There has been much discussion recently about robots taking over the duties of human labourers in the deep underwater workforce. Which prompts us to ask: what is it like to be a saturation diver? Certainly YAQUB AL-OMOUD seems in no hurry to hand over to the machines, even if he is…

UNDER PRESSURE

Above: The dive-helmet weighs close to 15kg and is fitted with a camera and audio set for communicating with the dive vessel.

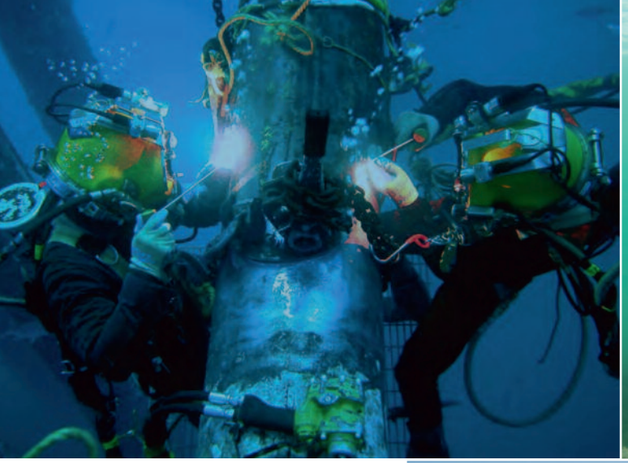
LATITUDE: 27° 46 13, LONGITUDE 48° 52 52. Sunlight winks and dances on the azure waters of the Arabian Gulf, and the already-hot morning air – well on the way to the day's high of 43°C – carries the sharp tang of salt as the helicopter delivers me to the dive-spot here at the port of Tanajib, 150 miles north of Dammam, Saudi Arabia.

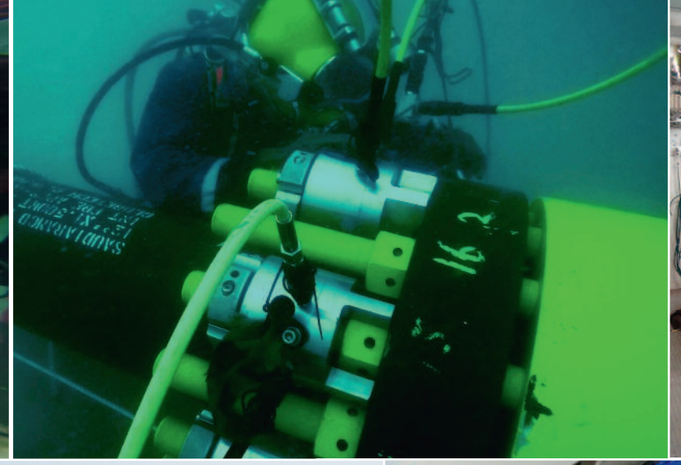
I'm not on holiday – though every day's an adventure. I'm a diver in the Underwater Inspection and Repair Unit (UIRU) of Saudi Aramco's Marine Department.

The department has a fleet of vessels that support the exploration, production and transportation of oil, in and around the company's concession areas.

Twenty-four hours a day, 365 days a year, we work from a number of the kingdom's ports.

My job is to ensure the integrity of Aramco's offshore subsea/underwater assets, including barges, ships, platforms, wells, rigs and subsea pipelines, by conducting inspections and any necessary maintenance and repairs, such as





welding – and even offshore construction work.

This job serves two passions for me. First, it meets my need for something bigger than myself. In some small way, what I do touches someone else along the spectrum of human experience.

So whether our energy finds its outcome in the fuel that gets you where you want to go, in the plastics that make your car safer, or even the coating on a medicine that makes you well – I'm glad to have a hand in it.

My other passion is the sea, and not just for the spectacular coral reefs and colourful marine life beneath the waves. I work in deep water. It is at once a vast frontier that is completely inhospitable to humans, and a global web of the intricate, vital eco-systems on which all life on Earth depends.

It's a tough, fulfilling and exciting job, and I'm lucky to be able to do what I love.

A COMPANY HELICOPTER drops me directly at the oil or gas installation where my awaiting vessel is stationed, or at the nearest port to board my designated vessel. I'll stay on board the vessel for an eight-week-long shift, five days on and two off, before returning home to my family for about eight weeks. Rest, recover and repeat.

The procedure for becoming an Aramco diver is challenging, and only a handful of applicants make the cut. Fitness is the first hurdle in applying for the job, and certainly for doing physically demanding work with heavy tools and equipment in an extreme environment.

Applicants undergo stringent medical and physical evaluations, followed by a three-month orientation programme devoted to onboard observation, and intensive safety and decompression training.

Another 90-day training session follows for specialised oil and gas industry diver training and competencies in areas such as hydraulic and pneumatic power tools, underwater welding and cutting. We also have to be skilled in our inspection and repair work, and incredibly safety-oriented, prepared for every contingency.

Earlier in my career I worked to a maximum depth of 50m, breathing compressed air. I would access the subsea work area by being winched down in a 2 x 1m mesh Launch & Recovery Systems (LARS) cage to handle one of the 20 to 40 requests coming in daily.

A diving supervisor monitored my dive at every stage, from pre-submersion to decompression and resurfacing.

My diving helmet featured a camera tracking my every move in real time, and the diver umbilical held my diving gases and wiring for my light and radio communication, with the surface dive panel overseeing the operation.

Top, from left: From subsea pipelines to rigs, platforms and vessels, the divers perform a wide range of duties including welding and inspection. The UIRU divers are on standby 24/7.

Above: One of the team is given assistance in preparing for a dive.

Working as a commercial diver breathing compressed air, I accrued the necessary hours at various depths to achieve my present qualification as a "mixed-gas bell diver", more commonly referred to as a saturation diver.

TO MIX METAPHORS, being a sat diver working as deep as 300m is the pinnacle of diving work.

There are relatively few of us around the world, based on the rigorous professional certifications and the specific physical and mental capacities required to be able to dive for extended hours at this great depth.

Our unit has five vessels that are deployed according to the job requirements, logistics, complexity – and depth. Two diving support vessels (DSVs) operate in shallow water of 2.5-15m; two other DSVs operate in 15-50m; and one Saturation DSV operates at 30-300m.

I'm on the Sat DSV. When I'm not performing my diving duties deployed from the diving bell, I'm in a high-pressure saturation chamber with up to six other divers.

Pressurised to about the same depth as our diving working depth from the bell, the hyperbaric chamber system allows us to breathe heliox – a mixture of oxygen and helium – to achieve inert-gas saturation within the body's tissues. That's usually a 24-hour process.

We sleep and relax in our saturation chambers, attaining equilibrium with the depth's ambient pressure.

Meals, prepared on site, are delivered through a pressure-equalisation hatch (referred to as the medical lock).

Because of the very light density of helium, our voices are remarkably higher-pitched than usual, making us sound like a cross between Mickey Mouse and Donald Duck. Voice descramblers are used to aid clear communication between us and the life-support technicians and diving supervisors controlling the systems on which our lives depend.

We wear hotwater-circulating wetsuits that pump water around the inner section of the suit for warmth in the deeper, colder depths.

Typically, air divers work from 10 to 120 minutes at 1 to 50m depth, then take some 40 minutes to gradually resurface to prevent decompression illness.

BESIDES ENSURING life-preserving occupational safety for divers, the decompression technology delivers huge time- and cost-saving efficiencies for the operating industry and customers, by reducing or eliminating the need for decompression stops other than depressurisation at the end of the assignment.

Clockwise from top left: At work under water; diver Yaqub Al-Omoud prepares to enter the saturation chamber, which allows diving for longer periods and greater efficiency in operations. It will be his home for six to eight weeks.

Twenty-four hours of decompression for every 100ft of pressure is the rule of thumb. The time efficiency and direct cost relation make this a safe, controllable and effective method of work production.

So a typical decompression would take around three days to complete at the end of our month in the chamber.

Getting to work is as simple as passing through an airlock (or transferring under pressure) from my chamber to the closed diving bell, which lowers my team (for a total of two to three of us in the bell) to the pitch-dark seabed or the required depth.

One or two of us then deploy from the bottom hatch of the bell and into the water, while the second or third team-member remains for safety cover, and to operate the internal gas- and pressure-valves inside the bell.

Once the operation is finished, the bell hoists us back to the vessel. The team then rotates prior to the next bell excursion.

Working on the ocean floor is like being in deep space – not surprisingly,

astronauts use saturation diving to train for their missions.

In fact, NASA was close to nominating divers for training as space-walkers rather than pilots, because of their familiarity with zero gravity and strong ability to carry out engineering and repair tasks in harsh environments.

A range of technologies, equipment and practices is required to make work in this setting not only possible, but safer and more productive.

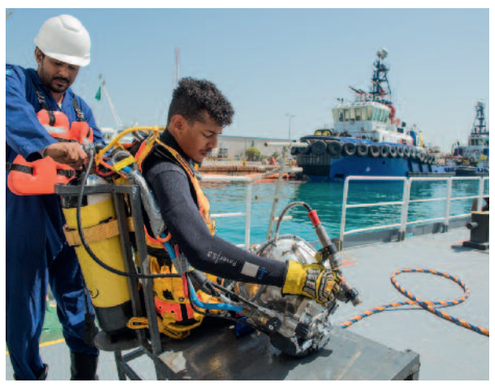
The oil and gas industry has to develop solutions to sustainably find and produce energy to meet growing demand without increasing risk to life or assets.

For operations closer to the surface, Saudi Aramco has developed a robotic technology that makes it possible to perform shallow-water asset assessments remotely from aboard the dive vessel.

Above: More members of the dive-team.

Right: Marine-life sightings have to be incidental to the task at hand.

Below: Preparations for a dive.



This Shallow Water Inspection and Monitoring Robot, or SWIM-R, can carry out visual inspections, marine-life cleaning, ultrasonic thickness readings and cathodic protection measurements while circumventing the obstacle and access issues that can pose problems for divers. The technology has been adopted by other ROV companies for its design philosophy.

I believe this innovation is just a hint of things to come, and that technology will continue to uncover ways to make the data collection, inspection and repair work in support of offshore oil and gas exploration more efficient, more effective and safer – while also protecting and even enhancing the offshore environment.

For thousands of years, these Arabian Gulf waters were plied by divers equipped with only a nose-clip, basket and length of rope, in quest of pearls – a rich commodity.

Working in the offshore sector, I feel that I'm part of a time-honoured seafaring tradition.

Like those hardy souls, I have a role in harvesting something of great value and importance to people everywhere – the vital energy resources from these forbidding yet life-affirming depths.