

'Freak' Waves Predictable

See Front Cover

➤ A HUGE, "freak" wave that severely damaged an Italian ocean liner last April, tearing apart heavy steel structures and killing three people, was not a freak at all, a U.S. Naval oceanographer has reported.

Waves were averaging about 30 feet high and coming every 12 seconds or so, said Dr. Richard W. James of the Navy's Oceanographic Office, Suitland, Md.—certainly rough seas, but not a full-blown storm.

The wave that did the damage was more than twice as high as average. It inundated the entire forward half of the ship, peeled back some steel flaring on the bow and broke windows high above on the bridge. Yet the chances of such a wave appearing were predictable, said Dr. James, and hitting it could have been avoided.

If a 1,000 waves like those shown on the front cover pass a ship, he said, there is a chance in 20 that one of them will be 2.22 times taller than the average. This means that the liner Michelangelo faced a wave more than 66 feet high. The broken bridge windows were 81 feet above waterline.

High waves can be avoided by ocean vessels through the use of "routing services," teams of meteorologists who keep constant track of sea and weather conditions, and of any particular problems of the ship such as unusual weight distribution. Dr. James started such a service for the Navy 10 years ago.

Apparently, Dr. James said, the Michelangelo either was receiving poor

service or was not using any, since enough advance information is usually available to enable avoidance of heavy seas. Sometimes, however, large ocean liners "feel they are immune to the weather," he said.

The Navy's routing service saves an average of 15 hours per ocean crossing, and commercial vessels can often save thousands of dollars in damaged goods, if efficient service is carefully heeded.

Cost of the service for commercial passenger liners is usually between \$100 and \$200 per crossing.

Nimbus-type satellites in the future will provide additional information on wave heights, predicted Dr. James, by radar analysis of shadows on the oceans. Although small height differences will probably not be detectable, he said, any wave big enough to show up at all will almost surely be worth worrying about.

OCEANOGRAPHY

Sunken Treasure Reveals Site of Danish Fleet

➤ **SUNKEN** treasure has confirmed the site of a 15-vessel Danish fleet which sank during a storm July 28, 1566, off the Swedish island of Gotland.

Now, 400 years later, the discovery of a silver spoon in lumps of material salvaged at depths of seven meters beneath the sea provided conclusive evidence.

The spoon was recovered by Swedish scuba divers who had been searching for remains of the fleet since the summer of 1959. It was engraved with two Danish shields relating to Vice Admiral Jens Truidson Ulfstand, commander of the Hannibal, one of the ships that went down.

Another rare find was a pistol with a wheel catch and finely engraved bone covering on the butt.

The first finds of any interest were made in August 1965 by Rune Fordahl and his diving team. They recovered formless, rusty lumps that held the remains of a cannon and cannon balls, the handle of a knife, a comb, and fragments of clay pots, glass and bone. They later found a musket that experts traced to the 16th century, and a Danish silver coin dated 1565.

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