Quality Control

The quality control program at SGL ensures that every survey is planned and executed to obtain final products of the highest quality possible. SGL incorporates important control procedures into all parts of the survey process.

PLANNING

Careful planning of the survey is an important step in eliminating problems later in the project and in meeting the project's objectives. The main points to be considered in the planning stage are as follows:

FLIGHT SPECIFICATIONS

Main specifications to be considered are:

- line spacing (traverse and control lines)
- line direction
- flight altitude or height above ground
- tolerances for altitude and positional deviations

Factors to be considered include:

a) *Will the survey, as specified, detect the anticipated targets?*
   Forward modelling is a good method to evaluate the amplitude and wavelength of the anticipated anomalies at the proposed flight altitude. Line spacing should be adequate to describe the field at the survey altitude, preferably with some redundancy.

b) *Is it physically possible to fly the survey as planned?*
   Steep topography, cultural features, continuous cloud cover on hill tops can make it impossible to fly a survey as specified. A change of the survey specifications or the survey aircraft may be required in such cases. (i.e. substituting a helicopter for a fixed-wing aircraft).

c) *The adequacy of the proposed navigation system to fly the lines as specified.*

EQUIPMENT

The survey system and individual instruments must be selected to conform to noise standards, under realistic survey conditions. The data acquisition rates must be adequate to describe the anticipated frequencies preferably with some redundancy. The SGL **SGDAS** computer based data acquisition system allows flexible data recording rates. Data from different systems can be recorded at different rates, up to over a hundred readings per second. Each reading is provided with its own time stamp with a resolution of 1/120 of a second.

With the increased number of computers in the survey aircraft, data acquisition and instrument control software is now a major part of the survey system. Before the start of a project, it is important to ensure that both the software and hardware to be used are appropriate for the job, are in working condition, and have been thoroughly tested and debugged.

AIRCRAFT

The type of survey aircraft chosen must be able to fly the survey as specified, in an efficient and safe manner. Important considerations are:

- Rate of climb of the aircraft in survey mode;
- Endurance in survey mode;
- Aircraft to ground communications. These allow the ground crew to monitor the progress of the aircraft, inform the air crew of diurnal conditions, and to answer technical questions that might arise, during a flight. The radio link should operate without disturbing the survey instruments.
- Aircraft maintenance facilities and spare parts supplies, for timely aircraft maintenance.

FIELD CREW

A well educated, experienced and conscientious field crew is the most important aspect of quality control.

FIELD OPERATIONS

PROJECT MANAGEMENT

During the field operation, each flight is planned to maximize data quality, and safety. Considerations for the quality of data include:

- Number and geometry of satellites for GPS positioning,
- Diurnal changes in the magnetic field for a magnetometer survey,

- Air turbulence in the survey area at the flight altitude,
- Clouds which might prevent flying lines as planned,
- Radio transmissions which may be required, and
- Other signals which might interfere with the geophysical instruments such as radar, microwave transmissions, radio or television transmissions.

GPS AND MAGNETOMETER REFERENCE STATIONS

Location:
Reference station magnetometer sensors should be located away from high magnetic gradients, large metallic objects, moving vehicles, power lines, and radio frequency transmitters. An easily accessible location is best so the field crew can regularly check for magnetic storms. The GPS antenna should have a clear view of the sky in all directions; trees, power lines and towers will interfere with the GPS signals.

Operation:
SGL's reference station magnetometers are micro-computer based. Data are recorded on a hard disk, which can accommodate months of data under normal circumstances. Time intervals for recording data are programmable, reducing the chance of missing data. Time synchronization is provided by GPS. The accuracy of the recorded time is better than one millisecond.

Checking:
On-screen profiles of the recorded magnetic values, altitude, latitude and longitude, and the recorded satellite ranges, enable the field crew to ensure that the reference station is working properly.

IN FLIGHT

SGL's survey aircraft are crewed by two people, both qualified pilots. During take-off and landing, both concentrate on the pilot's duties, while during survey operations, one crew member takes responsibility for the aircraft, while the other operates and monitors the geophysical and navigation equipment. Operation of the geophysical equipment is essentially automatic: the operator simply enters the number and direction of the line to be flown. All other functions are computer-controlled.

The instrument performance is monitored on a video screen, which displays analog traces of all data streams and the differences of selected data in real-time.

SGL's navigation program calculates the start and end points of each line in the survey area and guides the pilot to the start of a line. Once on the line, an analog needle shows the cross track position. A digital read out on the instrument panel displays the distance to the end of the line. The GPS altitude, and barometric and radar altimeters are used to monitor the flight altitude. UTC time synchronization to the nearest millisecond is provided automatically from the GPS receiver.

POST-FLIGHT

Promptly after each flight, data are transferred from the aircraft and copied onto a computer in the field office. The following quality control procedures are completed within 24 hours of the end of each flight.

- Copying of data for safe storage and transfer to the head office,
- SGL's visualization software generates data profiles directly from the acquired data files, producing an image of the data exactly as recorded, and allowing the data to be examined interactively,
- Post-processed differentially corrected GPS data are used to produce flight path images for review,
- Checking for data quality and completeness, with the help of appropriate computer programs,
- Reviewing of the records by the field operations manager.

Digital flight path videos are reviewed, during the field operations, to check the functioning of the video system. Preliminary contour or colour images and data profiles are produced in the field, as a test of general data quality.

TRANSPORTATION OF THE DATA

The best protection for the data during transportation is to have multiple copies stored at different locations. SGL's PC based system allows the field crew to make copies quickly and easily, immediately after each flight.

DATA COMPILATION

As in the field operations, quality control is an integral part of the data compilation procedure. The following are some of the main methods used.

- Checking of data for completeness, conformity with specifications, or unusual conditions, immediately upon receipt in the office,
- Plotting profiles of the data at various stages during the compilation procedure,
- Listings of error situations are investigated by the geophysicist in charge,
- Listing, and plotting in graphical form of levelling adjustments for magnetometer maps.

Before delivery all final data is checked to ensure that the correct data has been included, that the data is readable and complete. Data formats and media are described in detail in the project report.

PROJECT REPORT

The final report gives a complete description of the project area, survey parameters, aircraft and equipment, processing parameters, final products and delivered digital data.