Deepwater Construction
ROVs

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Technip
Work class ROVs
Work class ROVs

Definition

- Capable of deploying both a 5-function grabber and a 7-function manipulator
- Able to carry significant packages of tools (e.g. skid packages) subsea
- Able to hold station in high currents > 2 knots
- Worldwide estimate is ~ 1000 systems

Work class ROV configurations matured in early 1990s

Continual technology extensions in every area but especially in data systems
Technip work class ROV fleet

- Operating 35 work class ROV systems to support the construction vessel fleet
- Operating bases UK, USA, Brazil and South East Asia
- (Many additional ROVs systems through partnerships and contracting)
Depth rating and power
Depth rating

- Most work class ROV systems are 3000 m, a few are 4000 m – but how deep do we need to go?

- Hydrocarbon deposits tend to be found in basins and shelves – not the super deep places

- There were 28 major deepwater hydrocarbon discoveries in 2012 – none greater than 3048 m

- There are no known drillship orders for 4000 m, ONGC Ltd of India claim the world record for drilling in 3174 m water depth (June 2013)

- Long period between +3000 m discovery and +3000 m construction – where the bulk of work ROV activity occurs
Current ROVs technology is limited by the strength of the umbilical – beyond 4000 m the self-weight of the armor wire can become unsupportable, or at least inefficient.

Synthetic strength materials can easily extend this - but without the inherent robustness of steel armor wire.

Overall it seems that the bulk of future work class ROV activity over next few years is going to be at less than 4000 m – a depth where the ROV technology is already present and proven.
How much power?

Work class ROV power is usually expressed as the output at the electric motor shaft.

Early ROVs had 25, 50, 75 hp. Current generation are never under 100 hp and sometimes to 200 hp.

150 hp matched to appropriate thrusters gives more than 1 Te of thrust and will give more than 3 knots of station keeping ability. (This can be greater than the DP capability of the construction vessel).

Controllability through the power range is essential as most ROVs will be working in low thrust conditions most of the time.
Autonomous work class ROVs?
Autonomous observation ROVs

Autonomous Underwater Vehicles (AUVs) are observation class ROVs that have revolutionised the survey market. Their flying path precision and data quality are benefits in themselves.

They offer an attractive cost model compared to towed or tethered systems.

Sophisticated software gives target recognition. It is possible to recognise work scenes and intervention tasks.

But can they do work intervention tasks?
Autonomous work class ROVs?

Three challenges:

1. Need for real-time control – there is no high speed through-water communication technology capable of carrying video

2. Power – onboard batteries cannot store the energy levels required for robotics

3. Endurance – work class ROVs spend long periods in hover mode which requires high power consumption (compared with most constant speed ultra-efficient AUVs)
**Hybrid AUV – the Swimmer**

- The Swimmer* is an autonomous module that deploys without an umbilical.

- When at the subsea structure it plugs into the local power/data source.

- The ROV flies out from the deployment module on its tether.

- System was first tried in early 2000s and is once again being considered for new field developments.

* The Swimmer is a Cybernetix (Technip) patented concept.
ROV personnel
Operator personnel

Do we have a problem?

- After a brief hiccup around 2008/2009 the market demand for new ROVs has been strong and this has led to a high demand for personnel
- There is natural wastage as key personnel progress to offshore/onshore management roles
- Salary competition by itself will not fill demand!
- IMCA estimate a shortfall of 2000-3000 ROV persons over next 3-5 years
Operator personnel

Do we have a problem?

- The traditional source of trainees (ex-UK Armed forces) is limited
- All the major ROV operators have some structured training for core skills but there is no substitute for on-the-job experience and competence development
- An initiative is developing between contractors to have a shared training school
- The challenge is, as always, the cost. ROVs are expensive systems and training needs to be on today’s technology to be effective
Operator personnel

Do we have a problem?

- The increasing sophistication of the systems with powerful data networking requires a higher level of technical skills than the previous generation of ROVs.
- The same also applies to the hydraulic systems with fully proportional control functions.
- The development of ROV simulators has been a major help for piloting and manipulator skills - but diagnostic and maintenance skills are also essential.
- End clients need to accept the need to have different levels of skills – i.e. trainees - in ROV crews offshore.
Respecting the environment
The marine environment

- The number one concern is oil spillage
- The events at Macondo have sharpened focus on a long standing issue: loss of oil from ROVs during operations
- Significant differences in the world regions e.g. USA/UK/Canada which are all high focus areas with mandatory reporting of every incident but some important differences, which include:
  - Whether it causes a ‘sheen’ on surface of the water (USA)
  - Toxicity (USA)
  - If it is planned or not (UK)
  - Consequences of the incident
  - The tier of response* (UK)

* The volume of ROV oil is insufficient for a pollution control response
The marine environment

Can we use “enviro” oil?

- There are now some proven alternatives to mineral oils that are non-toxic and bio-degradable
- But … modern mineral oils are not inherently toxic either
- Bio-degradability has the negative of this potentially happening inside the ROV

However… the reporting requirements are unchanged: an enviro oil spill has to be reported

Maybe there will be a pure-water hydraulic ROV one day – there should no concerns about spilling water! - but the components to do this are not available yet
The marine environment

Can we use “electric” ROVs?

- By electric ROVs we mean systems with electric thrusters (instead of hydraulic motors)
- However, “electric” ROVs also use oil in their electronic boxes and motors
- Oil-free robotic solutions are not available
- Very few oil-free tooling solutions exist

- However… the reporting requirements are unchanged. An oil spill has to be reported
The marine environment

What about the existing ROV fleet?

- There are a very large number of work class ROVs in service, almost all hydraulic. What can be done?
- Adopt a “clean deck” principle – ROVs in hangers, zero tolerance of leaks, always work over bunds (fluid collection trays)
- Hose fittings are the most common leak source
- All major contractors now operate:
  - Hose registers
  - Replacement cycles
  - Best practice from onshore and full Pressure Equipment Directive (PED) compliance
  - Scheduled maintenance
- Prevention of spills is always better
Technology gap
Technology gap

Replacing the person in the water

- ROVs have replaced divers for deepwater operations but are still being used in shallower waters – why?

- Some existing infrastructure is diver only

- The inherent dexterity of a person and ability to solve problems – even when under pressure and encumbered by a diving suit has many advantages

- ROVs can, and do, manage every conceivable underwater operation but need much more forward planning and engineering

- In the last 20 years, the ROV robotics have hardly changed at all. Why can’t we deliver robotic solutions that can more comprehensively replace the “person in the water”? (discuss)
Thank you