Sinking Hypothesis

From Christley, Thompson, Galler Meeting 2/27/2008

Givens:

1. No depth charging took place
2. No mines in the area
3. No aircraft in the action
4. All compartments which show signs of catastrophic structural failure did not flood prior to exceeding crush depth.
5. No collision between vessels

Sinking Hypothesis

1. Japanese action (shellfire) damages boat causing loss of depth control
    - Hit on conning tower, detonates inside, overpressure wave disables conning tower and control room parties.
    - Hit on torpedo room, detonates inside, overpressure wave and/or fragments cause detonation of torpedo warhead or torpedo air flask
    - Hit on something as yet to be determined, for example hit on Fuel Ballast Tank #3A, detonates inside tank causing fuel oil spray inside control room disrupting control room personnel

2. Own torpedo detonation in or near Forward Torpedo Room
    - Due to actions of crew
    - Due to circular run or other derangement of a fired torpedo
    - Due to explosion or fragments of Japanese shell strike

3. Something within boat causes loss of depth control.
    - Broach with resultant loss of depth control
    - Broach with derangement of bow planes
    - Broach with derangement of stern planes
    - Broach with derangement of both planes.
    - Control room incident causes disabling of control room personnel
    - High pressure air leak

4. Fire

5. Flooding

6. Personnel Problem

7. Crew error, for example incorrect operation of equipment

8. Equipment failure
    - Hydraulics
    - Planes control
    - Air System

Comments:

Shell damage:

- Okun has stated that the shell likely would not penetrate any great distance into the water.

- If shears were visible but not the bridge, the main deck was at a depth of 10’ or greater.

- There is little if any clear evidence of a shell explosion in the remaining structure.

Own torpedo:

- Torpedo room does not show expected damage from internal explosion

- Circular run measurements indicate the hit should be aft, not forward.

- No means for crew to detonate the torpedo during normal operation.

- Detonation of torpedo would likely cause breach and flooding of Forward Battery.

Broach:

- Should be recoverable.

- May result in loss of depth control if improper actions are taken

- Severe broach may result in the following orders

    - Flood negative

    - Full dive both planes

J. Christley meeting summary and input:

We agree that there is insufficient evidence or no evidence that the following occurred

- A torpedo exploded in or near the torpedo room or anywhere else close aboard.

- The Japanese shell penetrated the pressure hull in either the main hull or conning tower.

We feel that the boat lost depth control and even though corrective action was taken, it exceeded its crush depth.

One scenario is: The boat was in the process of surfacing to engage the Japanese ship with its deck gun. The captain changed his mind when the boat was either struck by the Japanese shell or it exploded nearby and ordered the boat down quickly.

The other scenario is: The boat simply lost depth control by reason of the shifting of weights (water and torpedoes, becoming light forward) and broached (partial, unintentional sticking above the surface parts of the submarine). The captain ordered the boat down quickly to keep it out of the shell fire. The Japanese shell may have or may not have struck the boat or it exploded nearby.

In either case, the Japanese shell may have been a contributory factor, but it was not the cause of the loss.

Then our scenarios converge. We feel the boat took a sharp down

angle and increased speed. The angle increased as the stern planes jammed at full dive. Bow buoyancy tank was blown (proper action) to correct the down angle. Either with or without orders the electricians in Maneuvering Room reversed the shafts and went to a Back Emergency bell. The boat stopped then started backward the bow came up rapidly and the boat took on a sharp up angle. Moving now astern, the boat drove further down, backwards. This action may have taken place more than once as the crew struggled to regain control. At some point, either the bow or stern exceeded crush depth and the pressure hull failed. The extreme up or down angles would likely serve to render many of the crew unable to function to stop the boat's demise.

Here our thoughts diverge again.

One scenario is that the boat's Forward Torpedo Room failed first due to an extreme down angle and an inherent weakness in the vicinity of Frames 17,18,19 in the overhead of the compartment. This failure was followed by the failure of the remaining compartments in rapid succession.

We agree that the failure of each compartment took only milliseconds and the overall failure was only a few tenths or a few seconds in duration.

Another scenario is that the boat exceeded crush depth stern down and the compartment failure started with the stern.

We agree that the Forward Torpedo Room failed due to the weakness stated above. We disagree about when the torpedo room section parted from the ship.

One scenario: The hydrodynamic forces seen in the striping away of the superstructure also tore away the bow.

Another scenario: The bow hit the bottom first and folded up and back and separated.

A third scenario: The bow tore off sometime during the slide.

Charles Thompson input:

The summary provided by Jim on 2/28 is objective, as we discussed (unbiased) and in agreement as to the ultimate result, that Grunion imploded due to exceeding crush depth. The events which caused this depth excursion are our primary area's of disagreement, and as noted, the exact truth may never be known.

Relevant Questions:

1. Was the Grunion surfacing (for a gun action) or broaching. We have had significant discussion on this. Some vote for the broach, some for the surfacing. Either one had the same outcome, after the impact of shell 84, Grunion submerged. I do not think that this is resolvable from physical evidence. Input from former WWII sub skippers would provide a most probable answer.

2. Was the Grunion struck by a shell from the Kano Maru? Either yes or no, the results are the same. If yes, some damage may have been incurred, but nothing that should not have been recoverable. There is a hole of unknown origin in the conning tower fairwater superstructure aft. The hole in the cigarette deck appears from the photo to actually be in the vertical bulwark that surrounded the cigarette deck, the starboard side of which is now laying flat on the cigarette deck (the port side is torn off and laying over to port, attached only at the aft end fairwater). If the induction was struck and flooded, it would have resulted in a significant loss of buoyancy, a problem but probably not a serious one.

3. Did the bow or the stern implode first? Either is possible. I feel that the bow probably imploded first, as that is the simplest scenario. Grunion was doing everything she could to get her bow down, something happened (bow or stern planes jammed?) and before she could recover, she passed crush depth. She could have backed with stern planes jammed, come up and gone back down stern first. Of note. With an increasing bow down angle, air from the bow buoyancy tank would have been spilling out, as well as air from the ballast tank flood holes if the valves had not been closed, resulting in a loss of buoyancy, and making recovery more difficult. There is historic precedence for both bow down and stern down attitudes when struggling to regain depth control. There is extensive damage to the after torpedo room, but the after room, like the forward room had internal supports, not external supports surrounding 2/3 of the hull (like the rest of the hull), so a top down implosion would not necessarily occur unless it followed the engine rooms and maneuvering

room (zipper effect). The bow room certainly has as much damage, with approximately half the room missing. The fwd end of the ATR on the stbd side is clearly visible in the video. Reviewing the bridge/aft video, The fwd engine room hatch is visible, as well as what is either the after torpedo room hatch or the after torpedo loading hatch. On the CD provided by Jim, a photo I have not seen before (2564315), looking aft toward the stern, shows the stern closed chock and the top of the aft capstan. The aft torpedo room hatch should be just a few feet forward of the capstan., There is no clear video of this area from the top.

The only item left out of the Jim's summary which I feel is important is the dent in the aft periscope shear. This dent was made by something large, and (in my opinion) resulted in the shears being pushed forward.

Grunion Analysis based on data set prior to 2/27/08

Zack Galler

It is <u>beyond reasonable doubt</u> that

- wreck at x-lat, y-long is the USS Grunion

It is <u>highly probable</u> that

- Loss of Grunion was consequent to a depth excursion beneath crush depth
- All compartments were intact prior to exceeding crush depth
- Loss of bow was subsequent to compressive failure of the pressure hull at frames 17-18.
- Forward tubes were empty following last three-weapon salvo
- Aft torpedo room was empty for the duration of the engagement

- The MkIII TDC was functioning without material error during the engagement

- An accurate and tracking zero target speed solution was present on the MkIII prior and subsequent to the final salvo

- Initiation of the depth transient which ended below crush depth began with impact of shell #84

It is probable that

- Lower conning tower hatch was open between conning tower and control to facilitate communication and passage

- Flooding of control occurred subsequent to failure of the upper conning tower hatch under compression

- The progressively worse condition of hatches towards stern of boat indicates hull failures initiated at stern of Grunion.

- Shell #84 is responsible for the indentation and hole in the aft port fairwater

- One fragment from the impact is responsible for the hole in the deck of the aft fairwater

It is improbable that

- The bow remained attached after failure initiated at frames 17-18

- The shape/status of external induction piping provides information on whether or not they were flooded prior to exceeding crush depth

- The observed condition of stern planes provides information on status of planes prior to aft torpedo room exceeding crush depth

It is <u>highly improbable</u> that

- The loss of the Grunion was caused by a circular run torpedo
- The loss of the Grunion was caused by explosion of own ship torpedo

It is therefore <u>inferred</u> that

- The long periscope observation following the three torpedo salvo reported by Aiura was unnecessary for Grunion to refine the fire control solution on K. Maru
- Grunion's 90 degree starboard turn to bring K. Maru within gyro angle limits and enable hits closer to middle of target could have been replaced by a slower turn to port to engage the starboard side of K. Maru. The port turn would have shielded Grunion from gunfire.
- The trajectory of shell #84 and the location of the entry hole would have damaged either the main or ship supply induction valves, or both.

It is <u>consistent</u> with the above inferences that

- Grunion's CO was more concerned with time spent at datum (*defined as last place their location had been fixed by the enemy*) than with exposure to the K. Maru's forward gun
- The long periscope observation was for potential air and other surface contacts, in support of making a decision on whether to surface or disengage.
- Grunion was not preparing to reload and was intending to surface and engage with deck gun

- Aiura observed an intentional surfacing of the Grunion
- Shell 84 resulted in flooding of outboard induction piping, adding 16-20 tons of weight
- Secondary hole in deck of aft fairwater damaged Safety Tank Vent port riser
- CO response to impact of shell 84 was to secure surfacing and order emergency deep
- Recognition that boat was heavy due to flooded induction piping was delayed due to lack of instrumentation associated with outboard induction piping
- Initial crew efforts to compensate via trim system were inadequate
- Subsequent attempts to compensate via safety tank would have failed due to inability to pressurize tank
- Deballasting rates of MBTs are much slower than deballasting rate of the bow and safety tank due to respective connection to 600# air vs 3000# air. This effect is pronounced at depth.
- Attempt to pressurize bow buoyancy tank would have been successful, though would have resulted in a severe bow-up trim excursion that brought the Aft Torpedo Room below crush depth. Failure of the other compartments followed sequentially towards the bow.

Respectfully submitted Jim Christley Zack Gallar Jim Christley