From Apollo to Cognac

An aerospace-derived training simulator, an important aid to successful installation of the world's tallest oil platform, highlights spinoffs in the field of energy

Last year Shell Oil Company started oil and gas production from a new offshore platform called Cognac, located in the Gulf of Mexico about 20 miles off the coast of Louisiana. The world's tallest oil platform, slightly taller than the Empire State Building, Cognac represents an investment of some $800 million by Shell and 14 other members of the Cognac consortium. Its emplacement, at an unprecedented water depth of more than 1,000 feet, involved more than six years of development and construction effort, a job termed by a trade journal "as much a breakthrough in the offshore industry as (Neil) Armstrong's first step on the moon was to space exploration."

Coincidentally, space technology played an important part in the Cognac project. Like NASA's landings on the moon, deepwater siting of a structure as large as Cognac was something that had never before been done. The magnitude of the job dictated use of a number of high technology systems, including a training simulator which allowed installation crews to practice beforehand the complex tasks they would have to perform. Shell awarded the simulator contract to Honeywell's Marine Systems Center, Seattle, Washington. In the resulting Cognac Crew Trainer and Simulator, Honeywell incorporated technologies earlier developed under NASA contract for a lunar landing simulator.

Because of Cognac's great size, it was necessary to build the support "jacket" in three sections—the top section alone is larger than any previous Gulf structure—and move them by barge to the Cognac site. The installation plan called for four major operations. First, the jacket's base section, suspended between two derrick barges by multiple cables, was to be water-ballasted and lowered to a precise spot on the sea floor; there it would be anchored by 24 huge piles driven deep into the seabed by a massive underwater hammer remotely controlled from the primary barge. Next, the midsection was to be lowered and mated to the base section by means of a docking mechanism—docking poles in the legs of the midsection which fitted into "mating guides" on the base section. In similar fashion, the upper section of the jacket would be mated with the midsection. Finally, the 2,000-ton working deck would be constructed atop the completed jacket.

Although it sounds simple enough in brief outline, the installation job was enormously complex. It required an elaborate array of informational and display equipment, a key element of which was a Honeywell acoustic position reference system, wherein computer measurement of signals from transponders on the seabed allowed continuous determination of the relative positions of the derrick barges, the jacket sections and the target site on the sea floor. A radar ranging system insured that the derrick barges were always properly positioned with respect to each other. For docking sections together, the acoustic system provided initial reference information and underwater video cameras permitted visual sighting for final alignment. A telemetry system relayed data from a variety of sensors on such vital considerations as surface winds, wave heights and current strength; the amount of water ballast in the legs of a section being lowered; the tilt angle of a submerged section, which had to be controlled within a fraction of a degree; the status of the barge-mounted winches, how fast they were paying out cable and the amount of tension on each cable. Processed by several computers, all this information was fed to displays in the control center on the primary barge.

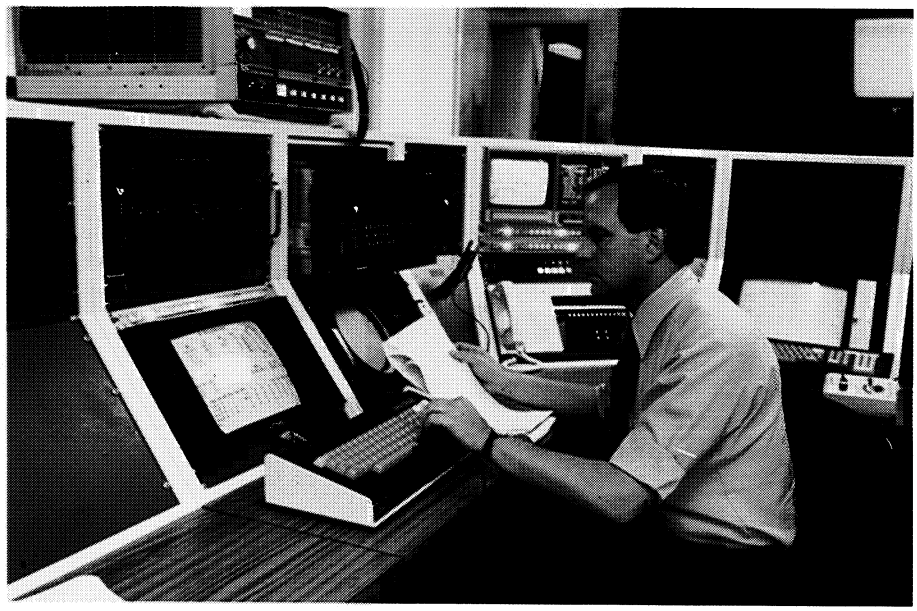
The Honeywell-developed crew trainer was capable of simulating each event involved in the installation task, for example, positioning the surface vessels, ballasting and lowering the sections, pile driving and maneuvering a section into position for docking. All simulator controls and displays reacted exactly as they would in the real operation. The system also simulated emergencies to prepare the crew for such abnormal occurrences as unexpected changes in wind or current, the snapping of a cable, loss of critical sensors or improper operation of ballasting valves. Beginning in 1977, Cognac installation crews used the trainer/simulator repetitively to familiarize themselves with the vast amount of data displayed in the control center and to practice the sequence of events involved in each of the major operations.

Cognac's base section was positioned in the summer of 1977; installation of the mid and top sections of the jacket was completed a year later, then the two-acre deck and a pair of drilling rigs were added in the latter part of 1978. With the completion of a pipeline in mid-1979, oil began flowing from Cognac to Shell's facilities at East Bay, Louisiana. Not until 1983, however,

At a site in the Gulf of Mexico, one section of the huge Cognac oil platform is launched from its transport barge. The section was then water-ballasted and lowered by cables to an underwater mating with another, previously submerged section.

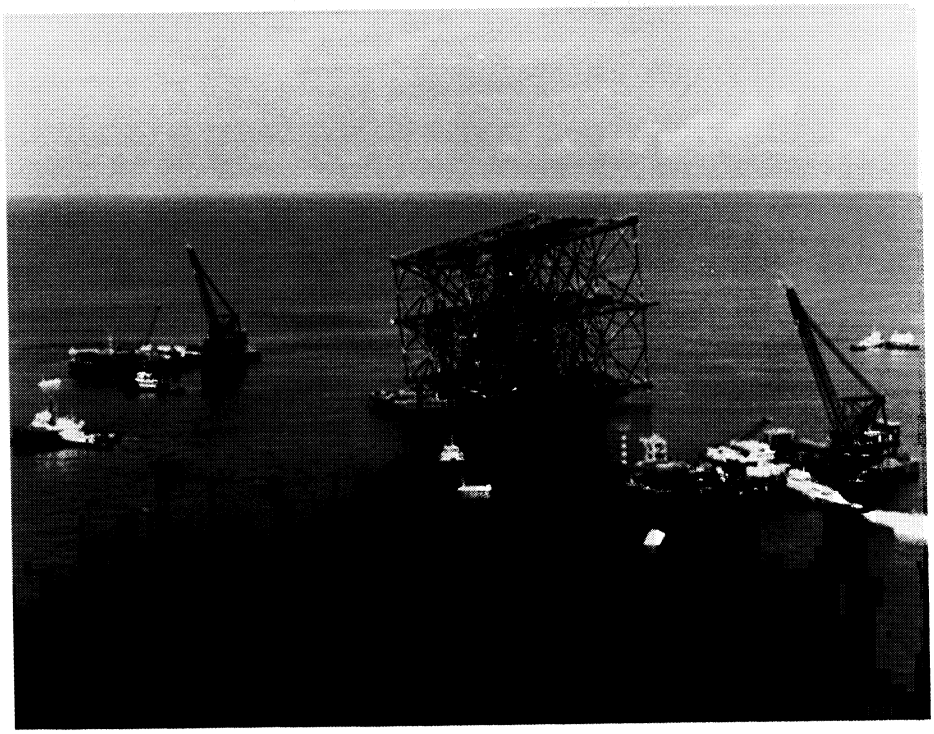
will Cognac reach full production, estimated at 50,000 barrels of oil and 100 million cubic feet of natural gas each day.

Considering the extraordinary nature of the job, Cognac's installation was carried out in remarkably smooth fashion. The Honeywell trainer was a major contributor, according to many of those involved, because it instilled in installation crewmembers confidence in their ability to handle the exacting tasks assigned them. In fact, some said, the actual operations seemed easier because the training sessions had been so demanding.



The highly complex job of installing Cognac's support "jacket" under water more than a thousand feet deep was directed from this barge-based control center. To enable crews to practice in advance difficult tasks never before accomplished, Honeywell Inc. developed a system for simulating the various underwater operations. In training sessions, the displays and controls pictured reacted exactly as they would in a real operation.

Taller than the Empire State Building, Cognac was built in several sections at Morgan City, Louisiana. Here the 8,000-ton midsection—one of three segments of the support jacket—is being towed through the Louisiana bayous to the Cognac site.



At the Gulf of Mexico installation site 20 miles off the Louisiana coast, Cognac's midsection is readied for launching. The structure was lowered by winches on the two derrick barges and joined to the base section anchored to the sea floor. Later the topmost section of the jacket was similarly lowered and mated. Operations were remotely controlled from the primary barge shown in the foreground.

These photos illustrate one of the many simulations performed by the Honeywell crew training system. The device at right models the method by which 24 giant piles—each more than 600 feet long—were driven deep into the seabed to serve as anchor posts for Cognac's support structure. The piles had to be lowered by a special elevator and maneuvered by operators in the control center to a mating with guide frames on the sea floor. The elevators were equipped with instruments whose signals reported the position of the descending pile relative to the guide frame. A television camera fixed to the pile provided visual confirmation on the console shown below. Repetitive simulations of this and other operations contributed significantly to Cognac's successful emplacement.