PROJECT TITLE: INNOVATIVE VISUALISAION PLATFORM FOR EXPLORATION DATA

(CLIENT; ORG_X; TEAM:Team_Vis)

AIM & BACKGROUND

Mineral exploration has become progressively more challenging in recent years as surface riches run out and mineral deposits are increasingly sought undercover, often beneath a thick layer of weathered rock, sediment and soil. This is a particularly significant issue in Australia, where it is highly likely that any significant future discoveries of precious and base metal deposits will be hidden by such cover. Thus, there has been significant investment in recent years by industry and government to collect data to help map subsurface geology below this veneer of cover. Specifically, ORG_X has been collecting and generating a large number of maps and derivative products in AREA_A. The undercover exploration environment is an order of magnitude more difficult than historical exploration in exposed terranes. Even with the best available regional geophysical datasets, there are significant uncertainties in geological interpretation, which in this setting, relies on the identification of distal signatures of ore deposits using pattern recognition at two levels. One is to recognise subtle variations of the signature contrasted against the background within a single dataset. And the other is to perform the complex synthesis of patterns from multiple datasets. Both of these tasks are highly complex; accuracy and efficiency of interpretation heavily rely on the interpreters' ability for inductive and deductive reasoning and their effective use of data visualisation and enhancement methods.

This proposal addresses the challenge of promoting full utilisation of all forms of ORG_X datasets using an integrated environment with a specific aim to improve the industry's investment confidence in AREA_A greenfield exploration. This provides an important strategic context for the state of AREA_A, which has invested, and is continuing to invest, significant resources in obtaining the datasets required to facilitate undercover exploration. The state therefore has a strategic imperative in ensuring that the datasets it collects are effectively used by explorers.

The main aim of the project is to develop a state-of-the-art integrated environment for geological, geophysical, geochemical, drilling datasets (2D and 3D) and their derivative products: namely the Innovative Exploration Data Visualisation Platform (IEDVP). The *IEDVP* has the following specific aims:

1. To provide an integrated interpretation environment for a large number of datasets, which can be used for ground selection by the industry. New data interpretation tools will be developed to assist consistent and objective interpretation involving a large number of ORG_X datasets. These will also allow the integration of interpretations from different datasets, and by different interpreters, to allow the identification of consensus and uncertainties in interpretations.
2. To facilitate the identification of distal signatures of ore deposits within the large number of ORG_X datasets. New data enhancement and visualisation tools will be developed to assist the enhancement of features of interest and to effectively visualise multiple datasets.
3. To gather and analyse statistics on ORG_X data utilisation which can contribute to ORG_X's strategies for future data collection and delivery. User-data interactions will be collected with user consent, to understand the value of different types and scales of ORG_X datasets in detecting distal ore signatures.

The proposed platform will differ from other existing GIS or modelling environments in that it will allow: easy manipulation of integrated 2D and 3D datasets; novel data display and enhancement; and intelligent interpretation tools that are not available elsewhere. An assistive tool to integrate multiple interpretations to identify the areas of consensus or disagreement is a new approach to determine interpretation uncertainty. In addition, exploration data utilisation analysis has not been previously collected and reported.

KEY BENEFITS

- ✓ Provide a unique environment for explorers to allow full utilisation of ORG_X datasets in understanding known AREA_A ore deposits and potential deposits in greenfield exploration. This will lead to an increasing confidence in exploration investment in AREA_A.
- ✓ Provide information on the value of ORG_X data in identifying mineral footprints which will contribute to a roadmap to guide ORG_X for future data collection and delivery strategies to promote better success in mineral exploration in AREA_A.
- ✓ Demonstrate an innovative pioneering approach to promote innovative mineral exploration of ORG_X at the world stage.

DELIVERABLES:

- ➢ An integrated platform that allows the visualisation and interrogation of datasets associated with major ore deposits in AREA_A. The platform will be extensions to industry standard GIS platforms, allowing the integration of geological, geophysical, geochemical and drill data, as well as map interpretations and 3D models. It will consist of the following features:
  - Better visualisation and enhancement of multiple ORG_X datasets (starting date – ending date) - New visualisation and enhancement tools for single and multiple datasets with a specific focus on improving the detection of distal signatures of ore deposits.
  - Methods to optimise interpretations (starting date – ending date) - An intelligent interpretation assistance tool that guides the interpretation to improve accuracy and consistency when integrating interpretations from multiple datasets.
  - Recording of the user data interactions, given user consent (starting date – ending date)
- ➢ ORG_X data utilisation report that summarises the value of datasets in seeking mineral footprints (starting date – ending date) based on user interaction, a series of products showing range of interpretations and targets over selected terranes of AREA_A.
- ➢ Multimedia presentations to support the use of the *IEDVP* (starting date – ending date).

DELIVERABLE GANTT chart (FOR THE CLIENT) - Timeline of tasks including client meetings, progress meetings, and development and delivery of each deliverables (if separately delivered to the client)

PROPOSED METHODS:

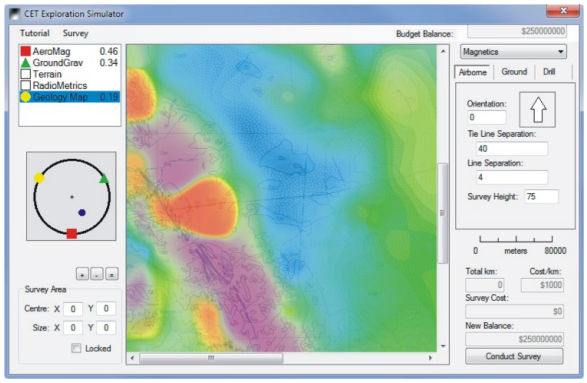

Figure 1: The circular, multi-dataset visualiser shown on the left hand side. The three selected datasets are visualised through a weighted combination determined by the position of the cursor dot relative to the other three symbols.

TASK 1: Better visualisation and enhancement of multiple ORG_X datasets

Traditional tools for geoscientific data enhancement and feature detection will be challenged for undercover exploration. Distal footprints of large ore systems can only be detected by subtle indicators contrasted from background. To address this, new data visualisation and enhancement tools will be developed. The development team has previously developed an image blender that effectively merges multiple datasets to generate a combined display (Figure 1). Along with this, effective ways to display data in varying frequency scales and a human perception based colour scheme will be investigated. These visualisation methods will address uncertainty based on conflict of information extracted from the different scales of a single dataset or multiple datasets. Data enhancement methods will focus on 'hard-to-detect' features. For example, deep-seated major structures in regional scale data may not appear as continuous linear features, but can

be recognised using clustering and patterns (e.g. homogeneity, deviation etc) of shorter lineaments. We will develop fabric and lineament curvature quantification methods to achieve this.

TASK 2: Optimising interpretations

Mineral exploration decisions heavily rely on understanding and combining information that may be complementary or conflicting from large number of different geological, geophysical, geochemical and remote sensing datasets. Due to the complexity of the task, subjectivity, and inconsistency of human interpreters, their results are highly uncertain. The proposed tools aim to support consistency in interpretation by guiding the interpretation process based on mutual information from different datasets that may support or conflict with the previous interpretation. The updated interpretation may be similar to the previous interpretation but with an increased/decreased certainty and/or an alternative interpretation with an associated certainty. In addition, different interpretations by individuals can be integrated to generate a confidence map for interpretation.

TASK 3: The platform development

This task will be conducted concurrently with Tasks 1 and 2 in the first two years to build the framework. The third year will be spent integrating the outcomes from Tasks 1 and 2 and refining the user interface. A robust framework in the EIP is necessary to house effective tools that can facilitate a wide range of datasets. This platform will facilitate the following functionalities:

- User friendly graphical user interface
- Individual and/or simultaneous display and manipulation of 2D and 3D datasets
- Importing and exporting of different proprietary data formats to allow specialised processing in other platforms
- Monitoring user-data interactions for collection

The platform will be tested for the integration and interpretation of ORG_X products for a number of specific areas in AREA_A for known deposits and greenfield areas.

TASK 4: General user evaluation, data utilisation collection, and analysis

Evaluation of the system will be conducted by a group of beta users. During this stage, the *IEDVP* will provide an opportunity for ORG_X to collect data on how datasets (types and scales) are used by individuals, and the interpretation processes favoured by users. To achieve this, tools will be specifically developed to collect data usage statistics, and user processes of interpretation. Also, this stage gives ORG_X an opportunity to evaluate the *IEDVP* and direct fine tuning of its development.

The *IEDVP* will be primed for public release, working closely with industry and educational users for evaluation and feedback. To achieve this, testing sessions will be sought with interested collaborators, in order to collect usage data, general feedback, and promote awareness.

PROJECT MANAGEMENT

Team members: Leader & team members

PROJECT MAGAGMENT GANTT chart (FOR THE TEAM) - Timeline of development tasks (by a group and by individuals) including team interactions, individual task deadline and final report writing deadline

APPROXIMATE BUDGET

A cost of $X per annum is requested over a four year period, totalling $TOTAL. This will cover salaries and on-costs (i.e. in terms of how many hours of work) of data scientists working in the team.

APPENDIX

Team member X (Full Name, Student number) … plan & contribution….