

A propulsion system for boats and small ships leads a sampling of spinoffs in the field of transportation

Space-Derived Waterjets

The American Enterprise, a high speed crewboat and supply vessel for the offshore oil industry, is propelled by three Rocketdyne waterjets. The propulsion units are direct spinoffs from the company's line of turbo-pumps, which feed propellants to rocket engines on space launch vehicles.



On Apollo lunar missions, the five mighty engines of the Saturn V moonbooster delivered an aggregate launch thrust of more than seven and a half million pounds. In producing thrust of such enormous order, the engines gulped liquid propellants at the incredible rate of 200,000 gallons per minute. The important job of feeding propellants to the engines under high pressure was handled by systems called turbopumps.

The turbopumps in Saturn V were the most powerful ever employed in space launches, but pumping systems of lesser capacity are used in most liquid rocket launch vehicles. The principal manufacturer of high-performance space-use turbopumps is Rocketdyne Division of Rockwell International, Canoga Park, California, which has built more than 7,000 of them. Now Rocketdyne is producing direct derivatives of its space-developed turbopumps for nonspace applications. Called Powerjets, they are propulsion systems for high speed boats and small ships.

The company manufactures three types of Powerjets, different in size and propulsive output but similar in principle. Water scooped into an inlet beneath the boat is channeled through the waterjet pump, which increases pressure then expels the water at high velocity from the rear of the vessel to provide propulsive thrust.

The waterjet provides reverse thrust for slowdown by diverting the waterflow forward. For steering, the waterflow can be directed to either side by controlling the position of the

waterjet's outlet nozzle; this allows elimination of the rudder, which in turn permits boat operation in very shallow water. The simplified design of the waterjet pumps also contributes to ease of maintenance.

Rocketdyne's mid-size pump, Powerjet 20, has demonstrated reliability in more than 26,000 hours of operation aboard The Boeing Company's Jetfoil passenger boats, whose design also incorporates other aerospace technology. Two Powerjets, driven by Detroit Diesel Allison gas turbine engines, propel the Jetfoil at 45 knots. Capable of carrying up to 300 passengers, Jetfoils are operating

The Powerjet 24 shown is the primary propulsion pump for the American Enterprise, which also has two smaller pumps. These spinoff waterjets provide propulsive thrust by expelling water at high velocity from the rear of the vessel.

across the South China Sea between Hong Kong and Macao, on inter-island service in the Sea of Japan, and on island-to-mainland service in Venezuela. Two new services across the English Channel will start this year, one from London to Ostend (Belgium), another from Brighton (England) to Dieppe (France). Next spring Jetfoil service connecting Dublin (Ireland) and Liverpool (England) will be inaugurated.

The latest application of the Powerjet line is to the *American Enterprise*, a high-speed (35-38 knots) crewboat designed primarily to serve the offshore petroleum industry; it offers considerably faster surface transfer of crews and supplies to offshore oil rigs than is available with current vessels. The 105-foot, 90-passenger crewboat is driven by three pumps, a centerline Powerjet 24, largest of Rocketdyne's pumps, and two smaller Powerjet 16s. The *American Enterprise* was developed by a five-company team, including Rocketdyne and Detroit Diesel Allison division of General Motors, whose engines power the pumps; other developers include Halter Marine Services, Inc. and George Engine Company, both of New Orleans, Louisiana, and Cincinnati Gear Corporation.

