Supplementary Gradient Information

UNITED STATES GEOLOGICAL SURVEY
ALASKA AEROMAGNETIC SURVEY
GRADIENT MEMORANDUM
Bettles, Alaska

Submitted by:

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Introduction

Excel conducted an aeromagnetic survey for the USGS from June 10th to August 29th, 2008 northwest of Bettles, Alaska in the Brooks Range. In addition to the tail stinger magnetic sensor, the plane was equipped with two wingtip sensors for a total of three sensors on the plane. Although only the tail stinger data was required for this project, data was recorded and processed for all three sensors. This configuration provides data from which horizontal gradients can be calculated. Figure 1 shows the magnetic sensor configuration on the plane.

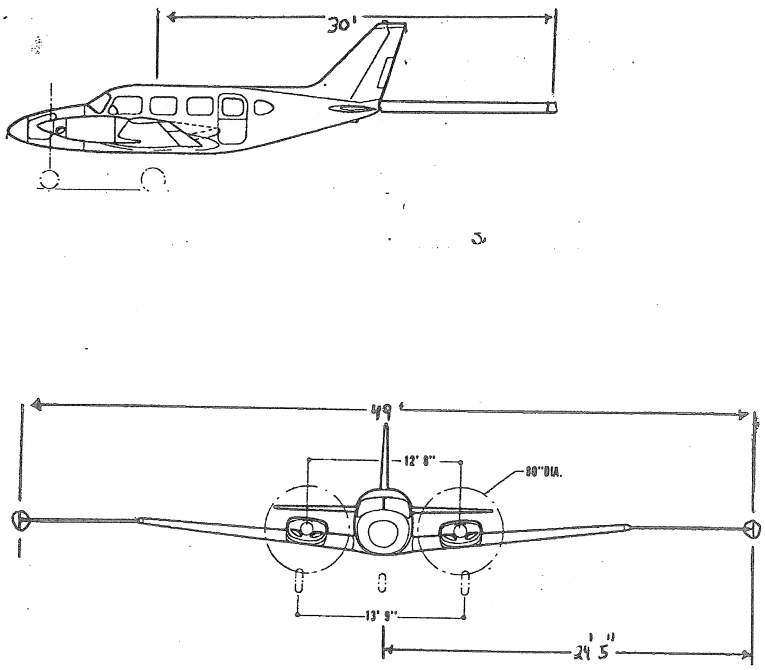

Figure 1: Magnetic Sensor Configuration of the Plane

The magnetic data from the wingtip sensors were noisier than the tail stinger data. We suspect that this noise is due to the magnetically noisier environment at the wing tips, due primarily to the proximity of the aircraft engines. Only one GPS antenna was mounted in this plane and hence the orientation of multiple sensors, with respect to direction of travel, could not be determined. The horizontal distance between the sensors varied with flying conditions such as if the plane was tipped or crabbing into the wind. Additional GPS antennas would be required on the plane to determine the exact orientation of the plane and provide horizontal dimensions used for the gradient calculation giving better results.

Observations

East-west, north-south, and total horizontal gradients were calculated both from the aircraft sensors and the total field grid. This allows for comparison of the measured gradient data versus grid calculated gradients to check data quality. The resulting maps are included below.

The measured gradient results from the aircraft sensors were significantly noisier than the grid calculated gradients. Compensation removed the predictable portion of the aircraft generated magnetic field, but the more random magnetic effects remained.

Over several of the largest gradient anomalies, the signal to noise ratio of the measured gradients was sufficient to allow the expected increased resolution of the measured gradients to dominate. In the areas with strong gradients, the measured gradients from the three sensors shows finer detail compared to calculated results. However, over most of the map area, the measured gradients offered no additional information over grid calculated gradients.

Conclusion

Based on the results of this test, when increased resolution is required, data acquisition funds will be more effectively applied by reducing flight line and tie line spacing than by recording multiple sensors on the aircraft. Perhaps in areas of intense horizontal gradients, where the signal to noise ratio of the data will be more appropriate, gradient data acquisition may be justified.

Enclosures

Several maps showing the results of the gradient data and comparison to calculated gradients from the tail stinger data are included on the attached DVD.

The following is a list of files provided:

A. Gradient Data
1. Alaska-2008-AeromagGradientData.txt
2. Alaska-2008-AeromagGradientData-ReadMe.txt

B. Maps
1. Alaska-2008-East-West_Gradient.jpg
2. Alaska-2008-North-South_Gradient.jpg
3. Alaska-2008-Total_Gradient.jpg
4. Alaska-2008-East-West_Gradient_Calculated.jpg
5. Alaska-2008-North-South_Gradient_Calculated.jpg
6. Alaska-2008-Total_Gradient_Calculated.jpg

C. Memorandum
1. USGS Alaska Aeromag 2008 Gradient Memo.pdf

HARDCOPY MAPS PROVIDED

1. Alaska 2008 Aeromagnetic Survey East-West Gradient - Measured (3 Mag Sensors)
2. Alaska 2008 Aeromagnetic Survey North-South Gradient - Measured (3 Mag Sensors)
3. Alaska 2008 Aeromagnetic Survey Total Gradient - Measured (3 Mag Sensors)
4. Alaska 2008 Aeromagnetic Survey East-West Gradient - Calculated (Tail Mag Only)
5. Alaska 2008 Aeromagnetic Survey North-South Gradient - Calculated (Tail Mag Only)
6. Alaska 2008 Aeromagnetic Survey Total Gradient - Calculated (Tail Mag Only)

Please see the operational report for all the details and procedures for this survey. This memo is only supplementary text for the gradient data.