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Basic ALSM Data Collection

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Basic ALSM Data Collection

Introduction

ALSM data collection consists of four basic components: mission planning, setup of GPS base stations, onboard setup and monitoring of IMU and GPS, data retrieval and format.

Mission Planning

During mission planning, client requirements are determined and a flight plan is developed. From client requirements, the boundaries of the survey area are delineated and the spatial resolution is determined. Calculations are performed to determine flight and onboard setup parameters to obtain the desired resolution.

To develop a viable flight window, the number of available GPS constellations, PDOP levels, and weather are analyzed. At a minimum, 6 GPS satellites must be within range for a viable flight window; however, the target range is 9 or more satellites. The target level for Precision Dilution of Position (PDOP) is 3 or less, but levels in the range of 3 to 4 can be functional. The flight window is selected based upon the time range availability for GPS satellites and functional PDOP levels. Additional components of mission planning include an initial site visit and topography review, personnel requirements, and weather considerations. When the window is open and weather permitting, "you fly." Refer to chapter 7.0, "Survey Planning," in the ALTM Training Manual for an in-depth review of mission planning and utilization of GPS software for determination of flight windows [1].

GPS Base Station Receivers and Setup

Receivers:
Ashtech Z-12 (company renamed Thales)
5mb and 10mb of built-in memory
Onboard GPS = 10mb
*Note: 10mb of plane memory will fill up in about 6 hours.

Micro Z-surveyor
20mb flash cards

The receivers log both L1 and L2 frequencies. All receivers log at 1-second intervals, both the plane and ground station receivers.

Operating Procedures:
At a minimum, two GPS base stations should be running on the ground within the project site or within a close distance range. Dependent upon project size, three or more receivers may be necessary to cover the range of the survey area. Offsets (instrumental height) must be computed from ground control point to static ground GPS antenna, and a minimum of 3-hours should be

logged on static base stations to get good positions. In addition, the offset from the sensor head to the aircraft GPS antenna must be determined. Furthermore, at some point during the survey, ground truthing is performed within the project area to obtain accurate, hard surface coordinates of the ground for accuracy assessment of the laser data.

Onboard Setup and Flight

Onboard Components:
The laser system calculates in real-time, and the GPS system interfaces directly with the laser computer system. The IMU consists of 3 gyros and accelerometers and cycles at ~= 50hz. The standard setup for the scanning mirror is 28hz at 20° half-angle. The laser pulse frequency is calibrated at 33khz and cannot be changed.

Flight Plan:
The Optech ALTM NAV software is utilized for planning and plane navigation and is monitored on the laptop. The pilot follows the flight plans that are setup with the software, and 50% overlap is flown between flight paths to correct for the poor data that occurs at the edges of the scan. The laser is turned on and off before and after each flight line.

Flight Protocol:
Standard flight altitude is 600m with a speed of 110 knots for a 1-meter ground resolution cell. Scans should not be performed when flying through clouds, and the max-angle for recording of water is 8 to 10 degrees due to reflectance problems at more extreme angles. The plane is flown at least once over the base station/s to allow initialization of the kinematic solution, and it is flown perpendicular to the flight paths to allow scale calibration for each flight and to check swath-to-swath vertical agreement. Additionally, 3 to 5 minutes of level flight are recorded before and after the survey to stabilize the IMU and simplify processing.

Data Retrieval

The onboard hard drive utilized with the laser system records IMU and laser data. The hard drive is removable and allows downloading of the laser data. The RAW format of the laser data is an Optech proprietary format. Once the survey is completed, the following data sets are retrieved: laser data from the hard drive, base station GPS data, and onboard GPS data. The data is then processed and a 9-column output format is obtained:

[time stamp, x2, y2, z2, last return intensity, x1, y1, z1, first return intensity]

The processed data can then be further processed and refined to generate project deliverables such as bare earth digital elevation models (DEMs). *Note: 9-column output is the traditional data form; however, a paradigm shift is arising which will provide an alternative processing output format. An in-depth discussion of data processing and the new output paradigm is presented in GEM Rep_2004_06_001.

References

[1] Optech, “ALTM Training Manual,” Version: 98a108 Rev 1.0, Sep. 1998.