Science Flight Report
Operation IceBridge Arctic 2012

Flight: **F12**
Mission: **ZigZag West (modified) & ESA CryoVEx**

Flight Report Summary

Aircraft	**P-3B (N426NA)**
Flight Number	13
Flight Request	12P006
Date	Thursday, March 29, 2012 (Z)
Purpose of Flight	Operation IceBridge Mission ZigZag West (modified) & ESA CryoVEx
Take off time	11:00 Zulu from Thule Air Base (BGTL)
Landing time	18:40 Zulu at Thule Air Base (BGTL)
Flight Hours	7.9 hours
Aircraft Status	Airworthy.
Sensor Status	All installed sensors operational.
Significant Issues	None
Accomplishments	• Low-altitude survey (1,500 ft AGL) of a sea ice transect along CryoSat-2 orbit 10462 and several zigzag transects flown in previous years. • CryoSat-2 underpass at 11:31 Z – 50 minutes before P-3 survey. • Joint survey with ESA's CryoVEx Twin Otter and ASIRAS radar. • Completed entire mission as planned. • ATM, snow, Ku-band, accumulation radar, gravimeter, magnetometer, DMS and KT-19 skin temperature sensor were operated on the survey lines. • The MCoRDS radar was not in operation due to sea ice mission. • Several pitch and roll maneuvers over sea ice for snow and Ku-band radar calibration. • Ramp pass at Thule at 2,000 ft AGL.
Geographic Keywords	Arctic Ocean, Alert, Lincoln Sea, Ellesmere Island.
Satellite Tracks	CryoSat-2 orbit 10462
Repeat Mission	Partial 2010, 2011.

Science Data Report Summary

Instrument	Instrument Operational			Data Volume	Instrument Issues
	Survey Area	Entire Flight	High-alt. Transit		
ATM	☑	☒	☒	60 GB	None
MCoRDS	☒	☒	☒	N/A	N/A
Snow Radar	☑	☒	☒	500 GB	None
Ku-band Radar	☑	☒	☒	500 GB	None
Accumulation Radar	☑	☒	☒	127 GB	None
DMS	☑	☒	☒	143 GB	None
KT-19 Skin Temp.	☑	☑	☑	7.1 MB	None
Gravimeter	☑	☑	☑	1.5 GB	None
Magnetometer	☑	☑	☑	120 MB	None

Mission Report (Michael Studinger, Mission Scientist)

Today marks the centennial of Sir Robert Falcon's death on the Ross Ice Shelf on March 29, 1912. There are many commemorative events taking place around the world today to remember the scientific accomplishments of the Terra Nova Expedition. One hundred years later we launch two aircraft from different locations and meet up over the Arctic Ocean on a track that has been flown by a spacecraft 600 km above us. A lot has changed to say the least, but nevertheless operating in remote polar regions remains a challenge even today. Today's polar research is driven by a spirit of international collaboration and today's flight is a fine example of what can be accomplished when many nations and organizations team up instead of competing with each other. Recognizing the enormous accomplishments of the early polar explorers we dedicate today's mission to the members of the Terra Nova Expedition who died in Antarctica.

The first part of today's mission was a joint survey with the European Space Agency's CryoVEx campaign. The plan was to fly three aircraft and CryoSat-2 within hours on the same satellite orbit. In addition to the P-3 (N426NA), the Technical University of Denmark (DTU Space) has chartered a DHC-6-300 Twin Otter (TF-POF) from Norlandair and has installed a laser scanner and ASIRAS, which is the airborne version of SIRAL, the radar that flies on the CryoSat-2 spacecraft. We had also planned to have a Basler BT-67 (DC-3) aircraft, 'Polar 5' (C-GAWI) from the Alfred Wegener Institute in Germany, participate in the joint flight. The Polar 5 is equipped with an EM-31 bird for measuring sea ice thickness, an airborne laser scanner, and nadir looking video and camera systems. Unfortunately, there was a technical issue with the EM-31 bird that could not be resolved in time for the flight and the Polar 5 did not participate on today's CryoVEx flight.

The choreography of events we had developed worked out perfectly. We had excellent weather in the survey area, which was an incredible help. We only have two orbits per day that are inside the temporary SAR mode mask of CryoSat-2 north of Alert (Fig. 1) and chose the early morning orbit that was flown by the spacecraft at 11:31 Zulu. The P-3 took off from Thule as soon as the airfield opened at 11:00 Z. At 12:12 Z we were close to Alert and heard on the radio that the Norlandair Twin Otter was taxiing. N426NA reached the start of the survey line at the coast of Ellesmere Island at 12:18 Z with TF-POF close behind us. The timing worked out perfectly – a job well done by everyone involved. At 13:16 Z we reached the end of the CryoSat survey line and turned towards waypoint RK04 of the ZigZag West mission plan. At 17:05 Z we reached the end of the survey line at waypoint NTSW and started climbing for the transit back to Thule.

It was a perfect day.

Individual instrument reports from experimenters on board the aircraft:

ATM: Both ATM systems worked well and collected good data along the entire line in cloud free conditions. ATM collected a total of 5.0 hours of science data with 100% coverage.

MCoRDS: The MCoRDS system was not operated on this flight due to the sea ice mission and the team used the flight for test recordings.

Snow and Ku-band radar: The snow and Ku-band radars worked well and collected 4.25 hours of data. No data was lost.

Accumulation radar: Worked well.

Gravimeter: Worked well.

Magnetometer: Worked well.

DMS: DMS worked well and collected data on the primary system only today.

KT-19 skin temperature sensor: System worked well.

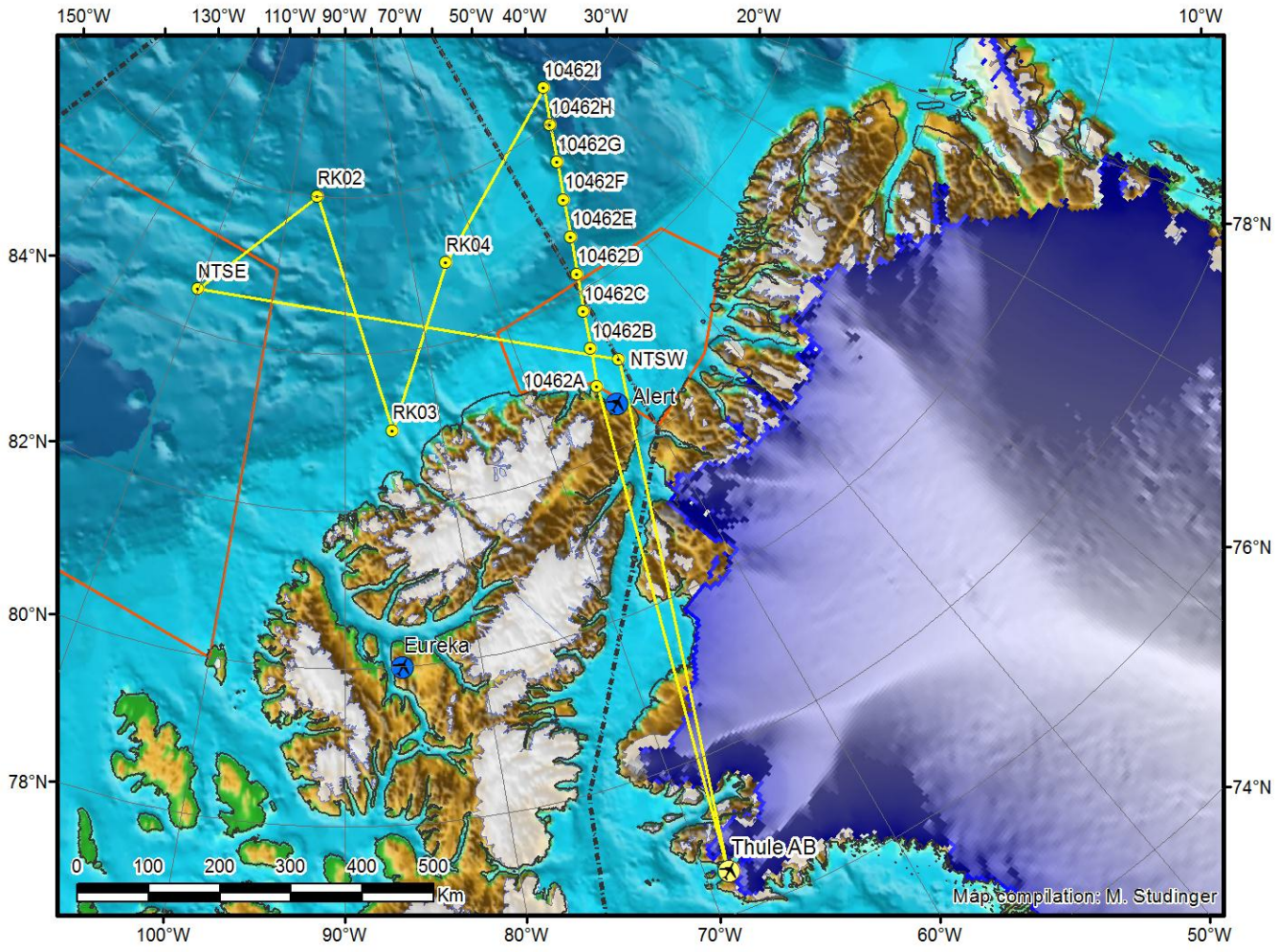

Figure 1: Today's sea ice mission plan (yellow). Red boxes outline the temporary CryoSat-2 SAR mode mask north of Alert and the "Wingham Box". We teamed up with ESA's CryoVEx experiment along CryoSat-2 orbit 10462 north of Alert.

Figure 2: DMS mosaic from Eric Fraim showing one of many refrozen leads we saw today. We saw many leads near the coast of Ellesmere Island on the western part of the survey that can be seen in the IR satellite image below (Fig. 3).

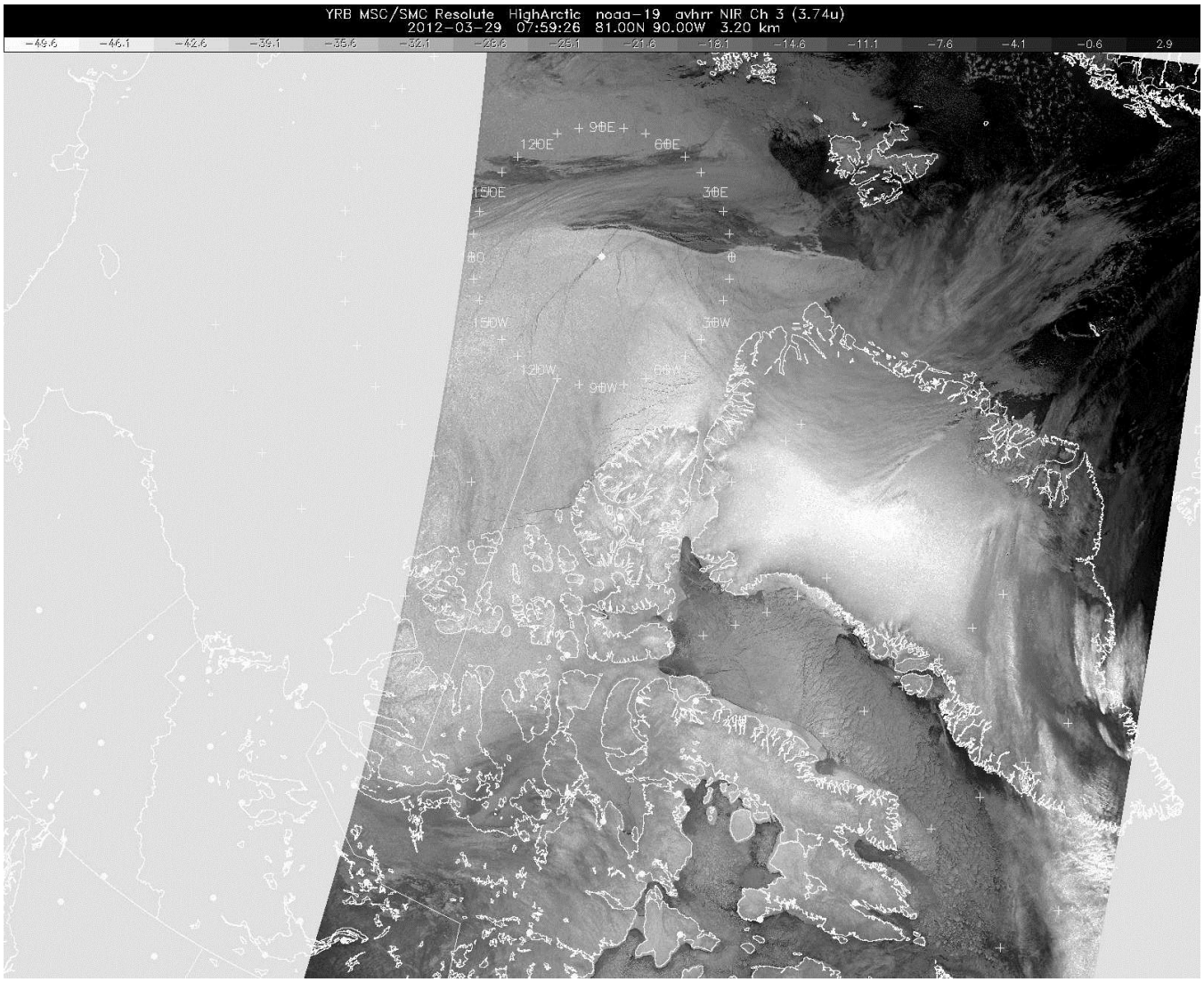

Figure 3: Infrared satellite image (3 µm) showing cloud cover in the survey area.