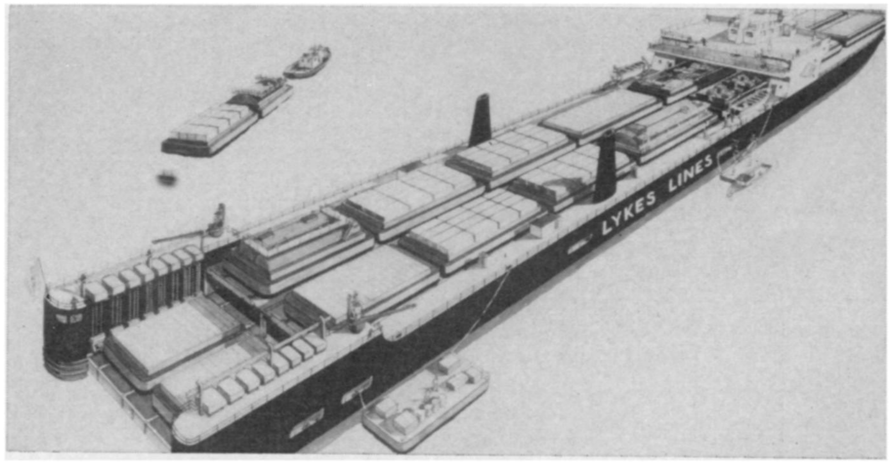
Nuclear crossroads

The U.S. lead is withering as other nations move

by Carl Behrens



Barge-carrying freighters: good spot for high-speed nuclear power.

It is a common complaint among European businessmen that U.S. efficiency consists largely of letting others pioneer new concepts and then plunging in with vast capital resources to flood the market once the bugs are out. The British Comet jetliner, a leader in transportation soon overwhelmed by U.S. planes, is cited as an example.

Whatever the justice of this attitude, it surely doesn't apply to the concept of nuclear power for merchant ships. Here the U.S., in the nuclear ship Savannah, has been a pioneering experimenter for five unremunerative years. And the prospects are that other countries, primarily Japan, Britain and West Germany, will steal a march on the pioneer.

The Savannah was built strictly as a demonstration ship; as such, it has limited cargo space, relatively inefficient handling equipment and not much economic potential. A large part of its available space is taken up in luxury cabins for very important passengers, fulfilling the ship's function as a showpiece. The expense of training and maintaining a highly specialized nuclear crew, as well as special dock facilities needed for a one-of-a-kind ship, add to its problems (SN: 6/24/67, p. 591).

If the Savannah has had a negative effect on U.S. shipbuilding's enthusiasm for nuclear power, its demonstrations have been effective abroad.

Now is the time, say British, German and Japanese engineers, to get into the nuclear propulsion business, on a paying basis.

Two factors are leading to present enthusiasm: the emergence of large, containerized vessels as the wave of the shipping future, and the development of propulsion reactors that are more efficient and smaller than those used in the Savannah.

The container revolution is bringing with it a demand for larger vessels to take advantage of the quick loading and unloading ability of that ultra-efficient, pick-a-back-like system. Although dockyard facilities for handling containers are astronomically expensive—special cranes, for instance, cost about $600,000, compared to the $60,000 for a conventional crane—the saving in turnaround time and labor costs promises to make up for the initial investment. And a large ship, which would take too long to load by conventional means, could be completely practical with fast-handling containers.

For black-ink operation, British engineers estimate, a nuclear propulsion system should put out about 40,000 shaft horsepower. This is still larger than cargo ships or tankers are now using—the 300,000-ton mammoth tanker being built in Japan at present will have a 35,000-horsepower conventional engine—but it is fast becoming a practical size for both container ships and tankers. Within 10 years, they suggest, powers of 100,000 shaft horsepower will be demanded.

The United Kingdom Atomic Energy Authority, after five years of research, has developed a propulsion reactor design that is felt to be ready for practical tests. Besides being smaller and lighter—it will produce 40,000 shaft horsepower at half the weight of the Savannah's machinery, which produces 22,000 horsepower—it also promises to use its fuel more completely, which is more efficient and makes possible longer periods between refueling. The British design aims at an average fuel burnup of 23,000 megawatt-days per ton of uranium. The Savannah achieved 6,930 megawatt-days per ton on its first fuel loading and after a partial refueling and rearrangement of fuel elements is expected to achieve something like 10,000 megawatt-days.

The British Government had steadfastly refused to invest in commercial nuclear propulsion, while it was still in the development stage, but now pressure is building to getting into the swim at a profitable point.

West Germany has gone farther than Britain, where commercial nuclear propulsion has not gone beyond the talk stage. The recently launched ore carrier Otto Hahn, although not yet a profit-making ship, incorporates some of the power plant advances that make nuclear power look like a paying proposition.

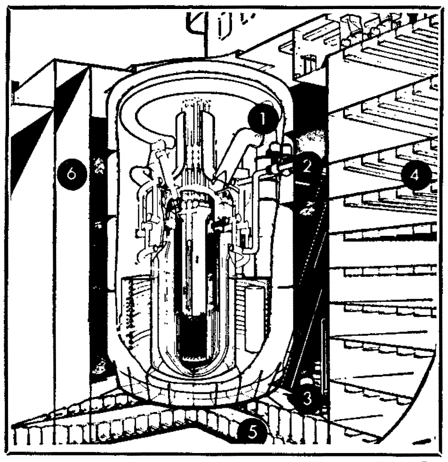
One of these features, well liked by British engineers as well, is the so-called integral system, in which there is no external piping carrying radioactive materials outside the reactor vessel itself.

In the Savannah the heat exchanger is outside the reactor vessel, while in the Otto Hahn it is inside, making it closer to the heat and thus more efficient, as well as decreasing the amount of heavy exterior piping needed to protect the radioactive coolant from accidentally being released.

But Germany is not stopping at the Hahn. Its recently announced five-year construction program includes plans for a nuclear merchant container ship to be powered by a 40,000 shaft horsepower reactor and to operate on a commercial paying basis.

Japan has also felt the pressure toward nuclear power. Three Government agencies have recommended that the nation's second nuclear powered vessel be a commercially profitable, nuclear container ship, along the same lines as the British plan, to be completed by November 1975. The first ship, a combined research vessel and cargo carrier, had its keel laid last November and is scheduled for completion in January 1972.

The recommendation, from the Japanese Atomic Energy Commission, the Science and Technology Agency and the Ministry of Transportation, envisages a slightly smaller ship than the British one, able to carry 1,000 8x8x20-foot containers, compared to Britain's 1,280. But it would cruise at 30 knots compared to 24 knots for the British ship.



UKAEA

British reactor: break-even point.

At this stage, Japanese shipbuilders hope that the Government will agree to foot all research expenses for the ship's development, with the understanding that private interests, later on, would finance the vessel's construction.

In the U.S., nuclear propulsion engineers are thinking in terms of larger, more powerful ships, somewhere in the 100,000 shaft horsepower range. But they are nowhere near building one.

Such a ship, says Delma Crook, manager of the Maritime Commission's nuclear ship program, would be between 800 and 900 feet long, carry up to 1,200 containers, and be capable of sustained speeds of 30 to 33 knots—someday. "There is zero construction today," says Crook. There are no plans for any construction, and, "All I can see bright" is that legislation has been introduced to allow commercial nuclear ship construction to come under a first-of-its-kind subsidy commonly given to new ship designs.

Meanwhile, a pioneering advance of another kind in the U.S. is the development of huge barge-carrying ships that give the transports independence of port facilities and flexibility in cargo-handling ability.

Three of the barge ships, being built for Lykes Lines by General Dynamics Corp., will carry 38 barges that together will handle 1,600 containers, or 17,500 tons of ordinary cargo. They are scheduled to enter service in 1971. They will have a conventional power plant that will put out 36,000 shaft horsepower, very close to the break-even point, as European engineers judge it, for nuclear power.

Crook contends such applications are crying out for nuclear propulsion and believes it is high time to get started on making it a reality.

Meanwhile, the Maritime Administration is girding its loins to go to Congress for money to keep the Savannah and its highly trained nuclear crew operating for another year. ◇