



**NTSB** National Transportation Safety Board

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*Office of Marine Safety*

# Human Factors and Crew Issues

# Captain and Staff Captain Errors:

- Not recognizing shallow water effects
- Not seeing effects of inappropriate INS rudder economy setting
- Increasing INS rudder limit



# Explanation of Captain and Staff Captain Errors:

- Did not understand aspects of the INS logic

# Additional Captain and Staff Captain Errors:

- Transferred control of a vessel to the second officer
- Were not on the bridge to assist him in dealing with vessel heading fluctuations



# Second Officer Errors

- Reacted exclusively to the largely red (to port) turn indicator
- Initially steered to port when he meant to steer to starboard
- Rapidly alternated between port and starboard wheel inputs

# Explanation of Second Officer Errors

- Task saturation
- Error of execution
- Consistent with someone under considerable stress



# Explanation of Second Officer Errors

- Opposing short- and long-term rudder effects
- Time lag between rudder command and rudder-ship response
- Steering inputs created oscillations out of phase with the vessel motions
- Lost situation awareness

# Crew Training and Experience

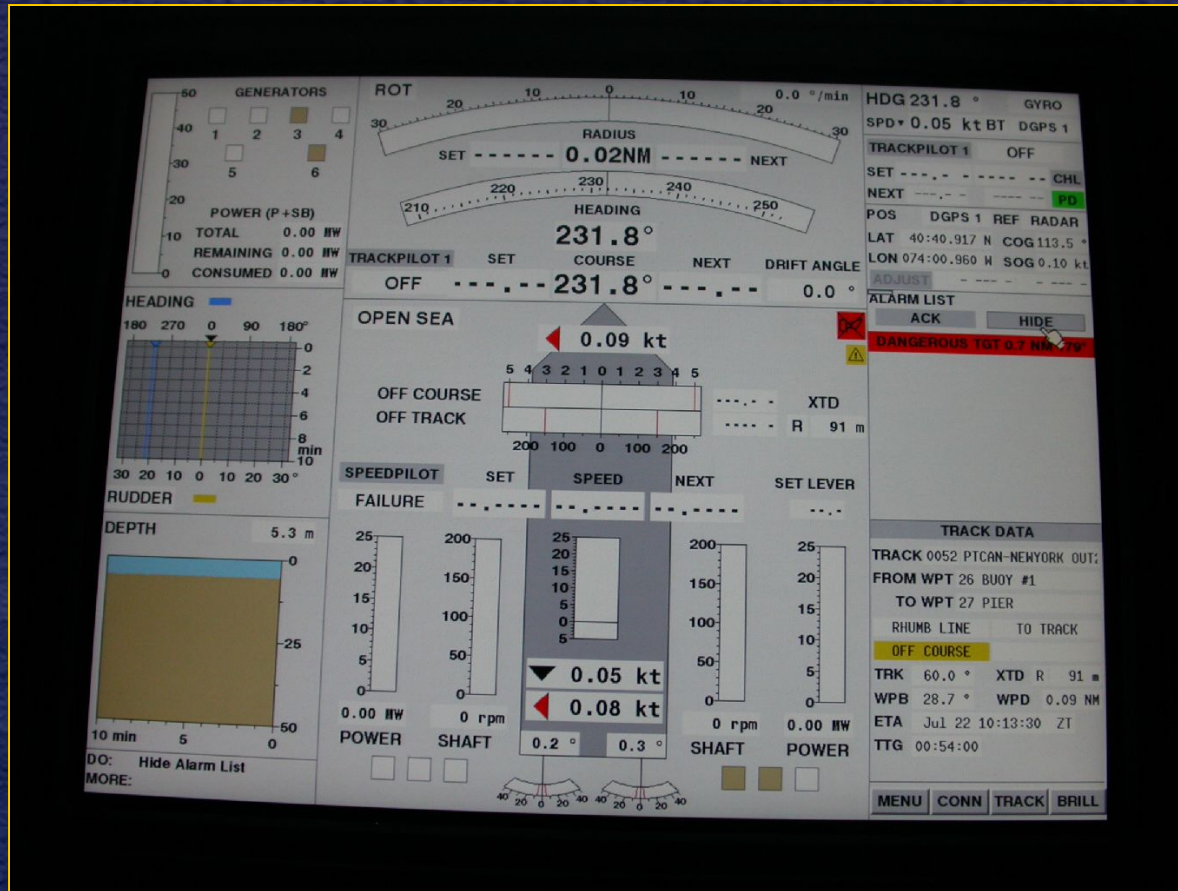
- Consistent with crewmembers of their rank and experience level
- All received formal INS training within several years of the accident



# Integrated Navigation System



# Display of an Integrated Navigation System





# INS Training

- Is not required under current U.S. and international regulations
- Varies across manufacturers, companies, and countries
- Does not require demonstration of proficiency

# INS Manufacturers

- Have no formal programs to collect data on heeling events
- Do not systematically incorporate data into INS design or INS training





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