

NEW APPLICATIONS

Small-Scale DP Systems

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L-3 Dynamic Positioning and Control Systems

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Introduction

Most DP Systems:

- are found on vessels 50 meters or longer
- support the offshore oil industry
- have at least some redundancy (> Class 0)

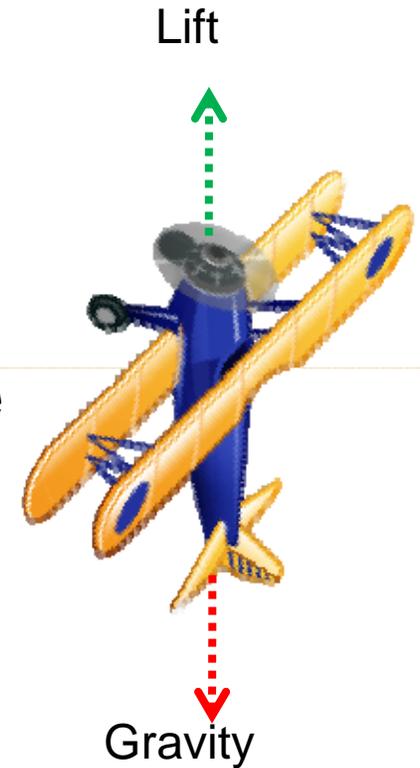
A potential market exists for:

- class 0 DP systems for small pleasure craft
- DP systems for USVs

This talk covers some key issues involved in placing a DP system on a small vessel

Scaling Considerations

- Time-scaling ($\sqrt{\quad}$ rule of thumb)
- Consider an airplane that can fly straight up (max lift = own weight)
- A model should have the same thrust/weight ratio as the full-scale version



Scaling Considerations

Time-scaling rule of thumb applies if:

- Model is geometrically similar
- Thrust ratings are scaled with mass
- Model has roughly the same average density

Then the time scale factor is \sqrt{k} , where k is the geometric scale factor ($k > 1$)

For example, if full-sized vessel is 100 times the size of the model ($k = 100$), then the time scale factor is 10.

Hardware Considerations



Mechanical Gyroscope (Anschutz) DGPS Heading Receiver (Trimble)



PRO-Series Controller (L-3 DP&CS) 3-Axis Magnetometer (MicroMag)



SMALL MANNED VESSELS

Actuation Issues

- Typical DP *actuators* include thrusters, main propellers, and rudders
- Most small boats only have actuation at the stern, and therefore could not DP
- These boats would need to be upgraded for DP
- A boat with two inboard motors and rudders is nearly capable of DP
- These boats would be a good starting point for a DP upgrade
- They can walk sideways by “splitting” their engines
- Full DP with twin inboards is theoretically possible, but most motors would have clutching issues

Twin Inboards and Rudders



Upgrading the Twin Inboard

- Adding bow thrusters to a boat with twin inboards would allow the vessel to remain in the same bias configuration
- Main engines would not have to change direction
- Bow thruster would have to be fast and strong

Bow Thrusters



Internally mounted



Externally mounted

Small Boat with a Bow Thruster





UNMANNED SURFACE VESSELS

About USVs

- Can be autonomous or remote-piloted
- Sometimes semi-submersible for added stealth
- Are typically small vessels, though larger military ships are inevitable
- Are often modified versions of small manned craft, such as SeaDoos and Jet Skis
- Can have somewhat limited range

USVs



Stingray (Israel)



Sea Scout (USA)



Interceptor (UK/USA)



Protector (Israel)



AMN 1 (USA)



Sea Stalker (USA)

Potential DP Applications for USVs

- Stationary sentries
- Low-speed formation control
- Autonomous docking, getting underway, refueling
- Other low-speed maneuvers
- Low-speed mine hunting
- Commercial fishing



Also Offered by DP Vendors

- Autopilot functionality
- Waypoint guidance while in transit
- Vessel-relative positioning



Final Statements

- The DP industry has much more experience controlling surface vessels than most universities, military organizations, research companies, etc.
- The DP industry should lead the way in developing control applications for USVs
- As DP systems become smaller and more cost effective, they will be found on smaller vessels, including USVs