



# *QINSy*

## A Quality Integrated Navigation System

### SYSTEM DEFINITION

#### Key Benefits of *QINSy*

- Constructed from Base Components and Application dependent add-ons means *QINSy* is not solely for one application, but whatever you want to use it for, wherever you want to use it.
- "No limits" design means the performance of *QINSy* is solely dependent upon the computer hardware; quite simply the faster the CPU and the more RAM, the more complex the task *QINSy* can perform.
- Developed in accordance with QPS's ISO 9001 policy and Microsoft's Windows Graphic User Interface Guidelines. These together mean *QINSy* is of a consistent, high, quality and easy to learn to use for those who are familiar with the Windows environment.
- *QINSy Mapping* integrates all aspects of terrain modelling, mapping, design and engineering.

#### *QINSy Survey* functionality:

- multiple objects, each with multiple sensors (single and multibeam echosounders, tidegauges, positioning systems, heading, motion, etc.)
- accurate time tagging using GPS PPS and UTC
- quality control displays:
  - alerts
  - colour coded coverage plots
  - raw and corrected multibeam waterfall
  - time series
- S-57 electronic chart and DXF overlay
- realtime data conditioning and data decimation
- powerful automated editing, with interactive editing

#### *QINSy Mapping* functionality:

- precise volumes (not in *QINSy Mapping Lite*)
- long and cross section profiles
- accurate maps
- 3D design tools (not *QINSy Mapping Lite*)
- reporting
- automated sheet assembly
- import / export: DXF, DWG, DGN, ESRI
- 3D visualisation
- Tools for ESRI *ArcView*

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## INTRODUCTION

*QINSy* is offered in two standard system packages for data acquisition and replay purposes:

- *QINSy Survey - for real-time use*
- *QINSy Office - for off-line and office use*

The modular nature of the software allows you to select various add-on display, driver, and utility modules to best customise one of the standard packages to fit your requirements. Start by choosing either *Survey* or *Office*. Additional modules may be plugged in at the time of *QINSy* purchase, or at a later date when your needs and/or budget change. A single software package able to handle different survey types is cost effective because it eliminates the need to purchase multiple navigation software packages from multiple software vendors, and personnel training costs are reduced.

The multi-tasking/multi-threading capability in Windows NT is fully optimised in *QINSy*. Each adjustment, each display and each I/O driver is a separate executable. Because the basic components remain unchanged, new drivers and displays are more cost effectively developed, and upgrading is simple, often requiring only an e-mail attachment. In terms of a real-time survey, this means you can open as many drivers, displays and adjustments as you wish and the system remains very stable. If you want 25 displays running simultaneously, you can do it, subject only to the amount of RAM, and the speed and number of processors you have at your disposal.

The accompanying table summarises the *QINSy* components that you get with each of the standard packages. Detailed descriptions of each *QINSy* component follow.

Two standard systems for mapping, planning and 3D project visualization are available:

- *QINSy Mapping and Route Design*
- *QINSy 3D Visualisation Tool*

## COMPONENTS

### Project Manager

The Project Manager provides a current overview of project status, allowing you to quickly determine what has and has not been done to date at the project level. Data related to each survey line is typically stored in its own relational database. The Project Manager tabulates all the databases in a survey against the actions that can be performed on each. When a particular action has been performed, the appropriate table cell is marked with the date. Actions reflect the phases of a typical survey, beginning with survey configuration (equivalent to setting up the survey header), data acquisition on line (launch of the Controller), data replay if necessary, and end of line statistical analysis. You can also launch data import and export routines.

### Data Storage

QINSy is very fast because it uses an in-house designed relational databases. File management is simple because, for each line, only two files are used to store all the data pertaining to a line:

- Set up and raw data database
- Results database

Specifically, the first database contains:

- General Survey Description, I/O and Geodetic parameters.
- Full Object, Node and Observation definition, i.e. the survey configuration.
- Sensor Definitions and On-line adjustment settings.
- ALL *raw* sensor data with time tagging in one common time frame, usually UTC. This means the entire survey can be re-processed if an error in the survey set-up is detected at a later date. Re-survey in the field may therefore be avoided.

The database format is proprietary, but tools are available to extract all data in various formats.

The *survey results database* stores position for every node in the network, together with error ellipse information. For each observation and adjustment the *Residual*, *W-test*, *MDE*, *A-Priori SD*, *External Reliability* and *Status* is also stored. Like the first database, the results database format is proprietary. However QINSy supports results output to pre-defined and user-defined formats.

The most important features of the Results Database are:

- Storage per network node; Latitude, Longitude, Height, Easting, Northing, 95% 3D error ellipse parameters and unique time tag.
- Scatter plots for position comparison.
- Time series for: Residual, W-test, MDE, SD, External Reliability, Elevation and Azimuths.
- Full support of UKOOA P1/90, P5/94, UPIS, ASCII, XYZ or customer defined formats.
- Wizard guidance and End of line and Statistical reports.

## **Geodetic Support**

Since almost all the world's datum's and projections are supported, QINSy will work anywhere on Earth. The geodetic features are:

- Datum support:
  - 9 datum's simultaneously from 50 pre-defined datum's
  - option to define your own datum
  - US State Plane co-ordinate system
- 7 Parameter datum shift.
- Projection support:
  - UTM / TM / M,
  - Tangent Plane,
  - Lambert Conical (1 and 2 standard parallels),
  - Cassini
  - Stereographic
  - Rectified Skewed Orthomorphic
- Unit support:
  - 12 pre-defined units,
  - user defined unit.

## **Controller**

The Controller fulfils various functions in QINSy, from controlling the time and type of data flow from one module to the other, to a launching pad for several user options:

- Program control
  - Set up and save personalised displays
  - Retrieve personalised displays
  - Launch of sensor calibration routines
  - Control of fix printout
  - Definition of steered point
  - Definition of observation and echosounder filters and their settings
  - Definition of motion sensors per object
  - Definition of real-time data acquisition and position filtering
- Adjustment set up
  - Wizard assistance in setting up network adjustments
- SOL set up
  - Wizard assistance in setting up survey line
- Data acquisition
  - Control of real-time positioning, data acquisition and logging of data
  - control of replay mode

## **Weighted Least Squares Network Adjustment**

The very fast and powerful network adjustment engine in QINSy can handle almost any type of navigation sensor, from GPS (pseudo ranges), LBL, USBL, rGPS, gyros to compasses and so on. QINSy exhibits great flexibility in being able to combine observations from all these systems in one weighted least squares network solution.

It is important to understand the advantages that a network solution has over the more traditional step by step approach to position calculation:

- It emphasises the geometric relationships between the nodes for which position is required, recognising that individual points do not react independently from each other to external forces.
- It reflects an integrated approach to positioning, thereby giving you a consistent solution with no internal contradictions.
- It makes the most of observation redundancy
- It supports proper statistical testing
- It provides a realistic description of precision and reliability, the two components of accuracy.

Since each network adjustment is a separate executable, you can define any number of adjustments, all of which will be solved simultaneously. Each adjustment is subject to rigorous statistical testing, offering you, and your client, proof of positioning accuracy in terms of both precision and reliability.

The most important features of the adjustment are:

- Weighted Least Squares Solution, including distance and elevation weighting.
- User defined SD's for individual observations.
- Statistical testing for:
  - F-test statistic per adjustment,
  - W-test statistic per observation,
  - Marginally Detectable Error (MDE) per observation,
  - External Reliability per observation,
- Iterative Data Snooping.
- User defined degrees of freedom.
- User defined observation A-Priori Standard Deviation.
- B-Method of statistical testing.
- Observation type independent adjustment combinations.
- Support for observation types:
  - Range/Range,
  - Pseudo Ranges (GPS),
  - RTCM corrections,
  - Bearing,
- Adjustment set-up by Wizard guidance.
- Compliant with the UKOOA Guidelines for Quality Control on DGPS.

### **PPS Timing**

- Uses Pulse Per Second and UTC output of GPS receiver as time frame in which ALL incoming and outgoing data is time tagged with an accuracy in the order of 1 millisecond.
- Enables extremely precise de-skewing of observations to a common precise moment in time.
- Essential for accurate multi-beam and USBL work.

## Navigation Sensor Support

QINSy will interface to almost any type of navigation sensor. The summary list below provides an overview of navigation sensor support. A full list of supported drivers is available on the QPS home page at [www.qps.nl](http://www.qps.nl). All current drivers are included with QINSy Survey.

- Single beam echo sounders.
- Multibeam echo sounders.
- Ultra Short Base Line acoustics (USBL)
- Roll, Pitch and Heave sensors.
- Streamer mounted Compasses and Vessel or ROV mounted gyro compasses.
- Depth and Pressure sensors.
- Tide Gauges.
- Conventional Radio Navigation systems (Microfix, Syledis etc.)
- Positioning navigation systems (NMEA position type output formats).
- Celestial navigation systems (GPS).
- Differential correction systems (RTCM).
- External header or QC telegrams and third party data strings.
- Time synchronisation using PPS/UTC Time Frame.

## Position Skewing And Filtering

Kalman filtering employs a measurement model and a dynamic model, e.g. gyro and speedlog, to model the objects motion. The 2 dynamic models are:

- Constant Velocity
- Uniform Circular Motion (for highly dynamic survey vessels)

For each of these models there are 5 settings: Very Low, Low, Medium, High, Very High. Relative timing of observations from different positioning sensors has always been a problem area in dynamic surveys. QINSy solves this issue; tagging all incoming and outgoing data very accurately time (1millisecond) in a common time frame, this being UTC, if the pulse per second (PPS) output of the GPS receiver is used.

- Observations are skewed to GPS pseudo range acquisition time
- Kalman filtered positions are skewed to the fix event
- Third party positions are skewed to QINSy position time and/or event time

In many cases, fully corrected data is therefore output in real time. For example, with integrated motion sensors, fully corrected multibeam data can be output in real time.

## Fix Generator & Data Storage Options

Fixes can be generated based on the following criteria:

- User defined time interval or distance interval
- Sailed or along line distance
- External trigger
- Manual hot key (man overboard, MOB)
- Pre-load output trigger with user-defined load time in milliseconds (primarily seismic and VSP)

Data can be stored based on the following user defined data storage intervals

- All Inter event data, based on defined output rate of sensor
- Every nth event

### **Winsocket Support for Raw and Results Data**

In a networked environment (LAN or WAN), raw and results data may be shared over Winsockets, using the TCP/IP protocol. The Internet itself can be utilised on rig move projects to perform remote QC for example. The same Winsocket drivers may be used in a multi-vessel spread to send raw data to a central point where positions are computed and sent back.

### **Import/Export Third Party Formats**

- Automated conversion of UKOOA P2/94 compliant ASCII files into the QINSy relational database and vice versa.
- Permits QC of, for example, differential GPS, which is stored as raw data in P2/94. QINSy computed positions can be compared with third party computed positions.
- Format of final positions stored in QINSy Results Database in UKOOA P1/90 ASCII format, which can contain, for example, antenna, reference point, source/gun, receiver group and tail buoy final positions.
- Format of final positions stored in QINSy Results Database in UKOOA P5/94 ASCII format.

### **Statistical Analysis**

A powerful analysis program is available to analyse all results by means of time series and scatter plots.

- Wizard assistance in data selection
- Select adjustments, observation properties, node properties, adjustment properties, position comparisons for examination.
- Set thresholds for intelligent flagging of “out of specs” items. Once limits have been set at the beginning of the survey, required end of line statistics can be quickly generated.
- Examine results on screen and/or print them.
- User definable scales, colours, timespan, plots/page

## **DISPLAYS**

A large number of different displays are at your disposal. Most can be extensively customised in terms of what data and associated properties you want to show. Because each display is a separate executable, you can open as many displays as you want, including two or more of the same display type. For example, several networked vessels working on the same survey but geographically separated by some distance, could all be tracked via several navigation displays, one showing an overview, and each of the others zoomed in on a particular vessel.

### **1. Node QC Display**

- Latitude, Longitude, Height, Easting and Northing.
- 95% ellipse axis.

- CMG, Gyro and SOG per node.
- User defined columns.
- User defined Co-ordinates, Geographical or Grid.

## 2. Observation QC Display

- Observation QC properties:
  - Residual,
  - W-test,
  - MDE,
  - A-Priori Sd,
  - External Reliability,
  - Observation Status.
- User defined columns.

## 3. Observation Physics Display

- Raw Observation properties:
  - Time of measurement,
  - Raw observation,
  - Quality Indicator,
  - Rate Range Correction (GPS observations only),
  - IOD (GPS observations only),
  - UDRE (GPS observations only),
- User defined columns.

## 4. Time Series Display

- Single, multiple and combined time series plots of:
  - Raw navigation data,
  - Adjustment related statistical results.
- User defined X and Y axis.
- Alphanumerical statistics (Min, Max, Mean and Sd).
- Multiple observation properties within one plot.
- User defined colour palette.

## 5. Alert or Traffic Light Display

- I/O alert of navigation data:
  - User defined time-out per navigation sensor.
- Raw data alert:
  - Age over limit,
  - IOD mismatch,
  - No Ephemerides,
  - Observation above user defined limit,
  - Observation below user defined limit,
  - Observation jump over user defined limit.
- Adjustment alert:
  - Distance off-line over user defined limit,
  - Position jump over user defined limit,

F-Test rejection,  
MDE or External Reliability over user defined limit,  
Number of adjustment iterations over user defined limit.

- Audible alarms and event message window.
- Store event messages to a log file on disk.
- Wizard guidance.

## 6. Scatter Plot Display

- User defined scatter plot of node comparison.
- Optional time series plots.
- Optional alphanumeric of comparison statistics for:  
Mean, Sd and number of rejected observations.
- User defined scales of X and Y axis.
- 95% Error ellipse

## 7. Navigation Display

- User defined layers for:  
Moving objects (vessel, ROV etc.)  
Lines, pipelines, targets etc. in Microsoft Access database format,  
AutoCAD DXF drawings (converted to fast plot format QXF),  
Digital charts in CM93 format according S57 standards,  
Multibeam Echosounder QC functions.
- Distance and bearing measurement.
- Waypoint planning.
- Real time multibeam data validation matrix layer showing:  
Mean depth per matrix cell  
Standard Deviation  
Number of multibeam observation hits  
Minimum observed depth  
Maximum observed depth
- Colour palettes for:  
Daylight bridge display,  
Dusk bridge display,  
Twilight bridge display,  
Night bridge display.
- Zoom options for chart level or user defined scales.
- Tracking of primary object or Relative motion tracking with primary object centred.
- User defined track plot length, including colour palettes.
- Grid presentation in Latitude, Longitude or Easting Northing.

## 8. Single Beam Echo Sounder Display

- Echo-sounder data presentation along a time axis or distance axis.
- User defined X and Y scales or observation centred.
- User defined colour palettes.

### 9. Error Ellipse Display

- 2D and 3D 95% Error ellipse for selected node.
- Statistics for a, b, c axis and theta.

### 10. Helmsman Display

- Left/right indicator of the selected node.
- Speed to line indicator of the selected node.
- Line oriented track plot with fix identification and object track.
- Graphical presentation of distance to SOL and EOL.
- Colour palettes for:
  - Daylight bridge display,
  - Dusk bridge display,
  - Twilight bridge display,
  - Night bridge display.
- User defined L/R, Speed and Track scales.

### 11. Alpha Numerical Display

- Entirely user defined display layout, font type and font size, colour palettes.
- The following information can be selected:
  - Raw observation data,
  - Position related data for selected node(s),
  - Line related data such as CMG, SOG, line name, fix number etc.
  - Three user defined comments or labels.
- Wizard guidance.

### 12. Bulls Eye or Target Display

- Alpha numerical information for:
  - Target Easting and Northing,
  - Along offset,
  - Current Easting, Northing, CMG, Speed and Heading,
  - Distance and Bearing to target,
  - Line or target name.
- Scaleable range circles.
- Graphical presentation of object shape.

### 13. Positioning System Display

QINSy accepts most NMEA type positioning system output formats. In addition to the position, whatever data is contained in the output string may be shown in this display. Hence, the Positioning System Display can present:

- Latitude, Longitude and Height.
- Quality measures of:
  - a, b and theta,
  - MDE and Unit Variance,
  - Sd's of Latitude, Longitude and Height, DOP's.
- Satellite numbers used.
- Error Ellipse.

#### **14. Adjustment Status**

- Summary of the statistical analysis of an adjustment

#### **15. Sky Plot Display**

- Satellite tracks per GPS antenna or RTCM Reference station.
- Alpha numerical presentation of:
  - Satellite Elevation,
  - Satellite Azimuth.
- Rising and setting information.

#### **16. Multibeam Echo Sounder Display**

- Colour coded waterfall display for *raw* data.
- User defined X and Y scales.
- Colour coded quality indicator per individual beam and various scrolling options
- User defined colour and screen layout

#### **17. Multibeam Swathe Corrected Display**

- Colour coded display for *corrected / filtered / decimated* data.
- Multiple swath/pipetracker and profiler systems in one display
- Waterfall and KP options
- User defined and auto scaling
- User defined color schemes
- Pipe picking utility

#### **18. Gun QC Display**

Used to quality control gun firing sequence. The color-coded graphical display makes it easy to spot misfires, or guns out of sequence. Various gun attributes can also be displayed.

#### **19. 3D Virtual Environment Manager (VEM) Display**

A real-time geo-encoded 3D visualisation of the underwater environment created from a DTM, optionally with 3D DXF import, in which you can “see” ROVs, side scan fish, divers, and other objects of interest “fly”. Options to change your viewing perspective in real-time. Please refer to “3D VEM Display” in “Add-On Modules” below.

#### **20. Profile Display**

A real-time geo-encoded 2D visualisation of the underwater environment in the x/z or y/z plane. Options include:

- Display of a digital terrain model (DTM) perhaps from a previous survey
- Display of multiple vessels including towed objects, all shown with true vertical and horizontal relationship
- Display of multiple real-time depth traces, from each of multiple vessels/objects

## **21. Analog Display**

Rather than showing a data value, for example Speed Over Ground, numerically (see Node QC or Alphanumerics displays) or graphically (see Timeplot display) you can use the Analog display to indicate the data value in an analog / meter manner.

## **QINSy UTILITY SOFTWARE**

A number of utility programs are available as plug-ins to QINSy.

### **Survey Line Generator**

- Automated generation of various Line types:
  - Single survey lines and Pipelines,
  - Site survey grids and Automated cross line and wing line generation,
  - Traverse lines,
  - Waypoint routes,
  - Targets and user defined target radius.
- Import of line data from ASCII files with user defined formatting.
- Import / Export of line data from or to the Microsoft Access Database.
- Graphical editing of lines.

### **Generic Input Driver Utility**

- Define your own driver to decode ASCII data strings (fixed length or delimited) from:
  - single beam echo sounders, pitch/roll/heave, positions, gyros, tide gauges, etc.

### **Geodetic Utility**

- Co-ordinate conversions for:
  - Grid to Geographical and visa versa,
  - Cartesian to Grid and Geographical and visa versa.
- 7 Parameter datumshift.
- Distance & Azimuth computation.
- Grid and Geographical line intersection.
- Import/Export of ASCII files.

### **USBL Calibration Utility**

- Reads data from various file formats.
- Z-Check and Spin calibration.
- 4 Quadrant Least Squares Adjustment solution.
- Detailed calibration report.

### **Velocity Profile Utility**

- Support for the following methods:
  - Chen & Millero
  - Del Grosso
  - Medwin
  - MacKenzie

### **Network Adjustment Utility**

- Manual data input.
- Weighted Least Squares Adjustment.
- Rigorous Quality Control.

- 75 Network Stations.
- 150 Observations.

### **DXF Conversion**

- Converts Drawing Exchange Format files to a binary format for faster response time in QINSy navigation display.
- Definition of DXF file datum and projection together with datumshift parameters to WGS '84 for correct registration on electronic chart.

### **RTCM I/O Tester**

- Decodes and displays RTCM, including station identity, to check correct data reception.

### **I/O Tester**

- Used to check correct reception of data from interfaced sensors.
- Display of raw data strings.
- Automatic configuration of ports via relational database import option.

## **ADD-ON MODULES per license**

### **DGPS QC**

*QINSy Survey* supports weighted least squares network adjustment. The DGPS QC module adds:

- independent computation of differential GPS positions using raw pseudo ranges and RTCM data.
- Combination of corrections from multiple reference stations in a single position solution.
- Weighting of individual pseudoranges.
- Reference station distance weighting
- Elevation masking for both mobile and reference station.
- Combination of observations from different navigation sensors in one adjustment. For example you could combine GPS pseudo ranges, differential corrections from multiple reference stations, radio navigation LOPs and acoustic ranges to compute position for all the nodes in a network.
- Rigorous statistical analysis
- Automated data snooping of erroneous observations

### **Multi-beam/Pipetracker/Mechanical Profiler Support**

- Acquisition and permanent storage of raw data
- Real-time data editing and filtering
- Real-time output of fully corrected XYZ made possible by real-time editing and extremely accurate timing of ALL data, including VRU.
- Real-time colour-coded waterfall image
- Real-time binning for coverage and data quality checks

### Swath/Scan Extract and Matching Tool

Supports extraction of user-specified swaths/scans from two different points files and the editing of one to match the other. The utility was developed for circumstances in which pre- and post-lay profiles do not match exactly due to noise in the positioning systems. The undisturbed portions of seabed common to both pre- and post lay swath/scan can be matched, generating a shift that can be applied to all the points in the swath/scan. Volume computations can then be based on matched scans to derive more accurate figures.

### Vertical Seismic Profiling (VSP) Support

*VSP Support* adds gun control to *QINSy Survey*. Hence it offers network adjustment and quality control functionality. Modules included are:

- Gun Controller with issue of pre-load shot time based on estimated time of shot and issue of actual shot closure.
- Gun QC Display to monitor firing sequence

### Seismic Support

*Seismic Support* adds gun control AND P1/90 utilities to *QINSy Survey*. Hence it offers network adjustment and quality control functionality. It is suitable for site surveys, ocean bottom cable, vertical seismic profiling (VSP) and high resolution 3D surveys. Modules included are:

- Gun Controller with issue of pre-load shot time based on estimated time of shot and issue of actual shot closure.
- Gun QC Display to monitor firing sequence
- P1/90 utility to *merge* shot and receiver records in seismic surveys.
- P1/90 utility to *interpolate* receiver groups positions between acoustic modules positioned by USBL.

### 3D VEM Display

A real-time geo-encoded visualization of the underwater environment created from a DTM, optionally with 3D DXF import, in which you can “see” ROVs, side scan fish, divers, and other objects of interest “fly”. Options to change your viewing perspective in real-time.

- Visualisation
  - Camera placement, light placement, shaded surface, multiple \*.PRO files, global and layer specific control of points, sets, plines and text, vertical scale.
- Surface Shading options
  - Points, wireframe TIN, shaded surface based on point colour, colour elevation shaded surface, geo-typical textures.
- Navigation modes
  - Rotational, fly through, move to point, path creation and playback of pre-recorded paths.
- Ortho Drape
  - Drape TIFF images (with TFW files) over the terrain surface.
  - Create fly through on top of orthophotos.
- Surface Editor
  - Create areas of average elevation, delete points, average elevation, re-layer points.

- Import of AutoCAD 3D Studio Files for object presentation.

### **Data Editing and Conditioning**

This is a very powerful tool for manual and automated data editing, conditioning and filtering. It offers:

- Grouping of observations into discrete groups to streamline filtering routines.
- Choice of multiple filter types which can be combined in different permutations. Filter types include: raw value, mean, median, fixed clip, adaptive clip, absolute value, nominal value, remove zero data, shift data, multiply data, apply latency and interpolate.
- Data viewing in both alphanumeric and graphical time series format.
- Zoom and pan modes.
- Edit, clip and interpolate mouse modes.
- Export of raw and/or filtered data to ASCII file.

### **Remote Display Support**

Provides a cost-effective solution in situations where control of displays by a remote user is the only requirement, without the need to run an additional full-blown QINSy Survey System. The client controller QINSy version has no other functionality than to allow the user to start and configure displays. For example, where the DP pilot and/or helmsman would prefer to change display content and scale himself, a less costly Client Controller version of QINSy could be installed on the network in the bridge, rather than a fully functioning QINSy. The server running the full-blown QINSy Survey package broadcasts data blocks over a Winsocket connection. Multiple clients on the network receive the data allowing the client to configure their own displays.

The server-client configuration can be extended to sharing of data over radio links too. For example, anchor-handling tugs could be clients receiving display information over telemetry links to a rig.

### **QINSy Mapping Project File (\*.PRO) Support**

In the standard QINSy Survey package, single beam, multi-beam, pipetracker and mechanical profiling data can be stored in ASCII X/Y/Z points files. This module supports output of X/Y/Z data to a QINSy Mapping (\*.PRO) template file, which is time efficient. When multiple sounding systems are in use, data from each can be assigned to a separate layer directly.

### **Side Scan Sonar Imagery Display and XTF Export (for Reson SeaBat 8000 Series)**

With the addition of side scan imagery to the QINSy system, Reson Seabat 8000 Series users have a new set of capabilities for target detection and identification. Users of other side scan units can expect support soon, since this is under development.

With side scan, the primary intent is to form an image of the sea floor that can be used to locate and identify features and bottom conditions. Each sonar ping is used to generate a line of data. Each line contains a series of amplitudes representing the signal return versus time or range. Higher amplitude indicates a strong reflector, which may be either the near side of a target or a more reflective surface. Low amplitudes may be the shadow of a feature or a less-reflective surface. When a series of these lines are combined and displayed, as the vessel

moves along the track, a two-dimensional image is formed which provides a detailed picture of the bottom along either side of the vessel.

The side scan data is output as an array of amplitude values which represent the amplitudes for each sample cell in the beam from a single ping. The side scan beam has the same 1.5° along-track beam-width as the bathymetry beam, but the across-track resolution is determined by the sampling rate rather than the beam-width. The result is that each amplitude value represents an area 1.5° wide by 5 centimeters. The side scan beam is designed with a much wider beam-width than the bathymetry beams so that each beam has a field of view from very near the vessel out to the maximum slant range of the sonar.

Once the sidescan data is measured, it is transferred to the top-side processor where it is processed separately from the bathymetry data to ensure data integrity. The final side scan data is output from the SeaBat Processor.

Side scan cannot be used to accurately measure depth, but it can provide a more detailed picture of the sea floor. This image can be used, together with bathymetry, to identify features and to help ensure that the survey does not miss any small, but significant targets.

The survey procedures for the collection of multibeam bathymetry and side scan data are different. For multibeam bathymetry, the transducer should ideally be located high above the sea-floor so a wide swath can be measured. For best side scan measurements, the transducer should ideally be close to the seafloor, looking out sideways, measuring the reflection from a low incident angle.

Because of these varying survey procedures, a decision should be made as to the requirements of the survey, and one of the techniques is compromised accordingly.

### **QINSy sidescan display/export/processing**

The on-line program will provide a real-time display, as well as the ability for the operator to select targets using the mouse. The designated targets will be stored in the form of full sonar resolution bitmaps, together with time and position of the data. Database Replay provides similar functionality

Side scan data is exportable to XTF.

The post-processing package, which is currently under development, offers the ability to generate a full survey mosaic. The side scan imagery data will be fully geo-registered to the surface defined by the bathymetry data. The future real-time display will be enhanced with the addition of automatic target detection.

## **QINSy MAPPING AND ROUTE DESIGN**

*QINSy Mapping and Route Design* is based on the Terramodel software from Spectra Precision. It integrates all aspects of terrain modelling, mapping, design and engineering. From importing XYZ points to final charting, all is at your fingertips with this package.

The key to *Mapping and Route Design's* high performance lies in its unique, point based data model, which allows you to work with greater speed, flexibility, and accuracy than do CAD based design programs. System speed is incredible because you're not constantly loading and unloading files as you communicate back and forth between the design software and the CAD host. Your design and drafting work is done completely in one package.

Data accuracy and integrity is improved because each point is unique, and the lines and attributes associated with that point are automatically updated when the point is edited. All data for a project is also stored in one project file, reducing storage space and making exporting and file maintenance easy.

A data processing, design and visualisation tool comprises several modules:

### **CAD Module**

CAD contains the database and graphics engines that are the foundation upon which all of the processing applications are built. It also includes a number of utilities and fundamental applications. CAD provides a complete drafting and design environment that, as opposed to other generalised CAD systems, was designed from the ground up with the sole mission of meeting the special needs of the civil engineering, surveying and construction, mapping and related professions. It provides the basic facilities for loading and saving project files, drafting, data entry, digitising, plotting and report generation.

### **COGO Module**

COGO adds advanced coordinate geometry calculations to the processing package, and is able to reach full potential because the coordinate geometry is built into the system, not added on. By truly combining CAD and COGO, the number of commands you are required to learn goes down, increasing productivity and reducing potential errors. It forms the perfect bridge between field survey, design and construction.

### **Contour Module**

The Contour Module supports generation of contours from Triangulated Irregular Network (TIN), utilising user defined settings and break-lines for complete control of surface generation. Contour also offers many advanced features including profile interpolation, cross section interpolation and plotting, as well as average end area volume calculations.

### **Site Design Module**

This module provides the ability to define a template or side slopes for a proposed design, project them onto a Digital Terrain Model (DTM) surface, and calculate the volumes between the two surfaces. You are then able to view, evaluate, revise and plan other aspects of the

project. Site Design enhances the speed and precision of the time consuming, inexact tasks of planimetric layout and volume calculations.

### **Route Design Module**

The Route Design Module provides:

- An advanced, easy to use graphical route design solution, suitable for the most simple to complex projects.
- A unique vertical alignment editing feature that makes the process purely visual, while enforcing geometric design criteria.
- Power modelling capabilities that produce fast and accurate results, even under the most complex conditions.

The module, built on the foundation of the CAD drafting environment, provides graphical solutions that instantly visualise each design decision or data entry, as the design evolves. Changes in design criteria, alignment alterations or adjustments for any reason, can be accommodated and their effects evaluated in minutes. The result is better designs, higher quality plans and increased productivity.

### **QINSy 3D Tool Lite**

QINSy Mapping and QINSy Mapping Lite now also includes a 3-D Digital Terrain Model (DTM) surface viewer. With simple mouse movements, a user can interactively change the display of a surface, in real-time. A snapshot feature allows the user to create a high-resolution raster image of any particular scene, which can then be imported into a report, plotted, printed, and presented to clients or co-workers for project visualisation and verification.

In addition, it provides the ability to register a non geo-referenced image to the project coordinate system using a two-point registration process that will scale and rotate the image as needed. The end user can automatically create plan and profile sheets with the correctly oriented and clipped images.

### **Tools For ESRI "ArcView"**

Brings the worlds of GIS and civil engineering together by giving ArcView users access to civil engineering, parcel mapping and land modelling tools.

- *Civil View*: Provides the link between ArcView GIS and TERRAMODEL civil engineering software. Use your ArcView data in TERRAMODEL for 3-D modelling, surveying or civil engineering applications such as roadway, sewer or site design. When you have completed your plan and profiles read them into ArcView for query and analysis. Select ArcView database fields to convert to TERRAMODEL Read Plan, Profile and Sheet Views from TERRAMODEL. Read and Write With AutoCAD Drawing Files
- *Contour for ArcView*: Runs completely inside ArcView. ArcView Tables, .DBF files, ASCII text files and ARC/INFO coverages can be used to compute a 3-D model and generate contours. 3-D Model using TIN. Input ArcView tables, DBF files or ASCII point files. Identify X, Y and Z elevations anywhere in your View.
- *Parcel Mapping for ArcView*: Allows you to input metes and bounds descriptions or digitize a plat map in TERRAMODEL to create your parcel boundaries. Read in parcel polygons, bearings, distances and other attributes as ArcView themes. Enter Metes and

Bounds or Digitize with Parcel ID. Link Parcel Maps with Property Database. Create COGO database for use with ARC/ INFO.

## **QINSy 3D VISUALISATION TOOL**

Visualisation products are revolutionising the way data is presented, understood and used. The technology enables users to visualise real 3D project data and then transform that data to present alternative scenarios in the client or public approval process.

QINSy 3D Tool offers a virtual reality solution for project visualisation and verification. It is 100% compatibility with QINSy Mapping \*.Pro project files

Additional features are: multiple navigation modes including - follow path, move to point, scene rotation, and view rotation and translation; interactive camera and light placement; interactive camera path generation; multiple surface representation modes including - point cloud, wireframe, shaded, color coded elevations and surface textures.

QINSy 3D Tool enables QINSy Mapping users to rotate, scale and light projects from any angle. They can then visually walk, drive or "fly" through the project. From there users can drop the design on top and check the effect on existing terrain or pick a viewpoint and stand on the new surface. Additional modules provide optional capabilities such as the ability to: edit in perspective view, which is perfect for bathymetry or laser scanning data; or drape Orthophotos over the surface and visually fly over the photography.