Click Here to See the Animation.

From DGPS Data to Dynamic 3D Vessel Visualization

At Alan C. McClure Associates, Inc. (ACMA), we are constantly looking for ways to transform onboard operational data, typically obtained from a Voyage Data Recorder (VDR), into engineering tools and visual deliverables that provide clear insight for our engineering team and our clients.

A recent project involved developing a geospatially accurate 3D visualization of a vessel's movement using actual DGPS antenna position, vessel heading, and operational inputs, including rudder angle, propeller direction, and engine RPM, all synchronized on a common timeline. By integrating several industry-standard software platforms, we recreated the vessel's path and orientation in a real-world environment with high accuracy.

Building the Engineering Foundation

Every successful visualization begins with accurate engineering data.

The process began in AutoCAD, where engineering drawings and vessel reference information were reviewed and organized. This phase established the foundation for critical vessel dimensions, reference geometry, and the coordinate control system.

Working from vessel plans and survey data, key reference points were identified to ensure the final 3D model accurately represented the physical vessel. Particular attention was given to the relationship between the vessel's geometry and the location of the DGPS antenna. Since the antenna position is often offset from the vessel's center of rotation and other critical reference points, accurately defining these relationships was essential to creating a reliable final product.

This engineering foundation ensured that all subsequent modeling and visualization accurately represented the actual vessel.

Developing the Three-Dimensional Vessel Model

Once the engineering framework was established, the vessel geometry was imported into Rhino 3D.

Using Rhino's advanced modeling capabilities, ACMA developed a detailed three-dimensional vessel model while preserving the dimensional accuracy required for engineering analysis. The model provided an accurate representation of the vessel and served as the visual platform for integrating the raw VDR data.

The ability to accurately represent vessel geometry is critical when evaluating vessel orientation, maneuvering characteristics, and interactions with surrounding infrastructure.

Processing the VDR Data

The VDR records DGPS position data along with operational and navigational data at regular intervals.

Using Microsoft Excel, ACMA engineers reviewed, organized, and processed this raw dataset into a structured format suitable for visualization. Data validation and quality control procedures were applied to ensure consistency between vessel position records, heading information, and operational inputs on a common timeline.

This stage transformed raw VDR data into a usable engineering dataset that supports advanced visualization and analysis.

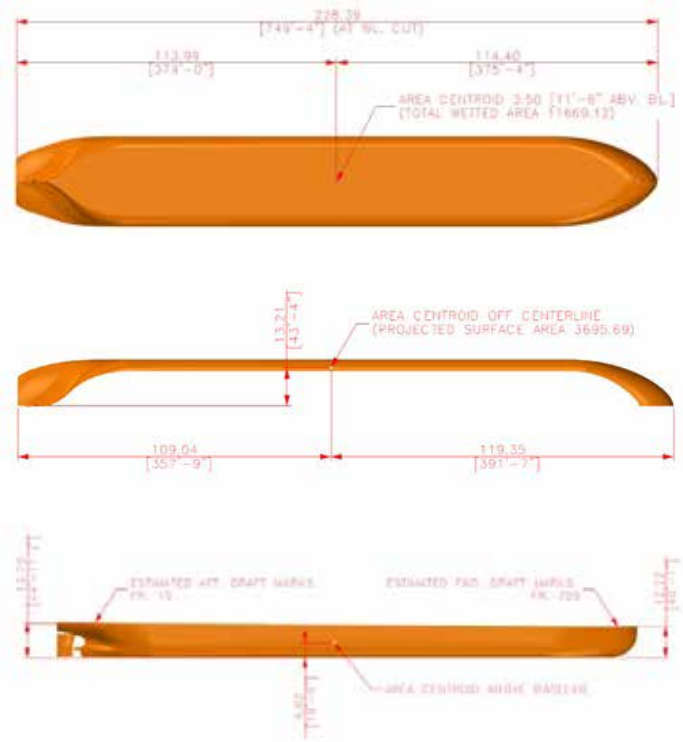
Integrating Geospatial Information

The processed vessel track was then imported into Google Earth Pro, allowing vessel movements to be displayed within their actual geographic environment.

The vessel model was aligned using the DGPS antenna coordinates and the recorded vessel heading, enabling accurate representation of the vessel's position and orientation throughout the operation.

This integration provided immediate context by placing engineering information within real-world surroundings, including waterways, shore facilities, structures, and project areas.

For many clients, this step alone dramatically improves understanding of operational



activities compared to independently reviewing traditional charts, coordinate tables, and time-history reports.

Creating Dynamic 3D Animations

To further enhance the visualization, ACMA integrated the geospatial data into Blender 5.0 to create a dynamic three-dimensional animation.

The vessel model was synchronized with the recorded DGPS positions and heading data throughout the operational period. Google Earth imagery was incorporated as a georeferenced basemap, allowing vessel movements to be visualized directly within the actual operating environment.

The resulting animation accurately recreated vessel position, heading changes, maneuvering patterns, and proximity to surrounding infrastructure and nearby vessel traffic throughout the operation.

The visualization can also be used to recreate and evaluate historical vessel operations, making it a valuable tool for forensic

investigations, incident reconstruction, and expert witness support.

Camera positions and viewing angles could be adjusted to create:

- High-level operational overviews
- Detailed vessel movement reviews
- Infrastructure interaction studies
- Project documentation graphics
- Client presentation materials
- Engineering investigation exhibits

This flexibility allows the same dataset to support multiple project objectives and audiences.

Applications Across the Marine Industry

Dynamic vessel visualization provides value across a wide range of marine engineering and operational projects, including:

- Marine construction support
- Vessel operations analysis
- Transportation studies
- Port and terminal planning
- Forensic investigations
- Incident reconstruction
- Project documentation
- Client communications
- Stakeholder presentations

By transforming raw VDR data into intuitive visual formats, project teams can better understand vessel behavior and communicate findings more effectively.

Why Visualization Matters

Marine projects continue to grow in complexity. Stakeholders increasingly require information that is not only technically accurate but also easy to interpret and communicate.

Traditional reports, spreadsheets, and drawings remain important engineering tools, but visualization technologies provide an additional layer of understanding that can significantly improve project decision-making.

At ACMA, we integrate industry-standard engineering software, geospatial technologies, and advanced visualization tools to create solutions that bridge the gap between raw data and practical understanding.

The result is a clearer picture of vessel operations, improved communication among project stakeholders, and enhanced support for engineering analysis, regulatory review, and project planning.

Click Here to See the Animation.

Alan C. McClure Associates, Inc.
Naval Architects • Engineers

713.789.1840
Click here to send us an email.

About ACMA

For more than five decades, Alan C. McClure Associates, Inc. has provided naval architecture, marine engineering, marine surveying, stability analysis, mooring analysis, vessel design, forensic investigations, and owner's engineering services to clients throughout the maritime industry.

By combining engineering expertise with modern analytical and visualization technologies, ACMA continues to help clients solve complex marine challenges with practical, innovative solutions.

Learn more at **www.acma-inc.com**.