



# SHEBA Reconnaissance Imagery, Version 1

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## USER GUIDE

### How to Cite These Data

As a condition of using these data, you must include a citation:

Fetterer, F. and N. Untersteiner. 2000. *SHEBA Reconnaissance Imagery, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center.

<https://doi.org/10.7265/N50V89RX>. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT [NSIDC@NSIDC.ORG](mailto:NSIDC@NSIDC.ORG)

FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/G02180>



National Snow and Ice Data Center

# TABLE OF CONTENTS

1	DETAILED DATA DESCRIPTION .....	2
1.1	Overview .....	2
1.2	About the Images .....	2
1.3	Image Data .....	4
1.3.1	Version 1 Imagery Data Set.....	4
1.3.2	Imagery Subset .....	5
1.4	Spatial Coverage.....	5
1.5	Temporal Coverage .....	6
2	REFERENCES AND RELATED PUBLICATIONS .....	6
3	ACKNOWLEDGMENTS .....	7
4	DOCUMENT INFORMATION.....	7
4.1	Publication Date .....	7
	APPENDIX A – METADATA TABLE .....	8

# 1 DETAILED DATA DESCRIPTION

## 1.1 Overview

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This data set consists of optical band reconnaissance imagery of the Surface Heat Budget of the Arctic Ocean (SHEBA) site acquired between August 1997 and October 1998. The 57 images cover a variable area on the order of 15 km by 40 km, at a resolution of about 1 m. Some but not all of the images contain the SHEBA experiment platform (the Canadian icebreaker *Des Groseillers*). Figure 4 shows a graphic of the ship track with the area covered. The imagery was released at the request of the National Science Foundation (NSF). Data were acquired as part of the Medea Environmental Intelligence and Applications Program. See section [1.3 Image Data](#) for more information on using this imagery. Image subsets (about 20 MB) and thumbnails of the full images are available in [Appendix A – Metadata Table](#).

## 1.2 About the Images

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In an unprecedented boon for Arctic science, the National Imagery and Mapping Agency has approved the release of imagery acquired for the SHEBA experiment site. Investigators will use the imagery to:

- Characterize surface conditions and their impact on the net radiation balance
- Locate instrument sites relative to ice features that may affect measurements
- Parameterize ice albedo and melt pond development for inclusion in climate models
- Study pond development in response to changes in temperature, cloud cover, and insolation
- Apply to a variety of other applications



Figure 1. Helicopter view of the SHEBA site during the height of the summer melt season.

In 2013, R. Kwok authored a paper that provided information on uses for these data:

Kwok, R. 2014. Declassified high-resolution visible imagery for Arctic sea ice investigations: an overview. *Remote Sensing of the Environment* 142: 44-56. doi: 10.1016/j.rse.2013.11.015.

The images below (from June 18, 1998) show how the SHEBA site appears in U.S. National Reconnaissance Imagery.

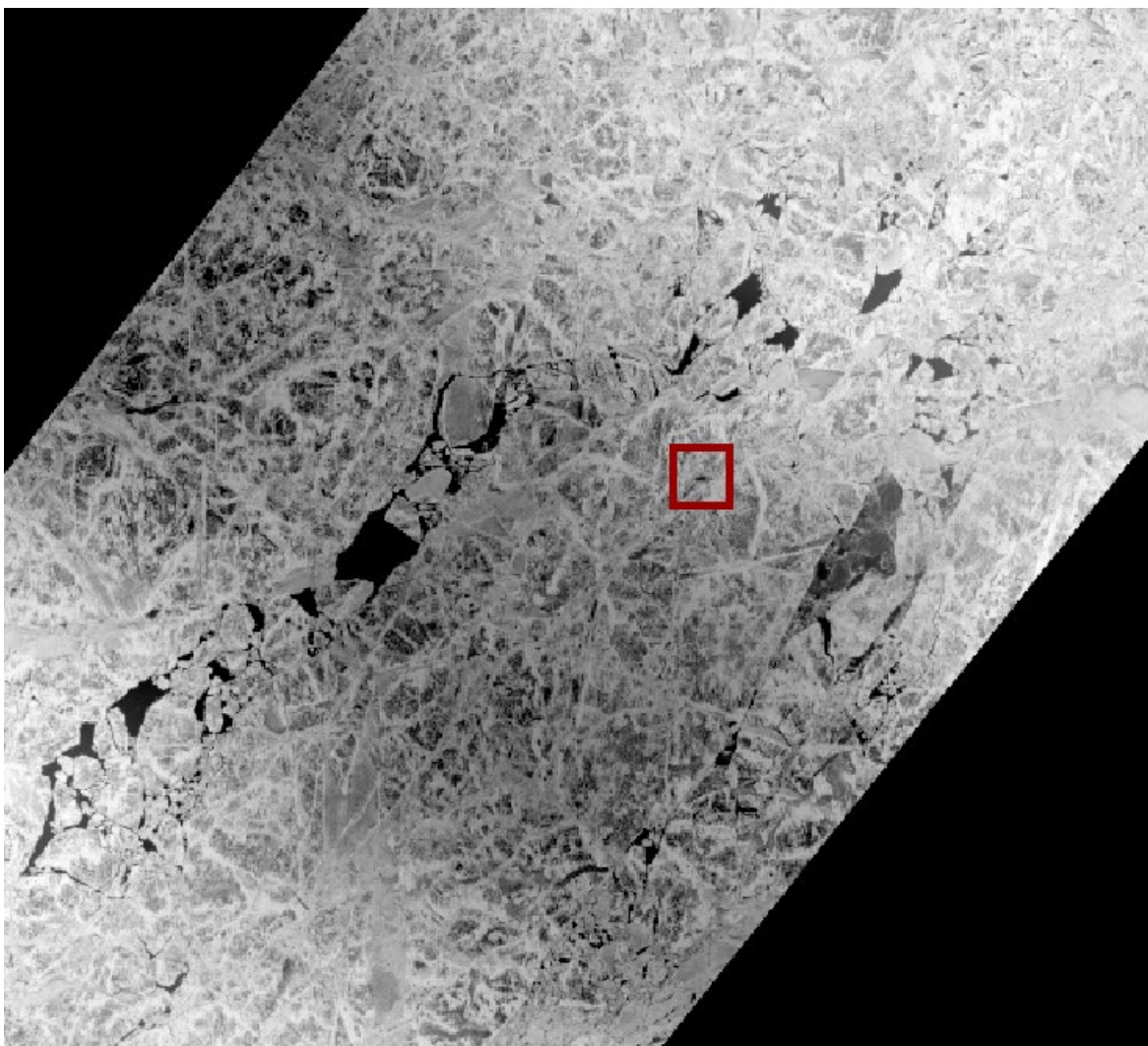


Figure 2. The square marks the location of the CCGS Des Groseilliers (a blow-up of this area is shown in Figure 3). The image covers 7815 meters across the swath width, that is, diagonally across the image.



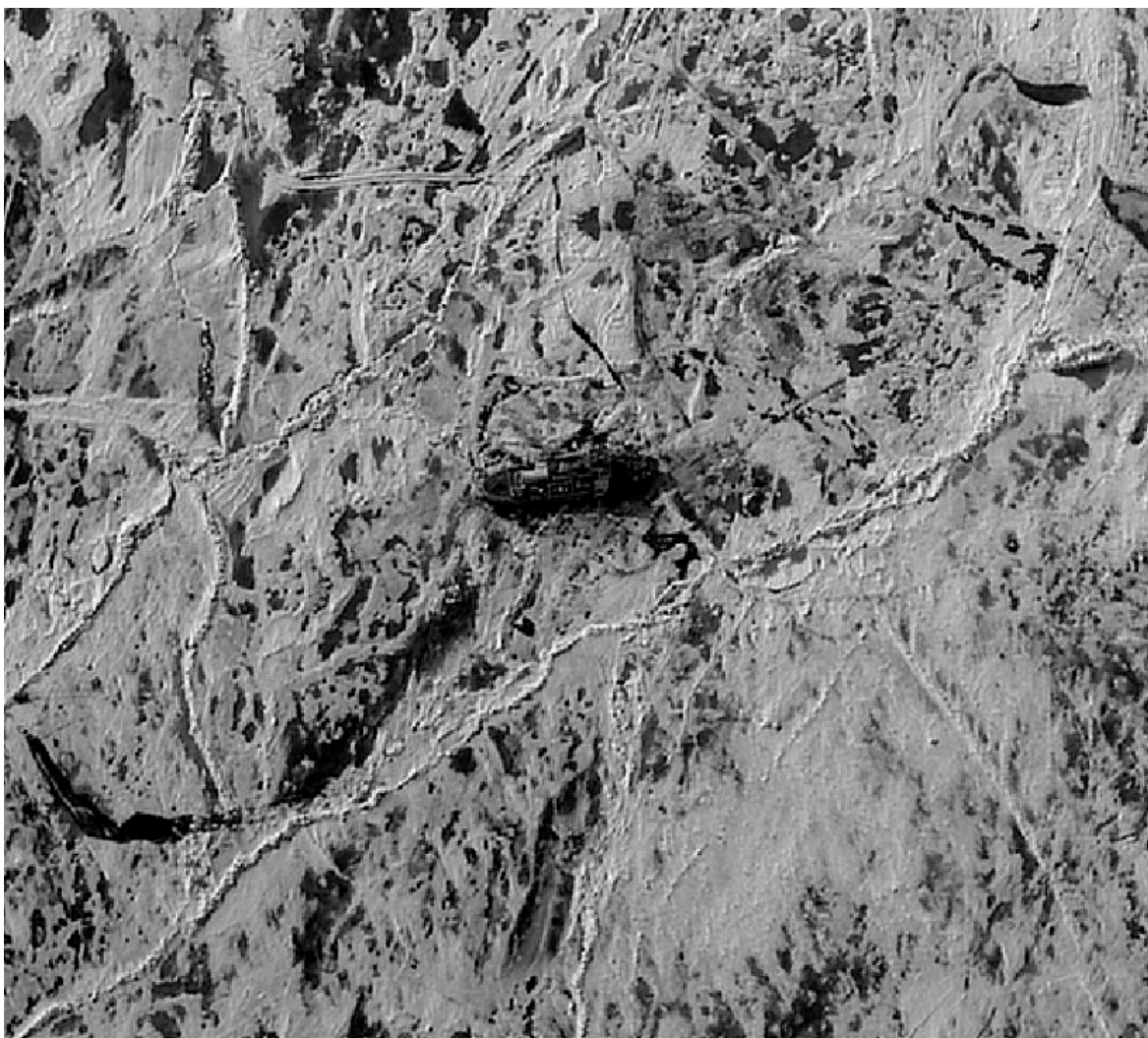


Figure 3. Close-up view of the Des Groseilliers (area included in the red square in Figure 2). The ship is 322 feet (~98 meters) long, and in this image is oriented with the bow pointing to right or northeast. Note that the summer melt season is in progress; much of the ice is covered by dark melt ponds.

## 1.3 Image Data

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### 1.3.1 Version 1 Imagery Data Set

Image data and additional image information are given in [Appendix A – Metadata Table](#).

Uncompressed file sizes range from 200 to 700 MB. Please be sure your computer system and software are capable of manipulating very large images before you acquire any images. You may prefer to use the smaller image subsets, which is explained in section [1.3.2 Imagery Subset](#).

Data are available in two projections Polar Stereographic and Universal Transverse Mercator (UTM), and three formats GeoTIFF, ERDAS Imagine, and Band Sequential Binary (BSQ). The images in Polar Stereographic projection have an embedded north arrow and scale bar. Associated

header files contain corner point, image dimension, and projection information. The Polar Stereographic projection, the same projection used for many of NSIDC's passive microwave products, is true at 70 degrees North, with a central meridian of -45 degrees. The UTM projection is in Zone 4N.

Table 1 summarizes naming conventions and describes file content.

Table 1. File Naming Convention and Content

File name example	Description
97AUG25_v1_polar_mapel.hdr	Header file for image in polar stereographic projection
97AUG25_v1_polar_mapel.tif	Image in GeoTIFF format, polar stereographic projection
97AUG25_v1_polar_mapel.img	Image in ERDAS Imagine format, polar stereographic projection
97AUG25_v1_polar_mapel.bsq	Image in band-sequential binary format, polar stereographic projection
97AUG25_v1_utm.hdr	Header file for image in UTM projection
97AUG25_v1_utm.tif	Image in GeoTIFF format, UTM projection
97AUG25_v1_utm.img	Image in ERDAS Imagine format, UTM projection
97AUG25_v1_utm.bsq	Image in band-sequential binary format, UTM projection

### 1.3.2 Imagery Subset

Subsets were created using the Version 1.0 reconnaissance images. The subsets cover 5 km by 5 km and are 5000 by 5000 pixels, or about 20 MB. The area of the original image covered by each subset was selected to avoid clouds, unless the *Des Groseillers* was obvious in the image, in which case the subset was selected to include the ship. In many images, the large-scale texture of the ice is not homogenous on a 5 km scale. Therefore while an effort was made to choose representative subsets, the subsets are not necessarily samples of average surface conditions. The subsets are in GeoTIFF format, can be obtained by HTTPS: <https://noaadata.apps.nsidc.org/NOAA/G02180/>, and are listed in [Appendix A – Metadata Table](#).

## 1.4 Spatial Coverage

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The approximate spatial bounding box for these data are the following. See Table A - 1 in the Appendix for specific locations of each image.

- Northernmost Latitude: 80° N
- Southernmost Latitude: 70° N
- Easternmost Longitude: 130° W
- Westernmost Longitude: 170° W

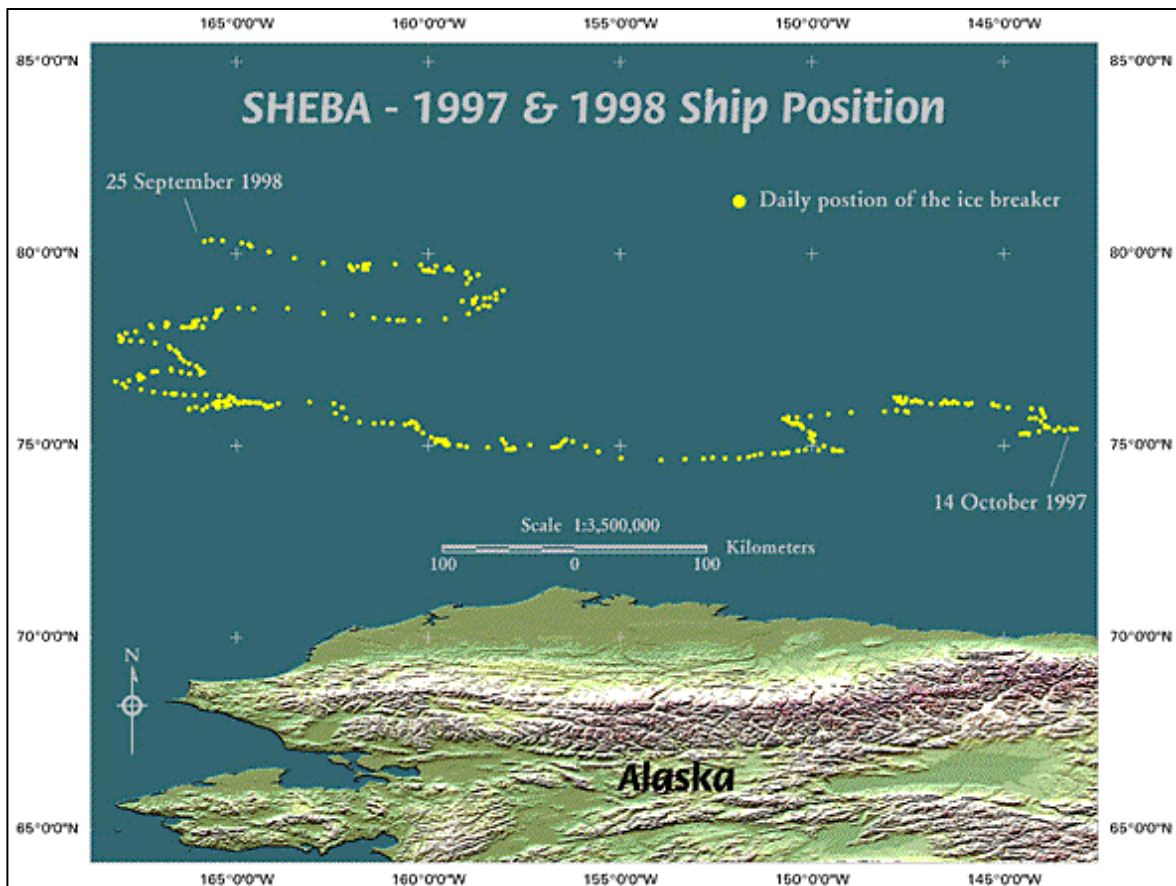


Figure 4. Track of the Icebreaker Des Grseillers's geographic position during SHEBA.

## 1.5 Temporal Coverage

The data span 25 August 1997 through 03 October 1998.

## 2 REFERENCES AND RELATED PUBLICATIONS

These references describe work done with similar imagery from the Medea Environmental Intelligence and Applications Program.

Fetterer, F., and N. Untersteiner, Observations of melt ponds on Arctic sea ice, *Journal of Geophysical Research*, 103 (C11), 24,821-24,835, 1998.

Fetterer, F., and N. Untersteiner, Melt pond coverage statistics from classified satellite data, in *International Geoscience and Remote Sensing Symposium*, (on CD-ROM), IEEE 97CH36174, Seattle, WA, 1998.

## 3 ACKNOWLEDGMENTS

The following organizations played major roles in making these data available:

National Science Foundation

United States Geological Survey

Department of Central Intelligence Environmental Committee

Earth Satellite Corporation

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## 4 DOCUMENT INFORMATION

### 4.1 Publication Date

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2000



## APPENDIX A – METADATA TABLE

NSIDC archives the SHEBA imagery indicated in Table A - 1. Thumbnails of these images are available by clicking on the image date in the left column of this table. Subsets of some of the images in .tif format are available to download from the [HTTPS subset directory](#). To obtain full-sized images, go to the [HTTPS hires directory](#) and search for the appropriate directory by date.

Table A - 1. Available SHEBA Imagery with Dates, Locations, and Size

Image Date (links to thumbnail of (x) size)	Download Image Subset (no subset available if blank)	*Geographical position of northwest and southeast corners of full-sized image (degrees minutes decimal-seconds)				Pixel Size (m)	Time (UTC)	Sun azimuth angle, to nearest degree	Sun elevation angle, to nearest degree	*Ship location	
		NW Longitude	NW Latitude	SE Longitude	SE Latitude					Longitude (dec.deg.)	Latitude (dec.deg.)
<a href="#">97AUG25_v1</a> (96K)	<a href="#">97aug25</a>	142 26 24.84 W	74 53 44.66 N	141 34 24.59 W	74 45 21.14 N	1.005640	4:45	292	5		
<a href="#">97AUG28_v1</a> (60K)	<a href="#">97aug28</a>	143 47 14.09 W	74 59 59.02 N	143 37 48.91 W	74 53 43.68 N	1.003200	5:00	293	4		
<a href="#">97AUG29_v1</a> (96K)	<a href="#">97aug29</a>	142 43 10.01 W	75 11 53.91 N	142 12 28.56 W	74 59 44.81 N	1.115500	1:30	245	16		
<a href="#">97AUG31_v1</a> (88K)	<a href="#">97aug31</a>	143 03 57.90 W	75 11 25.53 N	142 17 24.36 W	75 02 40.34 N	1.027709	2:30	255	13		
<a href="#">97SEP07_v1</a> (72K)	<a href="#">97sep07</a>	143 42 06.26 W	75 02 35.25 N	143 11 02.73 W	75 00 17.41 N	1.012000	20:45	169	21		
<a href="#">97SEP08_v1</a> (72K)	<a href="#">97sep08</a>	142 53 55.23 W	75 00 49.98 N	142 25 43.31 W	74 47 44.84 N	1.000000	2:15	253	10		
<a href="#">97SEP13_v1</a> (48K)	<a href="#">97sep13</a>	143 46 18.34 W	74 52 49.43 N	142 57 47.72 W	74 49 10.63 N	1.046500	20:00	155	17		

97SEP14_v1 (40K)	97sep14	143 37 25.48 W	75 05 11.08 N	142 57 54.09 W	75 01 10.38 N	1.069500	20:15	161	17		
97SEP29_v1 (55K)	97sep29	143 35 04.93 W	75 12 09.79 N	142 26 46.64 W	75 06 35.83 N	1.127000	19:30	152	11		
97OCT07_v1 (60K)	97oct07	143 34 52.85 W	75 12 40.71 N	143 07 30.41 W	75 00 39.01 N	1.046500	20:45	173	9		
97OCT08_v1 (62K)	97oct08	143 12 49.10 W	75 12 12.41 N	142 21 56.31 W	75 04 39.23 N	1.046500	0:00	222	5		
97OCT10_v1 (52K)	97oct10	144 41 49.13 W	75 23 56.82 N	143 54 05.15 W	75 17 28.35 N	1.104000	20:30	165	7		
97OCT12_v1 (40K)	97oct12	144 28 03.65 W	75 25 03.05 N	144 05 23.66 W	75 15 08.68 N	1.000400	22:45	200	6		
98MAY07_v1 (60K)	98may07	165 21 03.88 W	76 01 35.57 N	164 27 56.43 W	75 56 20.87 N	1.069500	5:45	284	14	165.162 W	76.062 N
98MAY16_v1 (59K)		165 07 32.84 W	76 10 01.64 N	164 47 47.16 W	75 59 48.26 N	1.226659	22:30	171	33	165.438 W	76.306 N
98MAY17_v1 (46K)	98may17	165 55 20.83 W	76 18 01.16 N	164 46 45.65 W	76 14 54.07 N	1.000100	2:30	239	27	165.788 W	76.326 N
98MAY20_v1 (28K)	98may20	166 36 06.38 W	76 26 33.00 N	165 38 25.38 W	76 20 53.00 N	1.292474	6:00	290	16	166.608 W	76.339 N
98MAY26_v1 (26K)	98may26	168 17 14.23 W	76 35 55.98 N	166 59 12.19 W	76 29 19.70 N	1.058000	21:30	154	34	167.482 W	76.465 N
98JUN02_v1 (36K)	98jun02	168 02 06.40 W	76 56 47.70 N	166 31 38.52 W	76 49 58.98 N	1.150000	21:00	146	33	167.504 W	76.799 N
98JUN04_v1 (36K)	98jun04	167 41 38.38 W	76 56 58.42 N	167 31 06.90 W	76 39 10.39 N	1.001000	9:30	337	10	167.516 W	76.852 N

98JUN06_v1 (32K)	98jun06	168 09 14.47 W	76 47 18.75 N	167 17 49.04 W	76 40 36.23 N	1.138500	1:30	217	34	167.076 W	76.932 N
98JUN09_v1 (32K)	98jun09	167 01 27.77 W	76 56 06.43 N	166 50 53.68 W	76 44 20.33 N	1.000000	9:45	341	11	166.426 W	76.92 N
98JUN10_v1 (68K)	98jun10	167 10 29.75 W	76 56 08.33 N	166 16 39.65 W	76 49 40.43 N	1.156291	1:15	217	34	166.212 W	76.873 N
98JUN17_v1 (52K)	98jun17	167 09 50.67 W	77 21 19.02 N	166 16 07.38 W	77 16 56.06 N	1.176243	22:00	159	36	166.458 W	77.283 N
98JUN18_v1 (36K)	98jun18	166 46 16.36 W	77 31 00.20 N	165 15 45.63 W	77 29 48.20 N	1.030296	2:00	226	33	166.504 W	77.392 N
98JUN22_v1 (44K)	98jun22	167 09 02.60 W	77 29 42.04 N	165 48 39.36 W	77 27 22.80 N	1.000000	22:15	165	36	167.118 W	77.673 N
98JUN24_v1 (56K)	98jun24	167 17 39.91 W	77 29 29.31 N	165 46 08.69 W	77 23 59.39 N	1.000500	4:00	261	26	167.761 W	77.732 N
98JUN25_v1 (48K)	98jun25	168 16 42.08 W	77 46 20.92 N	167 31 15.90 W	77 41 15.27 N	1.092500	3:45	253	28	167.995 W	77.722 N
98JUN26_v1 (27K)	98jun26	168 31 56.07 W	77 42 35.21 N	167 00 08.85 W	77 36 29.06 N	1.023500	3:15	247	29	168.022 W	77.726 N
98JUN27_v1 (40K)		168 41 11.59 W	77 46 57.83 N	166 56 32.07 W	77 41 37.82 N	1.069500	2:00	227	32	167.961 W	77.779 N
98JUL08_v1 (32K)		167 08 58.53 W	78 05 05.02 N	165 39 34.70 W	78 04 04.21 N	1.002000	23:15	180	34	166.408 W	78.088 N
98JUL11_v1 (35K)		167 21 33.02 W	78 06 58.73 N	166 13 38.16 W	77 58 05.04 N	1.138500	5:30	278	21	166.066 W	78.108 N
98JUL12_v1 (16K)		167 02 51.39 W	78 07 53.42 N	165 31 31.65 W	78 06 53.17 N	1.000500	23:00	179	34	166.227 W	78.09 N

98JUL20_v1 (15K)		167 05 57.19 W	78 14 42.79 N	165 12 55.26 W	78 13 41.94 N	1.001100	22:45	173	32	165.994 W	78.261 N
98JUL21_v1 (64K)	98jul21	166 24 32.31 W	78 15 14.37 N	165 45 02.61 W	78 06 45.33 N	1.115500	2:30	235	28	165.806 W	78.302 N
98JUL22_v1 (33K)		166 09 38.41 W	78 21 04.88 N	165 09 37.94 W	78 11 43.37 N	1.115500	3:00	242	26	165.546 W	78.341 N
98JUL28_v1 (39K)		165 25 04.50 W	78 33 48.15 N	164 26 59.59 W	78 25 32.25 N	1.192170	3:30	248	24	164.552 W	78.567 N
98AUG01_v1 (21K)		162 48 59.38 W	78 21 27.10 N	161 05 29.40 W	78 17 50.38 N	1.188007	22:00	168	29	161.419 W	78.324 N
98AUG13_v1 (26K)		159 43 15.27 W	78 54 10.58 N	158 10 31.73 W	78 51 21.14 N	1.000500	22:00	168	25	158.747 W	78.856 N
98AUG15_v1 (55K)		159 32 44.68 W	78 38 38.27 N	158 47 50.61 W	78 23 24.37 N	1.081000	5:45	287	11	158.537 W	78.837 N
98AUG16_v1 (55K)		159 32 20.06 W	79 01 42.62 N	158 47 38.28 W	78 47 42.74 N	1.046500	7:45	317	6	159.114 W	78.765 N
98AUG19_v1 (49K)		158 56 28.33 W	78 42 57.68 N	158 02 32.37 W	78 34 06.75 N	1.190400	5:30	288	10	158.235 W	78.961 N
98AUG23_v1 (38K)		160 16 49.15 W	79 30 14.76 N	159 13 44.42 W	79 22 17.71 N	1.127000	5:30	287	9	158.699 W	79.451 N
98AUG27_v1 (52K)	98aug27	159 54 00.91 W	79 29 29.35 N	158 09 01.50 W	79 25 23.16 N	1.092500	21:00	154	20	159.985 W	79.585 N
98AUG30_v1 (32K)	98aug30	161 12 55.31 W	79 45 16.96 N	161 01 27.11 W	79 23 52.81 N	1.000000	1:30	224	17	160.066 W	79.554 N
98SEP04_v1 (48K)	98sep04	161 14 12.13 W	79 32 39.90 N	158 46 35.02 W	79 27 12.23 N	1.003300	5:15	282	5	160.191 W	79.704 N

98SEP05_v1 (28K)	98sep05	161 15 50.93 W	79 46 31.39 N	160 15 12.45 W	79 42 41.40 N	1.001000	2:30	239	12	160.863 W	79.733 N
98SEP08_v1 (36K)		160 33 35.72 W	79 36 19.33 N	160 14 52.52 W	79 20 10.15 N	1.001100	3:30	255	9	161.664 W	79.692 N
98SEP09_v1 (56K)	98sep09	160 56 02.30 W	79 32 37.66 N	160 27 24.96 W	79 21 34.70 N	1.023500	1:30	222	13	161.839 W	79.665 N
98SEP12_v1 (60K)		163 08 51.08 W	79 36 31.86 N	162 01 02.18 W	79 30 52.66 N	1.046500	1:00	213	13	161.963 W	79.571 N
98SEP15_v1 (52K)		162 03 14.44 W	79 36 41.79 N	160 56 37.86 W	79 31 07.66 N	1.046500	2:00	230	10	161.67 W	79.638 N
98SEP16_v1 (48K)	98sep16	161 35 43.97 W	79 45 13.78 N	160 50 49.19 W	79 41 51.15 N	1.000500	3:15	251	6	162.04 W	79.689 N
98SEP22_v1 (48K)	98sep22	164 30 06.78 W	80 09 01.70 N	162 31 36.11 W	80 03 15.61 N	1.035000	21:00	153	9	164.858 W	80.277 N
98SEP23_v1 (56K)		165 45 13.64 W	80 27 16.19 N	165 14 54.65 W	80 14 22.78 N	1.115500	1:45	224	7	165.356 W	80.338 N
98SEP24_v1 (56K)	98sep24	166 02 15.00 W	80 09 07.06 N	164 41 02.15 W	80 04 20.73 N	1.000000	2:15	230	6	165.65 W	80.356 N
98SEP28_v1 (28K)		166 49 00.12 W	80 15 40.47 N	165 52 17.66 W	80 11 15.28 N	1.000000	2:00	228	5		
98OCT03_v1 (36K)		166 23 22.87 W	80 21 14.36 N	165 58 02.93 W	80 00 16.64 N	1.081000	23:15	186	5		

\* The geographical position of the image corner points was determined by the image processing software and satellite system parameters. Position errors of unknown magnitude exist, because images were not georectified with ground control points. The ship positions were interpolated to the nearest half hour, and were provided by the University of Washington. Not all images contain the ship.