Today’s Dynamic Positioning Systems

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History of Dynamic Positioning

- **Cuss 1 Mohole Project, 1961**
  - “Station keeping” w/ joystick control and acoustic transponders
- **Eureka, 1961 & Caldrill, 1964**
  - True DP using 3 analog controllers and taut wire
- Markets developed in the Mediterranean and the North Sea
- Commercialization by Honeywell in the late 1960’s
- **Seaway Falcon** was the first commercial DP system by Kongsberg in 1977
DP Equipment Classes

**Class 1**
Loss of position may occur in the event of a single fault.
Equipment need not be redundant.

**Class 2**
Loss of position is not to occur in the event of a single fault in any active component or system. Static components not considered for failure.
Typically achieved through redundancy.

**Class 3**
Loss of position is not to occur in the event of a single fault including a completely burnt fire sub-division or flooded watertight compartment.
Typically achieved through redundancy and compartment segregation.
DP system hardware philosophies
COTS (Commercially off the shelf) versus Proprietary

COTS
- Shelf life of processors, motherboards, video cards, etc...
- Up front cost savings ??
- Long term upgrade cost?
- Supportability

Proprietary
- Long term support
- Knowledgeable tech support (Certified internal training)
- Stable hardware platform (average life time 10-15 yrs, longer mean time between system upgrades)
- Long term cost savings
How do you see COTS (Commercially Off-The-Shelf) technology versus proprietary equipment?

**PF:** “We plan for a 10-year useful lifetime for electronic hardware. We’ve been able to extend lifetimes to 15 or 20 years with proprietary equipment, but not with COTS. It’s a question of whether the proprietary supplier has planned for long-term support and made the necessary commitment to stock critical parts. KONGSBERG has done a good job with the proprietary approach, both in design and support commitments. Because KONGSBERG has been so successful with their approach, we regard it as a competitive advantage.”

What is KONGSBERG supplying on the newbuild rigs?

**TL:** “On these rigs, the DP system and the integrated control system is all KONGSBERG, as are the safety systems. Our rationale was based mostly on past performance with KONGSBERG systems. With KONGSBERG, when we’ve had a conversation, we walk away feeling like there’s been a good exchange [of ideas, and the objectives are clearly understood].”

**PF:** “What comes to mind when I think about KONGSBERG is ‘professional’. When we buy systems, we expect excellent design, reliable performance and effective service and support. It all adds up.”

**TL:** “Our expectations have always been exceedingly high for KONGSBERG. And they’ve met those expectations.”
Importance of Sensor Input
Number of required units

Wind Sensor
Wind speed and direction measurements input to aerodynamic model

Gyro Compass
Heading input (heading control, geographic orientation)

MRU
Pitch, and roll measurements are required to correct Position Reference System fixes for the orientation of the vessel
Today’s Optional Position Ref Systems

• Differences of GPS systems – true multi referencing

• RADius / CyScan / RadaScan / Fanbeam / DARPS

• Acoustic Systems

• Tautwire

• Gangway
Differences of GPS Systems – true multi referencing

For the receiver to output GPS position coordinates of submeter accuracy, you must first select a differential signal from one of the following sources:

- **SBAS (WAAS/EGNOS, and MSAS)** – free service, limited Availability
- **OmniSTAR VBS or HP/XP** – paid subscription, available Worldwide
- **Beacon mode** – Correction received by the combined beacon/GPS antenna

DPS Engine comprises an "All in One" signal processing core with advanced algorithms and true parallel processing of all available signals including SBAS (e.g. WAAS, EGNOS, MSAS and GAGAN). DGPS/DGLONASS corrections from different sources are combined by the unique MULTIREF capability. There is no practical limitation to the number of reference stations handled by the DPS Engine. DPS 232 provides full decimeter accuracy with High Precision Services.
RADius / CyScan / RadaScan / Fanbeam pros vs GPS

- **Robust and precise relative reference** for DP operations when close to structures or other vessels
- **Complementary** to DGPS e.g. as DGPS tends to have reduced accuracy close to structure or other vessels, Relative Positioning Systems increase accuracy
- **Increasing integrity** by tracking multiple transponders and built-in accuracy assessment and performance evaluation
- Limited in relative distance from Target.
- A target must be hung from the structure\rig\platform in order to position off of. In some cases the target requires an activation key or ships power in order to utilize.
- (Fanbeam and CyScan only) Degraded signal quality with direct sun light, heavy rain, fog and false targets.
RADius operational advantages

- No moving parts
  - Solid state
  - Low maintenance cost
- Operates in all weather conditions
- Complementary to existing GPS positioning reference system
- Multi user
- Multiple transponder capability
- License free
- Integrity
- ‘shadow’ free
- False reflection free
Underwater Positioning
HiPAP family

**HiPAP® 500**
- Acoustic operating area recommended: ± 100°
- Operating range: 4000m
- Range accuracy: ≤ 0.10m
- Angle accuracy: ≤ 0.12° (0.2% of slant range)

**HiPAP® 350**
- Acoustic operating area recommended: ± 60°
- Operating range: 3000m
- Range accuracy: ≤ 0.20m
- Angle accuracy: ≤ 0.18° (0.3% of slant range)

**HiPAP® 350P**
- Acoustic operating area recommended: ± 60°
- Operating range: 3000m
- Range accuracy: ≤ 0.20m
- Angle accuracy: ≤ 0.18° (0.3% of slant range)
Light Weight Taut Wire

- Accuracy 0.2% of water depth
- Remote control from bridge
- Operational limits
  - 300 (500) m depth
  - ±20° angle (35% of water depth)
  - Favorite among dive support vessels – visual reference for divers
- Pipe laying
DP Applications

Research Vessels
Supply Boats
Crew Boats – how DP has now taken over that market. More multi functional fast vessels
Dredgers – time savings not having to go over missed areas, etc.
Ocean Tugs – offers additional functionalities to serve different operations
Anchor Handlers
Accommodation Vessels
Pipe layers / Cable Layers
Construction / Heavy lift Vessels
Military
Cruise Vessels
Drill Ships / Semi’s
ROV / Dive Support Vessels
Yachts
Icebreaker
Research Vessels
Supply Boats or OSVs
Crew Boats
Dredgers
Ocean Tugs
Anchor Handlers
Accommodation vessels
Pipe layers
Construction / Heavy Lift
Versabar VB10000

Lift specialists with a global reach
Military
Military
Cruise Ships
Drill Ships / Semi-Submersibles
Windmill Installation Vessel
USCG Mackinaw Ice Breaker
DP Design – A changing working environment
K-Master- The DP of Tomorrow.... Today!

- Mini joystick for equipment control
- Backup switch
- Alarms, Mode control and control transfer
- Microphone/speakers in backrest
- Space for additional operator units (both sides)
- Independent DP Joystick control panel (Touch)
- Radio PTT switches
- Touch Control Panels (both sides)
- Rotate wheel
- Joystick for DP and Independent DP joystick
- Thruster control levers (both sides)
- Seat adjustment controls
- Independent DP joystick control panel (Touch)
K-Master ergonomics

Sectors according to DNV NAUT-OSV

Hand Grasp
On Hand
Within easy reach
Within reach