




Custom Design Project Study
Marine Computer



ICP America provides customers with OEM/ODM services that include customized support from the start to the end of the project. We are your virtual factory, providing cost-effective manufacturing services and on-time delivery of products, all with the highest quality standards in the industry.

Overview of the Project

In 2007, we started working on a project with a long-time customer (since 2002) in the Marine Industry. We were tasked with the design and manufacture of an industrial computing component for a Dynamic Positioning System (DPS) that is used in supply vessels and work boats — primarily in the oil and gas industry. Each DPS contains between 4 to 10 of our units.

To start, we used off-the-shelf products and modified them to meet the marine industry's strict requirements. By the end of 2009, our products allowed the customer to transition to a completely customized system. By 2011, we had completed an improved 2nd generation of the product; we are currently working on a proposal for the 3rd generation of the system.

Why Use DPS?

As drilling rigs moved into deeper waters, jack-up barges could no longer be used and anchoring vessels became uneconomical. To develop a solution to this problem, the National Science Foundation outfitted a drillship, the CUSS I, with four steerable propellers that would allow the boat to adjust its position in any direction. The drilling vessel was able to accomplish its goal of drilling in deep waters without anchoring.



But the CUSS I was controlled with manual steering. This required constant manual adjustments and was only relatively accurate, within about a 180-meter radius of the desired position. Moreover, the vessel lacked redundancy: if the mechanical steering systems failed, there would be no way to accurately control the ship.

With a DPS, vessels are controlled using onboard computers that take in sensor data to maintain an exact position without user input. They also have built-in redundancy in case the DPS was to fail.

The Challenge

A DPS is a computer-controlled system used to maintain a vessel's position and direction by controlling the boat's propellers and thrusters. The system takes input information from various position reference sensors, wind sensors, motion sensors, and gyrocompasses, then computes the necessary adjustments based on the desired position and heading. A DPS can greatly improve the efficiency and performance of oil rig supply vessels.

DPS software needs to include a mathematical model of the vessel and its power systems. With this model and the data from the sensors, the system can compute the exact steering angles and thruster power required. With a DPS, supply vessels can operate when mooring and anchoring are not feasible due to excessively deep water or sensitive infrastructure such as pipelines or cables on the sea floor.

The DPS system needed to give vessels the ability to maintain their position relative to a fixed point on the sea floor, or to another vessel or platform. It also needed to have the capacity to weathervane the ship — giving operators the ability to manage the position of the vessel according to the direction of the wind, waves, and the current.

Application of the Product

The overall goal of the project was to design DPS equipment that meets the unique requirements of the oil industry. We designed proprietary software to measure the movement of the rig and platform, wave motion, vessel motion, GPS, and sonar. With this custom software, supply vessels are able to adjust their thrusters accordingly to keep the supply vessel within a 0.5 meter proximity when tethered to an oil rig. This is opposed to a typical system used for this purpose could employ up to ten computers, our customized hardware solution provides double redundancy with only two computers. Moreover, a standalone unit with a display and a joystick is available for use in case of an emergency. The controls on this backup unit are sufficient for safely moving the vessel away from the oil platform.



Summary of the Project Results

Our customized system resulted in several operational improvements for our client, including:

- **Excellent maneuverability** — Vessels are able to easily adjust position to manage environmental and operational challenges
- **Fast setup and easy to use** — Our system is intuitive and easy to install, leveraging existing steering and propulsion systems
- **Ability to operate in challenging environments** — The system lets outfitted vessels approach other vessels or drilling platforms in virtually any environment, regardless of depth or the presence of obstructions
- **Enhanced Redundancy** — Systems are in place to accommodate malfunctioning generators or thrusters, and even for switching to manual operation in the event of total system failure

Project Timeline

The entire project (1st generation) took place over the course of two years, a relatively short amount of time for ideation, design, prototyping, manufacturing, and implementation*. The entire project timeline is listed below:

- **May 2007** — We visited the customer's office and proposed a completely customized solution with a chassis and single-board computer (SBC) designed and manufactured by ICP America.
- **June 2007** — We sent the customer our first official proposal for the system.
- **July 2007** — The customer replied with changes to the proposed design.
- **August 2007** — We sent the second proposal for the custom system design and the customer requested yet more changes.
- **September 2007** — We sent our third revision based on the customer's specifications. The customer quickly accepted the proposal. We placed an order for a prototype to be delivered by December 2007.
- **January to November 2008** — We delivered the completed prototypes to the customer after carrying out extensive testing for nearly 12 months. Testing consisted of sea trials, DNV-certified testing, and agency acceptance testing.
- **December 2008** — All units passed the extensive testing processes.
- **January 2009** — Our customer placed production quantity orders with ICP America.



* To date over 700 units have been shipped to our customer and installed in vessels all over the world.

Conclusion

Our proprietary solution gave our customer the ability to manage vessels with superior accuracy and reliability. Furthermore, our system provides unprecedented levels of redundancy, which is extremely valuable in the offshore oil and gas industry, where system failure can be catastrophic.



Interested in learning more about our custom system design services?
Contact our team to discuss how we can help with your next project.