

NAVVIEW FEATURES

- Remote capable
- Ideal solution for
 - Rig moves
 - Anchor handling
 - Pipelay
 - Cable lay
 - Construction projects
 - Heavy lift
- Extensive features for heavy Lift & Construction campaigns
- Real-time catenary modeling using OrcaFlex™

NAVVIEW

INTEGRATED NAVIGATION SOFTWARE

The NavView positioning and navigation package combines 4D Nav's surveying, engineering and software development expertise with innovation and modern software technology.

NavView surpasses traditional real-time positioning software by incorporating awareness of 3D elements such as: seafloor, subsea structures, pipelines, risers and anchor lines in the water column. Combined with robust surface and subsurface positioning algorithms the result is a powerful real time visualization package for offshore construction operations.

ADVANCED ARCHITECTURE

NavView is developed using modern software tools and frameworks. This allows each NavView station to operate as a standalone navigation system with the ability to exchange data with other NavView stations or 3rd party systems using web services. This architecture enables full collaboration between geographically dispersed NavView stations via local and wide area networks (LAN/WAN). NavView systems operating anywhere in the world can communicate with each other as long as they are connected to the same IP network.

COMPREHENSIVE VISUALIZATIONS

NavView features industry leading real-time 3D display of all system components in the operations area.

This visualization of subsea structures, pipelines and waypoints together with ROVs updating in real-time against a seafloor DTM improves monitoring and comprehension of operations.

NavView also provides comprehensive 2D visualizations with extensive operator control. This includes selective display and configuration of each layer as well as individual entities. Native display of AutoCAD DWG files is supported using AutoDesk® RealDWG®.

STANDARDIZED GEODETICS

NavView integrates the European Petroleum Survey Group (EPSG) Geodetic Parameter Dataset maintained and published by the Geomatics Subcommittee of the International Association of Oil and Gas Producers (OGP). This provides an unambiguous and standardized means to configure the geodetics, minimizing the potential for error and discrepancy.

CATENARY MODELING OPTIONS

NavView supports real time catenary modeling of elements through the water column. These include: pipelines for S-Lay and J-Lay operations; anchor cables including complex systems using compound catenary calculations; and risers. Catenary modeling is performed using proprietary algorithms that support a One Position and Tension model and a Two Position model. Alternatively, NavView also integrates the industry standard Orcina OrcaFlex™ Finite Element Analysis package. This provides solutions to more sophisticated catenary engineering problems.

OPERATING SYSTEMS SUPPORTED

- Windows Vista, Windows 7, and Windows 8, Windows 10 (32 bit and 64 bit supported for all versions)

SOFTWARE ARCHITECTURE

- Modular and extensible architecture with distributed computing using web services
- User roles with authentication and authorization
- Native DWG read/write capability
- Microsoft SQL Server Spatial Support

DEVICES

- All device interfaces support serial, UDP Client/Server, TCP Client/Server and Network Services
- Log raw data in native formats for replay and reprocessing

GEODETICS

- Standardized EPSG Geodetic Parameter Dataset
- Separate definition of horizontal and vertical datum

CATENARY MODELING

- S-Lay and J-Lay pipe lay operations, anchor handling and riser monitoring
- Native 1 position with tension and 2 position models
- OrcaFlex® Finite Element Analysis package¹

CALCULATIONS AND VEHICLES

- Monitor and compare multiple positioning sensors
- Automatic or manual switchover on device failure

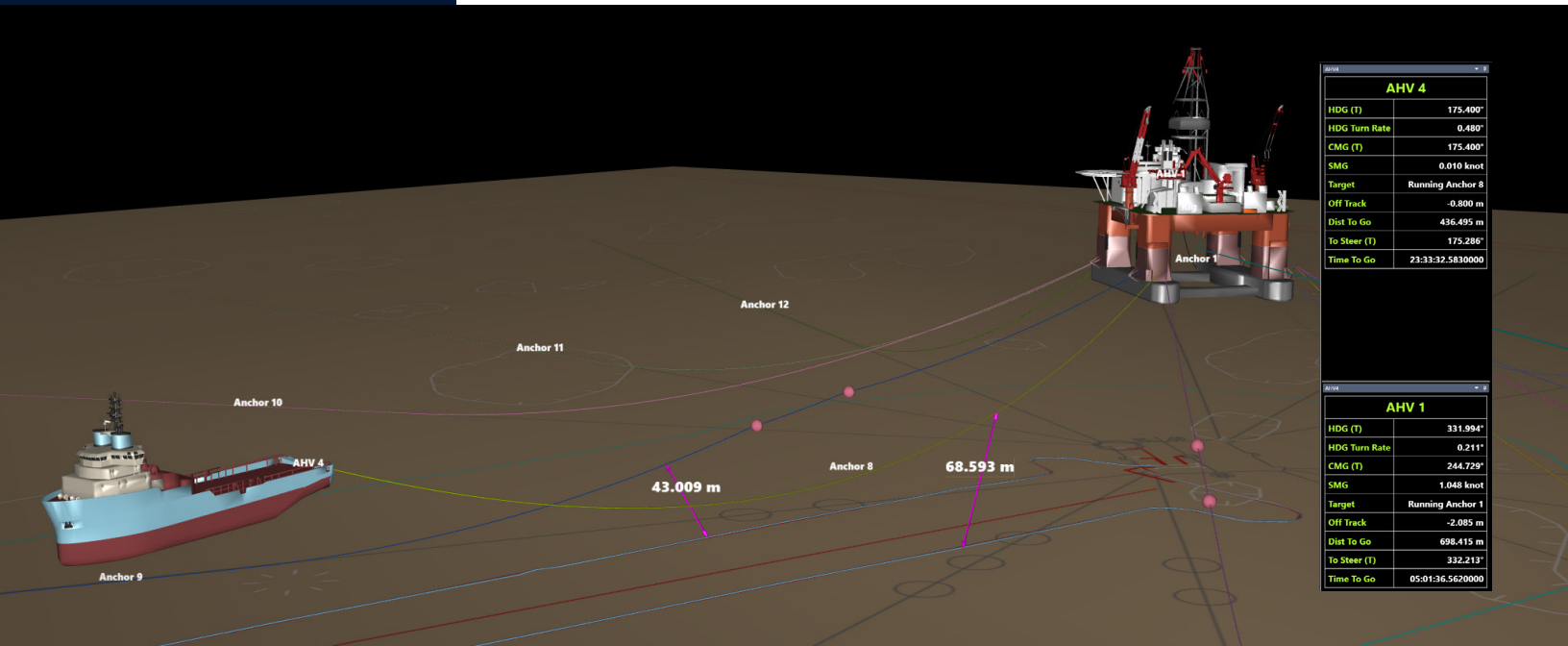
LOGGING AND ANALYSIS

- Metrology data logging and processing
- Comprehensive Data Analysis, reprocessing and reporting tools

REMOTE CAPABLE

- All features and applications of the NavView software suite are remote capable

¹ Requires an OrcaFlex™ license available from Orcina



FEATURES

- Inter-vessel communications using serial radio telemetry or IP radio networking
- Anchor operations managed from any vessel
- User friendly Anchor Planning and Anchor Manager tools
- Supports rig moves and pre-lay operations
- Hot standby of the managing NavView system supported
- Comprehensive data logging and querying tools for post mission analysis
- Real time anchor catenary modeling using OrcaFlex™ during anchor deployment and recovery¹

¹ Requires Orcina OrcaFlex™ license, not included with NavView

The Anchor handling features of NavView allows for the comprehensive visualization, networking and data management elements of NavView to support anchor operations.

Using NavView's comprehensive 2D and 3D graphic visualization, configurable text displays, data logging, data querying, networking, and intuitive operation, anchor handling is facilitated by adding a user friendly anchor planning and managing feature.

NavView inter-vessel communications supports serial radio telemetry and IP radio networking as an integral part of the anchor module. Rigorous data validation and performance monitoring enhance reliability and operator confidence.

Anchor management is supported via the Anchor Planning and Anchor Manager tools which each have their own intuitive user

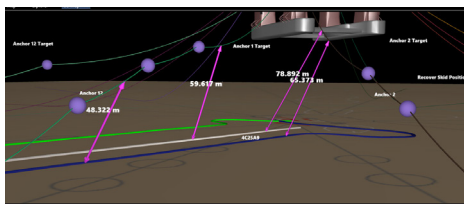
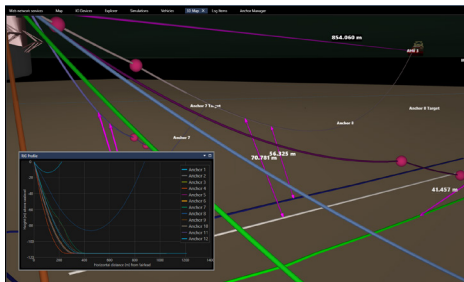
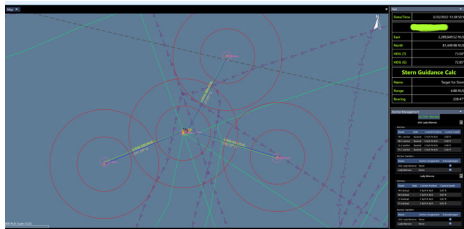
interface. Anchor operations are easily monitored using NavView's graphic and text displays. 2D Map windows display all vessels, anchors and anchor lines color coded to indicate their state, with background drawings depicting the work area, provide a comprehensive operational overview in one glance.

NavView's advanced 3D catenary modeling enhances the safety of anchor operations and provides spatial visualization and monitoring of anchor lines in relation to seafloor assets.

NavView Anchor handling is the optimal real time position and navigation tool for your anchor operations.

Master Telemetry			
Name	Status	Last Message	Next Update
Vehicle service			
RIG	✓	Publish position. Success.	2.2 s
AHV 1	✓	Query position. Success.	2.4 s
AHV 2	✓	Query position. Success.	0.8 s
AHTS Service			
AHV 1	✓	Query AHV 1 status. Success.	24.1 s
AHV 2	✓	Query AHV 2 status. Success.	23.9 s
Anchor Spread Service			
RIG	✓	Publish anchor spread. Success.	27.1 s
System Service			
AHV 1	✓	Set Horizontal CRS ID 23030. Success	--
AHV 2	✓	Set Horizontal CRS ID 23030. Success	--

Anchors		
Name	State	Current Position
Anchor 1	On Bottom	E 1,099,008.365 ftUS N 10,518,006.264 ftUS
Anchor 2	On Bottom	E 1,102,173.502 ftUS N 10,519,307.571 ftUS
Anchor 3	On Bottom	E 1,105,819.190 ftUS N 10,517,719.035 ftUS
Anchor 4	On Bottom	E 1,107,145.617 ftUS N 10,514,311.627 ftUS
Anchor 5	On Bottom	E 1,105,553.111 ftUS N 10,510,676.582 ftUS
Anchor 6	On Bottom	E 1,102,204.558 ftUS N 10,509,378.669 ftUS
Anchor 7	On Bottom	E 1,098,701.123 ftUS N 10,510,761.251 ftUS
Anchor 8	On Bottom	E 1,097,170.887 ftUS N 10,514,117.032 ftUS
Anchor Handlers		
Name	Anchor Assignment	Acknowledged
AHV 1	Anchor 1	✓
AHV 2	None	✓



INTER-VESSEL COMMUNICATIONS

Inter-Vessel Communications are supported using either serial radio telemetry or IP radios. Serial radio telemetry enable basic data exchange and anchor assignment commands to support standard anchor operations. IP radios enable the use of the NavView network service which supports comprehensive synchronization of configurations and data, including vehicles, waypoints, survey lines, background drawing files, between all vessels plus management of the anchor operation. Both approaches support optimization by the user and extensive monitoring capabilities.

ANCHOR PLANNING AND ANCHOR MANAGEMENT

Anchor Management is provided with the Anchor Planning and Anchor Manager tools, each accessed from their own window to simplify the process. Anchor vessel, fairleads, anchors, anchor lines, and target locations are setup from the Anchor Planning window. Control of the anchor operations is managed from the Anchor Manager window. Changes in the anchor spread and anchor assignments are immediately reflected on all vessels.

ANCHOR GUIDANCE

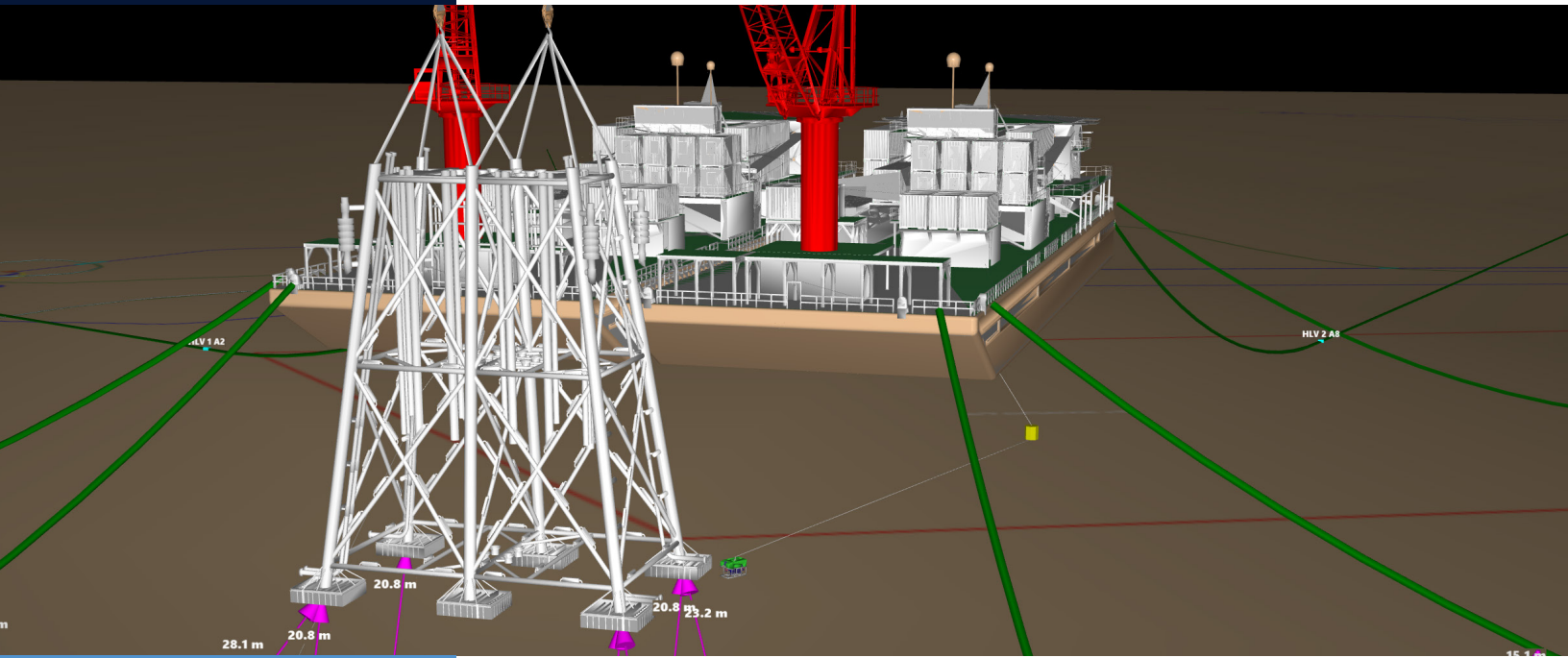
Guidance to navigate the running and retrieving of anchors and chasing pennants is automatically generated as anchor state and vessel assignment are set. The user can also configure additional guidance as required. Display of guidance information using 2D graphics, helmsman's offline, bullseye target and text view windows can be tailored to the user's requirements. The guidance data for any vessel is available on all vessels.

ANCHOR CATENARY MODELING

Anchor Catenary Modeling in real time is supported using Orcina's OrcaFlex™. Both simple and complex lines, with and without attachments such as mid-line buoys, can be modeled during running out and retrieval operations, and with the anchor deployed on the bottom. The results are monitored in the 3D and profile views.

CPA

Closest point of approach (CPA) between any two objects, such as anchor lines and flowlines or wellheads, enables real time monitoring of critical spatial relationships during anchor operations. The CPA results can be viewed in the 2D, 3D and text views.



FEATURES

- Flexible device IO using serial, UDP and TCP protocols
- Powerful 2D and 3D visualization
- Real time crane positioning for heavy lifts
- Remote motion monitoring
- Advanced pipe lay capability including Pipe Tally sheet and Cut to Length features
- Rigorous USBL calibration tool
- Extensive data recording and query capabilities
- Real time catenary modeling of moorings, risers and umbilicals using Orcina's OrcaFlex™¹

¹ Requires Orcina OrcaFlex™ license, not included with NavView

NavView's extensive features and capabilities provide the perfect solution for all your offshore construction projects. From heavy lift to pipe installation, and everything in between.

These features range from basic data recording and query tools, to specialized features such as application of heave, velocities, and accelerations to solve for remote motion.

The USBL calibration and analysis tool ensures USBL operations are performed at the highest possible level of accuracy. It can also reprocess and QC previous calibrations using data collected by other software packages and USBL systems.

Pipe installation support provides the usual features such as barge track navigation, but is enhanced with a Pipe Tally sheet and a Cut to Length tool. Combined with the

rigorous application of geodetic principles to the reduction of ellipsoid distances down to the seafloor and back, NavView's pipe lay processes provide an accuracy unequaled in the industry today.

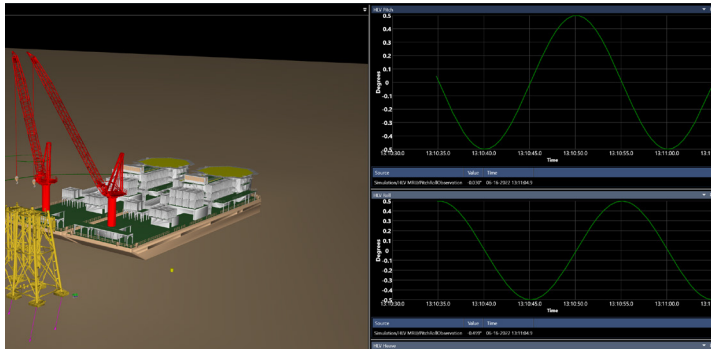
Heavy lift operations can receive real-time crane data inputs enabling NavView to position loads during lifting. Incorporating remote motion calculations allow these lifts to be carried out safer than ever before.

NavView is the right surveying tool for all your offshore construction projects.



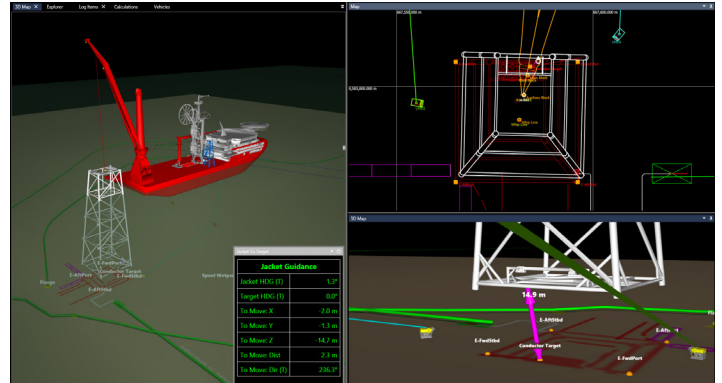
USBL CALIBRATION PROCESSING AND ANALYSIS

Rigorous derivation of the models and algorithms used for the USBL calibration and analysis result in robust solutions regardless of the peculiarities of the USBL head installation. This also enables flexibility in the design of the data collection pattern. In addition to processing data recorded by NavView, data can also be imported from other software packages and USBL systems for reprocessing and analysis.



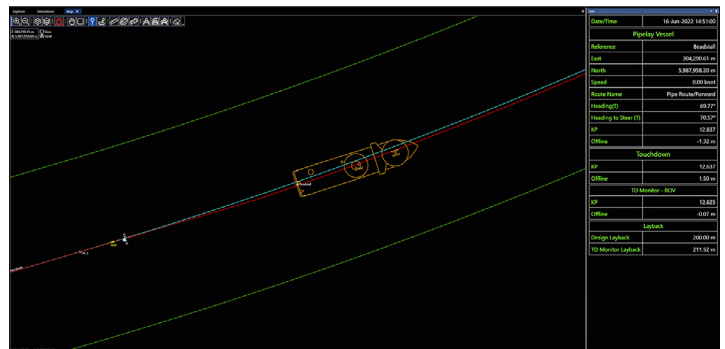
GENERAL MOTION MONITORING

Given the vessel's heave, linear velocity, angular velocity, and optionally angular acceleration, for any point on the vessel is available from appropriate sensors, NavView can calculate the linear velocity and acceleration plus heave, referred to as general motion, of any other point on the vessel. These points can be defined by static offsets or in the case of a crane tip monitoring, dynamic offsets. This information can be used to improve the safety of heavy lift operations.



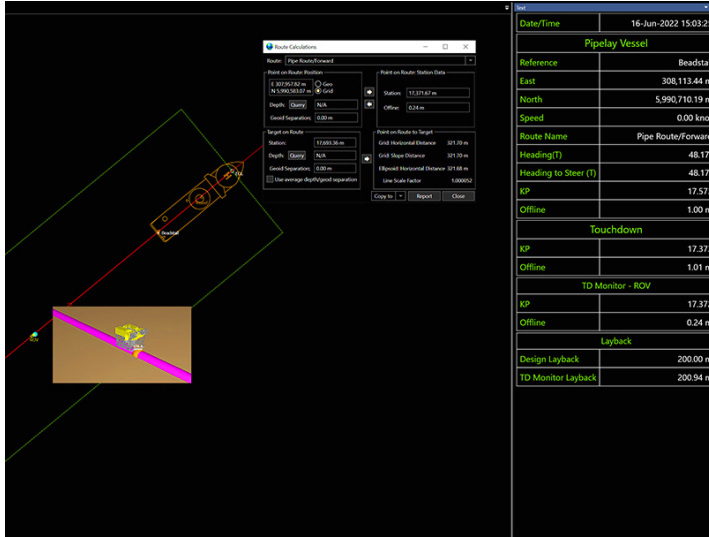
HEAVY LIFT OPERATIONS

NavView's Crane Connection combines real-time crane and vessel motion data with dimensional knowledge of the crane to translate vessel position and elevation to the crane's sheaves. Cable pay out is used to transfer sheave elevation to the load. Spatial relationships between the load and target locations plus the display of the crane and load in 2D and 3D greatly assist heavy lift operations.



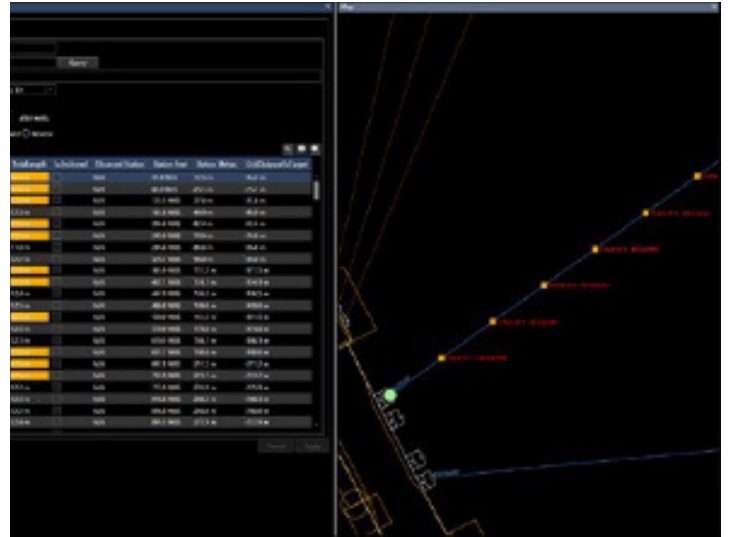
PIPE LAY

The Layback Connection supports pipe lay operations. Typical capabilities, including barge track and heading to steer, are augmented by extensive guidance and display options, plus NavView's approach to ROV TDP monitoring. Switching between ROVs monitoring TDP does not require changes to TDP data recording and displays simplifying the real time monitoring of pipe installation and recording of pipe as-laid data.



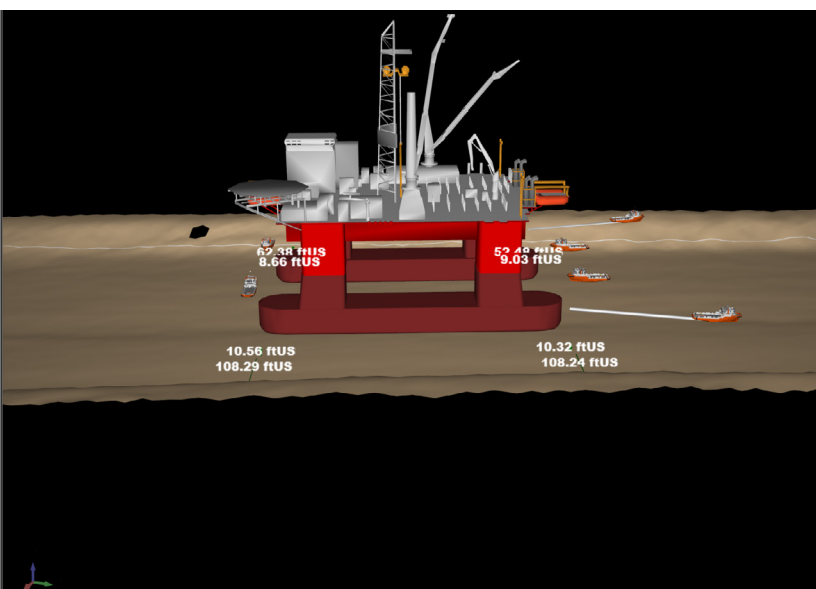
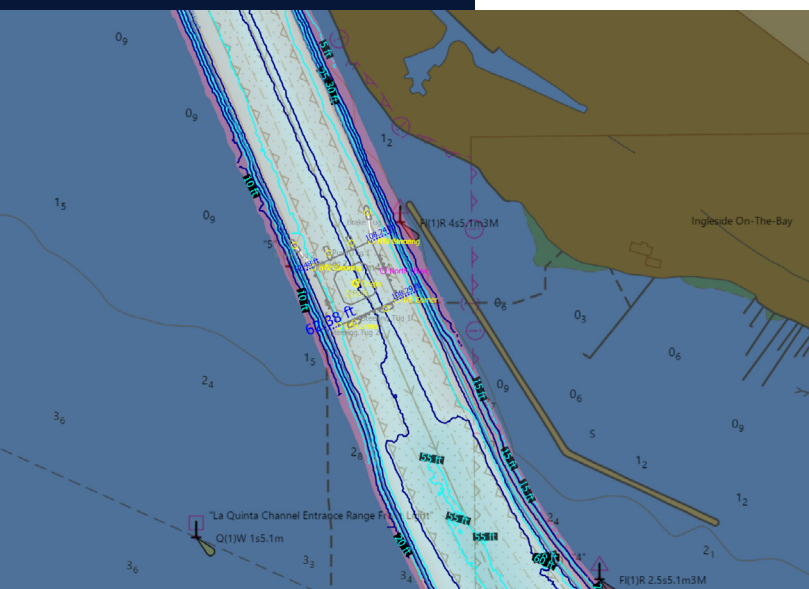
CUT TO LENGTH (CTL)

NavView's Route Calculation tool supports the CTL process. This tool calculates the actual slope distance at depth, referred to as the spatial distance, between the observed position and depth of a point on the pipe and the pipe's design end station and depth. In shallow water, the impact of accounting for the depth is minimal, but for deep water operations the improvement in the CTL determination is in the order of several feet, an amount that can be critical when trying to land in a small target box.



PIPE TALLY

With NavView's Pipe Tally feature users can import tally sheets, and with updates from ROV TDP monitoring, maintain them relative to the actual pipe installation. Combined with rigorous application of geodetic principles to correctly work with distances at depth, the prediction of weld locations is optimized. The display of these in the 2D views further facilitates monitoring for potential issues due to their locations. This can be critical when employing CTL for pipe installation.



FEATURES

- Quickly create multi-stage move plans using graphical planning tools
- Save move plans as report ready PDF files
- Visualize subsea fields on the 2D map or the true-to-scale 3D model
- Easily Interfaced to the rig and ROV real-time positioning sensors
- Integrated spatial database adds visualization of precise project site bathymetry
- Model anchor chain or wire catenaries in real-time using integrated OrcaFlex™ module¹

¹ Requires Orcina OrcaFlex™ license, not included with NavView

4D Nav offers advanced subsea visualization and rig move and tow route planning tools for use in offshore drilling and production environments.

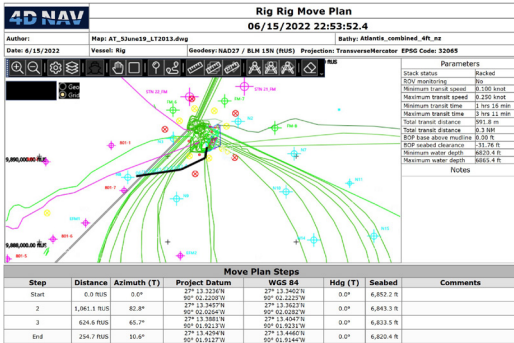
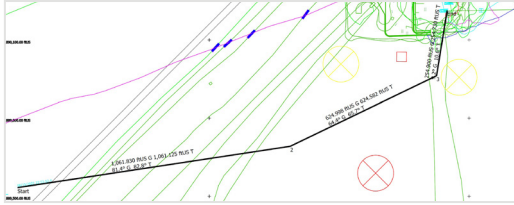
Utilizing the NavView™ suite of positioning and navigation software, rig moves are simplified with additional features that enable the planning inter-well rig moves, while improving the confidence and safety of operations performed subsea.

NavView's rig move toolset allows for a complete position monitoring and move planning tool. Position data from sensors or 3rd party software systems are easily interfaced to the system and used update 2D and 3D views of the vessel and ROVs in realtime. The advanced 3D modeling provides tremendous spatial awareness advantages, especially when ROVs are working around critical infrastructure.

Subsea field data may loaded directly from client AutoCAD™ DWG files and used as map overlays. Bathymetric data from hydrographic surveys are easily read into NavView's spatial database and converted to a DTM (Digital Terrain Model) used for seabed display as well as depth and altitude calculations.

Multiple NavView stations sharing data may be strategically located on the rig, as well as on support vessels working in the project area. Common network radios or satellite communications may be used to facilitate inter-vessel communications.

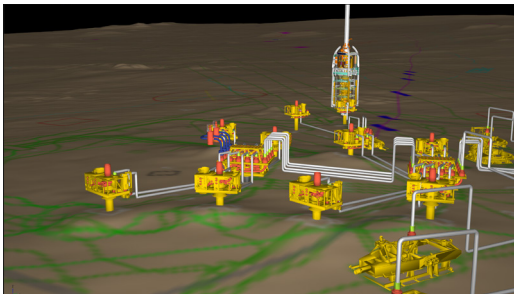
All data may be saved, making NavView an excellent spatial asset logging tool.



ROUTE PLANNING TOOLS

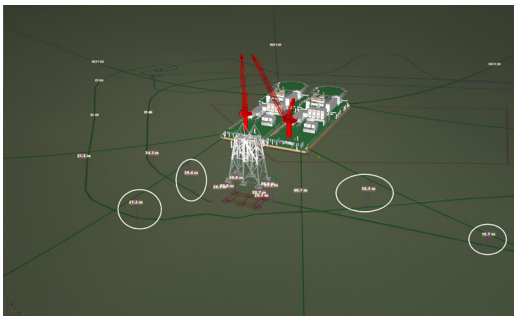
Visual planning tools allow prospective inter-well rig moves to be quickly and easily designed. NavView can search inside the move corridor for hazards such as structures, jumpers, flowlines and umbilicals. The proximity of each detected hazard to the move route, as well as its elevation above the seabed may be added to the move report.

Formal PDF move reports are easily created from NavView move plans. In addition to the move route, these reports can also include the seabed profile over the entire move, as well as a tabular listing of all the subsea infrastructure falling inside the move corridor. This represents critical safety data when moving between wells with a suspended BOP.



SPATIAL AWARENESS

NavView can read precise position data directly from sensors, or from most 3rd party survey systems. Position data is applied to the vessel or ROV models in real-time and may be presented on 2D or 3D map views. Multiple vessels working in the same project area can share RigNav™ data, providing a spatial awareness safety advantage for sophisticated Simops.



CATENARY MANAGEMENT

Built-in OrcaFlex™ integration allows NavView to compute and display complex anchor wire or riser catenaries. The catenaries are updated as the rig position changes, making this feature very useful for modeling proximity of suspended catenaries to critical subsea infrastructure as they sweep across the seafloor with the moving rig



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