

## Creation of a metadata for aero-geophysical surveys

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### Abstract

There has been initiative from departments at the national level for the development of database systems and application packages for its utilisation. A meta-database system was developed for the airborne geophysical surveys carried by Geological Survey of India. Geological information is also incorporated in the metadata to help users get an idea of the data content and its quality. The database was developed in a relational database model in Oracle, under client-server architecture. The metadata will help users to discover data as per user's requirement. Creation of the meta-database along with application development for their input and retrieval will thus facilitate their sharing with NSDI and other participating agencies.

### Introduction

Departments such as ISRO/DOS/DOD/SOI/NIC etc. undertook programs to create a national level database through the agency named National Spatial Data Infrastructure (NSDI) for resources and census information. The success of aero-geophysical surveys in mapping the mineralized belts of the country prompted Govt. of India to entrust National Organisations like NRSA and NGRI to undertake the National Programme of Aeromagnetic Surveys (NPAS). Accordingly work on development of database systems, creation of national resources database for the entire country and development of a number of application packages for utilisation of these data bases have been initiated by different agencies. These will be linked to the databases available in the country on topographic information from SOI, geological information from GSI and thematic information from NATMO etc.

### Earth Science Data System

In earth sciences we are deeply involved in correlating the observed geologic record and the complex processes that have shaped them. The earth has a complex record of the dynamic interaction of plates and rock formations. The complexities of these processes are now recognized through the application of new technologies, and an enormous gain in understanding can be realized only if multidisciplinary data are evaluated numerically, and integrated geo-spatially through the utilization of Information Technology.

Earth Science is a discipline that is strongly data driven. Researchers and government agencies often develop large data sets. The ultimate goal of the Earth Science community is to create a fully integrated data system populated with high quality, freely available data, as well as, a robust set of software to analyse and interpret the data. Fundamental new discoveries will require the availability of databases that encompass a variety of temporal and spatial scales.

The evolving data system would require the establishment of a facility where fundamental data sets are linked via broad bandwidth Internet connections.

### Description of AMSE Data

The airborne operations of Airborne Minerals Survey Exploration wing of GSI are carried out project wise by different flying agencies, under an operation code, encompassing different survey areas and state boundaries, which are described as survey blocks. The data of a particular operation is available block-wise. The processed data is in digital form, as well as in the form of processed aero-geophysical maps displaying aeromagnetic, aero-electromagnetic and aero-radiometric data. The nature of survey and coverage varies depending on the objective of the project. The airborne anomalies of the area are numbered and interpreted anomaly wise.

The metadata on the aero-geophysical coverage of AMSE was designed on a Relational Database model keeping in mind the inter-dependence and relationships of the data set.

An example of airborne geophysical survey parameters is as follows:

PROJECT / AGENCY AND PERIOD OF DATA ACQUISITION	STATES / AREA COVERED (SQ.KM )	INSTRUMENTS USED / FLIGHT ELEVATION /LINE SPACING
OHR (M/s. Aeroservice Corp. USA) / 1967-68	Andhra Pradesh, Bihar and Rajasthan / 90395 sq.km	Proton magnetometer /130 m above ground level /500m.
BRGM/CCG/1971-72	Gujarat, Rajasthan, Madhya Pradesh, Maharashtra and Karnataka / 76140 sq.km	130 m above ground level / 500 m
NGRI/1979-82	Bihar,Uttar Pradesh, Madhya Pradesh, Maharashtra, Gujarat, Andhra Pradesh and Karnataka / 143000 sq. km	Rb-vapour magnetometer / 120 m above ground level but along Narmada-Sone
NRSA (for NPAS) / 1980-1995	Between 8° – 24° N latitudes / 1368894 sq.km	Rb-and Cs – vapour magnetometer/ 1524 – 2895m. msl / 4 km

The table above depicts the major data sets collected by different flying agencies in different areas of the country. The above criteria or relationship was incorporated in the metadata along with details of survey data, nature of data, description of anomaly zones, mode and method of data acquisition, instruments used and whether ground follow-up has been taken up and if so, with highlights of results.

The aero-geophysical data are processed and then archived. The different steps of processing before it is tagged as processed are as follows:

- Vectorisation of 347 contour maps
- Creation of XYZ Files
- Gridding at suitable resolution
- GRF correction • Upward continuity above m.s.l.
- Merger of data. Removal of flight line and edge artifacts
- Projection of data onto 1:2 M base.
- Conversion of data into .img data

### The Metadata Model:

A relational model worked out is as follows:

Entity	Attributes
Project_Survey_Area  <i>Note: FS: annual field season programme of GSI</i>	Area_ID, Name of Investigation area Beginning year, Ending year, Latitude Max, Longitude Max, Latitude Min, Longitude Min States/Districts =>1,n, Degree_Sheets=>1,n Supergroups =>1,n, Groups =>1,n General geology, FSPs of coverage =>1,n Objective
Agency_Covered_Block	Area_ID, Block_ID, Block_Name, Flight_ID FSP_Year, FSP_Item_No., Physiography/terrain Geology of Block, Flight altitude Max Flight altitude Min, Beginning date Ending date, Topo sheets =>1,n
Agency_Block_Boundary	Area_ID, Block_ID, Point_ID, Latitude Longitude
FSP_Survey_Block  <i>change in flight direction will change the fsp_block_id</i>	Area_ID, Block_ID, FSP_Block_ID, FSP_Year Flight direction, General strike of formations Boundaries of FSP_Block=>1,n Starting flight line no, End flight line no Flight line interval, Navigation mode (GPS/Doppler) Sampling interval, Flight line km., Area covered Status of Data (processed/under processing)
FSP_Block_Rraw_Data	Area_ID, Block_ID, FSP_Block_ID, Flight_ID FSP_Year, FSP_Item_no., Raw_Data_Tape_No Recording Format, Flight_No., Operational Base
FSP_Processed_Block	Area_ID, Block_ID, FSP_Block_ID, Process_Block_ID, Flight altitude, Flight direction Starting flight line no, End flight line no Flight line interval, Sampling interval CD_1Fd_Label, CD_0.1Fd_Label
	Area_ID, Block_ID, FSP_Block_ID,

Processed_Block_Map	Process_Block_ID, Map_No, Map_Type Map_Title, Scale of map
Flight_Details	Area_ID, Block_ID, Flight_ID Name of aircraft, Flying agency Data acquisition system, Name of Magnetometer Name of EM system, Name of Radiometric system Height measurement
Description_Airborne_Anomaly	Area_ID, Block_ID, FSP_Block_ID Process_Block_ID, Map_No, Anomaly ID Method, Description of anomaly, Remarks TRIDEM_LF_Range, TRIDEM_MF_Range TRIDEM_HF_Range, INPUT_Channel_No Corroborated_by, Ground check_up Ground_geology, Ground_geochemistry, Drilling
Bibliographic_References	Name of Investigation area, Name of Report Accession No, Authors

### Conclusions:

The expanding network will need the use of spatial information. The geoscience community has benefited from improvements in information technology. Data storage, analysis, graphic applications have allowed geoscientists to improve the quality of their products. A next step is to seamlessly link the data sources, analytical applications and decision analysis tools. These linkages require an information technology infrastructure for automatic data retrieval, formatting and other processing necessary to move data between software applications and databases.

The database schema worked from the above entity relation is given below as an annexure:



The main screen of the data entry menu for the metadata is depicted below:

- [Aerogeophysical Database]

Action Project Area Agency\_block Agency\_covered\_sub\_Blocks(FSP Block) Processed\_block Window

Aerogeophysical Investigation area  
Agency Flight Details

Action Project Area Agency\_block Agency\_covered\_sub\_Blocks(FSP Block) Processed\_block Window

Description of Agency Block

Action Project Area Agency\_block Agency\_covered\_sub\_Blocks(FSP Block) Processed\_block Window

Sub Block Description

Action Project Area Agency\_block Agency\_covered\_sub\_Blocks(FSP Block) Processed\_block Window

Processed Block Description  
Processed Block Map  
Processed Block Data  
Airborne Anomaly  
Anomaly Followup

**भारतीय भूवैज्ञानिक सर्वेक्षण**  
**GEOLOGICAL SURVEY OF INDIA**  
**भू वैज्ञानिक सर्वेक्षण**  
1851

**AEROGEOPHYSICAL DATABASE**

Local input centre  
JAI Jaipur