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SeaDarQ at DEPOL07

Sea Trials 22-05-2007

E.A. Teeuw B.Eng

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1 Overview

On May 2007 SeaDarQ attended the DEPOL07 sea trials organized by the French Navy, French Customs and Cedre. During the sea trials four oil slicks were spilled: intermediate fuel oil, sunflower oil, Radiagreen® BDMF VLV and kerdane, each 1 m³. Those slicks were spilled by using the “open cylinder” technique. After releasing one slick, fluoresceine was added to visually mark the slick. Also a Norda type buoy for visual marking and a Argos type buoy for GPS tracking of the slick were released for each slick.

Each patch was released approximately one nautical mile from each other in a straight line, starting with the most persistent one. After the spillage of the last slick, the vessel patrolled along the slicks. At the end of the day, dispersant was applied on the appropriate slicks.

The SeaDarQ system installed on board of the supply vessel Alcyon was connected to the 12 feet Sperry radar antenna of TNO witch has the possibility to switch between horizontal and vertical polarization. The height of the antenna position was approximately 15 m.

This sea trial gave us the possibility to verify the visibility of the different types of oil, and what the effect is of using the V-V polarization in stead of H-H polarization.

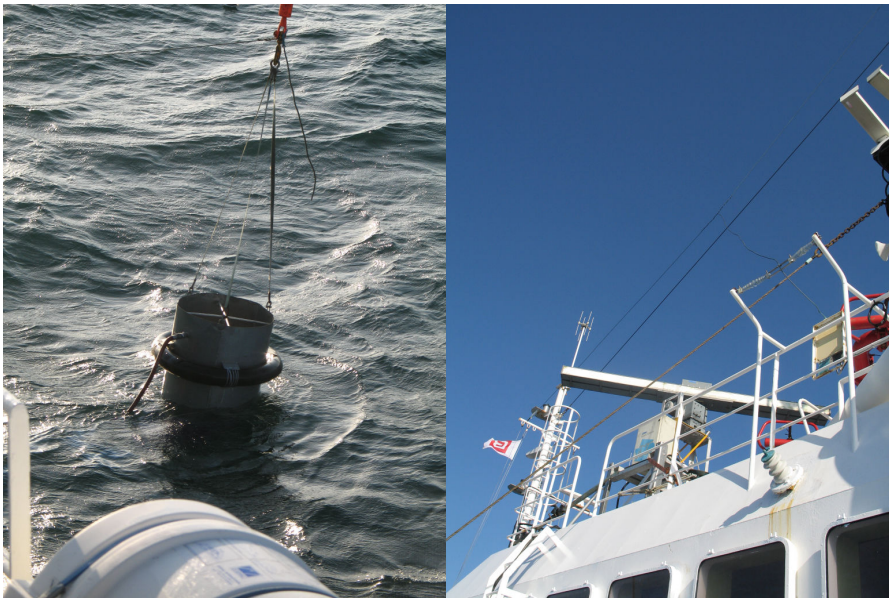

Figure 1 Left: Releasing oil using an open cylinder; Right: The radar antenna of the SeaDarQ system on top of the bridge.

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2 Spillage & Patrolling

The four slicks were spilled successively, moving one nautical mile west wards (25 minutes) to release the next slick. Starting with slick A (intermediate fuel oil) followed by B (sunflower oil), C (Radiagreen ® BDMF VLV) and D (kerdane).

After spilling the four oil slicks the vessel patrolled along the slicks to make recordings with the systems onboard of the vessel. The vessel moved along the slicks in the following order: D-C-B-A-B-C-D-C-B-A.

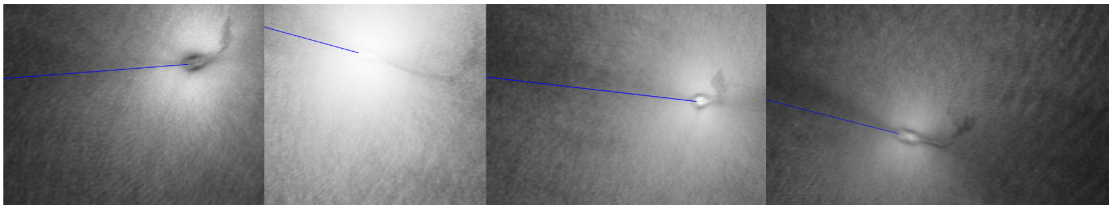

Figure 2 From right to left: Slick A to D, just after their spillage.

2.1 Slick A (intermediate fuel oil)

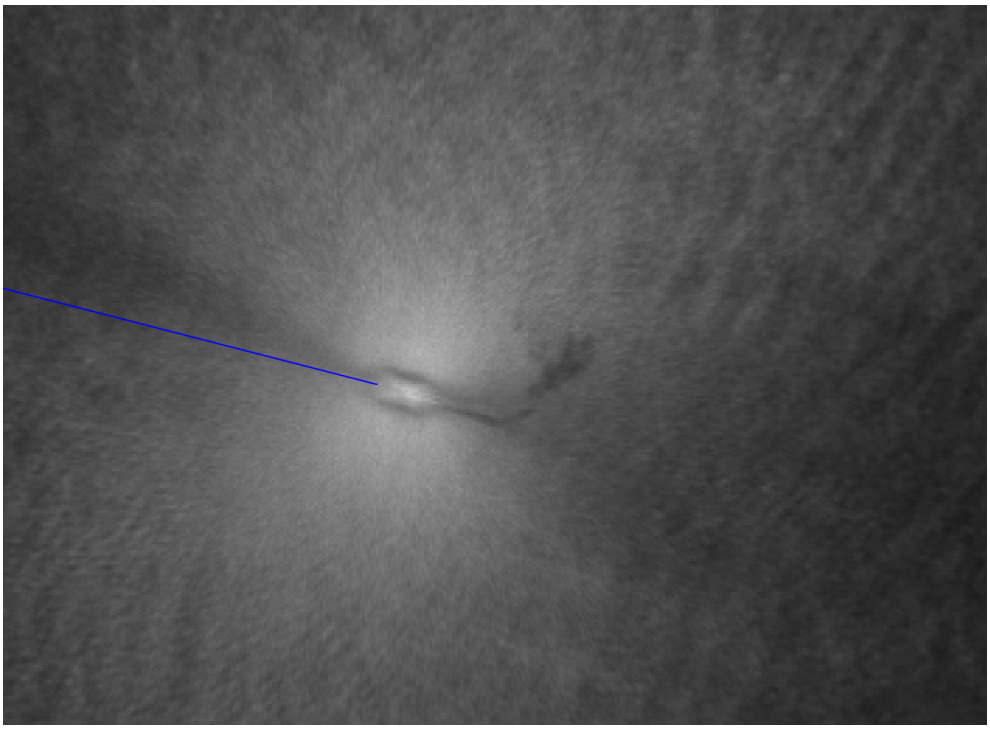

Figure 3 Slick A, 6 minutes after lifting cylinder (8:25 AM).

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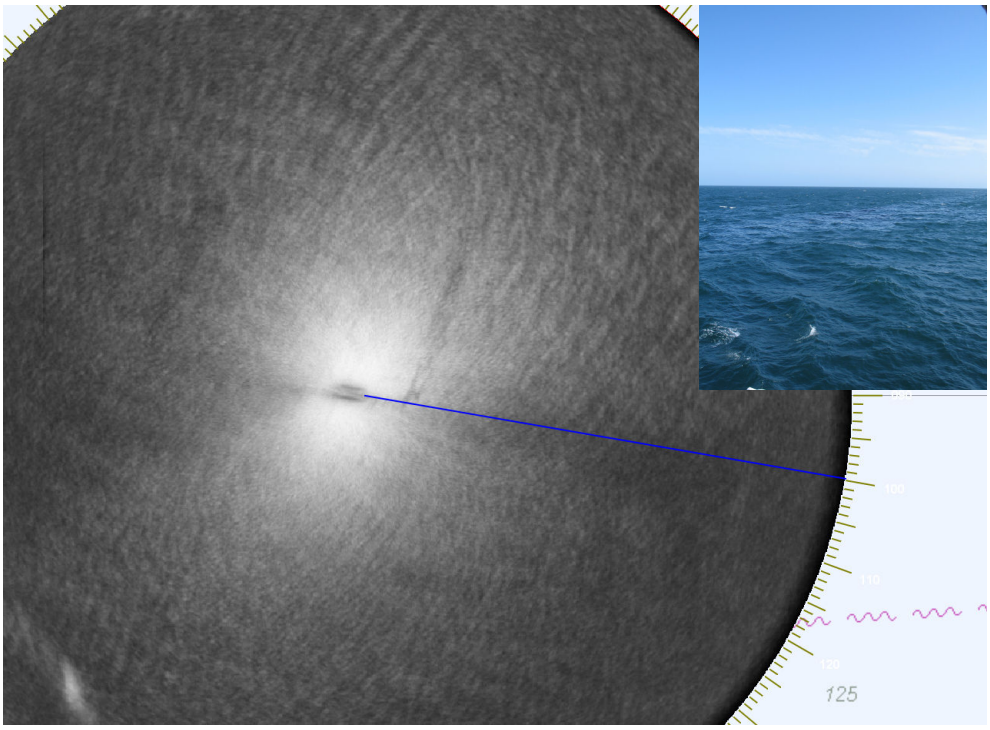

Figure 4 Right: Slick A, 1:54 after releasing; Left: Slick B (10:16 AM).

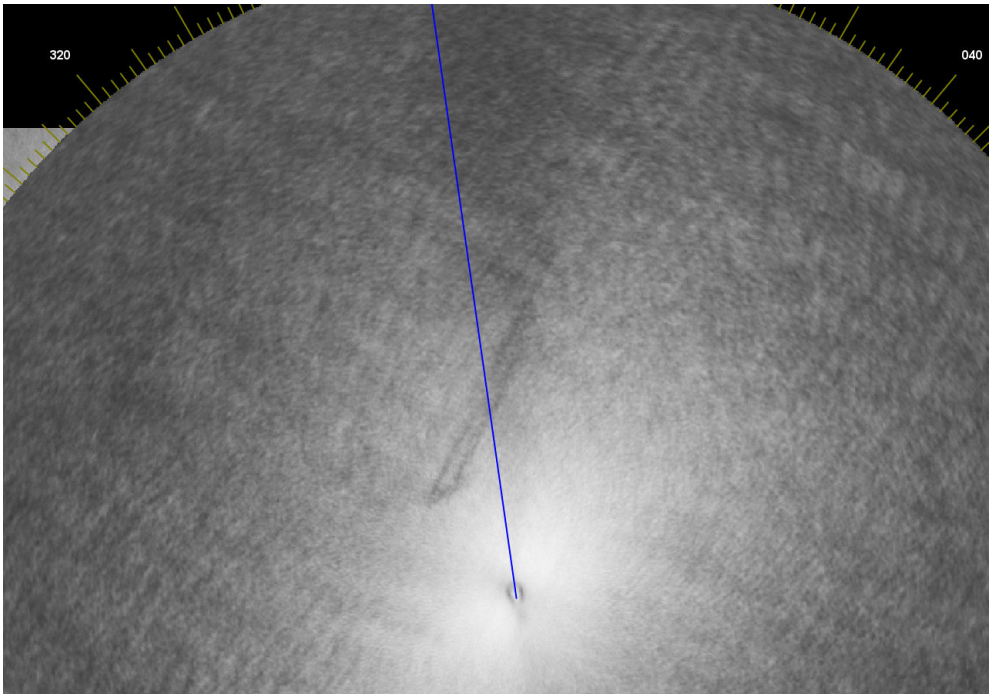

Figure 5 Slick A, 2:19 after spillage (10:38 AM).

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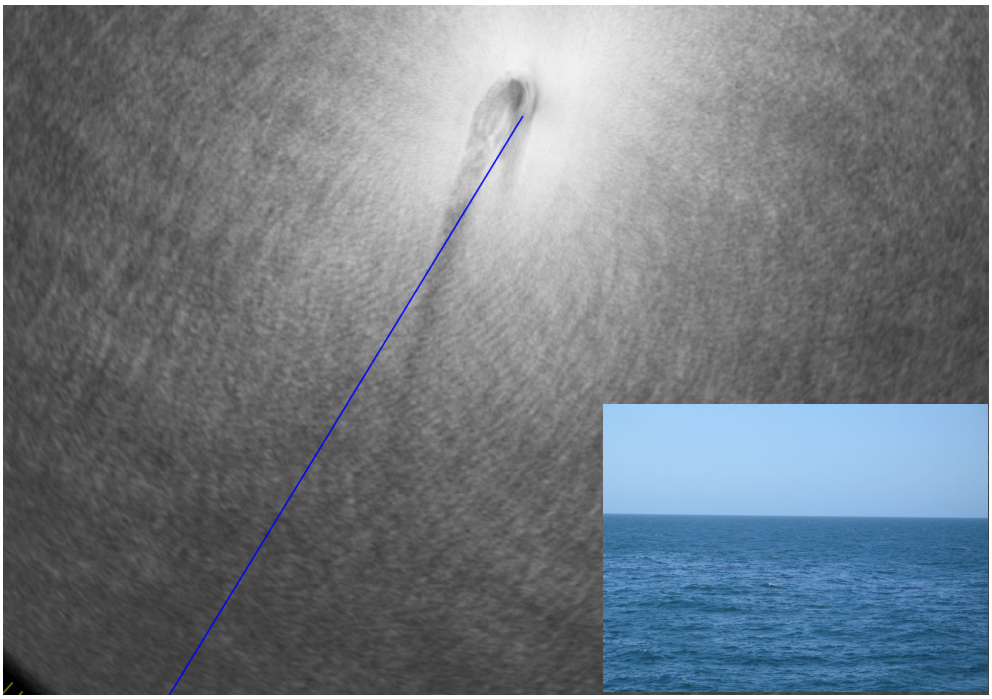

Figure 6 Slick A, 4:34 after releasing (0:53 PM).

Table 1 Statistics of slick A.

Time	Due time	Area	Length	Position (centre)	Figure
8:25 AM	0:06	14 ha	220 m	47°49.734' N, 5°29.715' W	3
10:16 AM	1:54	156 ha	1.5 km	47°49.508' N, 5°29.264' W	4
10:38 AM	2:19	205 ha	1.5 km	47°49.377' N, 5°29.251' W	5
0:53 PM	4:34	255 ha	1.7 km	47°46.917' N, 5°29.559' W	6

2.2 Slick B (sunflower oil)

Table 2 Statistics of slick B.

Time	Due time	Area	Length	Position (centre)	Figure
8:47 AM	0:03	13 ha	170 m	47°49.886' N, 5°31.211' W	7
10:08 AM	1:23	216 ha	1.3 km	47°49.819' N, 5°30.840' W	8
11:01 AM	2:17	330 ha	1.7 km	47°49.492' N, 5°30.739' W	9
0:09 PM	3:26	512 ha	2.1 km	47°48.870' N, 5°30.892' W	10

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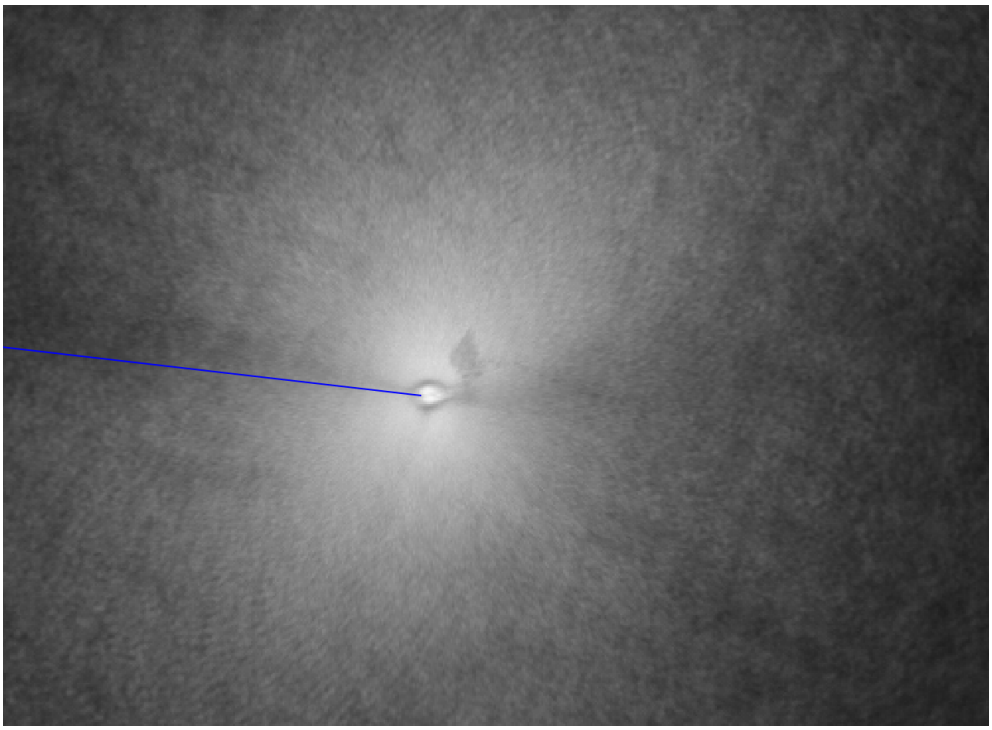

Figure 7 Slick B, 3 minutes after spillage (8:47 AM).

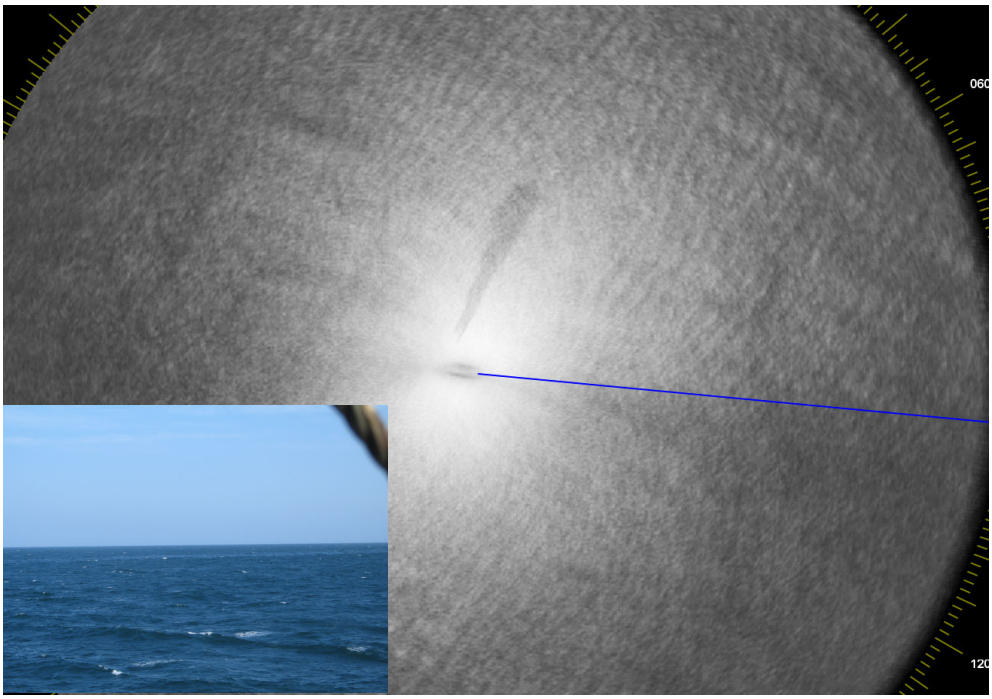

Figure 8 Slick B, 1:23 after spillage (10:08 AM).

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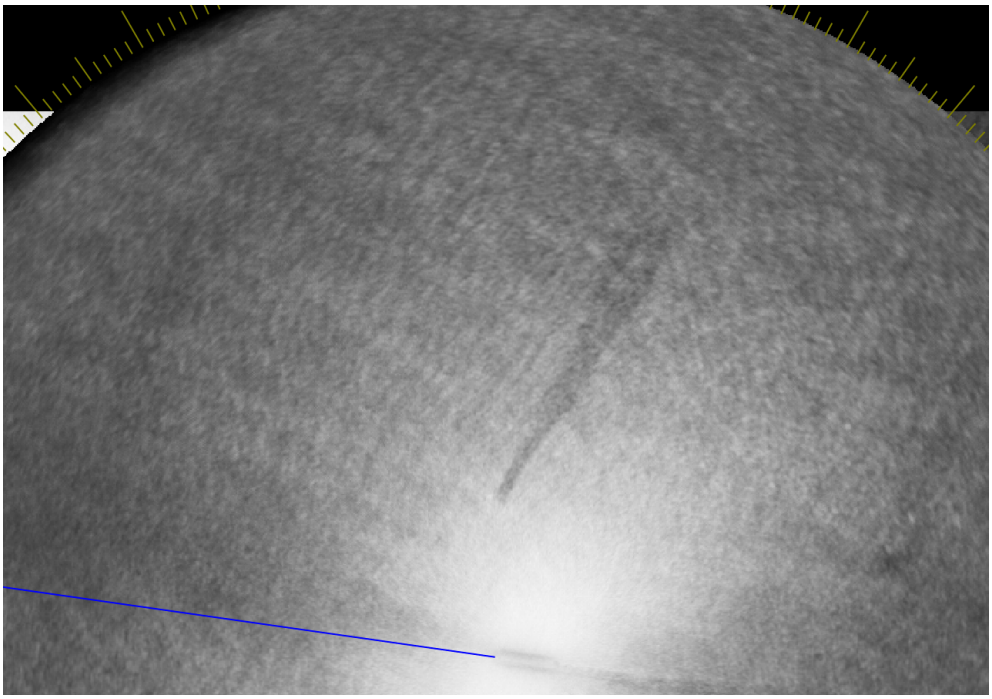

Figure 9 Slick B, 2:17 after releasing (11:01 AM).

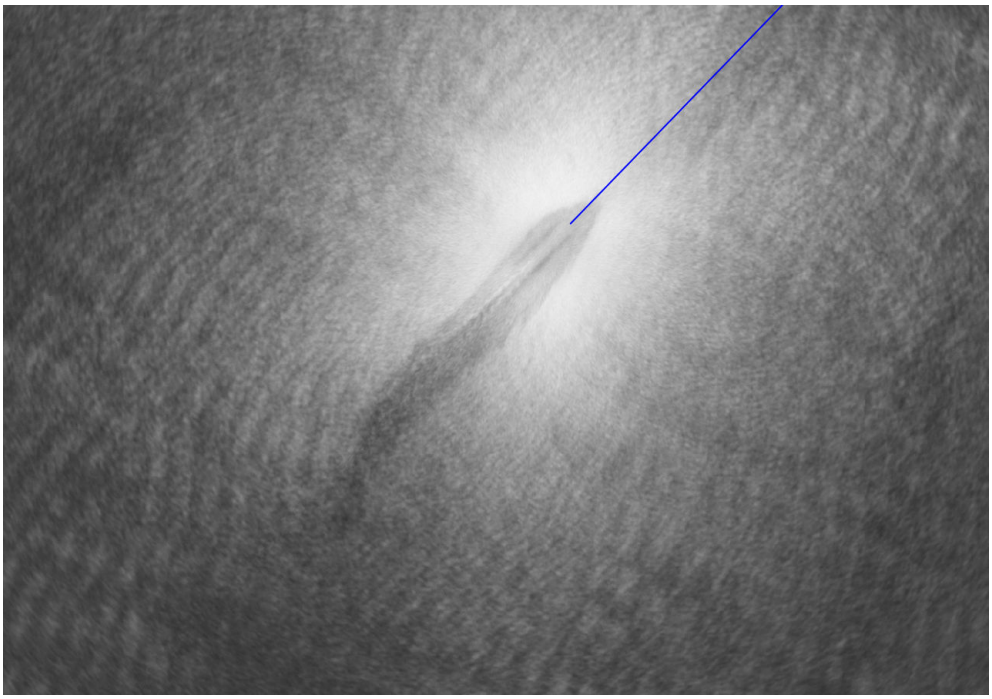

Figure 10 Slick B, 3:26 after releasing (0:09 PM).

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2.3 Slick C (Radiagreen ® BDMF VLV)

Table 3 Statistics of slick C.

Time	Due time	Area	Length	Position (centre)	Figure
9:17 AM	0:08	19 ha	220 m	47°49.938' N, 5°32.712' W	11
9:49 AM	0:42	120 ha	0.9 km	47°50.015' N, 5°32.570' W	12
9:53 AM	0:45	120 ha	0.9 km	47°49.971' N, 5°32.614' W	13
11:07 AM	1:59	363 ha	1.7 km	47°49.685' N, 5°32.499' W	14
11:29 AM	2:21	374 ha	1.7 km	47°49.451' N, 5°32.554' W	15

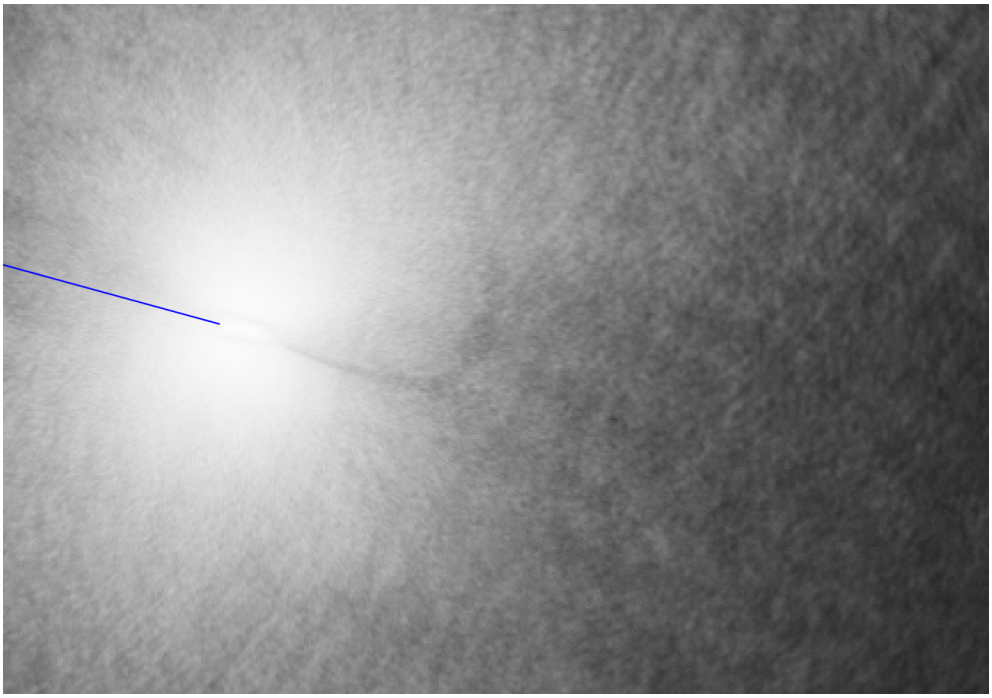

Figure 11 Slick C, 8 minutes after lifting cylinder (9:17 AM).

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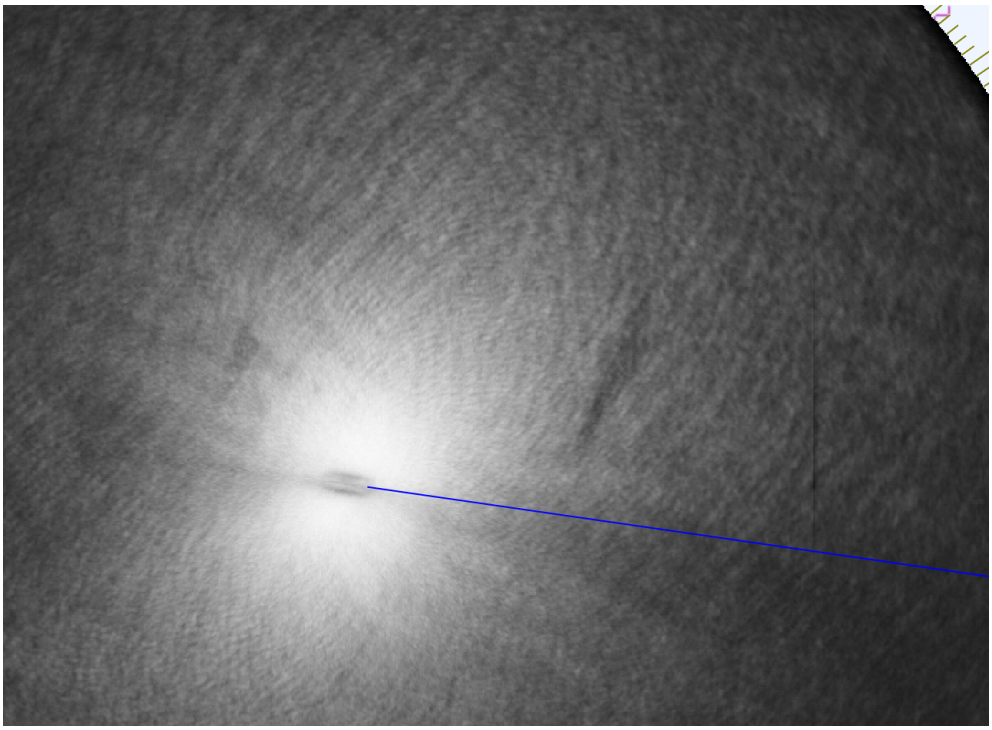

Figure 12 Right: Slick C, 42 minutes after releasing; Left: Slick D (9:49 AM).

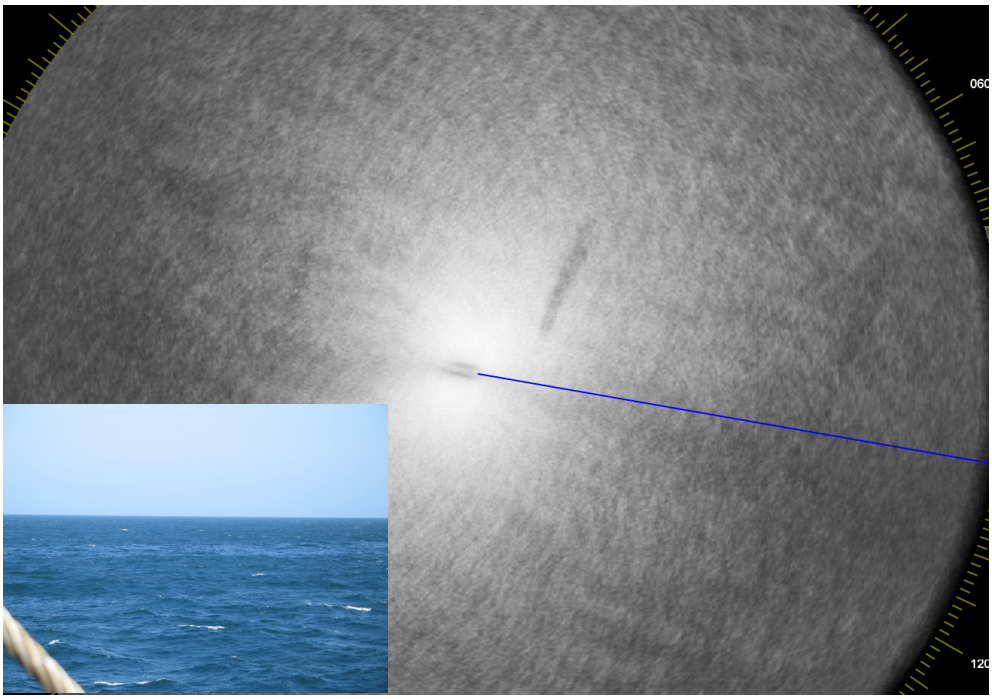

Figure 13 Slick C, 45 minutes after spillage (9:53 AM).

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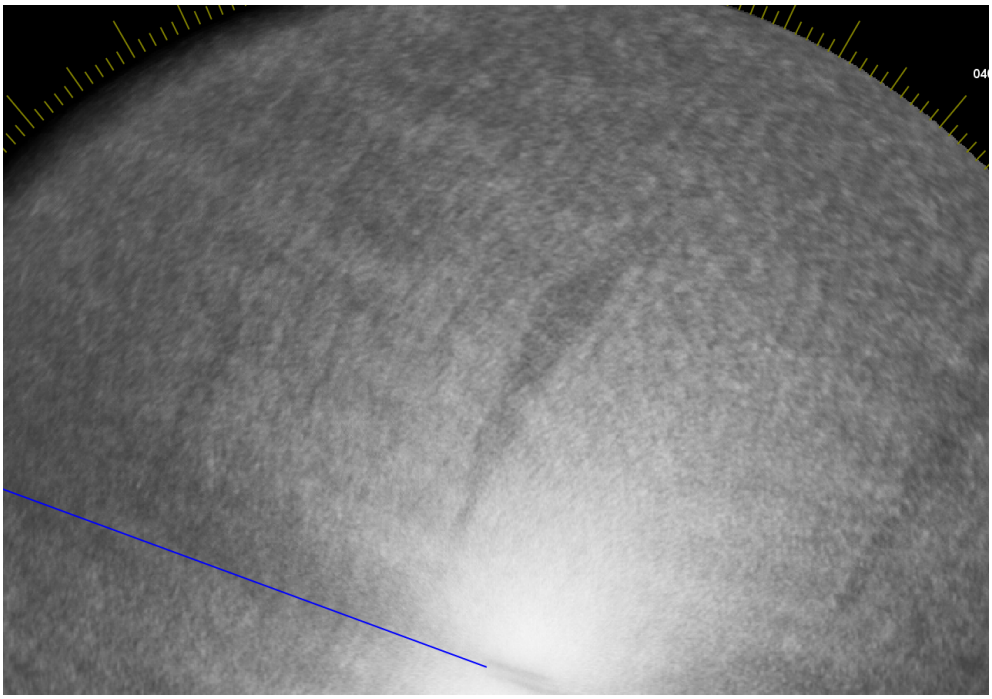

Figure 14 Slick C, 1:59 after releasing (11:07 AM).

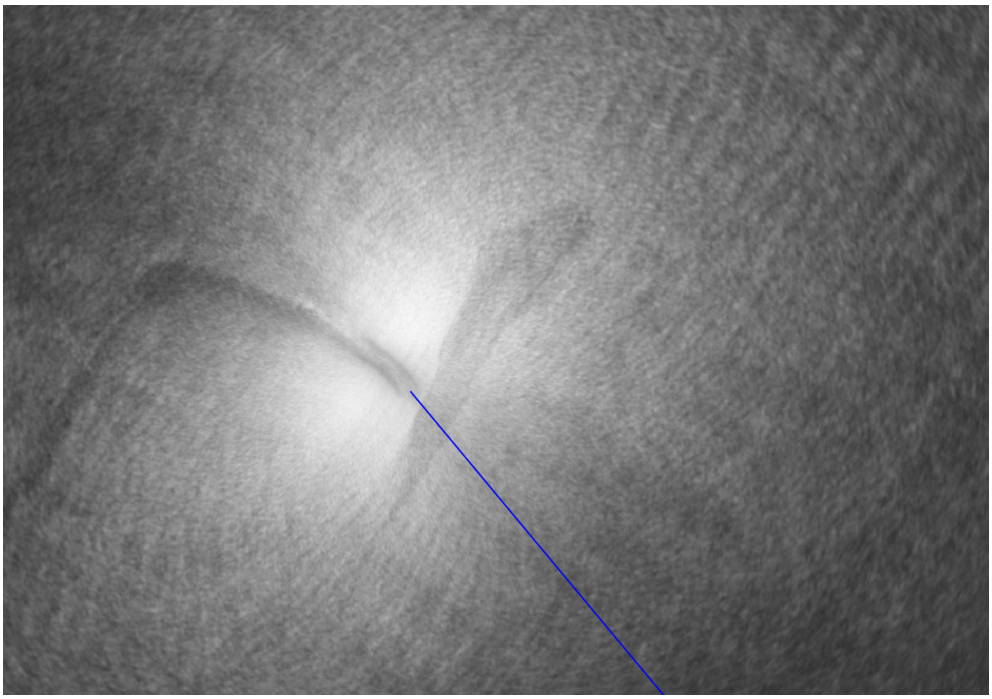

Figure 15 Slick C, 2:21 after releasing, coming from slick D (left) (11:29 AM).

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2.4 Slick D (kerdane)

Table 4 Statistics of slick D.

Time	Due time	Area	Length	Position (centre)	Figure
9:37 AM	0:04	18 ha	250 m	47°50.010' N, 5°34.189' W	16
9:49 AM	0:17	36 ha	300 m	47°50.009' N, 5°34.142' W	17
11:19 AM	1:44	151 ha	1.3 km	47°49.360' N, 5°34.010' W	18

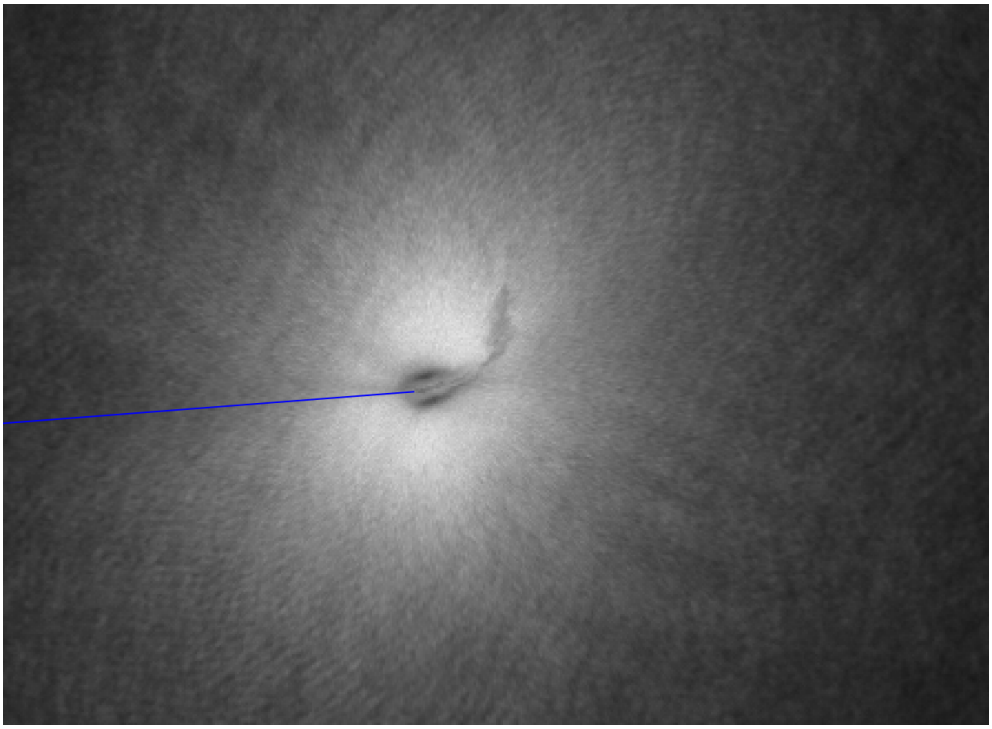

Figure 16 Slick D (kerdane) 4 minutes after spillage (9:37 AM).

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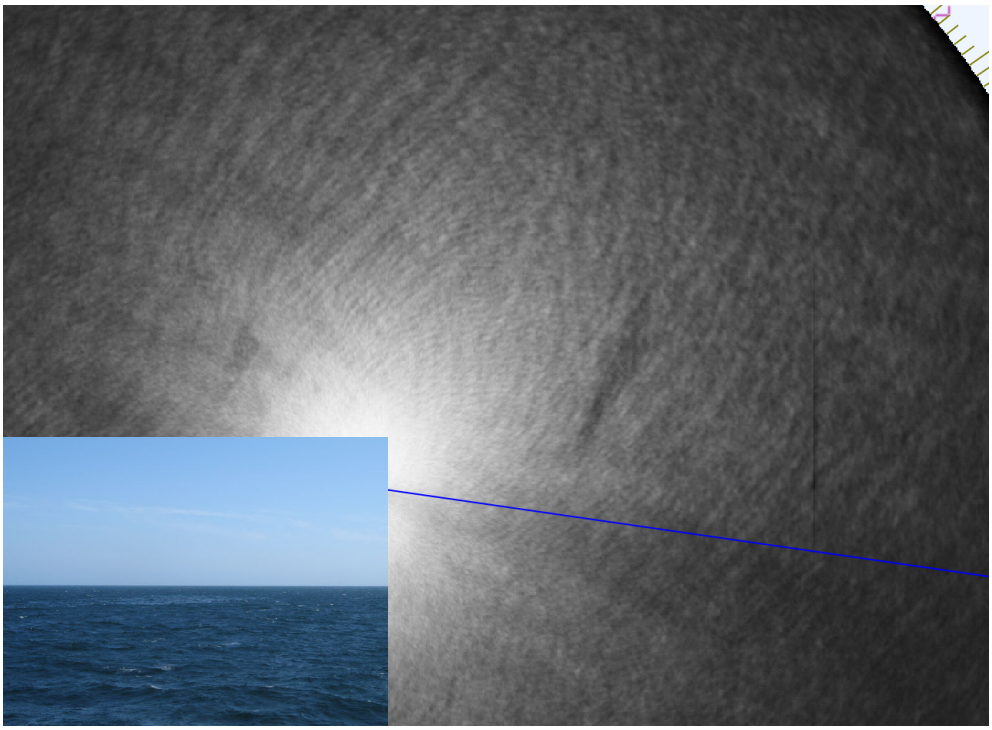

Figure 17 Left: Slick D, 17 minutes after releasing; Right: Slick C (9:49 AM).

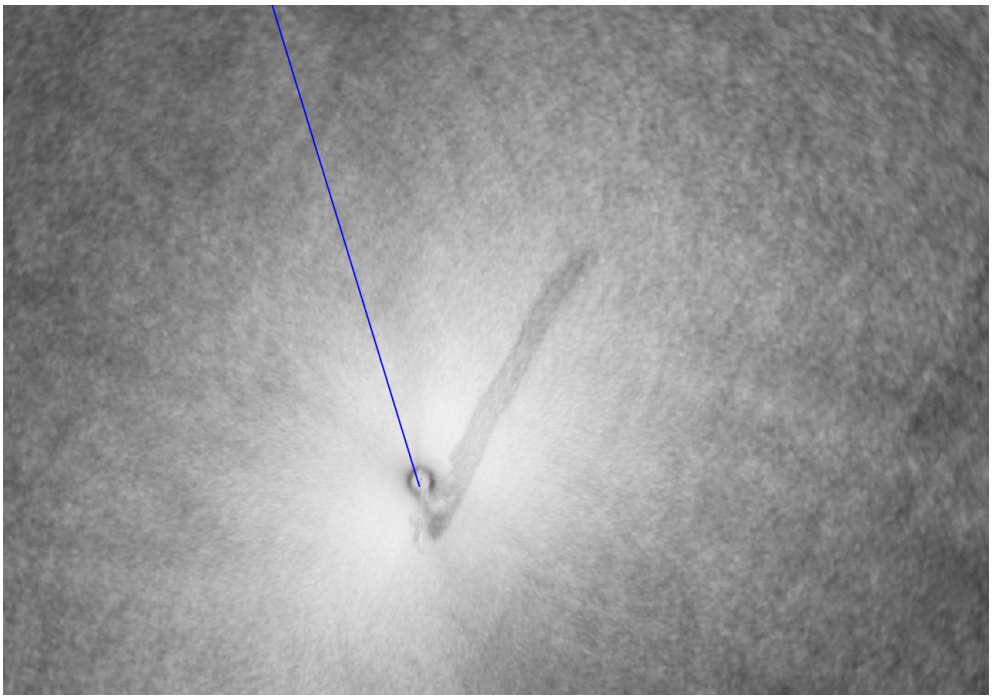

Figure 18 Slick D, 1:44 after releasing (11:19 AM).

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3 Dispersing

After a period of three hours patrolling along the slicks and making recordings, the dispersing of the slicks started. The dispersant FINASOL OSR-62 was used to disperse the appropriate slicks. Only slick A needed to be dispersed.

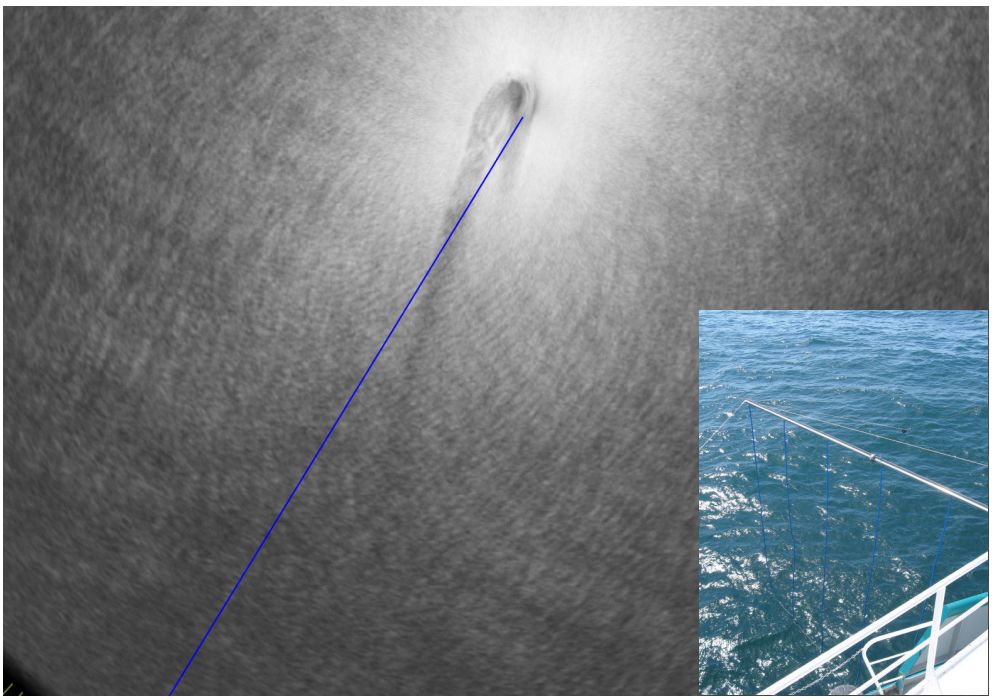

Figure 19 Slick A, 4:34 after spillage (0:53 PM).

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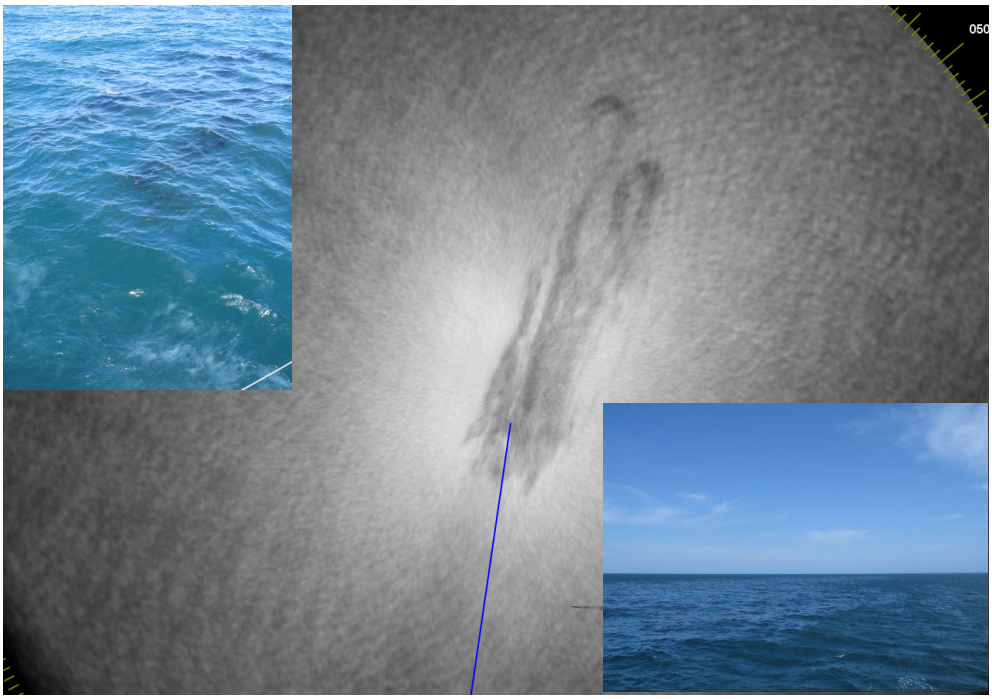

Figure 20 Slick A, 5:19 after releasing (1:38 PM).

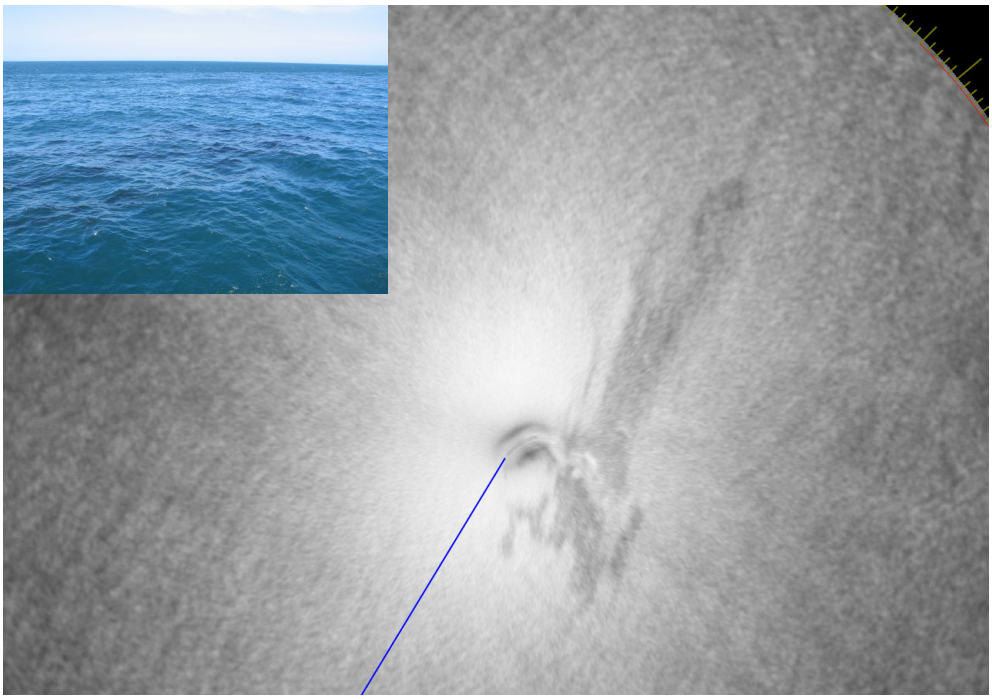

Figure 21 Slick A, 5:38 after releasing (1:57 PM).

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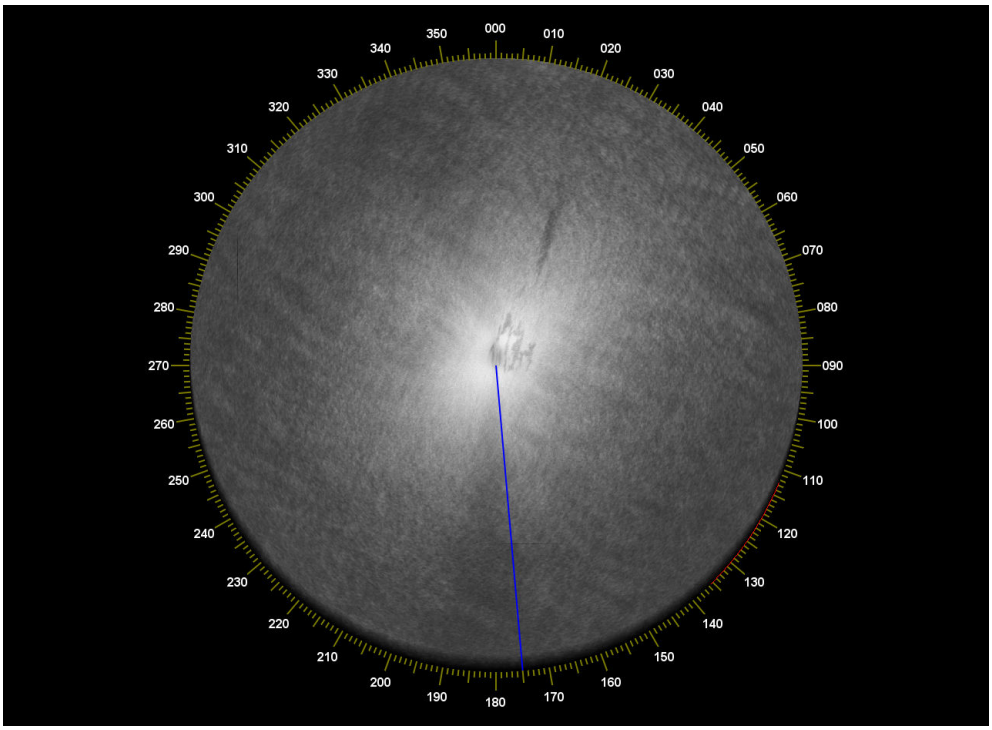

Figure 22 Slick A, 6:49 after releasing (3:08 PM).

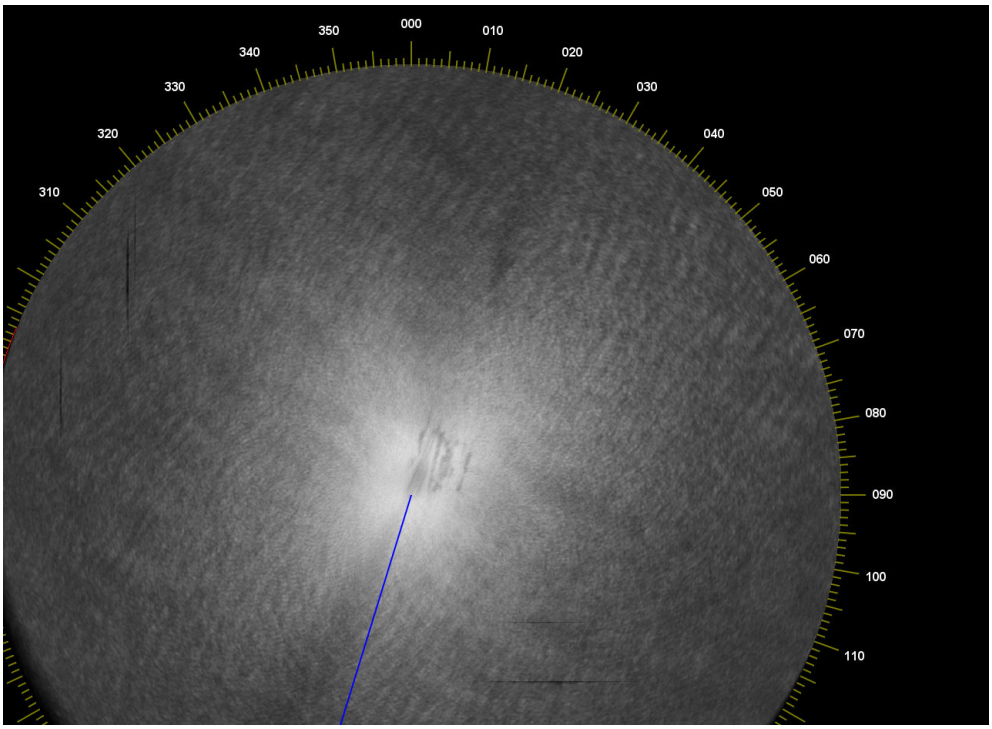

Figure 23 Slick A, 7:19 after lifting cylinder (3:38 PM).

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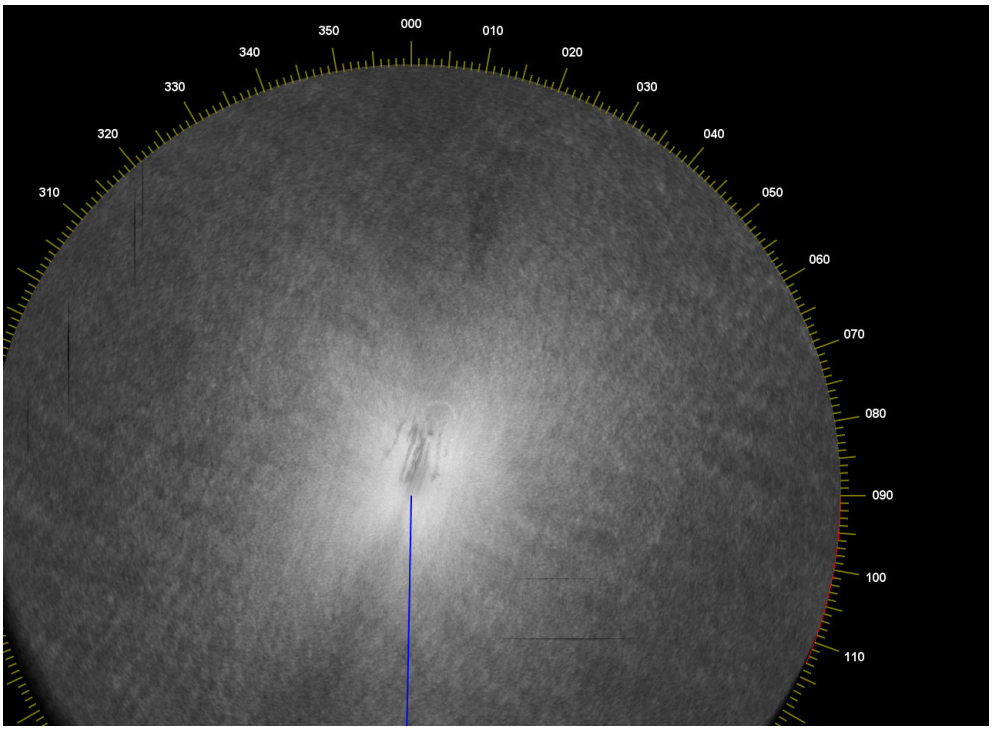

Figure 24 Slick A, 7:31 after releasing (3:50 PM).

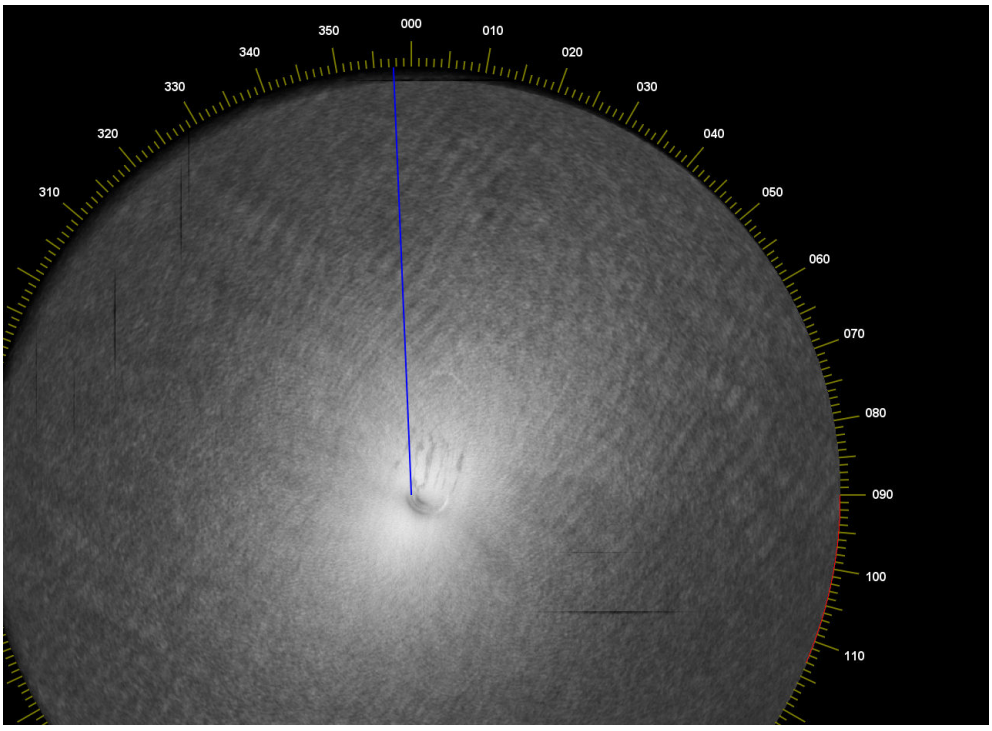

Figure 25 Slick A, 7:44 after spillage (2:03 PM).

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4 Polarization

During the sea trials we also experimented with the polarization of the radar antenna. The SeaDarQ antenna mounted on the vessel Alcyon actually has two antennas mounted with there backsides to each other. With a wave guide switch we can switch between either the horizontal (H-H) or vertical (V-V) polarized antenna.

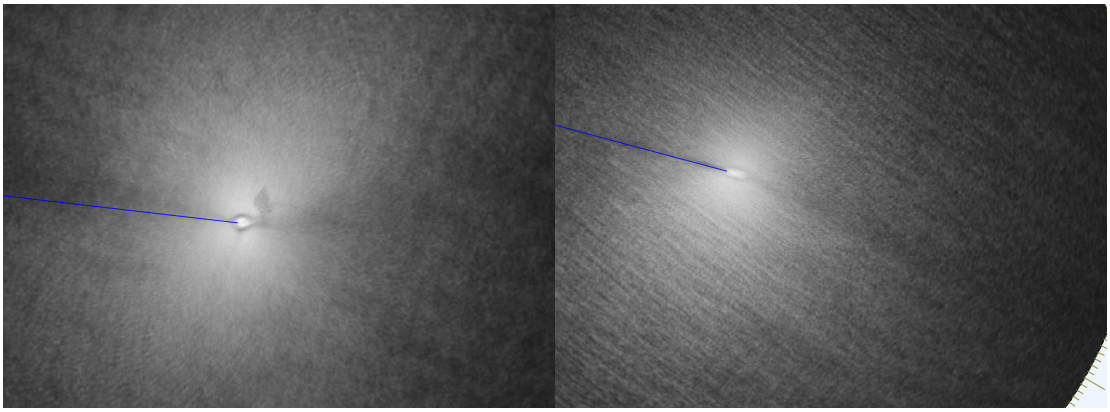

Figure 26 Slick D. Left: V-V; Right: H-H (8:50 AM).

The two images of Figure 26 are both taken around 10 minutes before nine. The right image is taken nine minutes after the left image, after moving 1.2 km west wards. The width of view for the right image is 5 km. The left image is created with vertical (V-V) polarization and shows slick D (kerdane). Horizontal (H-H) polarization is used for the right image.

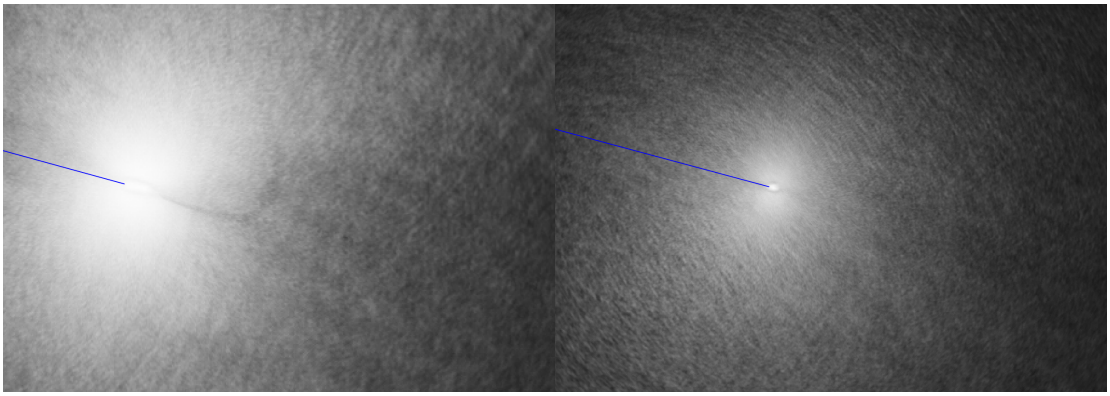

Figure 27 Slick C. Left: V-V; Right: H-H (9:15 AM).

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The two images of Figure 27 are both taken around 15 minutes after nine. The left image is taken five minutes after the right image, after moving 600 m west wards. The width of view for the right image is 5 km. The left image is created with vertical (V-V) polarization and shows slick C (Radiagreen ® BDMF VLV). Horizontal (H-H) polarization is used for the right image.

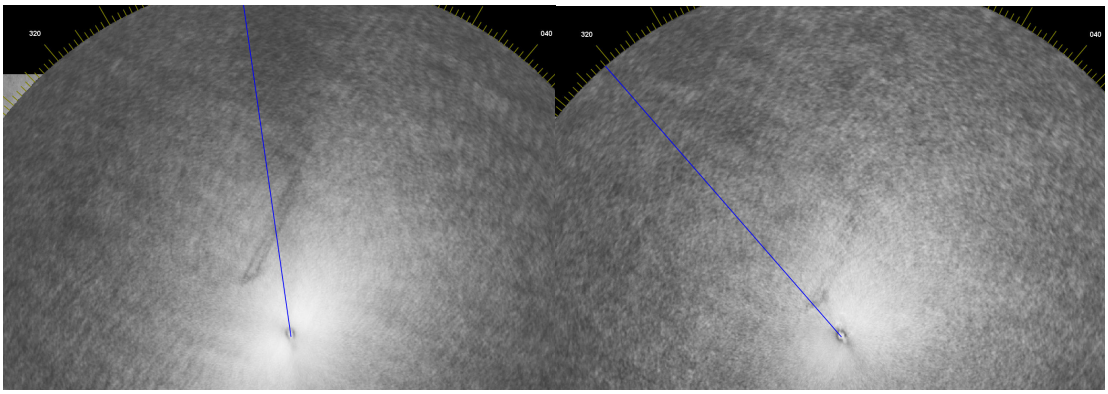

Figure 28 Slick A. Left: V-V; Right: H-H (10:30 AM).

The two images of Figure 28 are both taken around half past ten. The left image is taken ten minutes after the right image. The width of view for both images is 6 km. The left image is created with vertical (V-V) polarization and shows slick A (intermediate fuel oil). Horizontal (H-H) polarization is used for the right image.

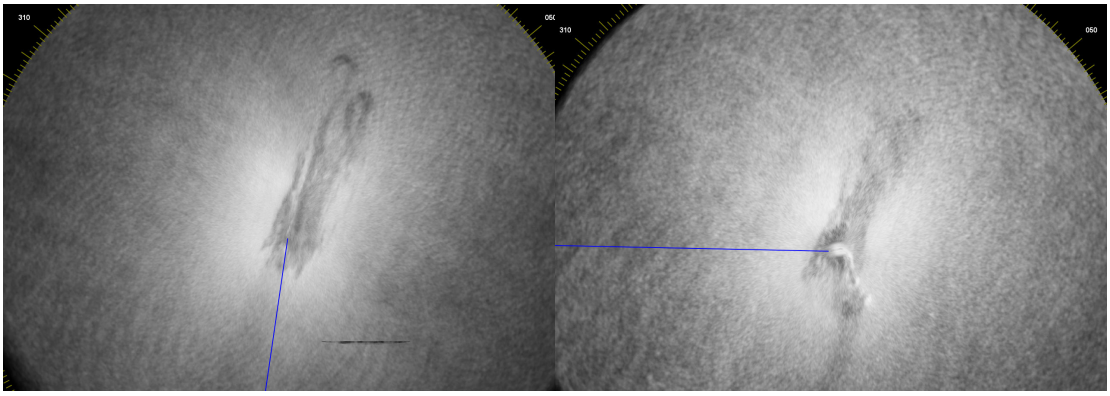

Figure 29 Slick A. Left: V-V; Right: H-H (1:40 PM).

The two images of Figure 29 are both taken during the dispersing of slick A (intermediate fuel oil) around half past one. The right image is taken seven minutes after the left image. The width of view for both images is 4 km. The left image is created with vertical (V-V) polarization and shows slick A. Horizontal (H-H) polarization is used for the right image.

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5 Small Targets

One other feature of the SeaDarQ system, besides oil detection, is small target detection. With this module we are able to see small slow moving objects. During a recording of slick C, we were able to see the buoy of slick B.

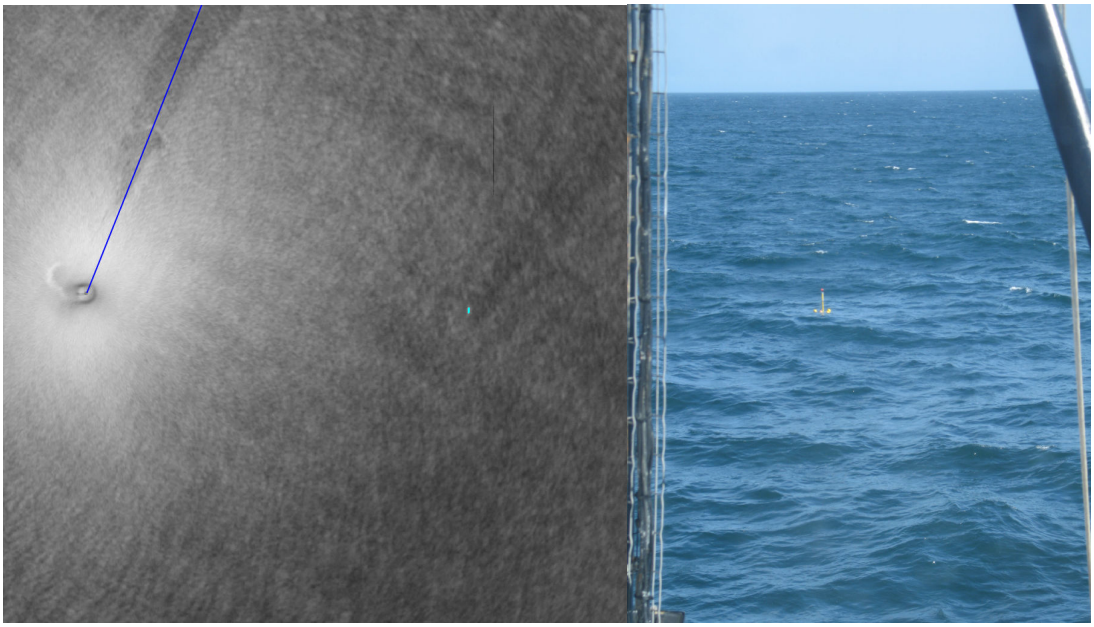

Figure 30 Buoy of slick B (11:36 AM).

In Figure 30 the vessel is located close to slick C. The buoy of slick B is visible as a blue spot. This image was taken at 11:36 AM and shows the buoy of slick B at 47°48.761' N, 5°31.256' W.

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6 Range Correction

During the sea trials we also had the opportunity to test a new type of range correction currently under development.

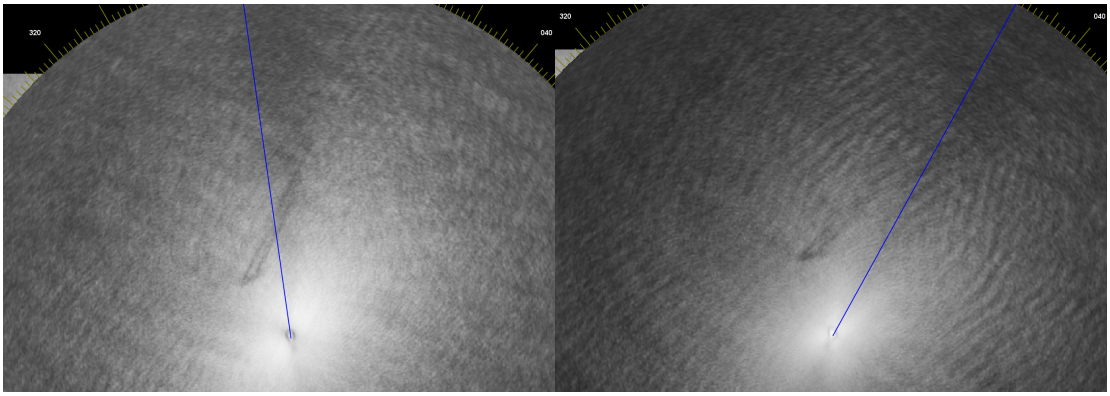

Figure 31 Slick A. Left: With range correction enabled; Right: disabled (10:40 AM).

The left image in Figure 31 is created with the new range correction switched on, the right image with this function off. Both images were taken close to slick A around 10:40 AM.