

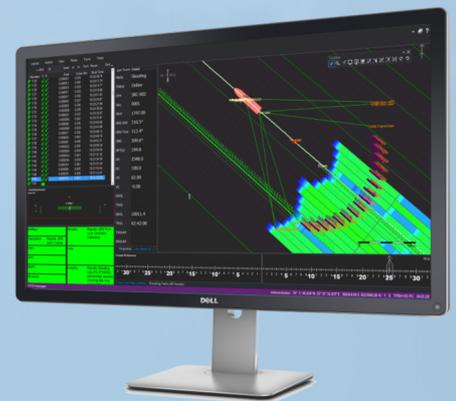
Triggerfish 3.0 for HR/UHR & PCable

Triggerfish 3.0 integrated navigation, synchronization and survey management systems for high resolution and ultra high resolution seismic acquisition have been developed to meet the specific requirements of shallow target and hazard identification surveys. Systems have been successfully deployed on surveys world-wide including oil-fields and offshore wind farms.

Crew Configurations

Triggerfish supports all streamer configurations, including Pcable. Common source systems are supported, covering air guns, sparkers and boomers.

- Single streamer
- Multi-streamer
- PCable
- Single source
- Multi-source
- Multi-vessel



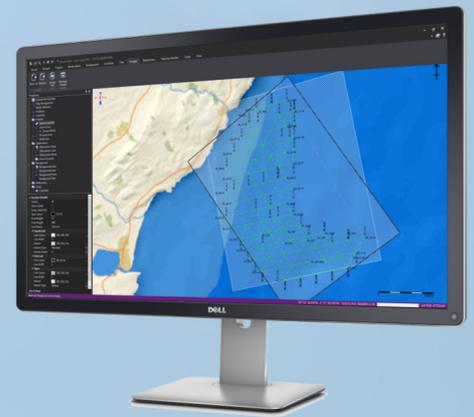
Features

- Scalable, distributed, client/server architecture running on robust Windows 10 IOT platforms
- User-friendly and intuitive configuration, operation, QC and reporting modules
- Fully integrated positioning models for vessel, source and streamers
- Catenary models for Pcable streamer systems
- Compatible with common industry source and recorder systems
- Compatible with common vessel autopilots including Kongsberg seismic track
- Kalman filtered, asynchronous, shot prediction methods; source, layback, GAM, CMP, remote
- Shot time alignment to seismic sample boundary
- Sub-metre/sub-second shot intervals with source fired ID messaging and absolute timestamps
- High quality, microsecond precision, bus-level timing systems; GNSS disciplined OCXO or TCXO
- Fully compatible with industry standards; OGP file formats (Px11) and EPSG geodetic database
- Point-by-point preplot definitions supporting 4D, spiral, dithered and non-linear lines.
- Custom QC and status data outputs (CSV)
- Integrates with real-time 3D binning systems
- Post-processing options available

Survey Design

Surveys can be built from scratch using the intuitive and comprehensive tools available in the Triggerfish *Survey Editor* application. Surveys can be stored and restored and edited off-line or on-line.

- Geodetic configuration containing OGP/EPDG database and codes
- Background mapping from shapefile, DXF, GeoTiff and manually via interactive editor
- Preplot import/export by text file, industry format files and by manual, interactive preplot editor
- Grid and spheroidal preplot definition
- Obstructions and active exclusion zones
- Tide table
- Bathymetry
- Velocity profiles



System Configuration

Configuration of software modules, vessel, towed equipment and sensor offsets and sensor interfaces is handled in the *System Editor* application.

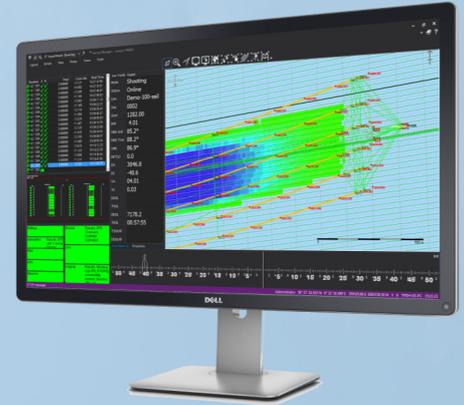
- Simple and intuitive “*drag-and-drop*” graphical user interface
- Configuration methodology compatible with OGP conventions
- Copy-and-paste functions to build repetitive features such as streamers and gun arrays
- Import/export of discrete objects (source array, streamer) from file
- Pcable catenary configuration tools
- Automatic back-up of configurations
- Interfaces by serial and network protocols
- Real-time monitoring of raw and decoded interface data
- Real-time monitoring of timing systems status



Real-time Displays

The *Survey Manager* application provides all the displays and controls necessary to manage and monitor acquisition activities and status. Multiple instances of the application can be running simultaneously across the vessel network.

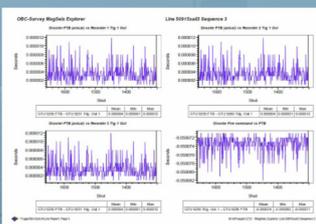
- Interactive maps with scale and rotation options
- “Traffic light” status indicators for critical systems status
- Helmsman cross-line and in-line steering displays
- Air gun timing, pressure and depth displays
- AIS/Radar target display and interactive information tables
- MOB and ZIPAS (Zone Incursion and Proximity Alarm System)
- Clear shot-by-shot status display; in-line/cross-line values, timing errors, gun header receipt
- Task list editor; allows tasks be stacked and calculates SOL/EOL time estimates and path length
- Interactive turn editor
- Geodetic calculator



Real-time and EOL Reporting

Navigation Monitor is an application that connects to the real-time server or reads data from acquisition log files. The application provides time series plots of raw sensor and computed metrics in time and shot domain. The system also provides data tables, age of data and frequency status displays and target position plots. Data can be exported in CSV format text files. EOL reports can be produced in PDF format

- Real-time and post-acquisition functions
- Multiple time series plots on the same axes
- Exception-only reporting via user-defined threshold and acceptance criteria
- Maths operator functions to manipulate and configure data
- Export of raw sensor data and computed metrics to text files
- Page configuration options for report design



Computer Hardware Systems

Triggerfish runs on Windows platforms. New systems provided by InProspect will be supplied with Windows 10 Enterprise IOT OS which is a light-weight version of Windows specifically designed for industrial “always-on” applications. As a Microsoft Partner company InProspect may supply systems with this OS pre-installed. If clients prefer to use their own computer systems, InProspect will configure these to run Triggerfish software.

InProspect can supply all form-factor computers; rack-mount (1U or larger), desktop or laptop machines.

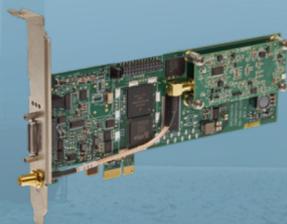
Interfacing options include network or serial hardware. InProspect can supply multi-port serial I/O devices or network server devices to support any interfacing needs.



Timing and Synchronisation Systems

Absolute time reference is provided by TSYNC embedded PCIe board installed in the Triggerfish server computer. The timing boards can be supplied with TCXO (temperature compensated crystal oscillator) or OCXO (oven controlled crystal oscillator) options. The oscillator is disciplined by the embedded GNSS receiver capable of utilising GPS, GLONASS and Galileo satellites. Each board supports four input and four output triggers and 1PPS and IRIG outputs. Because timing and event triggers are handled at the hardware level within the timing card itself there is no resolution ambiguity associated with systems that handle events within application software using the PC clock and referencing a 1PPS signal.

A custom hardware device; the TIU (Timing Interface Unit), attached to the TSYNC board provides opto-isolation of the TSYNC circuitry and provides voltage level and impedance setting of the output triggers; 5V and 12V low impedance outputs are available for standard square pulse outputs and a high impedance, 1.2V signal is provided for directly annotating seismic recorder channels.

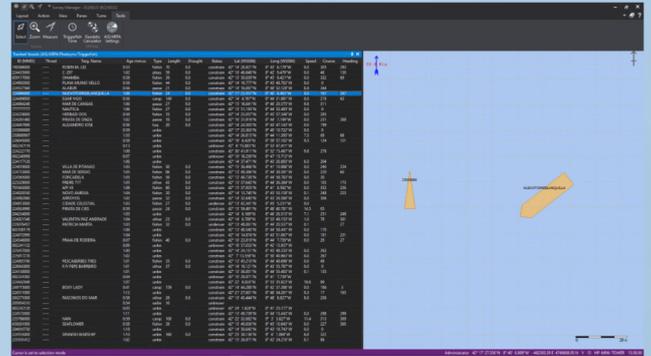


- Four input/output triggers
- 5V, 12V and 1.2V high impedance outputs
- Absolute, microsecond precision
- UTC, IAT and GPS time references
- GNSS disciplined oscillator
- OCXO or TCXO options
- Multiple board options to increase trigger inputs/outputs

Safety and Fleet Management

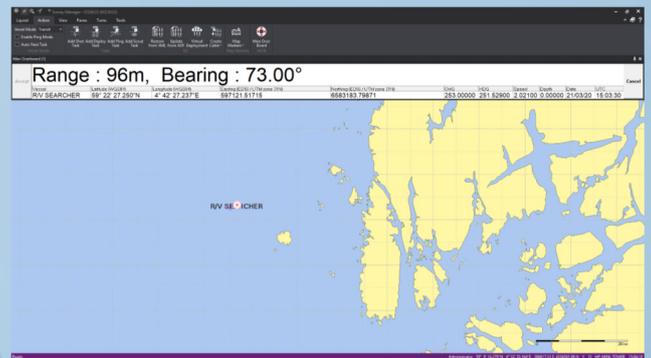
AIS/ARPA Targets

Triggerfish interfaces to AIS and ARPA radar systems and displays targets on the real-time system map and target information on the interactive table.



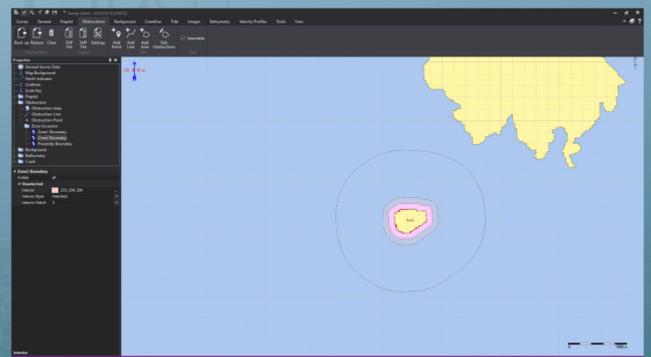
MOB Features

Man overboard events can be triggered by the operator in the *Survey Manager* application. Once initiated, the range and bearing to the event position are displayed on all nodes on the triggerfish network. The event is logged continuously to file until cancelled.



ZIPAS

The Zone Incursion and Proximity Alarm System responds to vessel or towed equipment incursions into defined zones around obstructions or vessels. Visual and voice synthesized signals are triggered by incursions. A proximity zone may be added which defines an area within which alarms are triggered if the current course would take the vessel or towed object within an exclusion zone. All ZIPAS events are logged to audit file.



Compatible Systems and Formats

Sensors

Type	Formats
dGNSS	GGA, GNS, VTG, GLL, RMC, ZDA, GSA, GST, GSV, Veripos, Trimble binary, Trinav, Posnet, SOJ/SOM, Magellan ASCII
rGNSS	Fugro, SeaTrack, Pro-Track, Posnet, BuoyLink
Gyrocompass	HDT, HDM, HTG, SOJ/SOM
Echosounder	DBK, DPT, DBS, DBT, Kongsberg/Simrad
Pitch/Roll	NMEA
Laser	Mars, MDL Fanbeam
USBL	Sonardyne, Kongsberg HPR400, NMEA
Acoustic	Sonardyne, Applied Acoustics
Streamer	Digicourse Binary, Digicourse ASCII, ION System III, Nautilus, TAP CMSX, Oyo Geospace
Weather	Anemometer, Water speed, Barometer
Tide	TideTrac, Geonica, Valeport
AIS/ARPA	NMEA
Firstbreak	GeoEel SEG-Y
Custom	<i>New interfaces will be developed to cover client requirements</i>

Supported Systems

Type	Model
Source Systems	Hotshot, Longshot, Bigshot, Digishot, SmartSource, Sparker, Boomer
Seismic Recorders	Geometrics, HTC, Sercel 428/408/Seal/SeaRay
Autopilots	Generic NMEA XTE APB, Kongsberg Seismic Track, Kongsberg C-Joy, STS500

Data Formats

Type	Format
Raw log files	UKOOA/OGP: P2/94, P2/11. Proprietary XML. Custom text outputs
Position record files	UKOOA/OGP: P1/90, P1/11. SPS. Custom SPS. Proprietary XML. Custom text outputs
Gun header	GCS90, SmartSource, Hotshot, Macha
Navigation header	Labo/Spectra, Hydronav, Uhead7, Syntrack, IAS, SPS, Shallow sequencer, Custom headers
Binning	UKOOA/OGP: P6/98, P6/11

Interface Protocols

Type	Format
Serial	RS232, RS422, RS485
Network	UDP, TCP (server), TCP (client)