factor in the oil spill detection service. With a 30 minute time-limit the human knowledge obtained from analyzing a large number of SAR images is very valuable, and can still not be fully replaced by automatic detection and reporting.

Operational oil spill service consept in Europe

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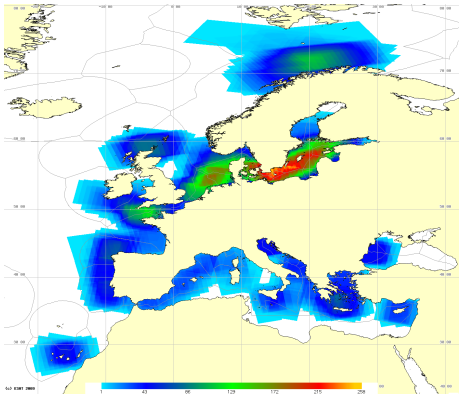
- Oil-spill service operationally in use in Europe since 1996
- Regional services
  - North sea service
  - Baltic Service
- CleanSeaNet service, coordinating monitoring for all EU coastal states since 2007
- Multinational Service Concept:
  - Cost sharing
  - One common web service
  - Reports distributed to affected member states
  - Baltic; Common flight planning
    - Diplomatic clearance to fly into each others area
- Service still provided by the service providers

EMSA



Coordinated surveillance, satellite and airplane observation

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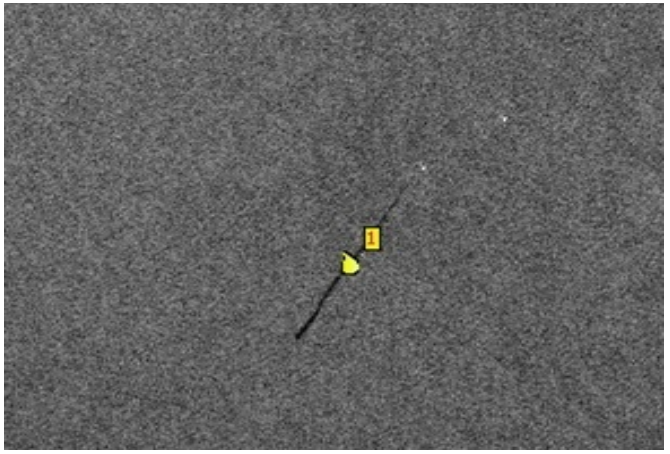

- Proven efficient for environmental monitoring
- Time of satellite images used for planning of airplane activity
- Direction to exact location
- Verification – documentation - identification

Oil slick detected by KSAT, reported in CleanSeaNet

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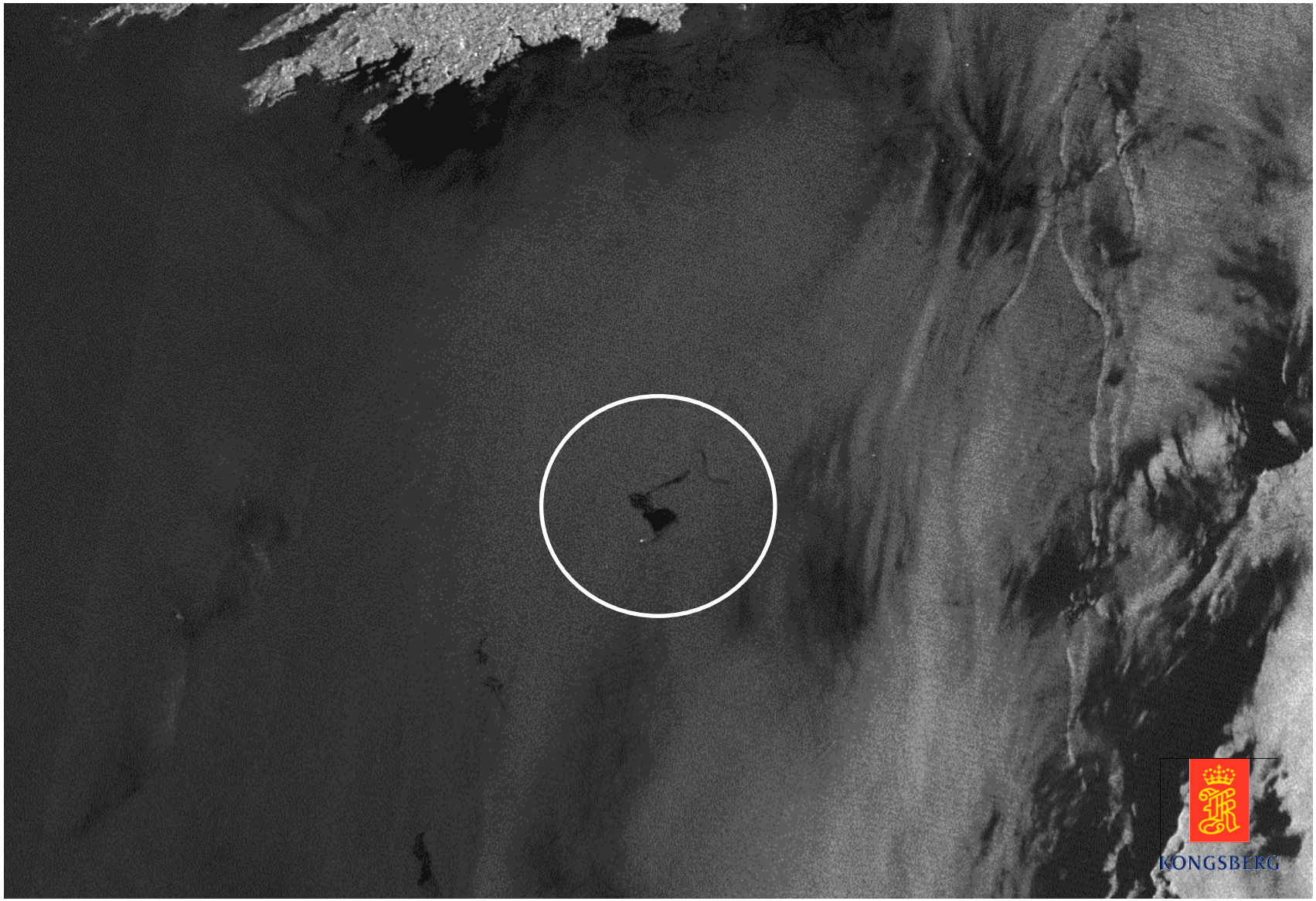

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Oil spill verified from UK Coastguard airplane (MCA)

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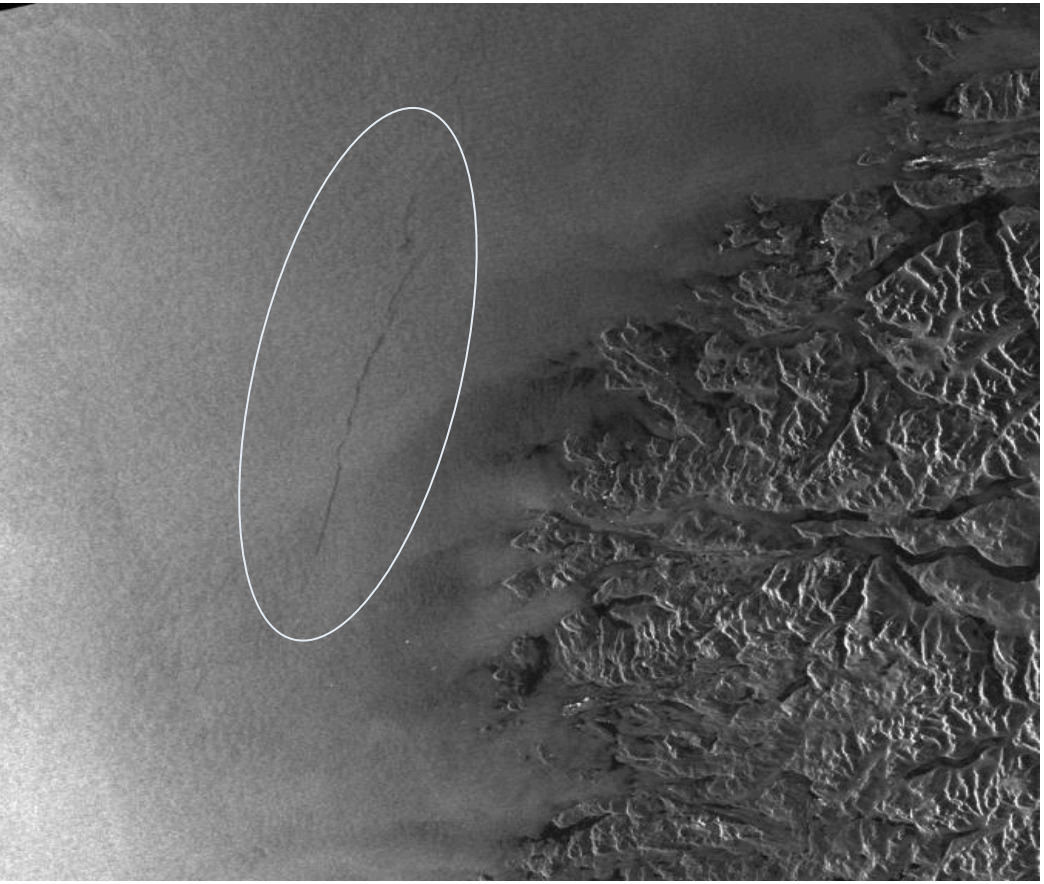
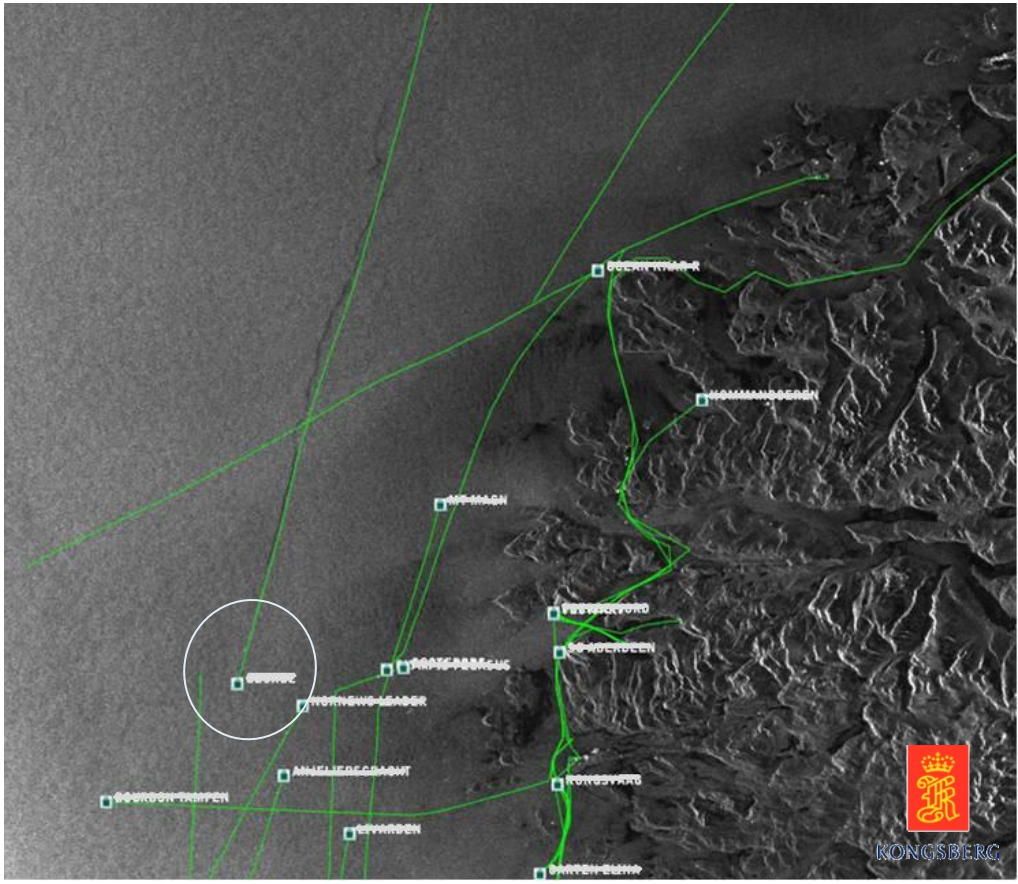
Courtesy MCA, Pollution Branch

Identification of Source



Oil spill off the Norwegian coast...



...Combined with AIS

Identification of Source

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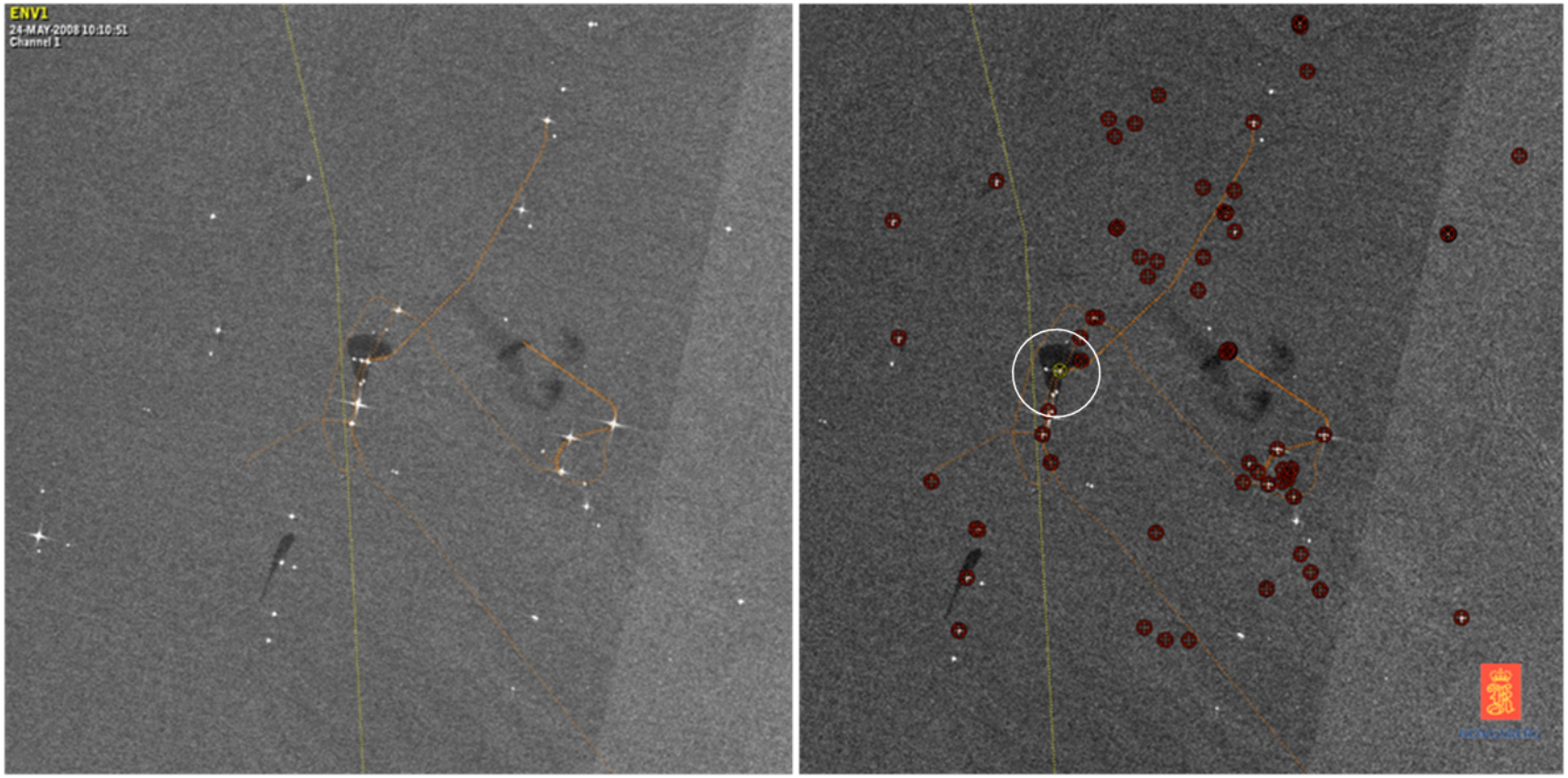

Oil spill from an oilrig detected from satellite. Image is overlaid with information of pipelines and offshore installations to identify the most likely source.

Oil spill verified from Coastal administration airplane

Courtesy Norwegian Coastal adminitration

Coordination of offshore monitoring Norway

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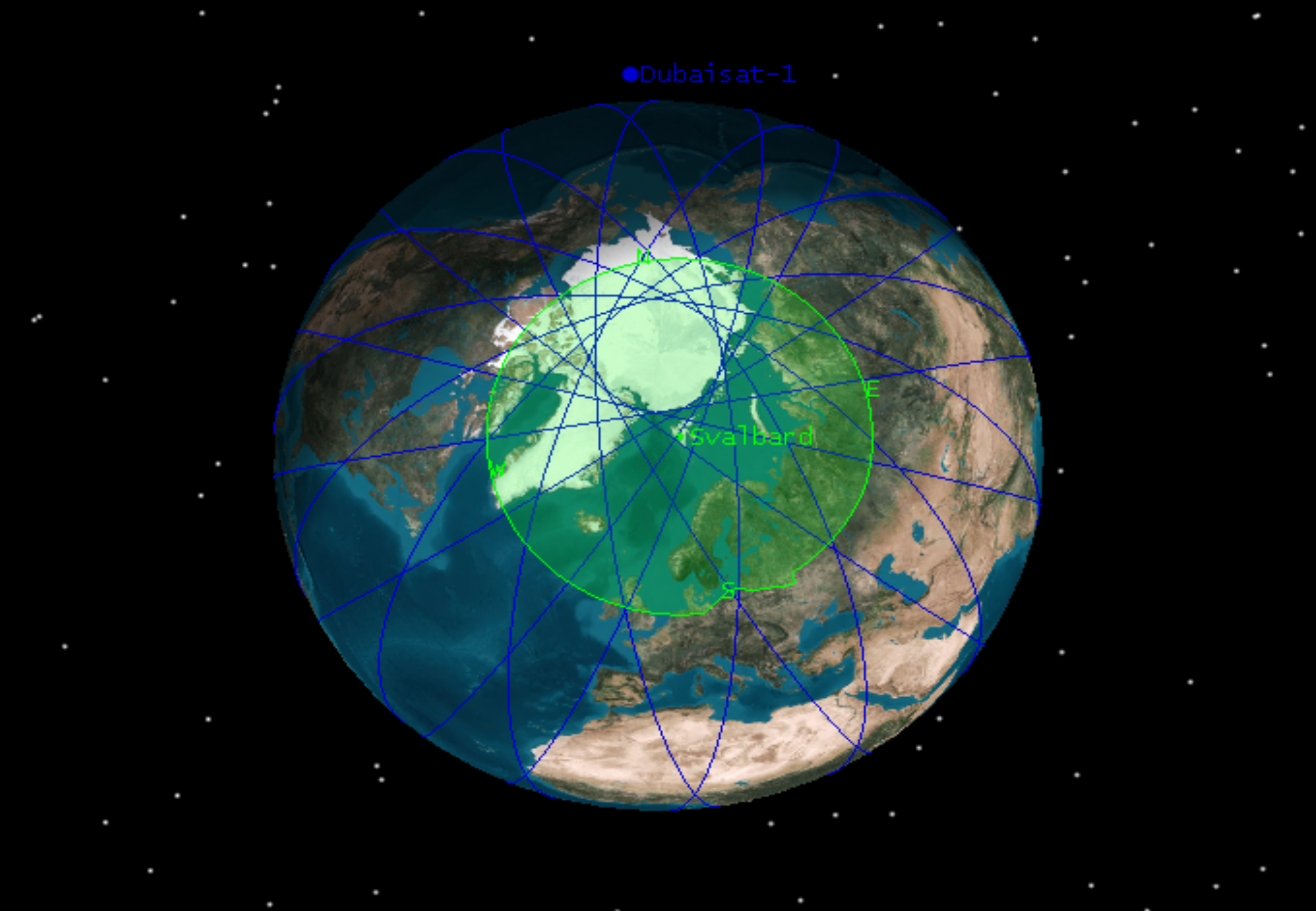
Dubaisat-1
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Svalbard
S

KSAT Multiple satellite operation; ”Multi mission”

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- Providing temporal coverage
  - Combination of relevant satellites to achieve requested coverage
  - Flexibility; footprint & resolution
- One stop shop; dedicated order and support desk
  - Planning and order handling
  - Data acquisition
  - Processing and analysing
  - Dissemination and integration
- Emergency support and redundancy
  - Multiple missions provides additional capacity
  - Several SAR missions ensures redundency if satellite failure
  - Future missions – unigue ground network positions for new missions

Why Multi-Mission Matters

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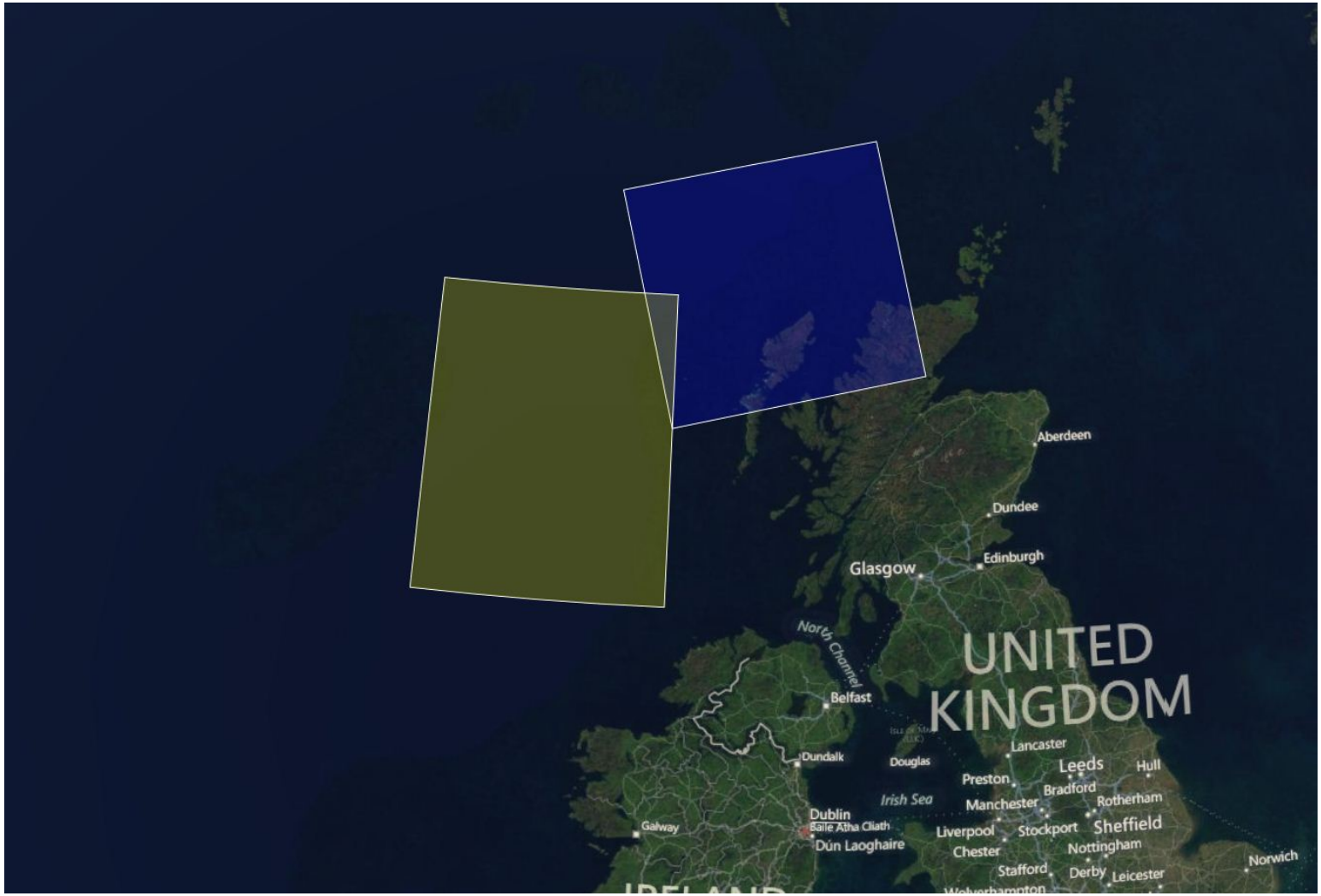

KSAT Multi mission

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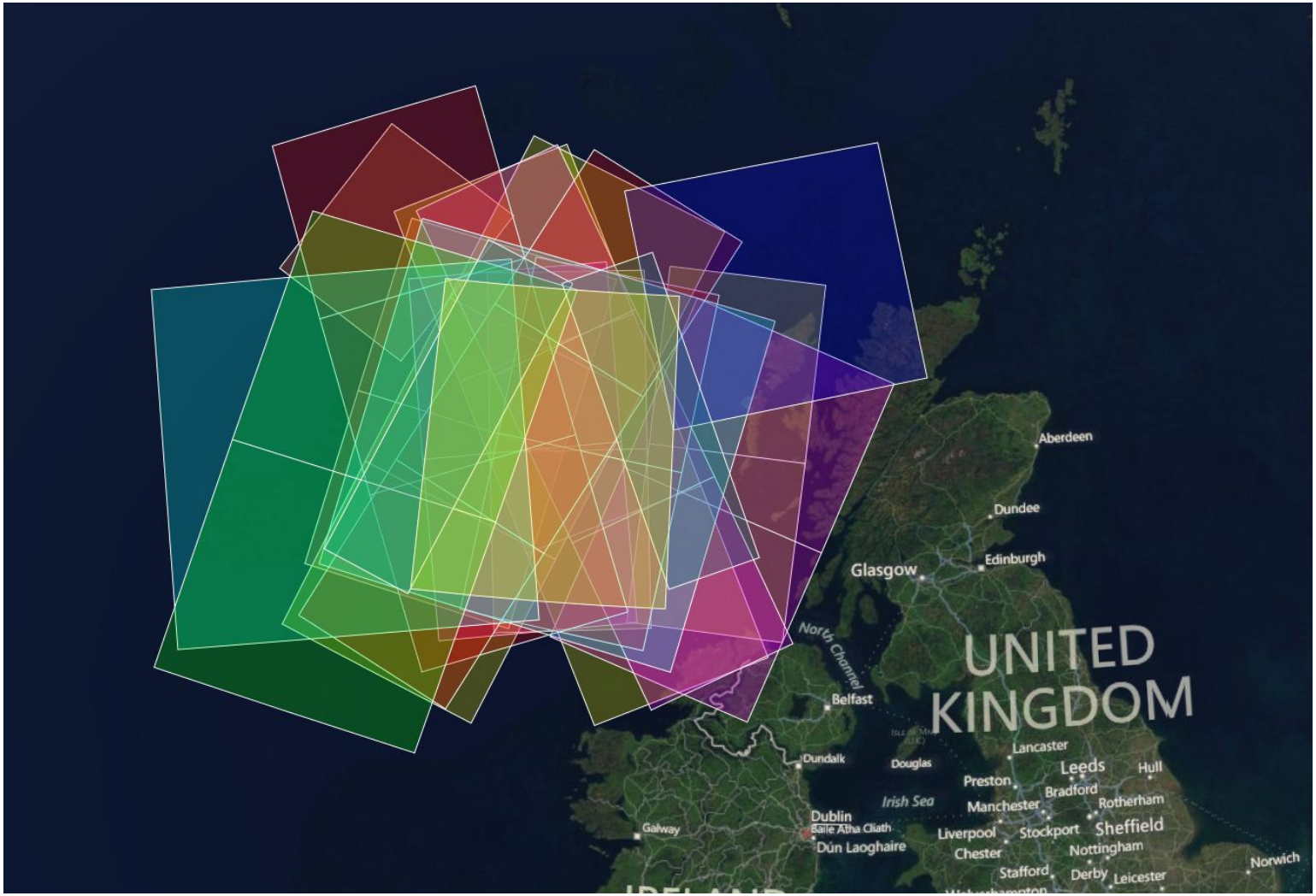

Multi mission

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Satellite	Sensor	Region	Start	Orbit	Pass	AreaCovered%
Cosmo-SkyMed-3	ScanSAR (HugeRegion) - Left	Englandsq	14.03.2012 04:47	18310	Ascending	56,86999893
Cosmo-SkyMed-2	ScanSAR (HugeRegion) - Left	Englandsq	14.03.2012 05:05	23064	Ascending	72,62000275
Cosmo-SkyMed-4	ScanSAR (HugeRegion) - Left	Englandsq	14.03.2012 05:29	7319	Ascending	62,13999939
Cosmo-SkyMed-3	ScanSAR (HugeRegion) - Right	Englandsq	14.03.2012 06:23	18311	Ascending	77,62999725
Cosmo-SkyMed-2	ScanSAR (HugeRegion) - Right	Englandsq	14.03.2012 06:41	23065	Ascending	64,30999756
RADARSAT-1	Narrow ScanSAR	Englandsq	14.03.2012 07:22	85389	Descending	39,31999969
TerraSAR-X	SC Full Performance Left	Englandsq	14.03.2012 08:07	26329	Descending	24,62999916
ENVISAT	ASAR/WS	Englandsq	14.03.2012 11:16	52508	Descending	100
TerraSAR-X	SC Full Performance Left	Englandsq	14.03.2012 17:19	26335	Ascending	21,27000046
RADARSAT-2	ScanSAR Narrow	Englandsq	14.03.2012 18:00	22183	Ascending	2,940000057
Cosmo-SkyMed-2	ScanSAR (HugeRegion) - Right	Englandsq	14.03.2012 18:20	23072	Descending	9,909999847
Cosmo-SkyMed-4	ScanSAR (HugeRegion) - Right	Englandsq	14.03.2012 18:44	7327	Descending	70,97000122
Cosmo-SkyMed-1	ScanSAR (HugeRegion) - Right	Englandsq	14.03.2012 19:09	25798	Descending	56,34000015
Cosmo-SkyMed-3	ScanSAR (HugeRegion) - Left	Englandsq	14.03.2012 19:39	18319	Descending	17,22999954
Cosmo-SkyMed-2	ScanSAR (HugeRegion) - Left	Englandsq	14.03.2012 19:56	23073	Descending	75,18000031
Cosmo-SkyMed-4	ScanSAR (HugeRegion) - Left	Englandsq	14.03.2012 20:20	7328	Descending	68,76000214
Cosmo-SkyMed-1	ScanSAR (HugeRegion) - Left	Englandsq	14.03.2012 20:44	25799	Descending	0,349999994
ENVISAT	ASAR/WS	Englandsq	14.03.2012 22:39	52515	Ascending	40,02000046

New Satellite missions

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Future satellite missions from 2012-2016

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- Risat – India planned 2012
- Sentinel constellation – Europe planned 2013
- Terrasar-X2 -Germany
- Radarsat constellation –Canada planned 2013
- Cosmo SKYmed 2
- SAR sensor is becoming increasingly interesting in many countries´futuere satellite programs

Summary

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- Synthetic Aperture Radar (SAR); excellent tool to detect oil slicks on the surface
- Near Real-time; provides timely alert of high risk findings
- Integration; provides information about possible source, wind , forecast/hindcast
- Predictability; excellent planning tool for aerial surveillance
- Coverage; multi mission operation ensures timely information, and flexibility in regards to redundancy
- We strongly believe in the SAR sensor for detection of oil slicks and that the multi-mission approach is the way to go , securing regular operational satellite monitoring services at all latitudes, and adding capacity for emergency support.

Thank you!

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