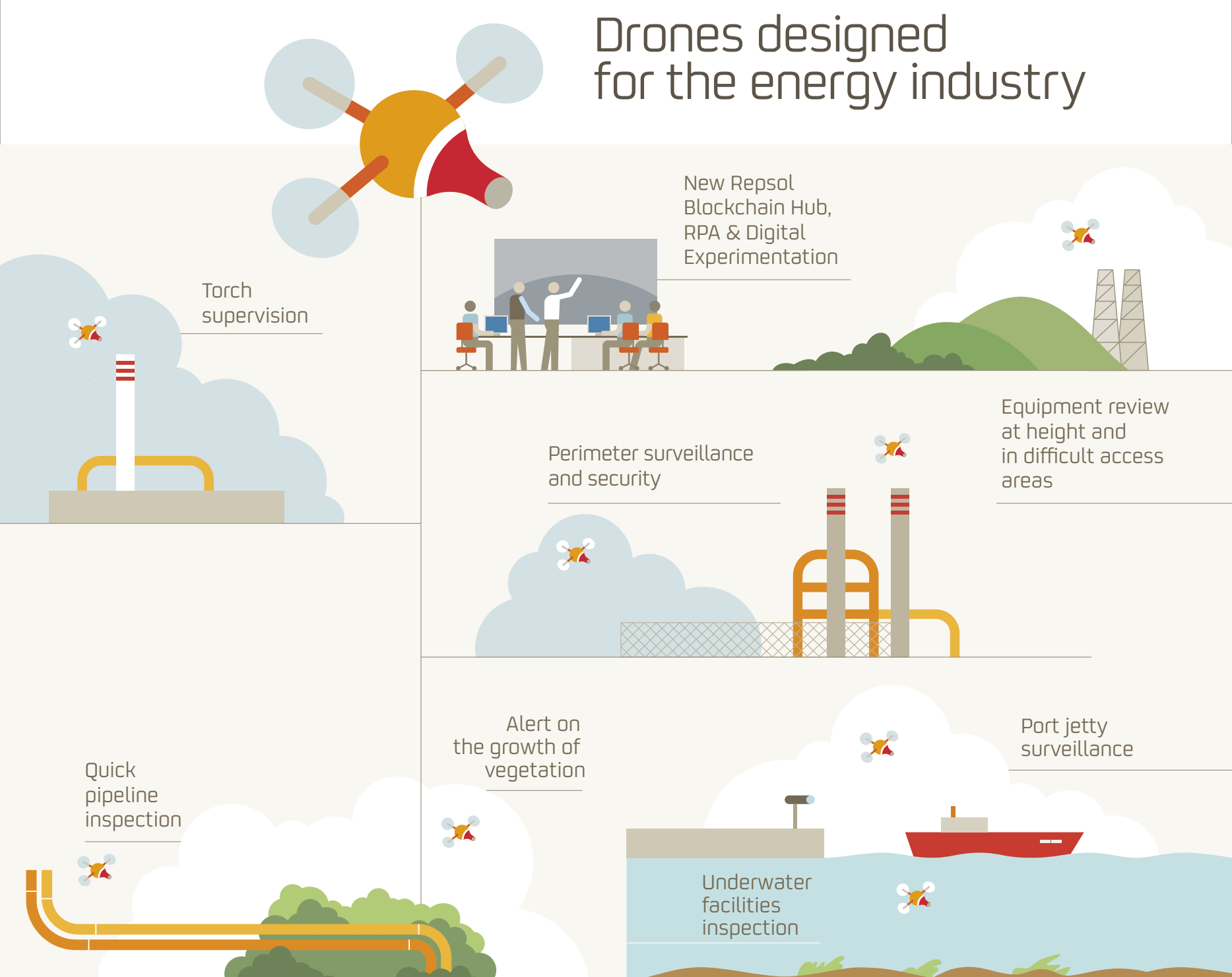


Drones designed for the energy industry



Remote operations support and mapping are among Repsol's priorities

Repsol is developing a program to analyze and test the applications of drone technology on its businesses in the short term. Reviewing submarine installations with an autonomous vehicle and reviewing complex piping structures with drones are the two latest concept tests that have been done with this technology, which can improve effectiveness and efficiency as well as reduce occupational risks.

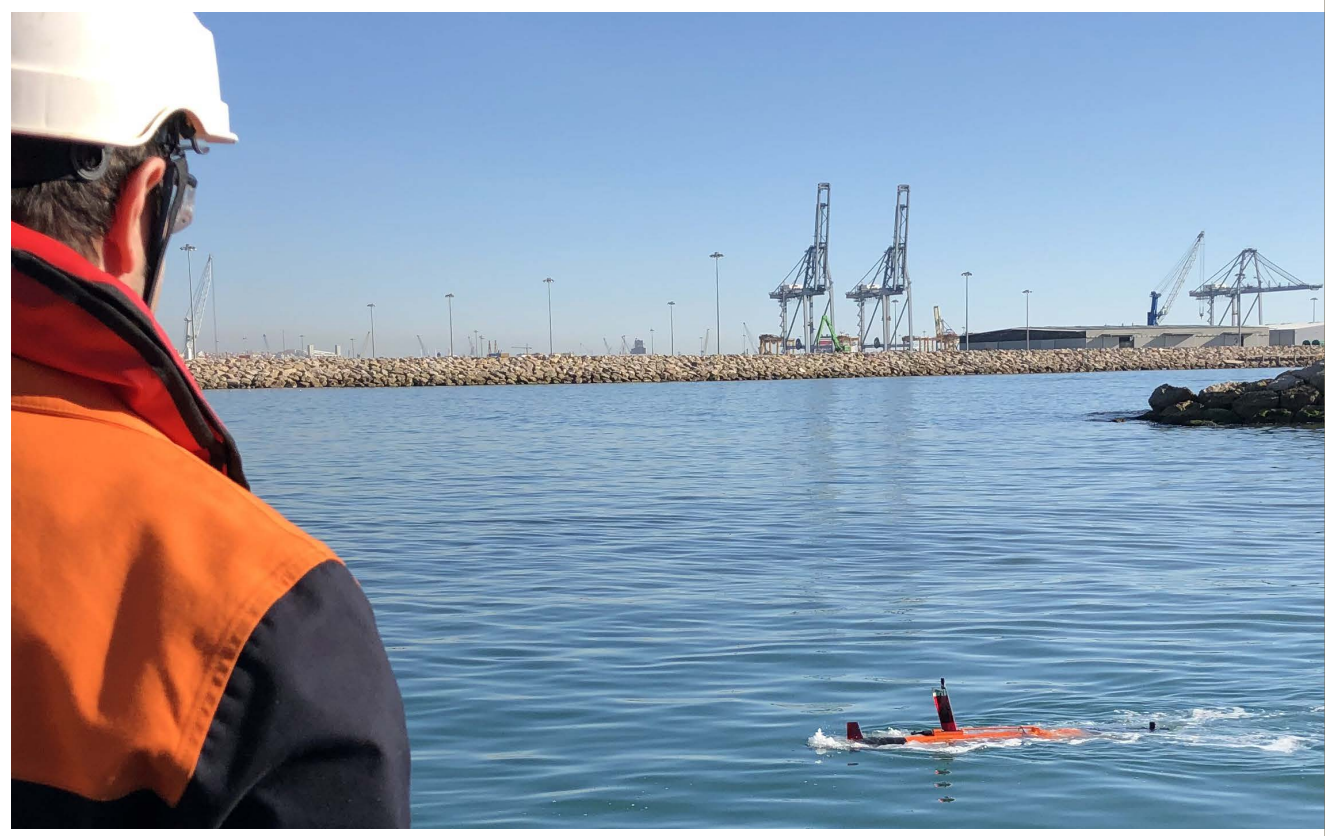
"Inspecting equipment in areas that are difficult to reach, supporting operations remotely, surveillance and security tasks, and mapping are the functions where this technology may add value for us," explains Eva Gómez, Digital Advisor of Hub Blockchain, RPA & Digital Experimentation at Repsol.

Drones already offer some features that allow a wide range of cameras and sensors to be installed and adjusted to the collect the information desired. The challenges include applying artificial intelligence and data processing "with tools that allow for automatic, reliable, and fast analysis, one of the lines of work that we are developing with the Repsol Data Analytics Hub."

Submarine inspections with Everis ADS

The first Repsol test with an autonomous underwater vehicle (AUV) was carried out in January at the Tarragona industrial facility, in collaboration with everis Aerospace and Defense (everis ADS), a tech company with a division specializing in unmanned systems. The aim was to analyze its performance in visual inspections of the port's jetty and sealine, the two-kilometer line of piping connecting the refinery to the ships.

"We use a light AUV that is easy to deploy," explains Elisabeth Pérez, Program Manager at Everis ADS, "that can travel several kilometers completely autonomously and delve up to 100 meters deep." The drone was equipped with video cameras and sonar to reproduce a task that is currently done by a team of scuba divers.



For Elisabeth Pérez, subsequent dives showed "that the AUV used makes it possible to supplement the scuba team operations. Underwater position precision, without GPS and other GNSS systems, will have to be improved for better proximity to the infrastructures, as well as real time image transmission."

"Although the test hasn't allowed us to make any conclusive decisions yet," Eva Gómez states, "we are going to keep working on the idea because it has potential for preventive maintenance on sub-aquatic structures, movement on the seabed, and early detection and quantification of leaks."

Machine learning to find corrosion

Another concept test, this time at the Puertollano industrial facility, with a flying Honeywell drone that had a high resolution camera and thermal sensors on board, sought out "a quicker, more frequent inspection" of the piping racks at this refinery, large structures at height, the review of which requires an industrial shutdown and the installation of costly scaffolding.

The section inspected is 350 meters long with up to three levels of piping, in a test "that includes 'training' an algorithm that uses machine learning to detect corrosion automatically," explains Gómez. To do this, a team of highly-qualified specialists in operations' reliability, corrosion, and data processing from both companies was formed.

Community of drone lovers

Through workshops with specialists from all the countries where Repsol operates, the Exploration and Production (E&P) business identified the applications that "are ready to be tested, such as pipeline inspection, thermal mapping, and alerts on the growth of vegetation, freight transport between our facilities, and perimeter surveillance."

Collaborative environments such as the Drone Lover Community are also promoted from the Hub, "the amount of people at Repsol who work on very different topics, but share a passion for this technology and also identify potential uses for their own tasks is surprising." This is the case, for example, with one of the company's geologists who is also an expert drone pilot, "with whom we've been working to open a line of work for applications in his field, such as taking aerial photos of geological outcrops to be used to build digital models."



Robotic arms could do work from a drone if a flaw is found

Artificial intelligence and robotic arms

"We currently have flying drones with great capabilities," ensures Elisabeth Pérez, but progress must be made "on miniaturizing the sensors, on autonomy, as well as on the systems and procedures that allow the operations to be integrated within the airspace." For Eva Gómez, the use of vehicles with artificial intelligence on board that automatically corrects flight operation to make it truly optimal and the integration of robotic arms to work on infrastructure "provide a very competitive advantage."

"Regulations are also key to this technology being expanded," continues Gómez. In Spain, its use is regulated by Royal Decree 1036/2017, "however most operations require specific authorizations, which slow the progress of the sector," she indicates. In Repsol's case, "we have a few restrictions about flying over our refineries, except in Puertollano, as they are all close to airports, which are highly regulated areas." In response to this technology's potential and while different tests and analyses are carried out, the company is preparing to use drones frequently in its operations, for which the service model that will regulate the internal use of drones has already been designed.

Collaboration between energy companies, manufacturers, regulatory bodies, and technological partners "is essential to continue applying drone-based solutions focused on our industry. At Repsol, we would like to participate in an ecosystem that co-develops this technology, making our know-how and facilities available," concluded Eva Gómez.



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