COORDINATING AND DELIVERING A 1.8 MILLION LINE KILOMETRE MAGNETIC, RADIOMETRIC and DEM SURVEY – A STATE GOVERNMENT PERSPECTIVE

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SUMMARY

In January 2017 the largest airborne magnetic, radiometric and elevation survey in South Australia's history began in the Gawler Craton. The aim of the South Australian Government is to use the survey as an opportunity to achieve best practice in relation to the coordination, landholder liaison, reporting and quality control of the survey, in tandem with collaborative partners at Geoscience Australia. Some of the outcomes include a series of test lines flown by all survey aircraft to assist in back-calibration of radiometric data; landholder and stakeholder information website to maximise public value; subscriber email updates; close liaison with field capture teams; timely delivery of survey data and results and a proactive approach in ensuring the data captured is of consistent, high quality across the entire survey region. The survey is being performed in three stages and each stage provides an opportunity to assess approaches and fine tune requirements. It is expected that the end result will set a benchmark for other jurisdictions performing similar work.

Key words: magnetic, radiometric, DEM, survey, government, Gawler Craton.

INTRODUCTION

The $10 million *PACE* Copper Gawler Craton Airborne Geophysical Survey (GCAS) has now collected around 616,000 line kilometres of magnetic, radiometric and terrain data, with 34% of the total survey area completed to date. When complete, the survey will have been executed in three tranches of acquisition, processing, data release and value adding; covering 341,000 km^2 of central South Australia and collect over 1.87 million line kilometres of new data, designed to expand opportunities for exploration by the mineral resources sector. The new data has a line spacing of 200 metres and is being flown at a nominal terrain clearance of 60 metres. Coordinating the first tranche of the Gawler Craton Airborne Survey began in September 2016, in a partnership between the Government of South Australia and Geoscience Australia (GA). Due to the size of the survey the Geological Survey of South Australia (GSSA) committed to roles in the procurement, landholder notification, quality control and community liaison for the survey.

Execution of the survey coincided with GA's planned updates of the specifications for airborne survey acquisitions. The contracts that were awarded for the first tranche of the survey included a revision of data submission formats and the additional requirement for laser altimeter data. The area being surveyed contains over 28,000 land parcels. In addition to landholder notifications via mail and print-media it was decided to engage with the community via a dedicated Community Information Website, managed by GSSA. The website was designed to provide near-real-time updates of aircraft flight plans as well as answering common questions and providing contact information of the contractors engaged in the survey. A subscription service provides email notification for stakeholders that require regular updates, detailing key events during the survey and subsequent data releases.

A prerequisite of the survey was the completion of a series of seven test lines near Whyalla in South Australia. Data obtained from the test lines is processed and provided to the client providing an opportunity to directly compare the radiometric results of each of the aircraft that flies the survey, while also enabling the survey contractors to familiarise themselves with the updated data submission requirements. The data obtained from the test lines is also valuable in background removal and back-calibrating the radiometric data for seamless integration of the seventeen survey blocks involved in the survey.

The first tranche of acquisition was completed in June 2017. Final data and grids for tranche 1 were received in September 2017 and released to the public shortly after. A project was initiated with the CSIRO to value add to the GCAS magnetic data. This has resulted in a series of enhancement products and a series of model products that will help drive exploration in the region.

METHOD AND RESULTS

STAKEHOLDER COMMUNICATIONS

Rural landholders were notified by registered post and print media. A dedicated website named "Gawler Craton Airborne Survey Community Information" was constructed to inform the community about aircraft movement and project status in near real time, functioning as a centralised resource relating to the survey. Figure 1 shows a segment of the webpage that includes a GIS map service. Using GIS, flight plans for the current week were uploaded for each aircraft; approximate aircraft locations were shown to inform

landholders and information about the status of each survey block. Relevant contractor information is presented so stakeholders can directly contact and liaise with survey contractors, should the need arise. This was utilised by several station owners who were mustering cattle using ultra-light aircraft and enabled mustering and survey activities to continue in tandem.

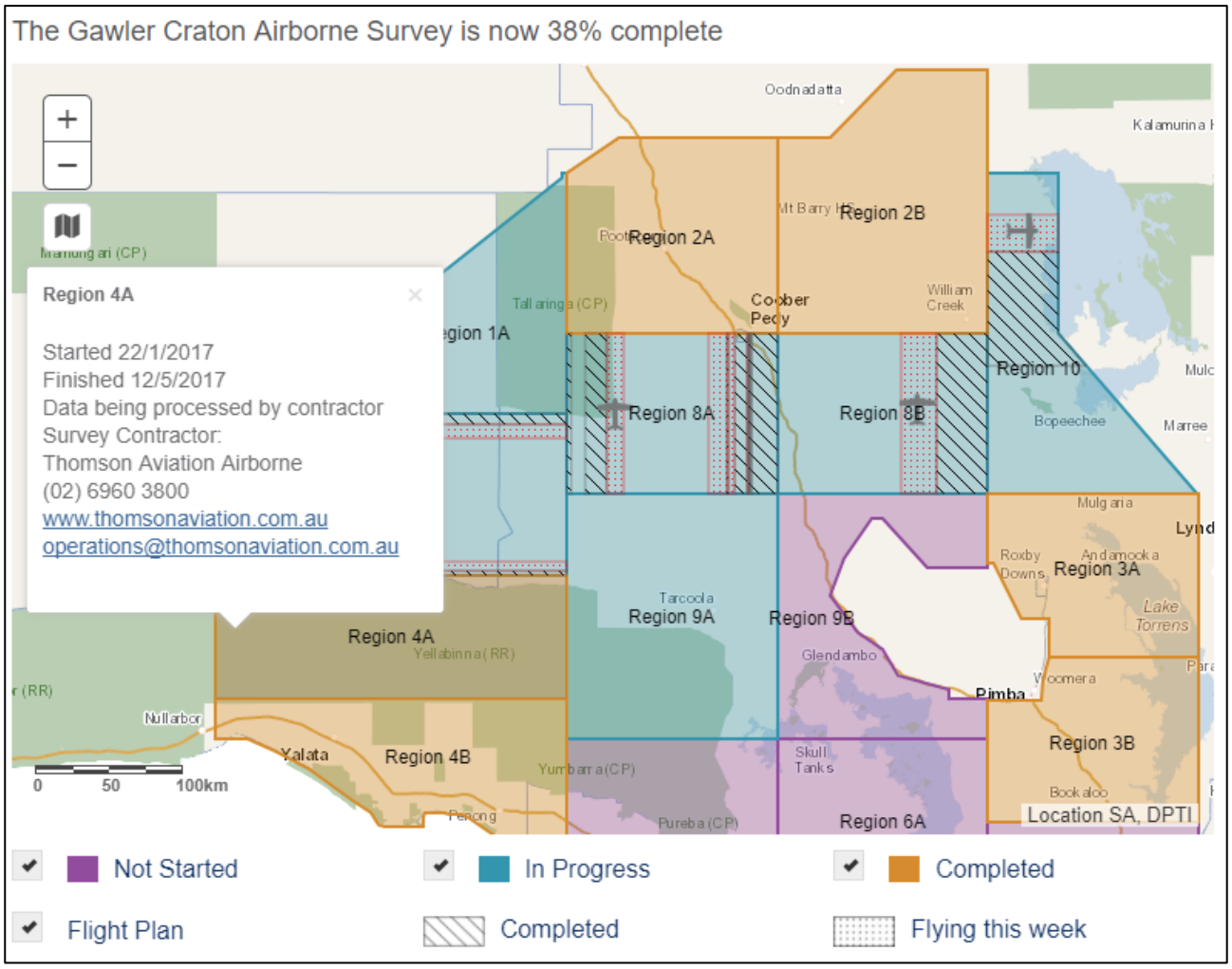

Figure 1: The Gawler Craton Community Information web page, providing weekly updates of flight plans and aircraft locations as well as contractor information, an email subscription service, data downloads and FAQ.

DATA SPECIFICATION UPDATES

Changes to the data specification are aimed at ensuring the raw data received by the state is complete enough to reprocess, should the need ever arise. The main changes requested for tranche 1 are shown in Table 1. Further changes made for tranche 2 included the provision of magnetic base station data at the same interval as field data are supplied and NASVD spectra as a final deliverable. Data formatting requirements have also been reviewed and updated to ensure consistency between all contractors taking part in the survey.

Raw Magnetics	**Action**
Laser Altimeter	Calibrated data - required
Radar Altimeter	Calibrated data - required
Raw Diurnal	File required
Time channel	Required
Comp box file - dated	Required
Raw Spectrometer	
Interpolate null value coordinates	Required
Time channel	Required

Table 1: Variations in data specification from Geoscience Australia's current requirements ensure all raw data captured during acquisition is complete and can be reprocessed, should the need arise.

WHYALLA TEST LINES

The Whyalla test lines are shown in Figure 2. Located 30 Km south of Whyalla airport, the seven test lines are 75 kilometres long, of which 20 kilometres are over water. The 200 metre spaced lines serve two purposes. First, the raw gamma-ray spectrometric data from the test lines are analysed to confirm, prior to survey commencement, that the spectra are suitable for processing using the NASVD method to reduce random noise. Second, a comparison of the processed test lines allows a comparison of the calibration of the different spectrometer systems used on the Gawler survey. The test lines include a section of data captured over water, which is used for accurate background removal. The mean concentrations of the radioelements over the test lines for the various systems used so far are given in Table 2. The means show significant variability of up to, and exceeding, 20 percent. The cause is most likely poor estimation of sensitivities using the Carnamah calibration range. It may be related to the way in which the Carnamah backgrounds have been estimated for both the airborne and ground spectrometers. We suggest that the way in which airborne geophysical contractors derive sensitivities using the Carnamah calibration range should be reviewed. Fortunately, the Whyalla test lines can mitigate the problem for the Gawler surveys by using the differences as scaling factors to correct the sensitivities to ensure consistency.

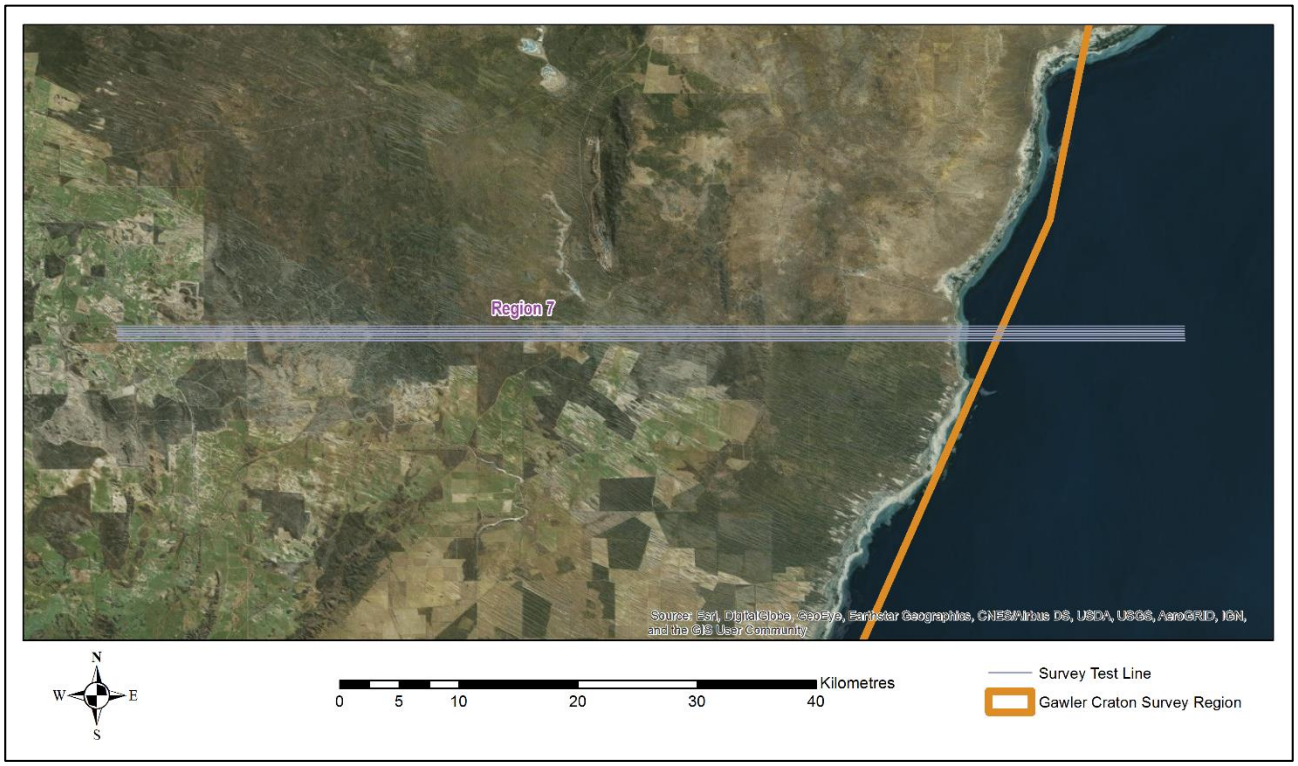

Figure 2: The Whyalla test lines. All contracted aircraft fly the test lines and the information informs future processing and allows comparisons to be made between instruments.

Project	Operator	Aircraft	K mean (%)	U Mean (ppm)	Th mean (ppm)
1280	MAGSPEC	VH–HIS	0.423	0.619	3.29
1281	MAGSPEC	VH–MDG	0.409	0.800	3.30
1282	Sander	C–GSGA	0.531	0.830	3.87
1283	Sander	C–GSGJ	0.502	0.652	3.67
1284	Thomson	VH–SUX	0.482	0.515	3.91
1285	Thomson	VH–THS	0.477	0.743	3.76

Table 2 Whyalla test lines results summary. Variations in average concentrations appear to be due to the estimation of sensitivities using the Carnamah calibration range.

VALUE ADDED PRODUCTS

The full set of value added products are listed in Table 3. The value add component of the survey begins soon after the delivery of the first tranche of data deliverables. Provision of the value added data provides explorers with the most comprehensive set of exploration data possible to facilitate informed exploration in the Gawler Craton. Part of the value add is to incorporate regional gravity products and depth to basement products derived independently within the GSSA. The value added data are a collaboration between the GSSA and CSIRO.

Grids (.ers) and grid images (geotiff and ecw)	**Model products (GoCad Tsurf, 3D dxf, and ModelVision tkm)**
TMI	Magnetic depth source models
RTP of TMI	3D inversion models of key anomalies
First vertical derivative of RTP	Apparent susceptibility attributed magnetic source depth point set
Total gradient (analytic signal)	Gridded depth to basement surface
Tilt filter	Triangulated basement surface
Automatic gain of in-line vertical derivative of TMI	Basement surface contour vectors
Trend	Magnetization direction analysis of suitable anomalies
Bouguer gravity	
First vertical derivative of (pre-conditioned) Bouguer gravity	**Vector products (MapInfo TAB, ESRI shape and dxf formats)**
	Lineaments and faults from magnetics and gravity
	Edge vectors (‘worms’) from gravity and magnetic data

Table 3: The value added products produced using the magnetic data from the Gawler Craton Airborne Survey consist of a series of standard filtered products, plus a range of modelled products and products incorporating regional, open-file gravity data and depth to basement data.

CONCLUSIONS

The quality of the data acquired to date exceeds that of any regional magnetic survey conducted in South Australia prior to 2017. The utilisation of the community information website as a stakeholder information tool has ensured that any public concerns have been dealt with promptly and to the satisfaction of all concerned, while raising public awareness and interest in the survey. While data gained from the Whyalla test lines are yet to be used for levelling and merging of all surveyed blocks, there is a high degree of confidence that the techniques used will yield good results. The plan to produce a series of value added products soon after the initial release of the data will increase the utility and value of the data and information arising out of the project.

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