EMIGMA is a powerful interpretation platform for many kinds of non-seismic geophysical data. But it is much more than that! It is an extremely useful self-learning tool for both the novice and the longtime professional to provide insights into geophysical processes thus helping the user to understand the characteristics of the responses of geophysical systems and also aiding in survey design. Once you are proficient in the product, you will discover that it can provide you with lasting and useful understandings.

This page is not intended as a comprehensive description of all the capabilities in EMIGMA but rather it is intended to give the reader an overall feeling for the *"Power of EMIGMA"*.

Data Organization: Data organization in the app is easy to follow and depends much on your individual preference. EMIGMA is not just another spreadsheet application. Rather, the backend of EMIGMA is an object database unlike any other non-seismic, commercial geophysical software product. With this design, EMIGMA's functionality is significantly more extensive than a simple spreadsheet application, allowing you to organize data in three levels: projects, surveys and data sets. You may have different projects based on a variety of criteria, such as the data type or interpretation method. Or you may choose to create a single project for multiple data sets to provide more ready analyses of different data types and integration of your interpretation across all data sets within a project. Or you can organize your data and interpretations, so that each of your interpretation projects is contained in only one database NOT simply in a new file for each survey!

Data Import and Export: A suite of imports is available allowing you to bring your measured data into the database using either the manufacturer's file format or as an ASCII columnar data file. One preferred method is to first import your data to QCTool to perform quality control, editing and any other processing as required. In QCTool, for example, you can view your data to remove bad data or perform filtering or merge dataa. Then, from QCTool, it is an easy few steps to import to EMIGMA for more exhaustive analyses and interpretation. After interpretation, modeling and inversion, your model data as well as models and inverse models my then be exported in a very easy and flexible manner to other applications.

EMIGMA is often smart enough to recognize your imported data and permits direct interactive modeling/inversion of your data. After import, there is no further need to define or specify any of the system parameters. This aspect is very unique for software supporting multiple types of data. When you import your data to EMIGMA, the survey and system parameters for each data set are stored to the database along with the data. Thus, upon clicking a button to model, invert or display data, the software automatically knows the system parameters and operates functionality without further need to define system parameters.

You can export the most important results to another EMIGMA database for archiving or sharing with others. Your interpolated grids/maps can be exported to various applications or can be re-used for other surveys in EMIGMA or for use in QCTool.

Data Processing: A comprehensive set of tools is available for editing, filtering, cleaning, trend removal, plotting, comparing your data along with many other special functions for particular types of data. If you have large data sets or wish to focus on certain areas of your data or its main structural attributes, you can easily create subsets of surveys within the same database or compress your data in a variety of manners. This allows you to more rapidly work with an interesting portion of the data without modifying the entire original data set and also gain quick overviews of structure or the principal features in your data.

Data Display and Analyses: EMIGMA's design criteria for data display are not just to create pretty pictures for your clients or your supervisor but to improve the data interpretation process by focusing on the use of your intuition. These aspects are encompassed in EMIGMA's data displays whether as 1D plots, 2D grids or maps or 3D visualization of the data.

3D Visualization: EMIGMA's 3D visualization functions can display your data (measured, modeled, processed, inverted) in 3D space as profiles, vectors, true 3D surfaces or 3D contoured surfaces and allows detailed analyses of anomaly position, shape and amplitude. You can examine your model from any viewpoint or manipulate it using a convenient array of menus and dialogs. Easy toggle buttons allow you to move through your data or semi-animate them for enhanced intuitive understanding. Data can be converted quickly into pseudo-sections, or transformed to other useful parameters such as apparent resistivity, analytic signal or decay constant. And in many other ways made possible by a variety of original imaging algorithms.

The visualization is also used to build or edit your 3D models or inversions. A single command will create a new model primitive, profile or other object with default settings that can then be modified for the specific model. 3D structural manipulators are available, while editing of your model becomes even easier owing to the simple and intuitive GUI. Editing of inversions can be made and the synthetic data for the revised

Gridding and Contouring: Five interpolation algorithms are available for 'gridding', along with various tools to view the results of your interpolations. The Grid Presentation and Contour tools allow you to switch between data channels and components without the necessity to load different grids; to easily select other grids that you have generated and to convert grid data to data imaging transforms such as apparent resistivity, analytic signal or decay rate. You may examine the values of your gridded data, overlay grids with profiles (transects), actual data, contours, or superimpose them on calibrated maps. The MultiGrid tool permits you to simultaneously view and compare up to four grids from the same or different data sets. Apart from the 2D representation of your data, you can stack multiple frequencies, time windows and separations proportional to depth for investigating your data three-dimensionally, generate pseudo-sections, depth images, carry out depth transformations and build 3D volume contours of your 1D and 3D inversions.

Plotting: EMIGMA's unique XY plotting capabilities make rapid analyses of data and comparison to model and inversion data quick and insightful. Plots are generated almost automatically. You can switch between components, separations, transmitters, profiles,

frequencies, time windows with simple clicks of a button or flip between decay and profile, from resistivity to voltage and back, arrange multiple plots on one page, build residual plots, adjust plot settings, scale and appearance and save plotting defaults, capture your plot for a report - all at a click of the mouse.

The second, Data Spreadsheet, is a relatively new tool for EMIGMA that contains a line plotter linked to dynamic spreadsheets. It is intended for QC data analyses and correction prior to advanced processing and modeling. You can do changes right in the plot, cut its portions or even drag it to fit your interpretation purposes, while checking the adjustments being made in the spreadsheet alongside.

Profile Viewing and Editing: Survey Editor is a somehat newer tool in EMIGMA allowing the user to look at the detailed locations of stations and profile while viewing data as "stacked profiles". You may edit and clean the survey locations by easily eliminating bad data points or removing whole profiles or even sections. Or, you can just window out portions of your data to select interesting subsets for interpretation. A number of new mapping features have been added to this tool that gives it considerable functional power allowing incorporation of maps in these views. This tool has undergone extensive new developments in the last few years. Map underlays and export facilities have been included along with more thorough ability to view sources and source nodes as well as underlaying projections of models beneath the survey. Models may be shown in projection and edited. Synthetic boreholes can be built to aid in designing drillholes. This tool is constantly evolving.

3D Modeling (Simulation): EMIGMA's 3D modeling contains a suite of algorithms all developed by Eikon Technologies. This is a great advantage of our product over similar applications where the algorithms are derived from academic codes. We can easily and quickly support and fix any problems arising in the platform. It is also an asset from the point of view of model building, as we know the details of the algorithms and their capabilities. For example, you need not select the proper algorithm for your data, whether it be EM, Resistivity, Magnetics, or Gravity, since the software itself loads the correct algorithm with default settings. As EMIGMA's roots are as a modeling application, there are also many "artificial intelligence" features built into the platform to provide you with quick and reliable results.

Most noteworthy are the speed and flexibility of our 3D modeling algorithms. But just as importantly, we pride ourselves on their exceptional accuracy from both a commercial and an academic perspective. As examples, we offer two 3D modeling algorithms for gravity, one standard and one enlightened approach providing not only speed but ensured accuracy as well. For magnetics, we also have both a standard and an advanced approach, with the latter including solutions for strong magnetic materials as well as the capabilities for magnetic interactions and permanent effects. We also have extended our unique EM Sphere algorithm which incorporates all the EM scattering mechanisms including all three effects due to magnetism. This algorithm is also capable of reproducing the EM responses up to several MHz. The algorithm can now be used for almost any EM survey including IP and MMR.

You can import model constructions (anomalies and layered earths) or build your own models based on the hypothesis of your geological environment. EMIGMA allows for

unlimited prism, plate and polyhedra targets, complex topography, multiple body interactions and provides fast and accurate 3D simulations, with a remarkable batch mode tool fully integrated into the platform.

In the last years, we have enhanced the capabilities to import/export from 3D CAD products

1D and 3D Inversions: Although 3D modeling is by far the most accurate approach to data interpretation, the industry for a number of reasons has become reliant on inversion applications. Eikon Technologies has been involved in the development of inversion algorithms for almost 30 years now. Our 1D inversions are available for frequency-domain EM (FDEM), Resistivity, time-domain EM (TDEM or TEM). Resistivity as well as land based CSEM and the more conventional CSAMT/AMT/MT approaches. Like many other things in EMIGMA, there is more than one way to perform your inversions depending on its type, quality and your interpretation objective. These algorithms are, of course, in almost continual development, and every year you will find significant improvements not only to the algorithms but also to the interfaces and visual tools for analyzing and displaying results. In general, these inversions are of both overparametrized and under-parametrized types with a range of parameter constraint capabilities as well as inversion of more than one component or data. As an example, for TDEM, you do a joint inversion of your Z component inside the loop and Z,X outside the loop thus substantially reducing the non-uniqueness drawback of 1D TDEM interpretation.

For some years, we have provided 3D magnetics inversion for susceptibility distributions. However, this has been extended to the distribution of source magnetization vectors. Thus, we overcome problems related to man-made sources and natural permanent magnetic features. Our extended 3D Euler deconvolution is available for magnetics and gravity applications and is supported by comprehensive post-processing and data display tools. 3D Gravity inversion capability is in continuous development as new surveys provide insights for improvement. We are very proud of our land-bases CSEM inversion utilizing the three-dimensionality of extended source currents allowing inversion for electric and or magnetic fields as well as multiple sources. This app can be used also for conventional CSAMT data thus greatly extending the usefulness of such data as now the near field data can be utilized. 3D Resistivity inversion exists for both strong and weak resistivity contrasts and this application is for both surface and surface to borehole surveys. 3D MT inversion is also enabled. And most recently, we have introduced 3D Thin-Sheet inversions which is a very comprehensive application for TDEM/FDEM, surface, airborne and borehole surveys. This app allows for the use of multi-component data and multiple thin-sheet targets.

The '*Power of EMIGMA'* results not only from the host of functionalities it offers, but also from the exceptional flexibility and responsiveness of the platform to the demands of the industry. Its many features can easily be customized for your application; they are being improved and updated continuously owing to the huge scientific and programming potential that was envisaged with the initial design