

See Serial Report
BB63(694)
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MEMORANDUM

From: Captain John Zabilsky, U. S. N.
To: Code 500

Subj: USS MISSOURI (BB63) - brief preliminary report of salvage operations

Encl: (1) Copy of my rept to ComCruant of 6 Feb 1950

1. I left Washington, D.C. on the morning of 18 January, 1950, and reported to ComCruant about 1300 on the same day. I remained on the USS MISSOURI, as a temporary member of the Staff which included Rear Admiral H. W. Wallin as Chief Advisor, until the ship was refloated on the morning of 1 February. Subsequent to refloating of the MISSOURI, I based at the Norfolk Naval Shipyard going over all calculations and preparing prints for future use in compiling a BuShips Technical Bulletin covering the salvage. I left Norfolk at 1630 on 8 February and reported to the Bureau of Ships at 0800 on 9 February.

2. Enclosure (1) is a brief preliminary report of the salvage of the USS MISSOURI which I made to ComCruant. No attempt was made to list chronologically the steps that were taken in preparing the ship for refloating. These had been rather fully reported in despatch progress reports as the work proceeded.

3. The salvage operation emphasizes the ability of the Navy, in unusual circumstances and under the pressure of public opinion, to accomplish in a very short time, a job of large magnitude. It is believed that no other agency could have done it any sooner, or in fact, in as short a time. The plan was logical. Its execution was excellent and resulted from good staff work. The stranding of the MISSOURI proved to be of considerable embarrassment to the Navy. It is believed that her salvage will not only nullify initial impressions, but serve to reflect even more credit to the Navy.

J. Zabilsky
Captain, U.S.N.

Prepared by J. Zabilsky, ext 3084
Typed by L. Pfeifle 2/9/50

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6 February 1950

From: Captain John Zabilsky, U.S. Navy
To: Commander Cruisers, U. S. Atlantic Fleet
Subj: USS MISSOURI (BB63) - Brief Preliminary Report - Salvage Operations
Encl: (1) Brief preliminary report salvage operations USS MISSOURI (BB63)

1. Enclosure (1) is a brief report covering salvage operations on
USS MISSOURI (BB63) during the period 17 January to 1 February 1950.

Respectfully,

JOHN ZABILSKY

Copy to:
COM NAVSHIPYD

Brief Preliminary Report Salvage Operations USS MISSOURI (BB-63)

1. The USS MISSOURI (BB63) ran aground in Hampton Roads, Virginia at about 0825 on 17 January 1960, while proceeding to sea from the Naval Operating Base. Her speed was about 12 knots which resulted in her traversing shoal water a distance of three ship lengths from the main channel. She finally stopped at a point 1.6 miles bearing 266°T from Thimble Shoals Light, near Old Point Comfort, on a heading of 053°T. The Missouri was refloated and pulled into deep water fifteen days later, at 0709 on 1 February, on the morning high tide.

2. Soundings taken immediately after grounding were reported to be 29 feet forward and 30 feet aft. These drafts were believed from the start to be only approximate. Her drafts upon getting underway that morning were recorded as 35'-9" forward and 36'-9" aft. A subsequent study of draft readings with the MISSOURI aground and comparison with actual tide readings revealed that at mean low water the ship was resting on a gradual slope with drafts as follows:

Forward	25.1'
Amidships	27.0'
Aft	28.7'

It was found that actual tides as recorded at Sewell's Point agreed very closely with those existing at the MISSOURI's location. At a tide of 2.6 which was the actual height of water recorded at Sewell's Point at time of grounding, her drafts were determined to be as follows:

Forward	27.7'
Amidships	29.6'
Aft	31.3'

3. The approximate load on the ground of 12,000 tons, which was the difference in displacements before and after grounding, made it very apparent that the Navy was confronted with a major salvage operation, one that could not be done in a day and would tax the ingenuity, skill and patience of the men involved. The MISSOURI is big. Each inch of mean draft lost in the grounding represented a weight of 150 tons that would have to be removed or equivalent amount of buoyancy restored to refloat her.

4. Commander Cruisers Atlantic Fleet, the type commander, immediately took charge of salvage operations. An analysis of the situation indicated that the MISSOURI was in no danger of loss or damage. It was in protected waters and not exposed to the destructive force of the elements. The operation was not an off-shore salvage job. Moreover, it was in the area of the Navy's greatest concentration of men, equipment, and facilities both afloat and ashore. Additional special salvage equipment could be readily provided from other areas to augment that which was available.

ENCLOSURE (1)

A consideration of the above factors, among others, led to the decision that the Navy could and would salvage the MISSOURI through its own efforts.

5. The general salvage plan adopted at the start of operations was to refloat the MISSOURI to deep water:

(A) By increasing her buoyancy and decreasing her displacement

- (1) By removal of the maximum fluids, ammunition, stores, personnel, etc.
- (2) By lifting her stern with pontoons.
- (3) By dredging and tunneling the sand from under her and letting her settle further.

(B) By pulling off

- (1) With nine sets of beach gear.
- (2) With 2 ARSD vessels fitted with especially powerful beach gear.
- (3) With seven or eight pulling tugs.
- (4) By using tugs for surging and twisting.

(C) By dredging an exit channel

It is interesting to note that this plan was strictly adhered to throughout the operation. Two early pulling attempts were made with powerful tugs, even though it was realized there was little chance of success, primarily as an exercise in coordinating a large group of vessels and because there was little if any interference with scheduled work. Tides and heights of water were continuously all important factors to consider, and the most favorable ones were not scheduled to come until the start of February. To take advantage of these approaching tides, COM GRILANT established 2 February as the date of the real attempt to free the MISSOURI.

6. The nature of the work was such that careful planning and scheduling of each operation, big or little, was required in minute detail. Dredging was needed around the ship to create a trough to permit settling. Barges had to be alongside for off-loading of removable weights of stores and fuel. Diving operations alongside were continuously needed. So many tasks had to be completed before others could begin that it required determination as well as foresight on the part of those in charge not to lose sight of the overall plan. As an example, the early installation of beach gear would have practically brought all other work to a standstill.

For this same reason, installation of pontoons at the stern, which served not only to provide buoyancy, but also to eliminate some of the large trim by the stern the ship would have in her approaching light condition, was intentionally interrupted for other urgent work.

7. General Observations

(a) As far as could be determined, the MISSOURI received only minor damage due to grounding. This was later verified in dry dock where estimated time to offset repairs was about 7 days. The only compartments known to be ruptured out of a total of about 450 in contact with the water were oil tanks B-29-F, B-37-F, and B-42-F. The plan that was followed aimed at minimum or no damage being sustained during salvage. The painstaking leveling of high spots in the exit channel, for example, was well worth while if rudder and propellers were to remain undamaged.

(b) When a job becomes tougher as the days pass, and the committed date is around the corner, there is apt to be a relaxation in requirements in order to meet a date. There was no lowering of standards during this operation.

(c) Throughout the entire operation, involving many men of all types of experience and inexperience, there was only one minor accident on the final day, when one man received a bruised leg as a result of a carpenter stopper bridle carrying away. Such results are not obtained through chance, but rather, by competent planning and supervision.

(d) The objective of the operation was of course the refloating of the MISSOURI. It served, however, another important purpose. It was a means of training men under actual rather than simulated conditions on a very large scale. This training, while emphasizing salvage, included seamanship, as well as all the artificer type of work the Navy is concerned with. Its influence, in the matter of logistic support, reached beyond the Norfolk area. That it was unexpected and consequently unrehearsed only served to make the salvage operation more valuable from this point of view.

(e) Considering these factors, the costs involved were very small and comprised the services of an Army and a civilian dredge, incidental work at the Norfolk Naval Shipyard, and transportation of a few personnel from other areas.

(f) It is believed that the salvage of the MISSOURI could not have been completed sooner than it was regardless of the methods adopted. The tides were not favorable for an earlier completion date.

(g) The desirability of maintaining salvage equipment in several locations in operating condition is borne out by the MISSOURI salvage. Submarine salvage pontoons arrived on the scene shortly after being requested. Assorted equipment maintained at NSD Bayonne and the Salvage School played a very important part in the operation. The cost of maintaining this equipment for a number of years was more than paid for by their contribution to the salvage.

8. Analysis of Load on Ground and Pulling Power

a. The tons aground during pull-off attempt 31 January, and during actual refloating on 1 February were found to be somewhat higher than had been predicted. Calculations, based upon the conditions of loading and drafts of the MISSOURI after refloating on 1 February, indicate the following :

31 January Refloating attempt:

It had been established, during the period aground, that mean low water as indicated on the MISSOURI draft gauges was:

Forward	25.1'
Amidships	27.0'
Aft	28.7'

At a 2.6' tide which existed that day:

25.1 + 2.6 = 27.7'	Bow draft
29.6'	Amidships draft
31.3'	Aft draft
28.3'	Bow draft at which bow would lift (From moment weight and moment buoyancy curves for existing condition)

Displacement at 29.5' mean draft =	45000
Correction for 3.5' trim (91×3.5) =	318
Corrected Displacement	45318
Displacement of ship after floating, under conditions of loading existing 31 January	46459
Tons still aground	1141

9. 1 February Refloating:

Bow draft at 3.3' tide which existed prior to complete refloating = 25.75'
Bow had actually lifted at 26.75' corresponding to a 1.65' tide. Had it not lifted, draft at 3.3' tide would have been 28.4'. (Bow lifted 32")

Draft at Frame 190 (Pivot point) = 31.65' at 3.3' tide
 $190 \times 4 = 760'$ distance bow from pivot
Trim = $31.65 - 25.75 = 5.9'$ (To pivot)
 $\frac{5.9}{760} = .00776'$ per foot.

840' (Distance bow to stern draft marks) $\times .00776 = 6.52'$ trim
When bow = 25.75' draft
Stern will be = 32.27' draft
Mean draft = 29.01' draft

These are the final drafts at a 3.3' tide just prior to refloating, with stern still aground.

Displacement at 29.01' mean draft	=	44150
Correction for 6.52' trim (88.5 x 6.52)	=	<u>577</u>
Corrected Displacement		44727
Displacement of ship after floating, under conditions of loading 1 February	=	<u>45462</u>
Tons aground		742

c. Even with an unexpected tide of 3.3' on 1 February there was an appreciable, though not excessive, load to pull off amounting to 742 tons. This appears to be borne out by the amount of pulling force required that morning. While the MISSOURI seemed to float off gently, at the time she did, all beach gear, including the Salvager and Windlass, were under good strain. In fact, numbers one and six beach gear wire ropes broke during the pull. In addition, the twisting motion of the bow assisted noticeably in the operation. The pull available with beach gear and Salvager and Windlass was estimated to be 600 tons. If a coefficient of friction of .6 was assumed, this was sufficient to pull a load of 1000 tons, which proved ample, though not without noticeable effort.

d. During the 31 January refloating attempt, the actual tons aground was calculated to have amounted to 1140. This approached the limiting load that the available power of beach gear and Salvager and Windlass alone could have pulled. Their pulling power had been estimated as 600 tons. There was, however, available and applied, the pull of powerful tugs totalling in excess of 300 tons. Some of this pull was later lost due to a broken tow line. Nevertheless, the total pulling force available should have moved the MISSOURI. That it did not, proposes the following questions:

1. Was the ship impaled on some rock or other obstruction such as a wreck which would resist a pull?

Inspection of the ship in drydock showed moderate dimples in the hull extending for about 25 feet directly aft of the damaged oil tanks, B-29-F, B-37-F, and B-43-F. This area was not fully explored by divers and consequently there is a good possibility that there was added resistance to pull due to this cause.

2. Is the effective pull of tugs, under conditions that existed, as great as the 10 tons per 1000 H.P. that was estimated?

There is undoubtedly considerable information as to ability of tugs to tow various loads at sea when the tow moves. There is a lack of such information when there is no motion. In the latter case, it is conceivable that the strain applied, while appreciable, is not continuous as in the case of beach gear, but rather oscillating due to wave and current motion. With beach gear, the wires are actually stretched and kept that way. Any stretch in tow line to a tug is undoubtedly relieved by the tug being eased back.

3. The coefficient of friction due to the type of sand and bad conditions may have been appreciably higher than assumed. Strandings are not frequent occurrences and many of those that do arise are of small enough magnitude to require only small pulling efforts with little regard for coefficients. While small scale model tests are not considered conclusive, those made at the Norfolk Naval Shipyard during salvage operations on the MISSOURI are an indication that considerably higher than the .5 coefficient used in planning could have existed.

e. It is interesting to note that had a 3.3' tide occurred on 31 January as it did on 1 February, the tons aground would have been in the order of 230 tons, which, except for the possibility of the deterring action of rocks in such places as existed in the hull, indicates that the MISSOURI would have been refloated with even more ease than on 1 February. This is not surprising and was the basis for the decision to fill the forward peak tanks and reinstall the anchors and chain. The reduction in trim gained by this action had the effect of reducing the load aground and consequently, the power needed to refloat the ship.

f. The displacement of the MISSOURI as determined from draft readings taken on arrival at Drydock Number 8, Norfolk Naval Shipyard, corrected for known changes such as ballasting while enroute to the Shipyard, showed the ship to be about 625 tons heavier than can be definitely accounted for. At first glance, this may appear appreciable. However, the MISSOURI is a big ship. Any error in reading of her drafts on getting underway 17 January would have a pronounced effect since each inch of mean draft represents 150 tons. These drafts were the starting point for calculating predicted conditions. The amount of weight removed was also large, being in the order of 12000 tons. Even slight variations in individual weights removed could accumulate to represent an appreciable amount as a whole.

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