NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 14, 2018

Group Chairman's Factual Report

METEOROLOGY

DCA17PM018

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A. ACCIDENT

Location: Approximately 56 nautical miles southwest of Yokosuka, Japan
Date: June 17, 2017
Time: 0230 Japan Standard Time
1730 Coordinated Universal Time (UTC) on June 16
Vehicles: *USS Fitzgerald* collision with *M/V ACX Crystal*

B. METEOROLOGIST

Paul Suffern
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist did not travel for this investigation and gathered the weather data for this investigation from the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Centers for Environmental Information (NCEI). Data was also gathered from United States Coast Guard sources. All times are Japan Standard Time (JST) on June 17, 2017, and are based upon the 24-hour clock, where local time is +9 hours from UTC, and UTC=Z (unless otherwise noted). Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The approximate accident site was latitude 34.5222° N, longitude 139.072° E.

D. FACTUAL INFORMATION

1.0 Synoptic Situation

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction, the Ocean Prediction Center, and the Weather Prediction Center, located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found at NCEI.[1]

[1] Chart information is found at: https://nomads.ncdc.noaa.gov/ncep/NCEP

1.1 Surface Analysis Chart

The NOAA northern hemisphere sea-level pressure analysis chart for 2100 JST, June 16, is provided as figure 1 with the approximate location of the accident site marked within the red circle. The chart depicted a surface high pressure center over the Sea of Japan stretching southward over Japan with a surface pressure of 1014-hectopascals (hPa). A surface low pressure center was located east of Japan over the northwest Pacific Ocean with a surface pressure of 1006-hPa.

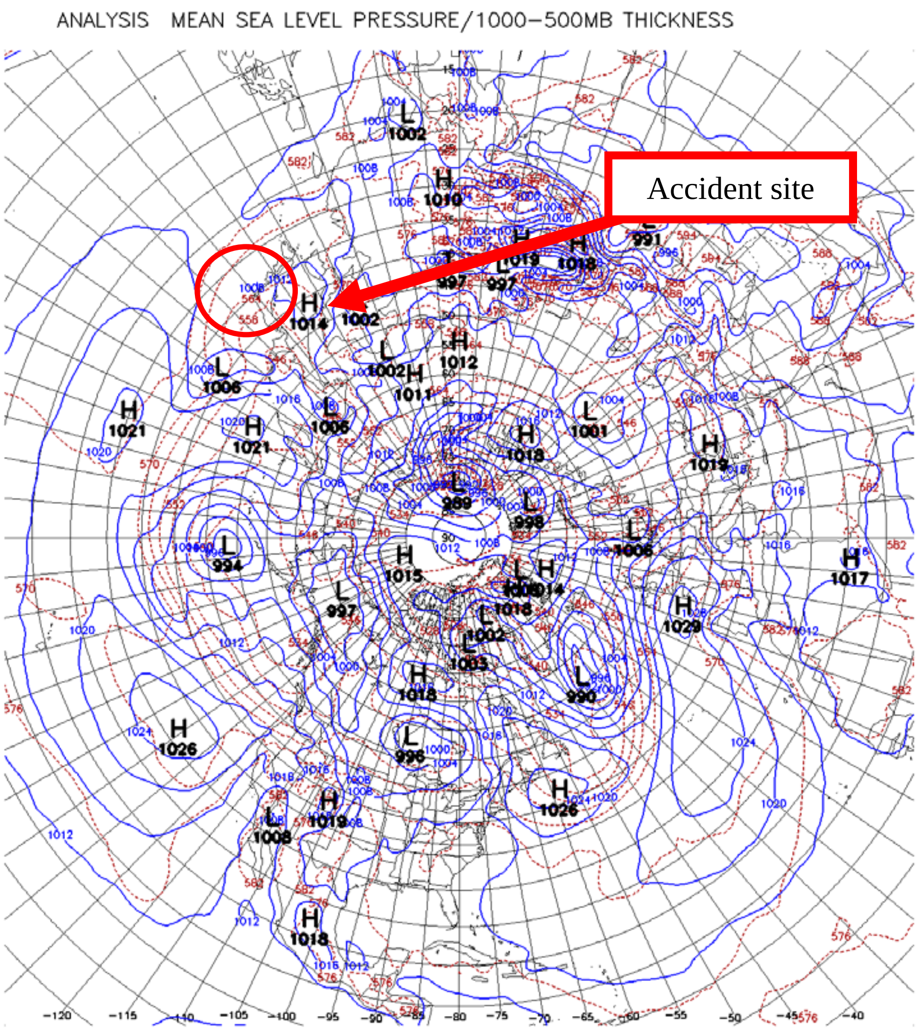

Figure 1 – NOAA northern hemisphere sea-level pressure analysis chart for 2100 JST on June 16

1.2 Upper Air Charts

The NOAA northern hemisphere 500-hPa analysis chart for 2100 JST, June 16, is presented in figure 2, with the 300-hPa analysis chart for 2100 JST, June 16, presented in figure 3. Mid-and upper-level troughs[2] were located east of the accident site in the northwest Pacific Ocean at 2100 JST on June 16.

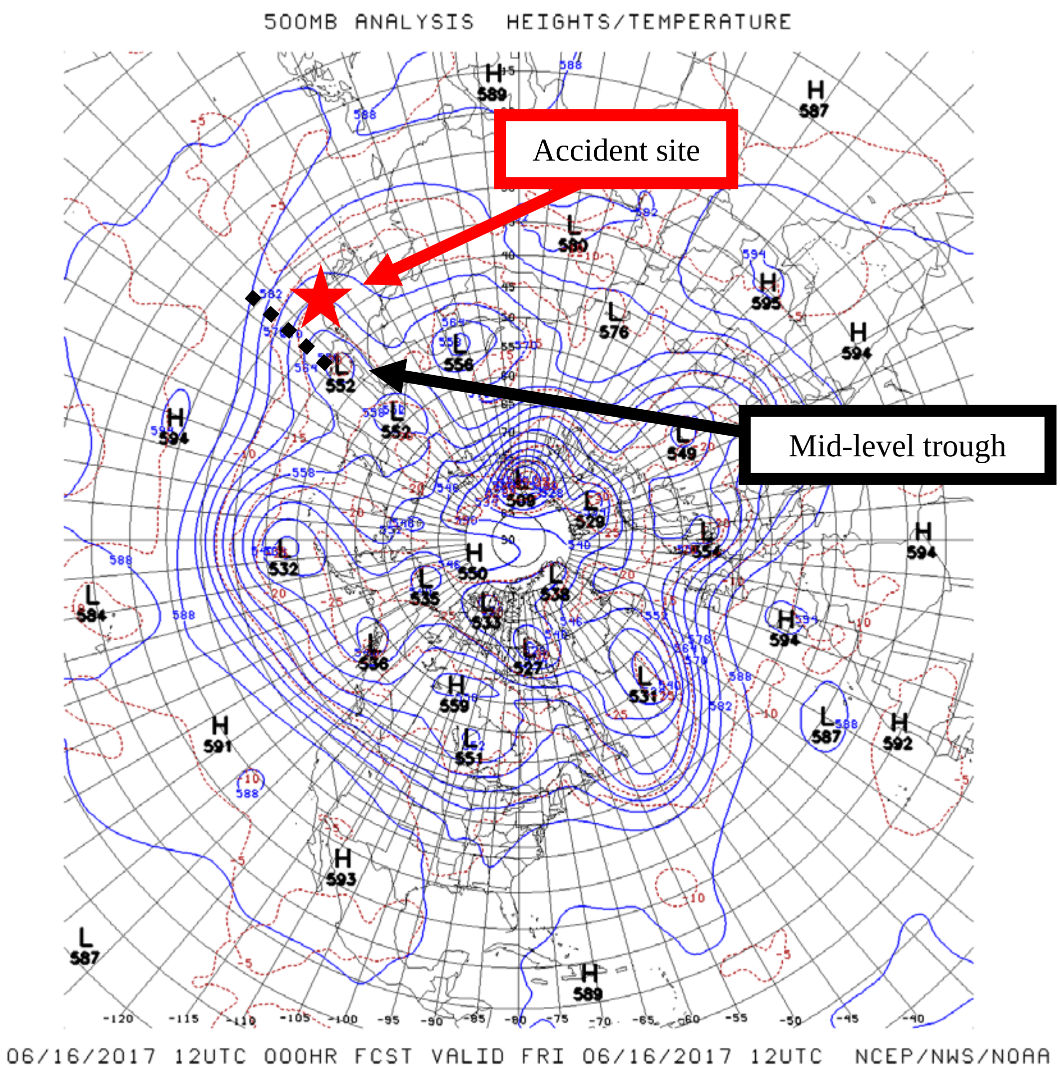

Figure 2 – NOAA northern hemisphere 500-hPa analysis chart for 2100 JST on June 16

[2] Trough – An elongated area of relatively low atmospheric pressure or heights.

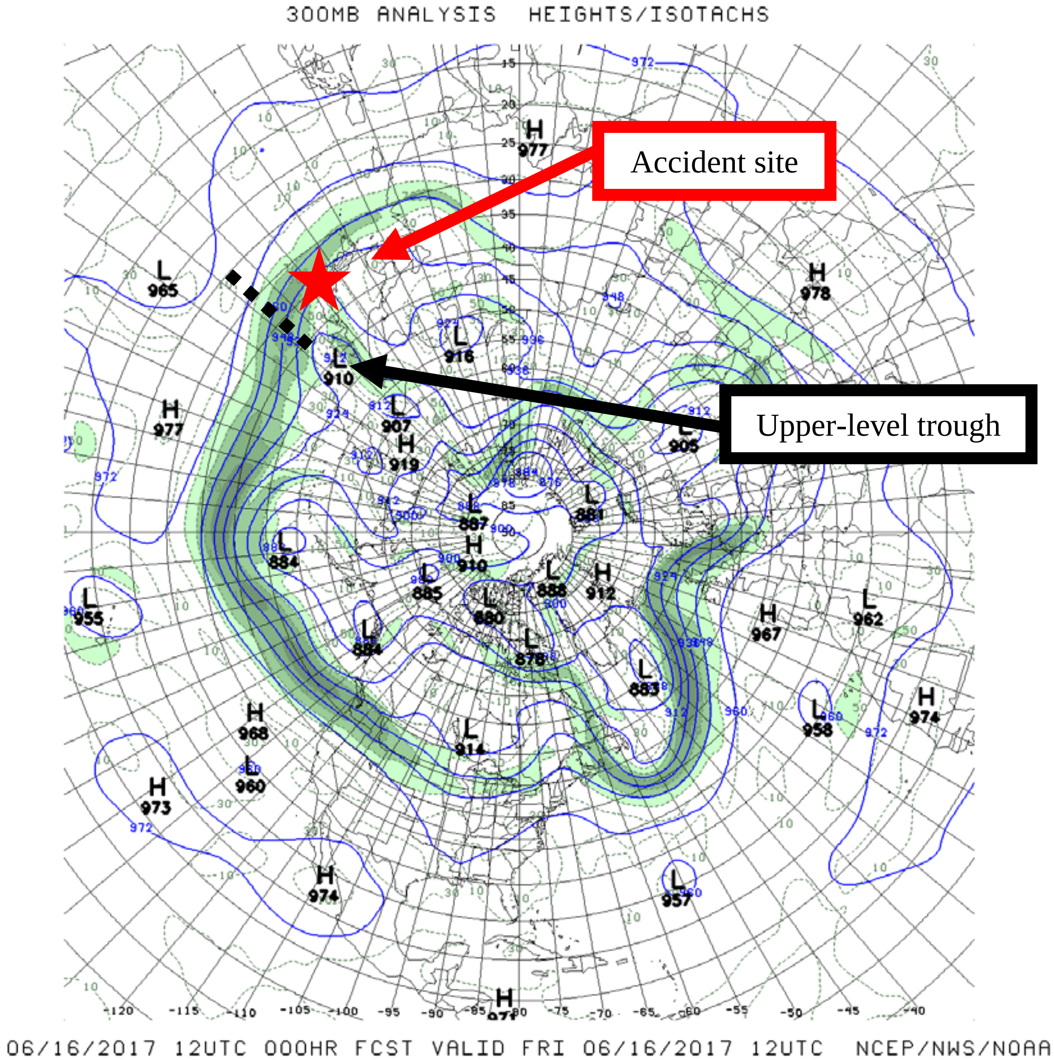

Figure 3 – NOAA northern hemisphere 300-hPa analysis chart for 2100 JST on June 16

2.0 Surface Observations

The area surrounding the accident site was documented using standard Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 4 is a Google Earth map with the accident site and the closest weather reporting locations marked.

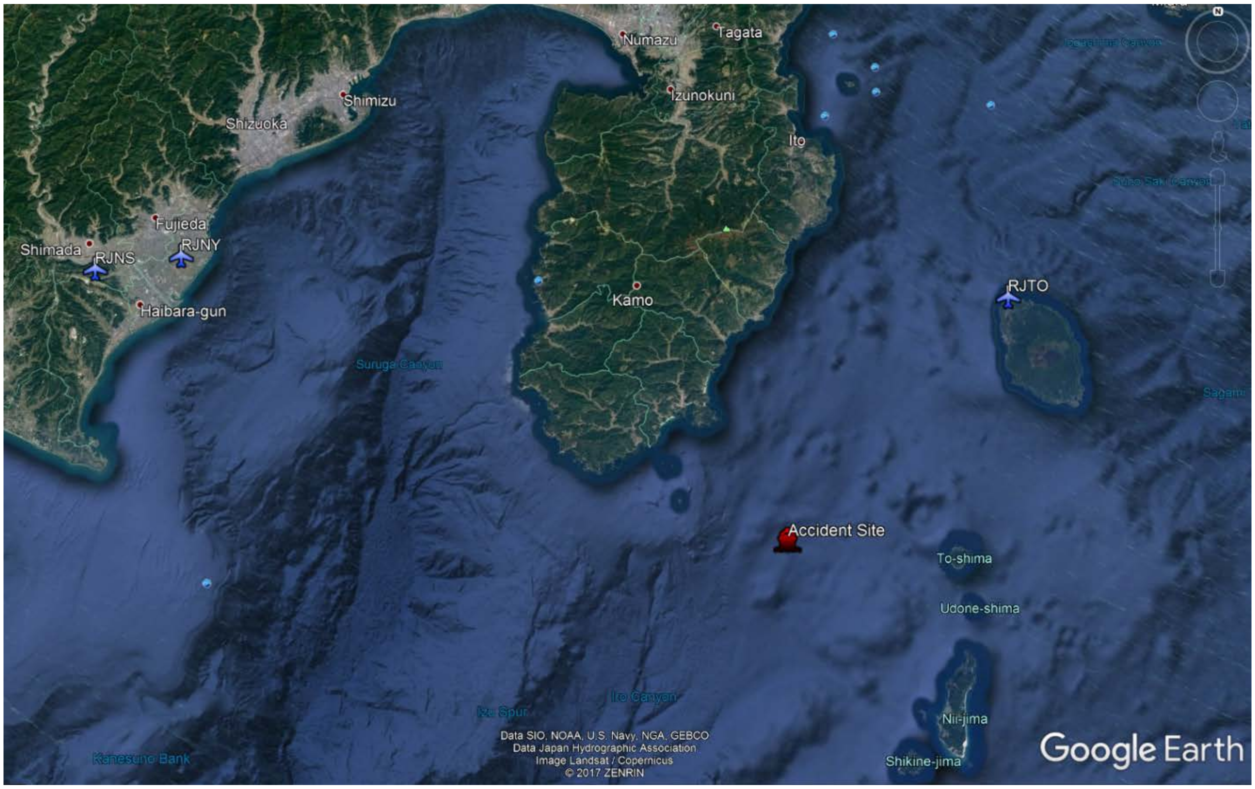

Figure 4 – Google Earth map of accident area with the location of the accident site and surface observation sites

Oshima Airport, Japan (RJTO), was the closest official surface weather station to the accident site. RJTO was located 21 miles northeast of the accident site at an elevation of 134 feet (figure 4). The RJTO METAR reported "NIL"[3] conditions from 1900 JST on June 16, through 0700 JST on June 17. The following observations were taken and disseminated during the times surrounding the accident before and after the NIL reports:[4]

[1600 JST on June 16] ***METAR RJTO 160700Z 21016KT 9999 FEW025 BKN/// 25/18 Q1004=***

[1700 JST on June 16] ***METAR RJTO 160800Z 21017KT 9999 FEW025 SCT/// 25/18 Q1004=***

ACCIDENT TIME 0230 JST

[3] Where an airport or terminal operates on a part-time basis (less than 24 hours/day) the METARs/TAFs issued for those locations will have the abbreviated statement NIL or AMD SKED AFT (closing time) Z, added to the end of the forecast.

[4] The bold sections in this NWS product and the rest of products in this report are intended to highlight the sections that directly reference the weather conditions that affected the accident location around the accident time. The local times in section 2.0 next to the METARs are provided for quick reference between UTC and local times around the accident time.

[0800 JST on June 17] ***METAR RJTO 162300Z 04012KT 9999 FEW030 SCT045 21/14 Q1011=***

[0900 JST on June 17] ***METAR RJTO 170000Z 05011KT 9999 FEW030 SCT/// 22/15 Q1011=***

RJTO weather at 1600 JST on June 16, wind from 210° at 16 knots, 10 kilometers (km) visibility or greater, few clouds at 2,500 feet above ground level (agl), broken ceiling at unknown height, temperature of 25° Celsius (C), dew point temperature of 18° C, and an altimeter setting of 1004-hPa.

RJTO weather at 1700 JST on June 16, wind from 210° at 17 knots, 10 km visibility or greater, few clouds at 2,500 feet agl, scattered clouds at unknown height, temperature of 25° C, dew point temperature of 18° C, and an altimeter setting of 1004-hPa.

RJTO weather at 0800 JST on June 17, wind from 040° at 12 knots, 10 km visibility or greater, few clouds at 3,000 feet agl, scattered clouds at 4,500 feet agl, temperature of 21° C, dew point temperature of 14° C, and an altimeter setting of 1011-hPa.

RJTO weather at 0900 JST on June 17, wind from 050° at 11 knots, 10 km visibility or greater, few clouds at 3,000 feet agl, scattered clouds at unknown height, temperature of 22° C, dew point temperature of 15° C, and an altimeter setting of 1011-hPa.

Shizuhama Airbase, Japan (RJNY) was the next closest official surface weather station to the accident site. RJNY was located 42 miles west-northwest of the accident site at an elevation of 23 feet (figure 4). The RJNY METAR reported "NIL" conditions from 1400 JST on June 16, through 0000 JST on June 18, except for the two SPECI observations below:

[2010 JST on June 16] ***SPECI RJNY 161110Z 27015G26KT 9999 FEW030 24/10 Q1004 RMK 1CU030 A2966=***

[2146 JST on June 16] ***SPECI RJNY 161246Z 34005KT 290V040 9999 FEW030 23/13 Q1006 RMK 1CU030 A2972=***

ACCIDENT TIME 0230 JST

RJNY weather at 2010 JST on June 16, wind from 270° at 15 knots with gusts to 26 knots, 10 km visibility or greater, few clouds at 3,000 feet agl, temperature of 24° C, dew point temperature of 10° C, and an altimeter setting of 1004-hPa. Remarks; 1 octa of cumulus clouds with cloud base at 3,000 feet agl, altimeter 29.66 inHg.

RJNY weather at 2146 JST on June 16, wind from 340° at 5 knots, wind direction varying between 290° and 040°, 10 km visibility or greater, few clouds at 3,000 feet agl, temperature of 23° C, dew point temperature of 13° C, and an altimeter setting of 1006-hPa. Remarks; 1 octa of cumulus clouds with cloud base at 3,000 feet agl, altimeter 29.72 inHg.

Shizuoka Airport, Japan (RJNS) was the next closest official surface weather station to the accident site. RJNS was located 47 miles west-northwest of the accident site at an elevation of 443 feet (figure 4). The RJNS METAR did not report any weather conditions from 2100 JST on June 16, until 0730 JST on June 17, but the weather conditions reported closest to the time of the accident are displayed below:

[2000 JST on June 16] ***METAR RJNS 161100Z 26019KT 9999 FEW030 24/09 Q1004=***

[2100 JST on June 16] ***METAR RJNS 161200Z 27015KT 9999 FEW030 22/10 Q1006=***

ACCIDENT TIME 0230 JST

[0730 JST on June 17] ***METAR RJNS 162230Z 06007KT 330V100 9999 FEW030 22/13 Q1011=***

[0800 JST on June 17] ***METAR RJNS 162300Z 07008KT 010V110 9999 FEW030 22/13 Q1011=***

RJNS weather at 2000 JST on June 16, wind from 260° at 19 knots, 10 km visibility or greater, few clouds at 3,000 feet agl, temperature of 24° C, dew point temperature of 9° C, and an altimeter setting of 1004-hPa.

RJNS weather at 2100 JST on June 16, wind from 270° at 15 knots, 10 km visibility or greater, few clouds at 3,000 feet agl, temperature of 22° C, dew point temperature of 10° C, and an altimeter setting of 1006-hPa.

RJNS weather at 0730 JST on June 17, wind from 060° at 7 knots, wind direction varying between 330° and 100°, 10 km visibility or greater, few clouds at 3,000 feet agl, temperature of 22° C, dew point temperature of 13° C, and an altimeter setting of 1011-hPa.

RJNS weather at 0800 JST on June 17, wind from 070° at 8 knots, wind direction varying between 010° and 110°, 10 km visibility or greater, few clouds at 3,000 feet agl, temperature of 22° C, dew point temperature of 13° C, and an altimeter setting of 1011-hPa.

2.1 Local Marine Observations

There were no known official buoy observations within 200 miles of the accident site.

3.0 Satellite Data

Infrared data from the Himawari number 8 (HIMAWARI-8) data was obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System software. Infrared imagery (HIMAWARI-8 band 13) at wavelengths of 10.4 microns was retrieved for the period. Satellite imagery surrounding the time of the accident, from 0100 JST through 0500 JST at approximately 5-minute intervals were reviewed, and the images closest to the time of the accident are documented here.

Figures 5 and 6 present the HIMAWARI-8 infrared imagery from 0230 and 0245 JST at 3X magnification with the accident site highlighted with a red square. Inspection of the infrared imagery indicated cloud cover from southwest through southeast of the accident site and south to southeast of RJTO. The cloud cover was moving from west to east (attachment 1). There was no cloud cover above the accident site at the accident time. It should be noted these figures have not been corrected for any parallax error.

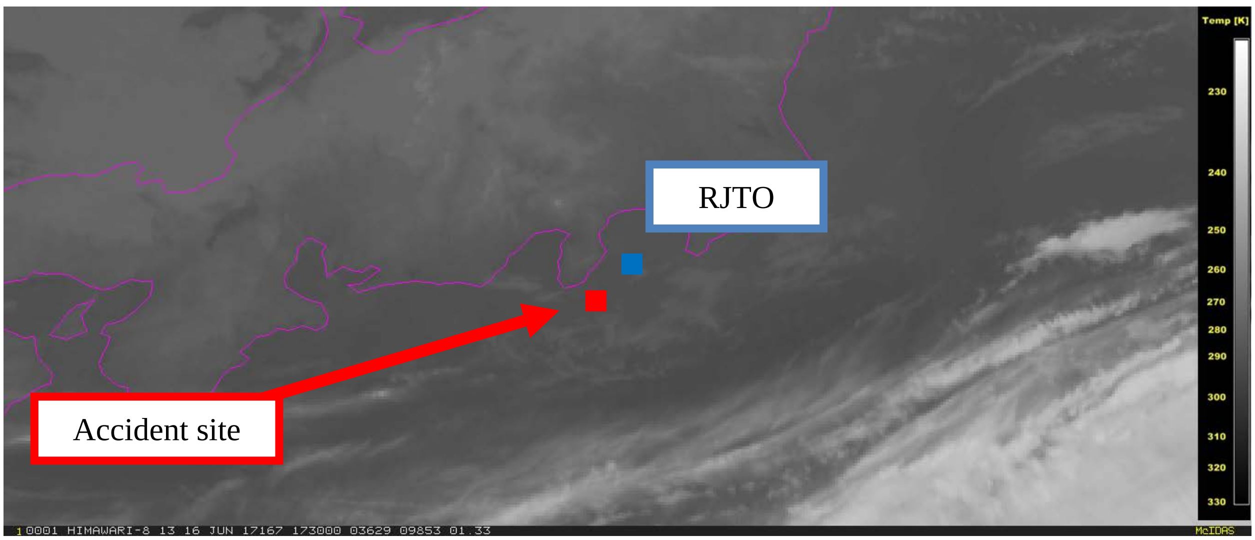

Figure 5 – HIMAWARI-8 infrared image at 0230 JST

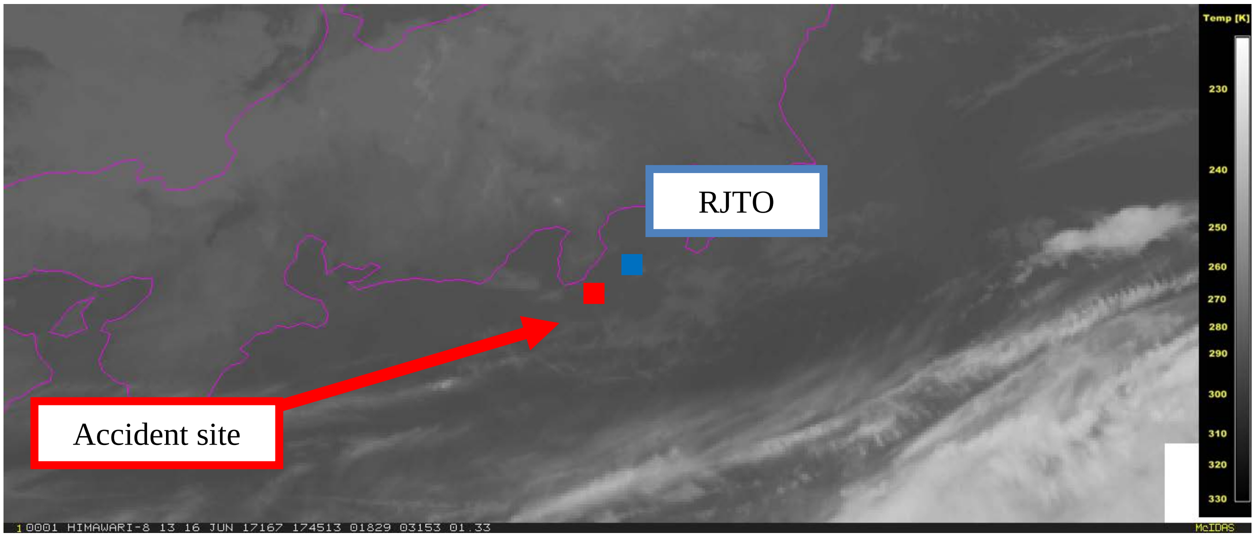

Figure 6 – HIMAWARI-8 infrared image at 0245 JST

4.0 Radar Imagery Information

No official weather radar imagery could be retrieved for the accident site around the accident time.

5.0 Marine Information

Data was retrieved from the Naval Oceanographic Office Global Hybrid Coordinate Ocean Model (HYCOM)[5] and the NOAA Wavewatch III (WW3)[6] model for the accident site around the accident time. Data from the HYCOM and WW3 were available at 3-hour time increments. At 0000 JST HYCOM and WW3 indicated a sea surface temperature of 20.85° C, an air temperature of 20.95° C, a surface sea current from 232° at 1.645 knots, a wind from 027° at 16.67 knots. At 0300 JST HYCOM and WW3 indicated a surface sea current from 227° at 1.846 knots, a wind from 034° at 14.02 knots, a wave height of 2.40 feet, a wave direction from 024°, and a wave period of 2.95 seconds. Figure 7 shows a regional view of the HYCOM surface sea current data surrounding the accident site from 0200 JST.

[5] https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/navoceano-hycom-glb
[6] http://polar.ncep.noaa.gov/waves/index2.shtml

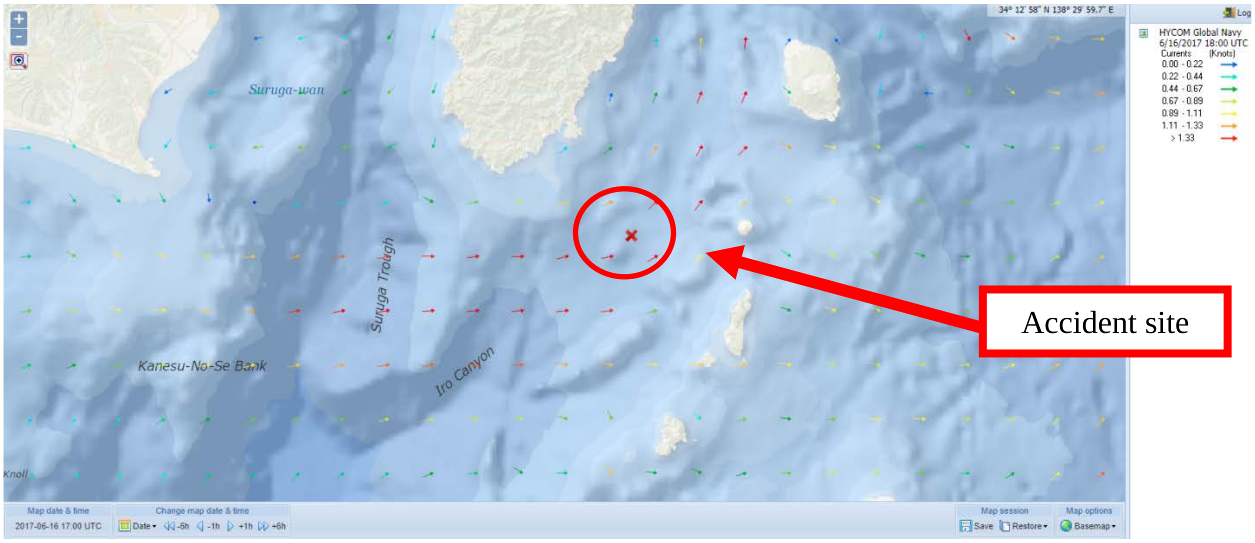

Figure 7 –HYCOM surface sea current information around the accident site from 0200 JST

6.0 Witness Information[7]

The master of the *M/V ACX Crystal* indicated that the visibility was 10 miles at the accident time. Several individuals from the *USS Fitzgerald* were interviewed and they reported the weather as "nice" or "good" at the accident time.

7.0 Significant Wave Height

The standard ocean wave forecast set forth by the World Meteorological Organization (WMO) instructs that the countries responsible for the weather forecast for the world's oceans use significant wave height for their ocean wave height forecasts. The Ocean Prediction Center and the National Hurricane Center's Tropical Analysis and Forecast Branch are responsible for the NOAA forecasts for the northern Atlantic and Pacific oceans. NWS Weather Forecast Offices (WFO)s are responsible for NOAA forecasts closer to the coastal regions (including the Bering Sea) and the NWS Anchorage WFO was the responsible office for the weather forecast for the accident area.

[7] For more information please see the witness interviews and information located in the docket for this accident.

The wavy water surface in the ocean is made up of an entire spectrum of waves and the waves can vary quite a bit for a given wind speed and fetch. Significant wave height is defined as the average height of the highest one-third of the waves in a wave spectrum. Figure 8 shows a typical wave spectrum distribution. This distribution shows that for a given wavy ocean surface the most probable wave height and mean wave height a person would encounter would be lower than the significant wave height, with statistically a much smaller chance of encountering a wave whose height is larger than the significant wave height. For example, given a significant wave height observed of 20 feet, the mean wave height encountered by a vessel for that wave spectrum would be 12.8 feet with the most probable wave height encountered of 12 feet. However, the highest 10 percent of waves within that wave spectrum would be 25.4 feet and the highest 1 percent of waves would be around 33.4 feet high. The highest wave a vessel would likely encounter within a wave spectrum whose significant wave height was 20 feet would be 40 feet. From the HYCOM and WW3 data for the accident site, with seas[8] of 2.4 feet, the highest wave heights the accident vessel could have expected would have been 4.8 feet with most of the waves encountered around 1.4 feet high.

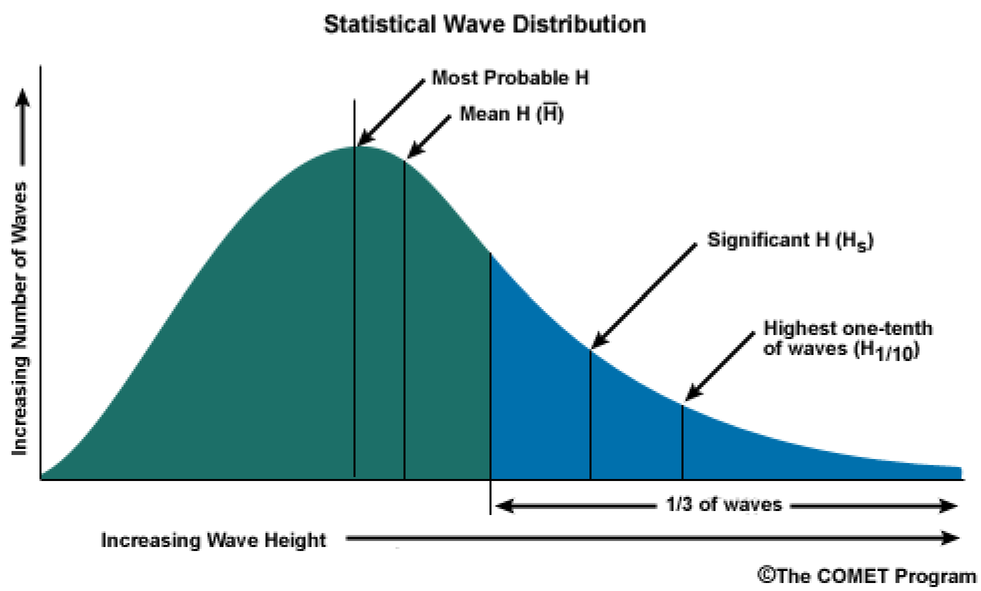

Figure 8 – Typical statistical wave distribution

8.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on June 17, 2017, indicated the following:

[8] Seas = significant wave height

SUN

Begin civil twilight	0401 JST
Sunrise	0431 JST
Sun transit	1145 JST
Sunset	1858 JST
End civil twilight	1928 JST

MOON

Moonrise	2332 JST on preceding day
Moon transit	0522 JST
Moonset	1118 JST

The phase of the Moon was Last Quarter.

E. LIST OF ATTACHMENTS

Attachment 1 – HIMAWARI-8 weather satellite animation from 0200 to 0300 JST

Submitted by:

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Paul Suffern
Senior Meteorologist

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