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Today's Dynamic Positioning Systems

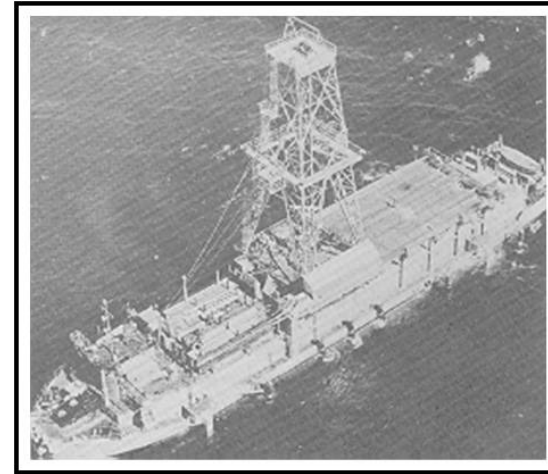
Nick Van Overdam
Andrew Phillips

History of Dynamic Positioning



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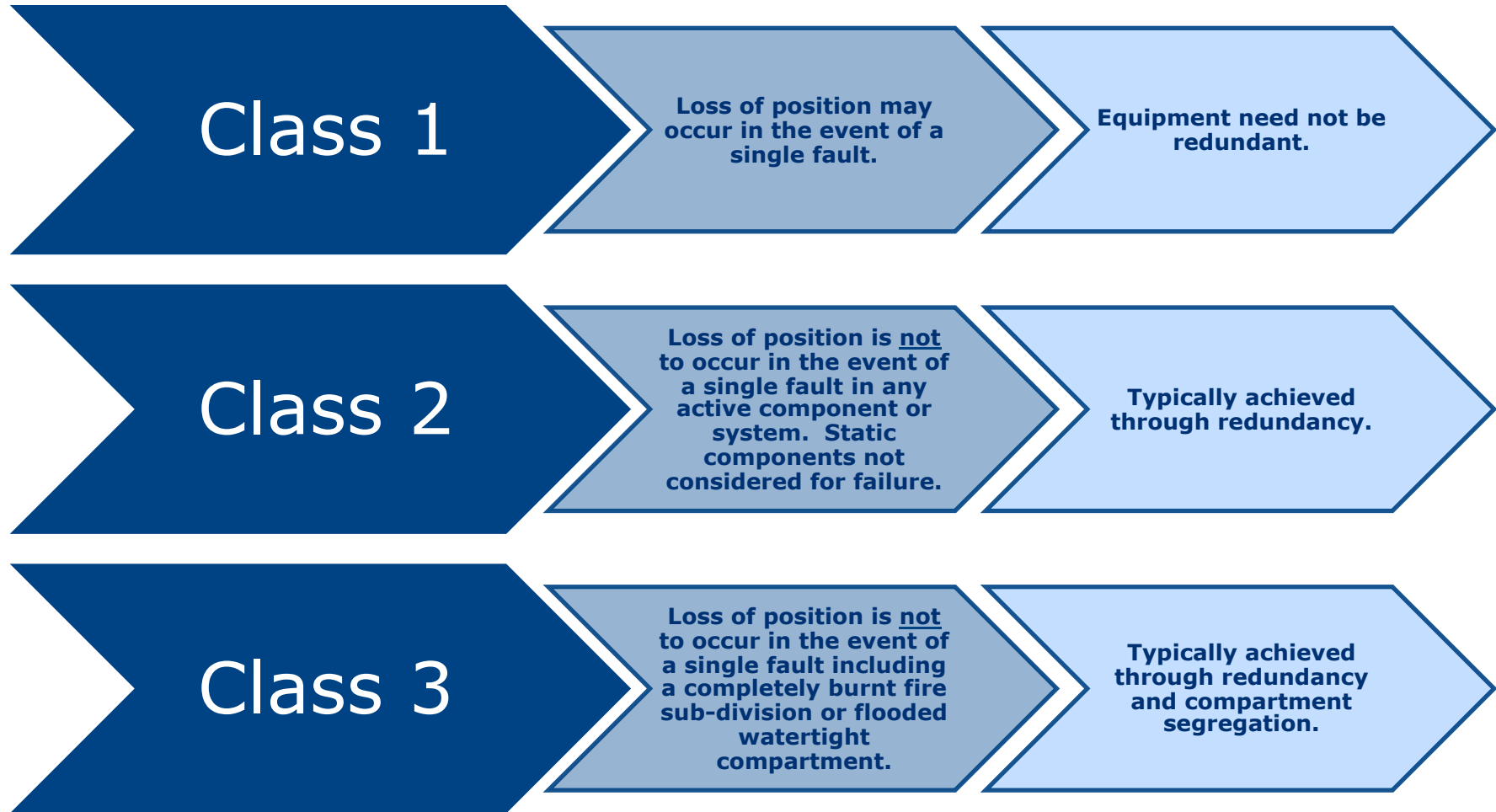
- *Cuss 1* Mohole Project, 1961
 - “Station keeping” w/joystick control and acoustic transponders
- *Eureka*, 1961 & *Caldrill*, 1964
 - True DP using 3 analog controllers and taut wire
- Markets developed in the Mediterranean and the North Sea
- Commercialization by Honeywell in the late 1960’s
- *Seaway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



DP Equipment Classes



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DP system hardware philosophies

COTS (Commercially off the shelf) versus Proprietary



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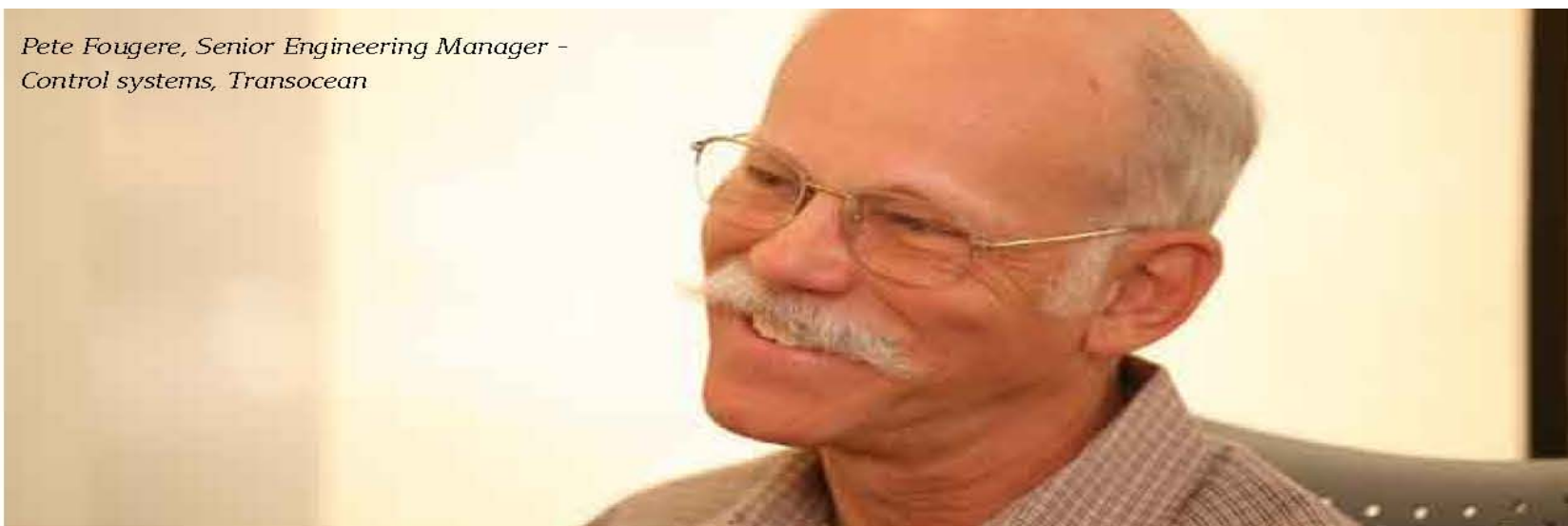
COTS

- 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

*Pete Fougere, Senior Engineering Manager -
Control systems, Transocean*



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.” ■



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Importance of Sensor Input Number of required units



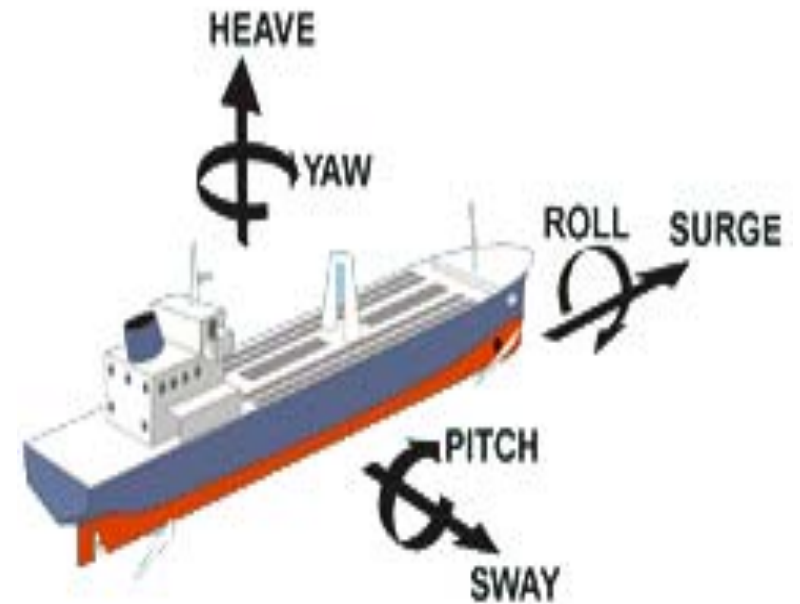
Wind Sensor
Wind speed and direction
measurements input to
aerodynamic model



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



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Today's Optional Position Ref Systems



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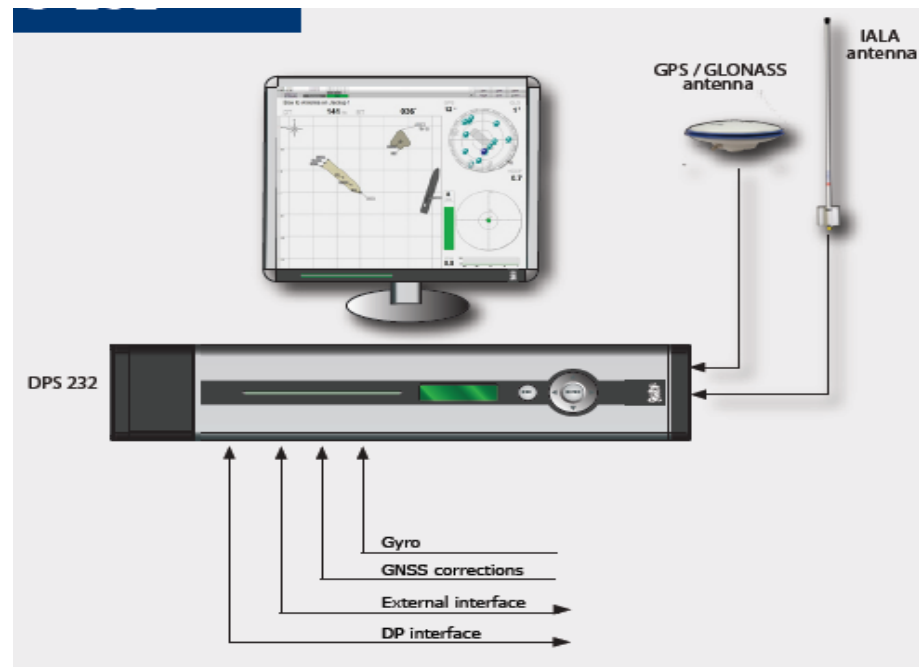
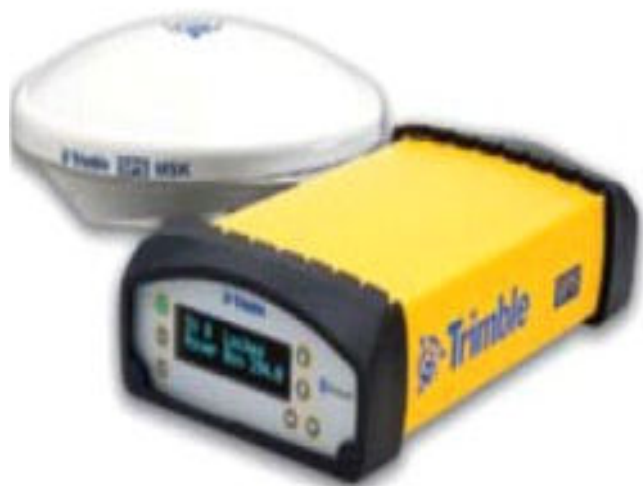
- Differences of GPS systems – true multi referencing
- RADIUS / CyScan / RadaScan / Fanbeam / DARPS
- Acoustic Systems
- Tautwire
- Gangway

THE FULL PICTURE

Differences of GPS Systems – true multi referencing



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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

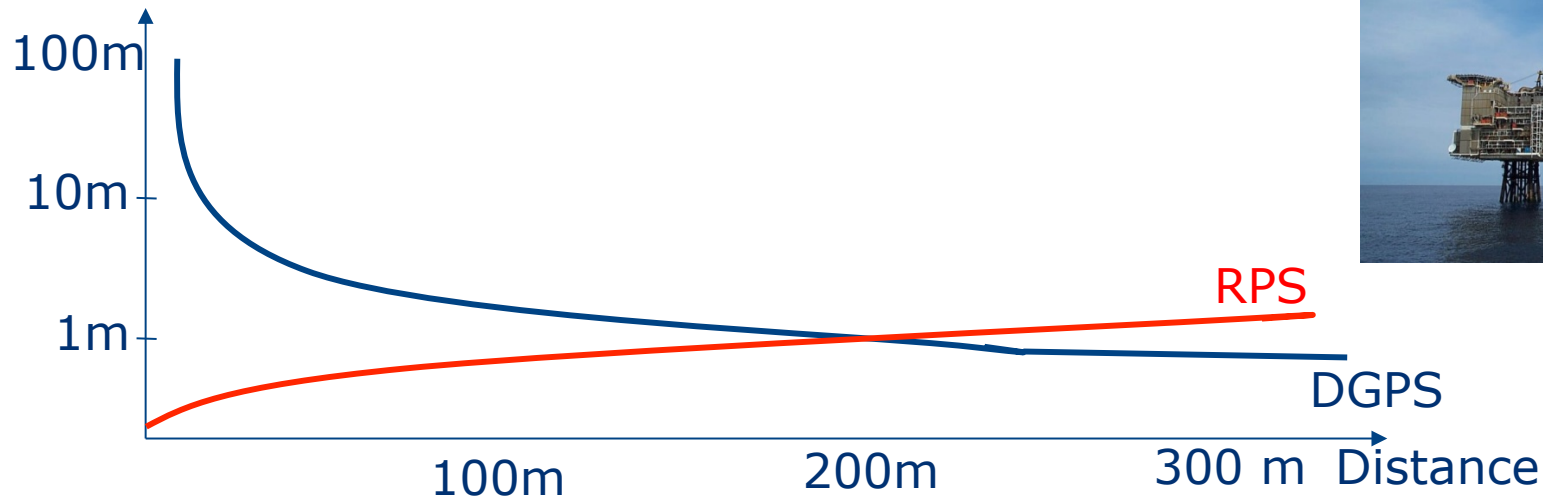
- Beacon mode – Correction received by the combined beacon/GPS antenna

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



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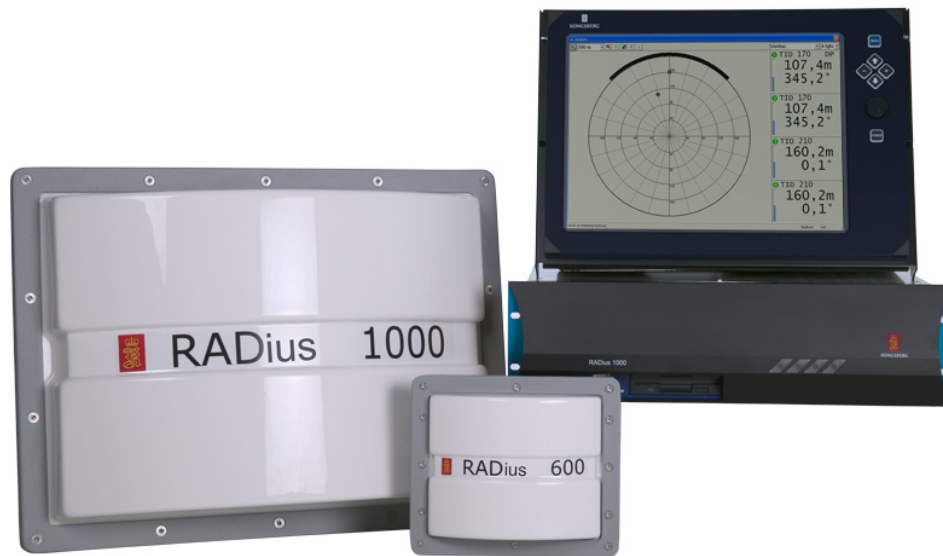


- **Robust and precise relative reference** for DP operations when close to structures or other vessels
- **Complementary** to DGPS e.g. as DGPS tends to have reduced accuracy close to structure or other vessels, Relative Positioning Systems increase accuracy
- **Increasing integrity** by tracking multiple transponders and built-in accuracy assessment and performance evaluation

RADius / CyScan / RadaScan / Fanbeam Cons vs GPS



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- **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.**



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RADius operational advantages

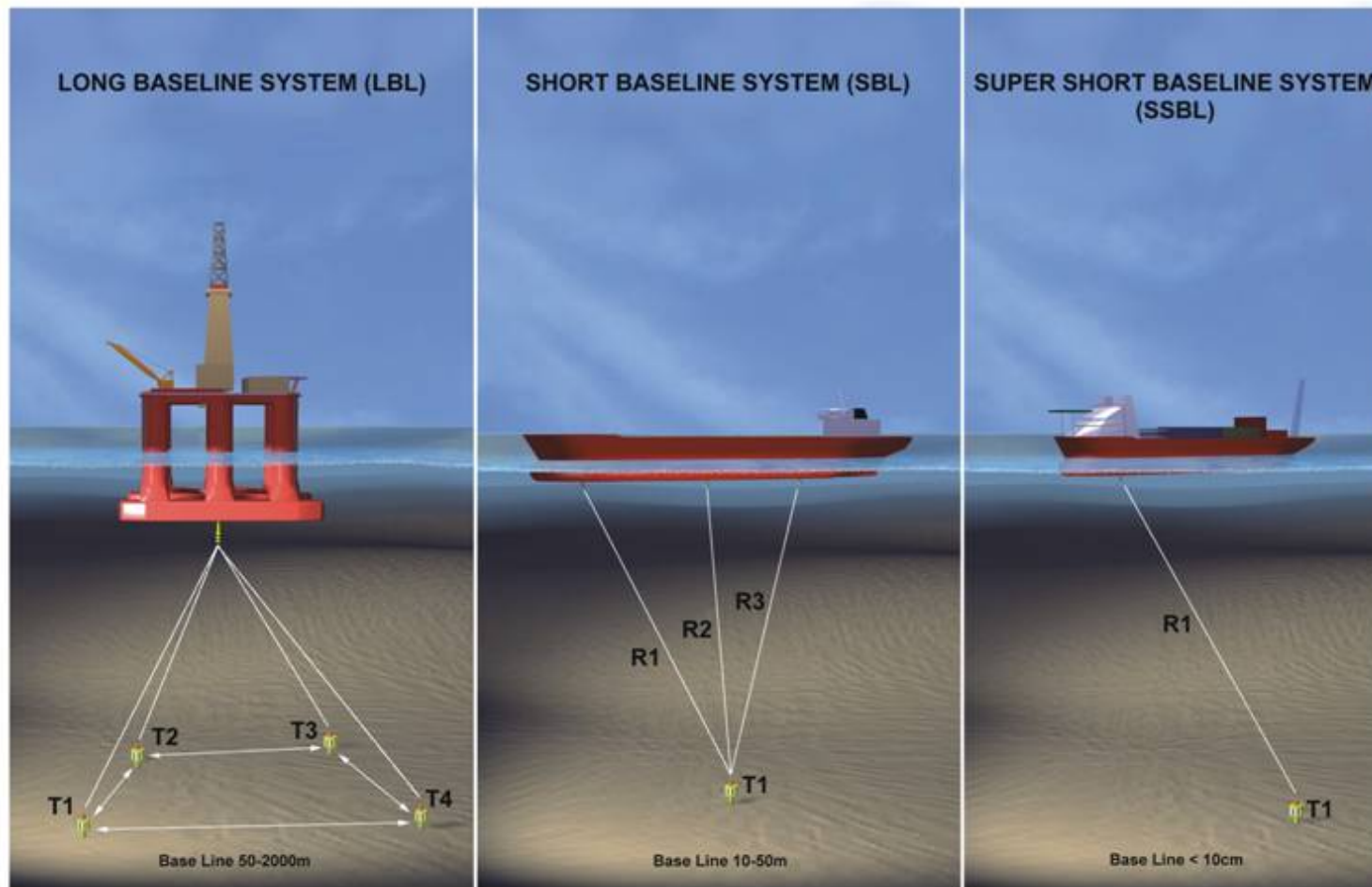
- No moving parts
 - Solid state
 - Low maintenance cost
- Operates in all weather conditions
- Complementary to existing GPS positioning reference system
- Multi user
- Multiple transponder capability
- License free
- Integrity
- 'shadow' free
- False reflection free



Underwater Positioning



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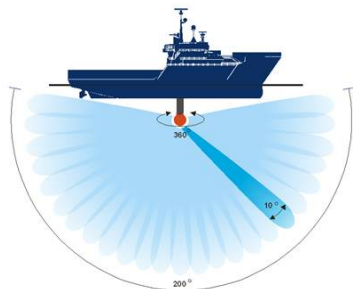
HiPAP family



Gate valve
500 mm
392 mm
60 kg

HiPAP® 500

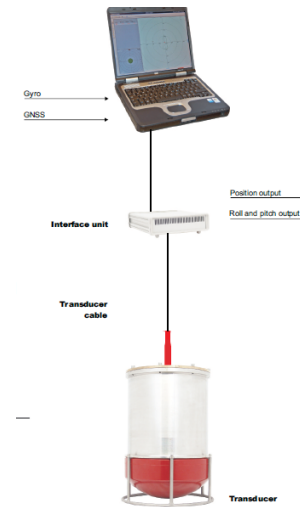
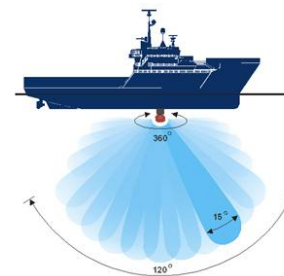
- Acoustic operating area recommended: $\pm 100^\circ$
- Operating range: 4000m
- Range accuracy: $\leq 0.10\text{m}$
- Angle accuracy: $\leq 0.12^\circ$ (0.2% of slant range)



Gate valve
350 mm
320 mm
30 kg

HiPAP® 350

- Acoustic operating area recommended: $\pm 60^\circ$
- Operating range: 3000m
- Range accuracy: $\leq 0.20\text{m}$
- Angle accuracy: $\leq 0.18^\circ$ (0.3% of slant range)



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HiPAP® 350P

- Acoustic operating area recommended: $\pm 60^\circ$
- Operating range: 3000m
- Range accuracy: $\leq 0.20\text{m}$
- Angle accuracy: $\leq 0.18^\circ$ (0.3% of slant range)



THE FULL PICTURE

Light Weight Taut Wire



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- Accuracy 0.2% of water depth
- Remote control from bridge
- Operational limits
 - 300 (500) m depth
 - $\pm 20^\circ$ angle (35% of water depth)
 - Favorite among dive support vessels – visual reference for divers
 - Pipe laying



THE FULL PICTURE

DP Applications



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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

THE FULL PICTURE

Research Vessels



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Supply Boats or OSV's



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Crew Boats



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Dredgers



KONGSBERG



Ocean Tugs



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Anchor Handlers



KONGSBERG



Accommodation vessels



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Pipe layers



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Construction / Heavy Lift Versabar VB10000



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Military



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Military



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Cruise Ships



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Drill Ships / Semi-Submersibles



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Windmill Installation Vessel



USCG Mackinaw Ice Breaker



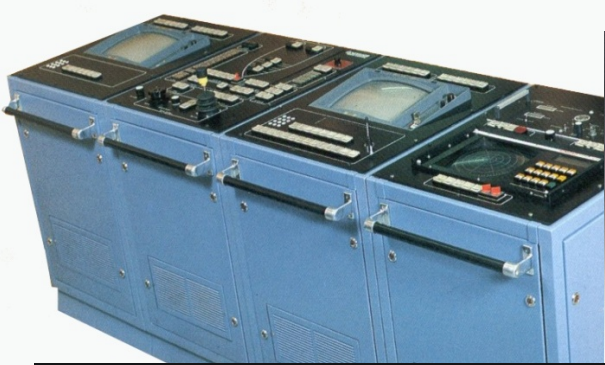
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DP Design – A changing working environment



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K-Master- The DP of Tomorrow.... Today!



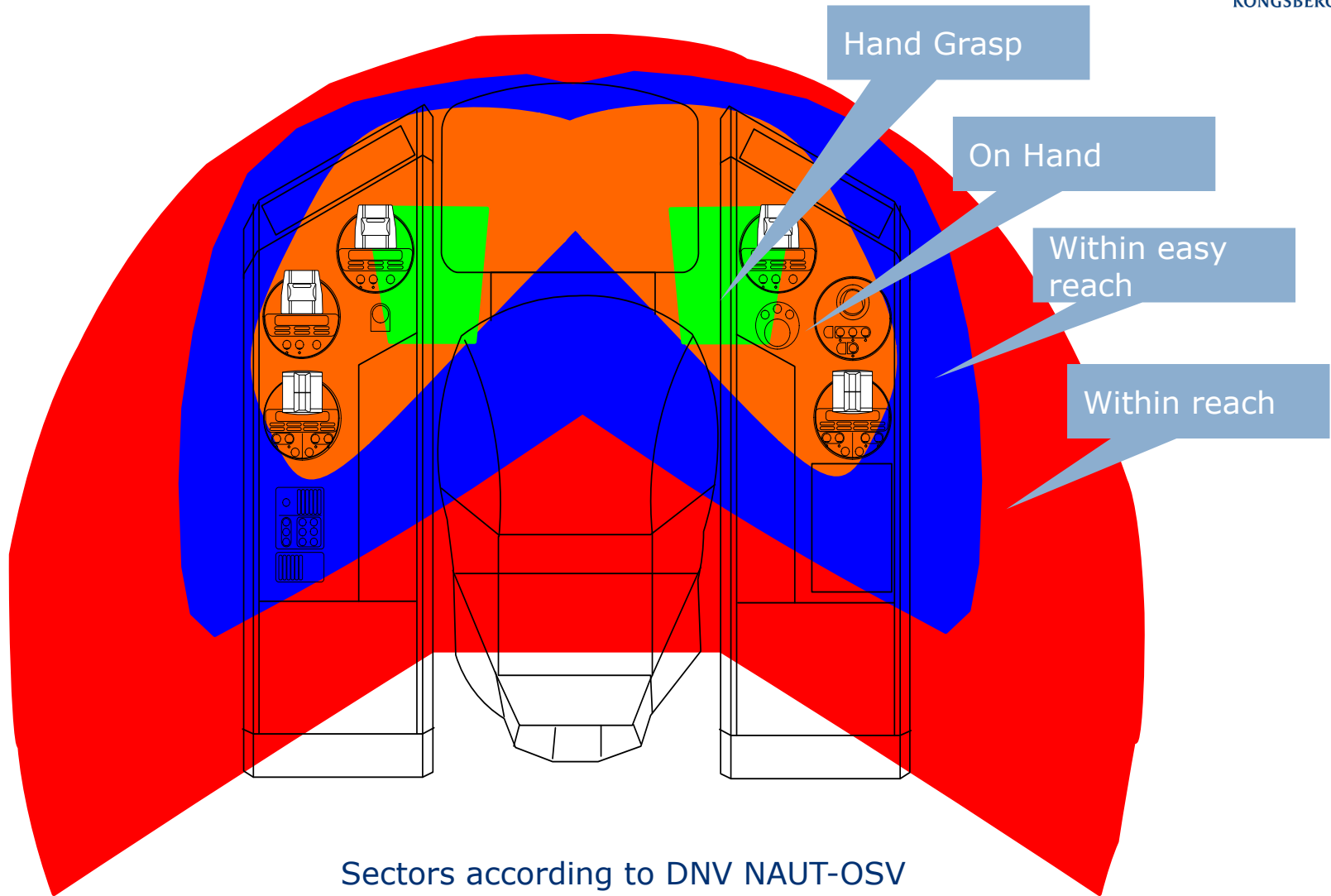
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K-Master ergonomics



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FUGRO Symphony – Aft Bridge – K-Master



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Local Customer Support



Jan Roger Hellerud
President KM Inc

Bert Erik Bjerkli
Regional Manager CS

Nils Even Urkedal
Lead Engineer

Nikita Muller
HR Administrator CS

Key Customers

Mike Knight
Manager rental & subsea

Alario Durkan
Training centre Manager

Jon Holvik
Vice President of Sales

Julie Long
Controller

Tracy Perole
Office Manager

Ove Nyhus
Manager DP and NAV

Eivind Ailing
Manager DP SW

Oyvind Bruvoll
Manager Automation

Robert Glass
Manager Merchant

Barbara Hirsch
AMS Manager

Evelyn Neese
Receptionist

Sam Westhead
Key Support Engineer Navy

Gregory McNeely
Service Coordinator

Bjorn Ole Virje
Lead System Engineer

Wenche Andersen
Technical Advisor

Charlene Almond
Sr Coordinator

Cherlene Almond
Sr Coordinator

Site / Office

DP Projects

DP Support team

DP / ICS HW

ICS and PA SW

Cargo & Sensors

After Market Support

Ronald Johnson
HW Engineer projects

Michael Parra
IT / Tech Advisor HW

Andreas Iversen
Technical Advisor SW

Hayyan Alder
System Engineer

Christopher Ekwelik
Sys. Engineer

Kevin Rice
Sr. Service Tech

Kelly Dempster
Coordinator

Brian Gaudy
Field Service Technician DP

Jason Borvillian
Service Technician

Nathan Ruth
System Engineer

Christopher Ekwelik
Sys. Engineer

Gregory Bury
Sr. Service Eng

Tiffany Carter
Coordinator

Ryan Gauthreaux
Service Engineer

Per Hermundstads
Service Eng

Nigel Casar
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Alejandro Ramirez
Sys. Engineer

James Taylor
Service Tech

Patrice Robinson
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Jason Perito
Service Engineer

Bård Lauritzen
Service Engineer

Veera Ganeshan
System Engineer

Vivek Baner
Sys Engineer

Jason More
Service Tech

Jason Dussell
Coordinator

Jake Leger
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Brandon Nicolai
Service Eng

Krzysztof Gajewski
Sys. Engineer

Vivek Baner
Sys Engineer

Jeremy Henry
Service Engineer

Rene Muñoz
Coordinator

Mario Munoz
Service Engineer

Eric Raahing
Service Engineer

Fabio Florez
System Engineer

Jeffrey Fontenot
Sys. Engineer

Chris Harris
Service Engineer

Nick Rizzuto
Logistics Coordinator

Brad Barth
Service Engineer

Eric Raahing
Service Engineer

Rafael Pinedo
System Engineer

Jonathan Ram
System Engineer

Jared Walker
Service Engineer

Jason Love
Warehouse Administrator

Jessica Neveu
Service Engineer

Eric Raahing
Service Engineer

Adrian Paruss
System Engineer

N.N
System Engineer

Vincent Roman
Field Service Engineer

Harold Marzloff
Warehouse

Eric Raahing
Service Engineer

Eric Raahing
Service Engineer

Matthew Dupre
System Engineer

N.N
System Engineer

Jason Hizenlager
Service Tech

Harold Marzloff
Warehouse

Eric Raahing
Service Engineer

Eric Raahing
Service Engineer

Hayes Waggeman
Sys. Engineer

N.N
System Engineer

Jason Hizenlager
Service Tech

Harold Marzloff
Warehouse

Eric Raahing
Service Engineer

Eric Raahing
Service Engineer

Feras Koran
Sys. Engineer

N.N
System Engineer

Jason Hizenlager
Service Tech

Harold Marzloff
Warehouse

Eric Raahing
Service Engineer

Eric Raahing
Service Engineer

Peter Twil
Sys. Engineer

N.N
System Engineer

Jason Hizenlager
Service Tech

Harold Marzloff
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Eric Raahing
Service Engineer

Eric Raahing
Service Engineer

Stan Radanov
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N.N
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Jason Hizenlager
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Harold Marzloff
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Eric Raahing
Service Engineer

Eric Raahing
Service Engineer

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System Engineer

N.N
System Engineer

Jason Hizenlager
Service Tech

Harold Marzloff
Warehouse

Don Weaver
Logistics Manager

Thomas Thomassen
Training Instructor

Ted Murphy
Sr Sales Manager

Nickie Chesler
Accounts Payable

Rental and Subsea

Training

Sales

Administration Houston

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