TO THE NEW YORK TIMES
VIA THE NEW YORK TIMES WASHINGTON BUREAU
FROM ROBERT TRUMBULL

REPAIR: V

PEARL HARBOR, Dec. 18. (Passed by naval censor)---Because the battleship Oklahoma is upside down in the waters of Pearl Harbor, the major operations in her salvage are being performed backwards. But they work as well.

The day may come when this maltreated warship will again stand proudly erect. The engineers now at work on the Oklahoma know that this is possible. If the navy decides that need of the vessel justifies the monumental labor required, the job will be done.

The novel methods which would be used in reclaiming this 29,000-ton battlewagon, whose upturned keel is now a curiosity to motorists on the public highway from which she can be seen, have already been tested successfully on models. They will work on the ship itself; the engineers are as sure of this as they are sure that there is an exact science.

Japanese aerial torpedoes, streaking for the Oklahoma as she tugged contentedly at her moorings in Battleship Row on Dec. 7, 1941, tore five great sections from her hull below the water line to port. In the bedlam of explosions, yells and death cries, the Oklahoma heeled and sank. The tons of sea rushing into her mangled port side displaced her great weight, and she rolled slowly over to 150 degrees from the vertical.

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Her masts bent sideward as they slammed into the mud and coral bottom. Her top structure and turret tops gouged the sea floor too, and her port bilges plowed up a huge patty of mud which covered her wounds. The tremendous explosions of the torpedoes within her burst her insides, and she bled tons of oil.

That was all, except the continuing pressure of her ponderous weight in the ooze, the suction of the water into her opened hull.

Now the essential problem in salvaging the Oklahoma is, of course, how to turn her upright. After that, the methods used so successfully on the Nevada, California and West Virginia can be applied again, with the inevitable adaptations to the peculiar conditions bound to arise in the Oklahoma's case.

To get the flotation necessary to disengage the Oklahoma from the bottom before she can be righted, the water inside must be eliminated. This cannot be done by pumping, for the sea would merely flow in, ton for ton, through her topside (practically speaking, as she lies topsy-turvy now, her top is her bottom).

Therefore, when the salvage barges drew alongside the rusted round hulk that appears from a distance like a huge floating cigar, they brought not pumps, but complicated equipment for blowing the water out with compressed air. Continuous pressure must be maintained to keep the water from rising inside again.

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Whereas the first operation in the Nevada, California and West Virginia was to close up all apertures through which water could pass into the hull, on the Oklahoma the primary object is to open the hatches below, so that the water can be forced out.

First the divers made their painstaking surveys, charting the changes made in the ship by her brutal beating Dec. 7. She lies with a third, or perhaps a trifle more, of her underside exposed and sloping at a 30-degree angle. Fortunately, enough of the torpedo damage lay outside the thick coating of mud that it could be plotted.

Explorations by the divers inside the ship at first appeared to be an almost impossible job. Admiral Furlong explained the difficulties succinctly to the writer and to Keith Wheeler of the Chicago Times:

"Any sailor can find his way around in a ship that is right side up. But when you send a diver to work under water in pitch darkness where everything he is familiar with is upside down and he's actually walking on the overhead like a fly---that's something else."

The mess inside a ship that has been torpedoed and has lain in salt water for a full year is confusing enough, as Wheeler and I found out when we looked for ourselves, without turning it upside down besides.

It remained for a diver to solve the difficulty. R. H. Snow, then a chief water tender, was fascinated by the problem.

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Finally he hit upon the idea of a scale model of the Oklahoma, inverted in exactly the position of the ship. The divers would study the model before going down, and thus at least would be able to orient themselves to a world where everything is opposit

Snow's model worked so well that, in appreciateion, he was promoted to warrant grade. The models were constructed carefull of composition board and glue, each section labeled and put together so that each deck can be lifted away, bringing the compartments below to view. The ingenious model has now been studi and re-studied hundreds of times---already more than 1,500 man-hours of diving have been devoted to the Oklahoma---and it will be even more valuable when the ship is righted and she has to be rigged for pumping.

The preliminary data on the Oklahoma's condition---the angle at which she lay, her depth in mud, and every imaginable factor-enabled the engineers to study the gargantuan forces needed to right her. It turned out that it would not be great expenditure of force, but rather a cleverly disposed and remarkably economic application of power, that would succeed.

First, however, there was the troublesome matter of relieving the dead net weight of the vessel computed at 27,000 tons, to get the necessary flotation.

The main hull was sealed sufficiently to contain a large bubble of air extending 20 to 25 feet below the surface, if the air could be pumped in and the water blown out. Two additional bubbles could be formed even farther below, in the upper starboard compartments. These bubbles, when achieved, would give a positive buoyancy of about 18,800 tons.

Buoyancy obtained, the next step was the more puzzling one of bringing to bear sufficient force to pull the ponderous mass topside up. The engineers calculated that they would need a maximum rotary force of 8,000 tons, which would probably leave some to spare.

Now they needed a place to get the power, and a way to supply it. The first problem was solved simply. On Ford Island on the stretch of shore that parallels the 583-foot length of the Oklahoma, they placed an ample power station. Now, what to do with the power once they had it?

Sparing the details of months of work, here is the answer they found:

The pull on the Oklahoma's hull must be evenly distributed along her side, for any one section would give away in the titanic tug-of-war. The engineers charted 21 points at which to place the stress. Then they planted huge concrete anchoring blocks on Ford Island.

Now the power must be applied directly to the hull of the Oklahoma. Points were marked for the erecting, on the sloping hull itself, of a corresponding 21 triangular frames of stout

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planking, called "A" frames, 40 feet high. These frames, their feet resting in steel and timber brackets built into the hull, would receive the strain on the side of the ship facing Ford Island.

From the apex of each "A" frame to big steel plates welded to the inverted vessel's starboard side, and known as "pad eyes", a heavy steel cable will take the tension.

Ashore will be 21 five-horsepower electric motors, one for each "A" frame and cable. The motors will be geared at 8,000-to-1 ratio to heavy steel tackles attached to the concrete anchor blocks. Running through 16 pulleys at one end and 17 at the other, the tackles will yield an advantageous ratio of 17-to-1.

Now, the ends of the tackles will be connected to the apexes of the "A" frames aboard the ship by still more giant cables, which will be linked to the tension cables attached to the pad eyes. The whole intricate business multiplies the force of the five-horsepower motors ashore by 136,000 times as applied on the ship.

No miscalculation will be discovered when the motors are finally set to work. The engineers made steel models, one-fifth scale, of the sections of the ship to which the stress would be applied. Then, they applied pressure scaled accordingly. This effort was well worth the trouble, for it was discovered that the pull would buckle the transverse frames.

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This will now be obviated by the welding inside the ship of steel braces---another annoying, dirty, but necessary job.

Cmdr. F. H. Whitaker, present chief salvage officer under Admiral Furlong, has even calculated the number of hours it should take to right the Oklahoma when everything the Navy and Pacific Bridge Company engineers pronouce in readiness.

"We'll pull her over about a degree and a half in an hour", he said. "Since she is over 150 degrees, theoretically she should be back on her keel in 100 hours. But we expect delays, of course."

"Such delays might include," he added, "the necessity for dredging as the Oklahoma's mass shifts uneasily on the bottom. But they'll take that in their stride."

"Matter of fact", he told us proudly, "she already is up five-eighths of an inch, due to the buoyancy of the air in her hull."