Swarming in Warfare and the Battle of Surigao Strait;
A Paradigm for 21st Century Warfare?

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Abstract

There are many differing strategic ways of attacking an enemy. The ways of doing this have varied over time and as technology has changed the ways of doing the attacks have themselves changed. A recent conception called swarming assumes a highly distributed but highly interconnected, inter-netted, attack force, which has significant flexibility during the attack. It is argued that the swarming approach is new and is predicated upon the technological advances in command, control, communications, computing, and intelligence. We argue herein that there was an initial example of swarming at the Battle of Surigao Strait. Ironically, the same day, on the Samar Island battle, the forces under the fleet admiral, 7th Fleet, Admiral Kinkaid, did not use what had been used just hours before and was almost devastated by the Japanese attack through the San Bernadino Straits. These two battles are simultaneous examples of two distance strategies, one swarming and the second nearly resembling a classic melee. This paper examines the Battle of Surigao Strait; with lessons learned both positive and negative.

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Tables and Figures

1   INTRODUCTION

As one looks back over sixty years on the battle of Surigao Strait, and especially as one looks at the new strategies of war such as the proposed concept of swarming, one can see that the battle Surigao Strait was NOT the last great Naval Battle, but frankly the first battle of a new way of warfare, namely that of swarming[2].

Swarming has been characterized by Arqilla and Ronfelt as follows[3]:

1. Autonomous or semi-autonomous units engaging in convergent assault on a common target
2. Amorphous but coordinated way to strike from all directions
3. "sustainable pulsing" of force or fire
4. Many small, dispersed, inter-netted maneuver units
5. Integrated surveillance, sensors, C^4I for "topsight"
6. Stand-off and close-in capabilities
7. Attacks designed to disrupt cohesion of adversary

As Arquilla and Ronfelt further state:

"Swarming has two fundamental requirements[4]. First, to be able to strike at an adversary from multiple directions, there must be large numbers of small units of maneuver that are tightly inter-netted—i.e., that can communicate and coordinate with each other at will, and are expected to do so. The second requirement is that the "swarm force" must not only engage in strike operations, but also form part of a "sensory organization," providing the surveillance and synoptic-level observations necessary to the creation and maintenance of "topsight." Swarming relies upon "the many and the small," as well as the notion of a command element that "knows" a great deal but intervenes only sparingly, when necessary. These two fundamental requirements may necessitate creating new systems for command, control, communications, computers, and intelligence (C4I)."

However, when Oldendorf's entire attack group assembled in Surigao there were several key technological changes as well as attack strategy changes, which had occurred.

First, technologically the whole attack body had a communications system facilitated by the TBS (talk between ships) as well as other radio systems and frankly also the other older systems including night-lights[5], the between ships system. The ships had highly effective radar for determining where the enemy was. The ships had very sophisticated computers for targeting and fire control, especially of the torpedoes. Finally the attack group had and utilized the strategic element of the Combat Information Center, the CIC. The CIC was introduced into operations by Commander Wylie in late 1943 after the success of destroyer leader such as Captain Arleigh Burke and Wylie gathered the whole approach while in battle at the Battle of Tassafaronga on the destroyer USS Fletcher with Commander Cole as its captain. Wylie, Naval Academy class of 1932, was then on the Nimitz planning staff in Pearl Harbor have served considerable combat time[6].

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[2] See Arquilla and Ronfelt at Rand.

[3] See Arquilla and Ronfelt Swarming and the Future of Conflict, Santa Monica, CA: RAND, 2000. Online at http://www.rand.org/publications/DB/DB311.

[4] From Arquilla and Ronfelt.

[5] In a strange way the night lights used by the Signalman was a secure low data rate system, which allowed point to point but inter-netted communications. The prime example of how effective this was occurred after the Albert W Grant (DD 649) had been hit by the Denver and the Grant managed to establish a net communications link with the Pennsylvania and then in turn with the flag, Oldendorf, who immediately called a cease fire. The IFF and other communications systems had been hit by friendly fire but the alternative optical light system worked perfectly.

[6] See Hone, T., C. *From Concepts to Capabilities through Learning* ; which states: "*The problem was that the new radars had produced a lot of relevant data, but the individual ships lacked a process for turning that data into essential information that*

This was the first battle where all the elements came together for the first time; command, control, communications, computing and intelligence. The CIC was the element, which allowed for that communications. The C^{4}I scheme of Arquilla and Ronfelt for what they perceive is the next generation of warfare using C^{4}I was there in Surigao for the first time. Unlike Jutland, Midway, Coral Sea, or any of the prior Battles, C^{4}I was active.

Furthermore the weapons were now much effective. Torpedoes were used extensively and then backed up by the battle line's big guns. The PT boats and the Destroyers, specifically DESRON 24, 54, 56, literally swarmed the Japanese fleet of Nishimura in a loosely coordinated manner, relying heavily on the command and control elements via the CIC. The PT boats were at the entry to the Strait and the Destroyers were positioned as the Japanese fleet came through. The swarm of Destroyers and PT boats were in constant communications, and there was, with the exception of the cruiser Denver, constant and effective command and control via the CIC. The PT boats, not truly adequate attack elements, did, however, provide intelligence and thus combined in the context of the CIC was a critical element.

Where the arrogance of a captain on the Denver both ignored and overruled the CIC control element on his vessel, there was damage and death; where there was not, such as on the Pennsylvania, there was success and the saving of life. Thus it is argued that understanding Surigao is understanding swarming warfare. Understanding the Grant (DD649) and its sister destroyers and their coordinated action, highly linked via the CIC with the entire attack group is understanding the future of naval warfare.

In this paper we restate the swarming principles as articulated by Arquilla and Ronfelt and expand upon them., We then place them in the context of an analysis of the battle of Surigao Strain and show that all of the elements as characterized by Arquilla and Ronfelt for swarming were met in that engagement and then we use that engagement to reach several conclusions on what seems to work well and what did not. Lessons from Surigao are valuable. All too often this is looked upon as an artifact of the old way to fight. In reality is a paradigm for a new way. The battle of Samar on the following day, with Kinkaid and the lost Halsey is a way in which not to fight a battle.

The Battle of Samar, the second battle of Leyte demonstrated incompetent communications, lacking command and control, and the gross disuse of the swarming capabilities of the destroyers and lack of presence of the PT boats. It was looked upon by Kinkaid as an old style battle, and he never used Oldendorf and his forces that were still chasing

their captains could act on. There was one exception, however. The executive officer of new destroyer Fletcher, Lt. Commander J. C. Wylie, Jr., had rigged a radar control room "just off the chart house" where he could monitor in real time the information from Fletcher's radars and the reports sent Fletcher by other ships. Wylie spoke directly to Fletcher's captain, who stood in his traditional post on the bridge, informing the captain of friendly and hostile ship movements that the captain could not see. Wylie did not create any new equipment. Instead, he organized that equipment in such a way that he could draw useful information from all the data that the equipment produced......As Fletcher's captain noted in a 19 November 1942 report, "the officer [Wylie] in Radar [sic] control was able to keep the Captain constantly informed of the tactical situation, which was often visually obscured; was able to select and then designate gun targets; and was able to coordinate the fire-control tracking and torpedo-director pointing for torpedo fire."8 In short, Wylie provided his commander with "situational awareness," with the result that Fletcher came through two very severe engagements in November essentially unscathed....Fletcher's successful performance was documented in reports to the Pacific Fleet Destroyer Type Commander in Hawaii, Rear Admiral M. S. Tisdale, and in reports to the senior Navy commands in the Pacific and in Washington.10 Early in 1943, Tisdale transferred Wylie to his staff and directed him to produce a short handbook on how to use the available equipment and new data evaluation procedures to create a CIC. Wylie and his colleagues produced the "CIC Handbook for Destroyers" in two months. The "first run of about five hundred copies… was an immediate success and within a short time was widely reprinted and distributed throughout the navy." Tisdale then sent Wylie to Washington to gain the support of the Bureau of Ships (responsible for search radars and plotting equipment), the Bureau of Ordnance (responsible for fire control radars), and the Atlantic Fleet destroyer type commander....The next step was to institutionalize the CIC The next step was to institutionalize the CIC concept—that is, to build on Wylie's operational innovation to make it both the standard operating procedure and a stimulus for further advances in technology. Making the CIC a Navy-wide standard was done by issuing handbooks and tactical bulletins. The Pacific Fleet staff also began publishing a special journal (CIC) in 1944, and fleet tactical doctrine was formally changed that same year.13 New military occupational specialties were created, CIC schools were set up, and newer ships were altered so that they had sufficient space for the equipment needed by a working CIC. Facilitating this rapid institutionalization of the CIC concept in surface warships was the effort already expended in the Pacific to create effective air defense (or "fighter direction") centers on board aircraft carriers."
see: http://www.oft.osd.mil/initiatives/stiletto/docs/Concepts%20to%20Capabilities%20Paper%20April%202006.pdf
also see: http://www.destroyerhistory.org/fletcherclass/ussfletcher/index.html

Shima and the other fleet. We argue that the failure was not as much in Halsey and his attempt to follow a phantom Japanese force but in Kinkaid and his gross failure to understand what Oldendorf and his attack group had just accomplished. When Halsey left with the 3rd Fleet, Kinkaid did not use Oldendorf as he had done in Surigao and the loss was significant at the Battle of Samar Island[7].

2   SWARMING DEFINED

Arquilla and Ronfelt have been developing insight into a tactic called swarming. He argues that there are four paradigms of attack and that the most recent which is heavily dependent on technological advances in communications and inter-netting in a highly distributed manner is called swarming. Arquilla and Ronfelt further argue that it is the ability to increase the information procession capabilities that have enabled this and further that there have been great advances in embedded "structural information". We argue that the Battle of Surigao Strait was perhaps the first example of swarming and that it occurred because all of the technological advances that Arquilla and Ronfelt have envisioned were in effect operative at that time, and at that time for the first time.

Arquilla and Ronfelt classify the four paradigms as follows:

1. Melee: This includes linear face-offs, with easily dissolved formations and in these melees the command and control nearly impossible during battle. The mass of forces just charge and do whatever, and there is no coordination. To some degree this is a street fight, groups just mass, and then a spark ignites the whole process. The fight just goes on its own.

2. Massing: In this paradigm Arquilla and Ronfelt argue that there is some form of stacked and geometric set of formations for set-piece battles, with a front, a rear, and "waves". In this type of warfare there are defined Doctrines for maintaining hierarchy, shape, thrust. In massing it is assumed that the group all has some idea as to why they have assembled and that they have also pre-agreed on some set of general principles of the battle. However as the Prussian strategist Count Helmuth von Moltke has said: "No plan survives contact with the enemy."[8]

3. Maneuver: This is a set of complex, synchronized, fast-tempo, multi-linear operations to surprise, penetrate, and flank the enemy. Arquilla and Ronfelt argue that it is an application of mobile mass at "decisive point" to achieve victory. An example of a Maneuver was the Battle of Tsushima in 1905 and the Battle of Jutland in 1916. The Battle of Tsushima was the most decisive sea battle of the Russo-Japanese War of 1904–1905. It was fought on May 27-28, 1905 in the Tsushima Strait. In this battle the Japanese fleet under Admiral Togo destroyed two-thirds of the Russian fleet under Admiral Roshestvensky. The Battle of Tsushima was the only sea battle in history in which battleships fought a decisive fleet action. Tsushima was the battle in which Togo had the Russians cross his "T". Namely his battle line ran horizontal to the Russian fleet allowing Togo to use all the guns on his ships to wreak havoc on the Russians. The Russian fleet was out-maneuvered.

4. Swarming: Arquilla and Ronfelt argue that the prime characteristics of his swarming strategy are[9]:

- Autonomous or semi-autonomous units engaging in convergent assault on a common target
- Amorphous but coordinated way to strike from all directions—"sustainable pulsing" of force or fire
- Many small, dispersed, inter-netted maneuver units
- Integrated surveillance, sensors, C4I for "topsight"
- Stand-off and close-in capabilities
- Attacks designed to disrupt cohesion of adversary

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[7] See Potter, Halsey and see Halsey and Bryan. Both books treat the failure of Halsey to stay lightly. Buell's in Spruance looks at what Spruance did at the Marianas and the Battle of the Philippine Sea as the opposite of Halsey. However the two Admirals had different orders. Halsey was to find and fight the Japanese and Spruance was to defend Turner and his landing forces.

[8] Miller, War Plan Orange, p. 333.

[9] See Arquilla and Ronfelt, Swarming.

The following Table depicts the swarming elements as defined by Arquilla and Ronfelt and the specific characteristics as occurred in the Battle of Surigao Strait.

Table 1 Comparison of Swarming and Surigao

Swarming Characteristic	Surigao Embodiment
Autonomous or semi-autonomous units engaging in convergent assault on a common target	The common target was Nishimura's fleet. The units attacking were several fold; PT boats at the entrance of the Strait, separate destroyer Squadrons, DESRONS 24, 54, and 56. All converging all autonomous with a single goal in mind.
Amorphous but coordinated way to strike from all directions—"sustainable pulsing" of force or fire	The DESRON strike forces were loosely coordinated. Particularly with Captain Smoot and DESRON 56. The destroyer attack approach was section-by-section one after the other and with loose coordination with the Flag.
Many small, dispersed, inter-netted maneuver units	The inter-netting was essential. The use for the first time of the CIC, the Combat Information Center, and radar and radio, allowed for this real time inter-netting.
Integrated surveillance, sensors, C^{4}I for "topsight"	The CIC accomplished all of the C^{4}I functions. The submarines Darter and Dash provided early warning and notice of the enemy progress; the PT boats provided initial swarming of the forces but at the same time established a highly distributed communications and surveillance network.
Stand-off and close-in capabilities	The strategy of Oldendorf was two fold: one was clear swarming with the destroyers and PT boats, The second was his approach to a "crossing the T" with his battle line. Oldendorf actually combined a maneuver strategy behind the swarm, but in swarming theory this was the stand-off and close-in approach.
Attacks designed to disrupt cohesion of adversary	The clear strategy as discussed by Oldendorf was just that, disruption, drive Nishimura back, and destroy as much as he could. Oldendorf was aware that Shima's fleet was behind Nishimura.

We build on this analysis and provide the details to show how it was implemented. The CIC is a dramatic step forward in this design of a war tactic.

3   PRELUDE

In the context of the Second World War, there were elements, which helped facilitate the ability of the commanders at Surigao to effect a swarm. These elements range from a long range process of war planning, called at that time War Plan Orange, which envisioned a war between the US and Japan. There were many other such War Plans but this one by the late 1930s seemed to be the one of the most interest.

Thus many commanding officers, especially Naval officers, had the opportunity to work the war game elements of WPO. Second there was a change in technology, and one, which was all too quick; in weapons, communications, sensors such as radar and sonar, and most importantly the beginning of a systems view to warfare. Third and this we

believe is a critical change, there was a blending in the Navy of Naval officers with Academy training and NROTC and V7 USNR officers. Thus there was a mix of new people and new ideas. For example, Nimitz personally headed the first NROTC unit at UC Berkeley[10]. He had been very successful there and the men coming from those units eventually became a key set of players in evolving war strategy.

3.1   War Plan Orange (WPO)

The United States military, both Navy and Army, had been considering war plans since the 1890s. The plan, which had focus in the Pacific, was War Plan Orange, WPO, which was based upon an assumption that Japan would be the aggressor and attach the United States' outlying interests[11]. The plan was a naval plan, namely the assumption was that the attack would be navy to resources, namely ground resources. There was limited inclusion of aircraft in the plan even as it was modified through the 1930s.

The plan in many ways was an offshoot of the strategic thinking of Alfred Thayer Mahan, one of the first heads of the Naval War College located at Newport, RI. Mahan had developed various theories of warfare, including naval warfare, in the latter part of the nineteenth century. Mahan had an approach which looked backward at past battles and then using the facts as presented to him at the time attempted to do two things; (i) develop some generalizable principles which could be employed to secure victory, and (ii) develop strategic scenarios for potential wars. In essence Mahan was a war gamer[12]. He developed the principles and through his tremendous writings popularized this concept. He had many adherents including President Theodore Roosevelt.

Mahan had a concept that there were six principal conditions, which affected the sea power of a nation; (i) its geographical position, (ii) its physical conformation, (iii) the extent of its territory, (iv) population, (v) the character of its citizens, and (vi) the character of its government. These principals were to many today obvious but that the time it was Mahan who started such strategic thinking, trying to incorporate in some manner a set of measurable elements in assessing war. Rather than just saying the classic "I think....", Mahan approached the problem by saying "The facts are......" In addition, to Mahan facts were frequently better than ones opinion, informed or otherwise.

The Naval War College, as founded and for a period of time headed by Captain Mahan, would on an annual basis bring up and coming officers in for training in naval strategy. As part of that training, the group would participate in a war gaming exercise. There were many such War plans, including war with Great Britain and Canada.

However one of the generally more interesting was War Plan Orange, WPO. WPO had three phases as a continuing part of its execution. The Phases of the WPO included:

Phase I: The US had many remote outposts in the western Pacific and these outposts were generally lightly defended. The Japanese would attack these distant outposts. This would be the opening gambit. The question would be where, which ones, and how critical would they be.

Phase II: The US would then attack westward using its then existing naval and air power. The inclusion of air power was introduced in the 1930s. The naval and air power elements, excluding large troop engagements in this phase were political decisions made by Roosevelt, FDR, during the Depression. The country could not afford nor would the politic and tolerate a large standing Army. Some ships and some aircraft were acceptable so much of the defense bet was on naval and air capabilities because they were viewed at less expensive than large scale troop elements. In addition, they did not require a draft or other such unacceptable political move. Phase II would then be a holding action until the US could respond.

Phase III would take time and resources; men and materials. It would the island by island hopping phase and this meant that a great deal of troops and logistics would be required. However, the strategy and assumption in Phase III

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[10] See Potter, Nimitz, pp. 142-143.

[11] Miller, War Plan Orange, we rely heavily upon this excellent work for background on the WPO and its evolution.

[12] See Sullivan.

was that by acquiring the islands and bases and by choking Japans sources of oil, food, and other strategic elements, Japan would surrender without having to ever set foot on Japan itself. To get to Phase III, military planners relied upon conscription. Large numbers of men would be required and they had to be trained and supported.

There were several observations of the WPO. First, there was a recognized need for an expeditionary force. Namely a readily deployable Marine Corps integrated with the Navy. The Army may or may not fir in but in a Naval war game the Navy was the prime player. Integration of forces was at best a distant forethought. Second, was the total lack of integration of Japanese culture into the plan. The Japanese with Bushido would never surrender short of total annihilation. The plan did not account for the culture, a key element in the Mahan set of principals. Third, the plan included what would become the principle of strategic bombing, namely that the air power could have an end in itself. All throughout World War II air power would have limited strategic impact, Japan and Germany lived through Dresden and Tokyo fire bombings. It was only Hiroshima that began to get Japans attention.

Expeditionary versus massive forces was a Navy versus Army strategic difference. It would be the difference between Nimitz and MacArthur. Nimitz effected his island hopping via expeditionary forces whereas MacArthur used massive troop deployments. In both cases however they had overwhelming numbers of troops.

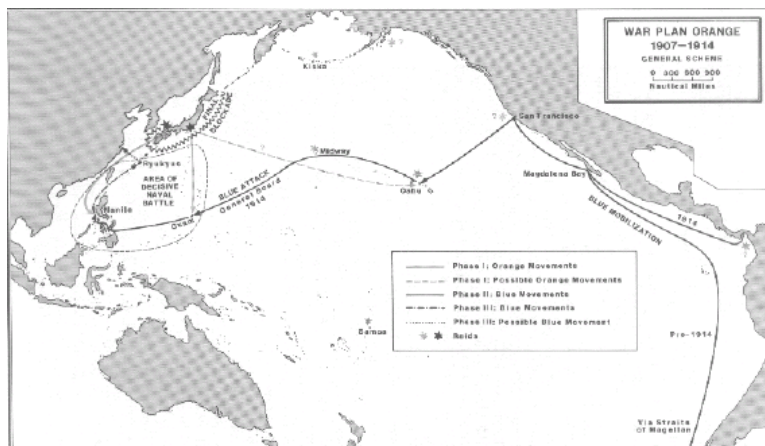Miller presents an overview of WPO in his superb book on the topic and it is shown below:

Figure 1 War Plan Orange, see Miller

Ironically Hawaii does not even appear in the WPO of the 1930s.

Mahan thought strategy, he changed his views frequently as he obtained new information. He relied on "facts". This is what he tried to inculcate in the Naval War College. Facts can and do change. Thus Strategy is not static, it has to have a dynamism, which is reflective of reality, namely the facts. It is not a religion with unchanging tenets. It must reflect the reality of the time. Mahan at first could not envision any country other than Britain threatening the US since only they had a true comparable naval power. However, that was in the 1890s. The assumption was large naval power and fact at that time was Britain. However as things changed the facts then allowed for the inclusion of Japan as a threat and the reality of WPO became more as every day passed. WPO became in many ways the road map for the journey the Grant will take.

It would be fair to say that most likely none of the men on the Grant had read Bywater and probably never heard of Mahan, with the possible exception of Nisewaner and Higginbotham, and even for them it would have been as an Academy student at best in some class where they had to memorize, not think. As Nisewaner would say; "Act, don't think!" that was the dictum of ship command. However there were others doing the thinking; it was Nimitz, a believer in Mahan, and a strategist who did just that work. His actors were Halsey, Kinkaid and Spruance, albeit Spruance was also a key strategic thinker as well.

Miller recounts further details on WPO. He makes certain statements, which further clarify the strategy in WPO. Specifically Miller states amongst others the following four observations as to the Naval mindset just before the War:

"The American strategist's war objective simply stated was to win. They rarely reflected on the chance of a US defeat."

There was no perception of defeat or of any form of compromise. Thus the attack at Pearl was to be an electrifying shock.

"The goal of unlimited war was unlimited victory."

This principle evolves into the construct of unconditional surrender, total unmitigated defeat of the enemy and total and complete subjugation. The goal is critical to the way the men thought. This goal would be promulgated downward to every man, every able bodied seaman knew what they were fighting for. There was not political battle in the background, victory was total and complete.

"The strategy the planners adopted was....unlimited economic war."

The economic element may have been what some historians contend started the war. The FDR embargoes of July 1941 turning off oil to Japan may have been a "last straw". However the facts speak otherwise, Japan was invading Borneo and Brunei, taking the Dutch oil fields, and the embargo may frankly have been superfluous. It became an excuse for Japan, and a weak one at that.

"The perception of a limited public endurance goes far to explain the ....vigorous counterattack....expect a long war but...operate to gain victorious conclusions in the minimum possible time..."

Roosevelt was first a politician, and second he wanted to be re-elected. He knew as did the military that the public will allow war for just so long.

Thus the public must be given victories, on a periodic and continuing basis[13]. Getting stuck in any swamp will not allow any war to continue. The public will revolt. FDR knew this well which is one reason for the attacks on North Africa, the Germans were far and few between, the US was untested, and many small victories were achievable. The island hopping strategy could, if successful, achieve these small continuing victories. The public would be there to support the effort.

3.2   Bywater

In 1925 an English writer, Hector Bywater, who was a journalist living in Japan, was a military journalist who had developed an excellent knowledge of all the capabilities of the worlds naval powers[14]. After a brief while in Japan he came to see that Japan could after World War I become a strategic threat. In 1925 he published a futuristic book about a futuristic war, one in 1931-1933, initiated by Japan against the US. In certain ways the book would presage Pearl Harbor. The attack was on the Philippines, and in a manner, which almost mirrored what actually happened on December 8, 1941 and following.

If MacArthur had read and understood Bywater then perhaps he may have learned something. The Japanese attack the Panama Canal, rather than Pearl, and the IS forces via their naval resources retaliate. The book alleges to cover

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[13] See Dallek, FDR and American For Policy, p. 321. Dallek states that the North African strategy was key for three reasons; (i) deny Germans a strategic control point, (ii) best chance for initial success against Germans, (iii) most importantly is provided quick action to boost morale. FDR clearly saw any wars as action with two fronts; the one against the enemy and the one at home.

[14] See Maycock, Bywater, for a good overview of Bywater's approach. Bywater's book is at times interesting and at times tedious. Bywater has no paragraphs, for example, and his ending is after the fact unbelievable. His details however are startlingly true. He sees exactly what is happening to the Philippines. He does not see Pearl but the US position was not clear in 1925.

only the first two years of the war although its ending is a bit strange, the US drops leaflet bombs on Tokyo and the Japanese just surrender.

In the next section we discuss the technological changes.

4   THE WEAPONS AND TECHNOLOGY

The canons of the man-o-war or even of the World War I battleships ships were replaced by integrated command, control and communications systems and computer controlled guns towards the end of World War II in the Pacific. The destroyer was designed for fast but lethal attacks in a divers set of wartime environments. It is designed to deal with aircraft, submarines, other ships, land support, and whatever else may come along. It may be used as a picket ship where it has the duty to guard at a distance an aircraft carrier, it may act as a torpedo launcher, attacking enemy vessels, and it may play the role of antisubmarine warfare vessel searching out enemy subs and attacking with its antisubmarine weapons such as depth charges.

All of the weapons on a destroyer in World War II were supported and/or facilitated by what at that time was high tech support systems. The figure below depicts how the destroyer as a weapon system was operated in late 1944. It was an integrated complex system, which was to be inter networked via the CIC.

Destroyer Weapons Systems Command, Communications and Control
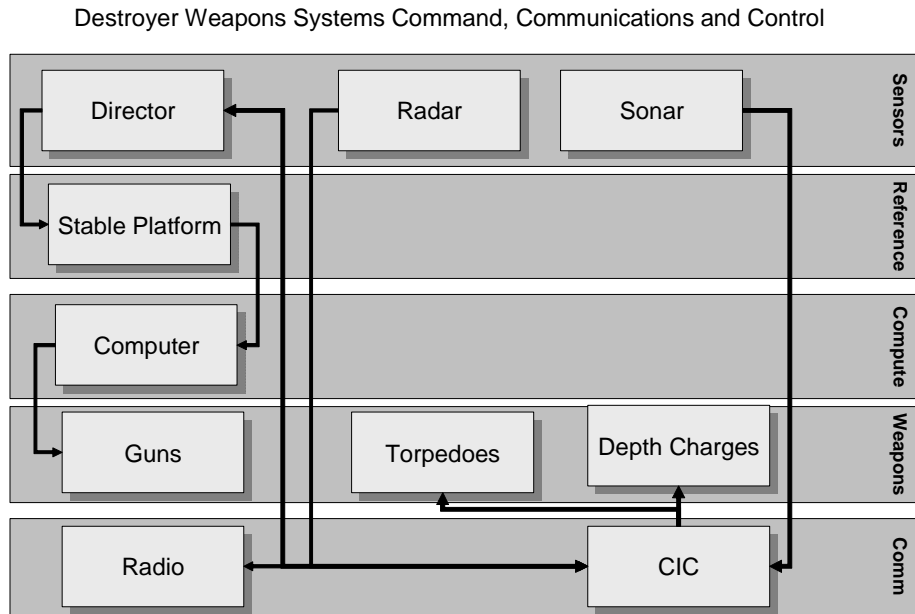
Figure 2 Weapons Systems Elements and Architecture

4.1   Radar

The Destroyer had three types of target sensors; radar, the Fire Control System, and sonar. Radar is generally thought to be the most prominent, however the Fire Control System was truly a marvel and went to the heart of this new approach. Radar on US Naval ships in World War II used the generation and transmission of extremely high frequency pulses to send out from an antenna and to get reflections from targets and then using this information to ascertain certain information about that target. New generations of this equipment were issued almost monthly and upgrades were a continuous process as the developers themselves learned more. There were several such radars,

each for a separate purpose. One was for long range detection of aircraft (SG), one for integrating with the Director and fire control system (Mark 4) and one for surface scanning (SG[15]).

Battleships and Cruisers used different types of fire control radars. These were the Mark 3 and Mark 8 fire control radars and they are compared in some detail the table below. The system are critical to the understanding of this battle. The Mark 3 and Mark 8 were used in conjunction with the Mark 38 and Mark 34 Director respectively, the optical unit combined with the stable platform or reference plane.

The battle line of the US in Surigao Strait was composed of the six battleships were evenly split between Mark 3 and Mark 8 radars. The battleships with the Mark 8 did most of the shooting since they could acquire the target faster and had better accuracy.

4.2   Fire Control Systems

Fire control systems were undoubtedly the most complex systems on board a ship. The problem that a fire-control system solved was an extremely complex problem of spherical trigonometry, estimation, identification, and prediction[16]. The fire control system in Fletcher class destroyers was in many ways the first *electronic warfare system* ever deployed. It was a harbinger of what electronic warfare has become today. The seamen on the destroyers did not fully appreciate where they were in the development of new warfare systems, they were using their brains more that any warriors in the past. They were not just the oarsmen at Salamis, but each played an integral role in the fully integrated system. It consisted of the following three elements:

1. Director: The Director was an optical-mechanical device, which allowed for the determination from a defined point on the ship of the targets range, azimuth and elevation. This meant that with a good Director and an experienced fire control man operating the Director the ship could at least fire where they should if they could see the target.

2. Stable Platform: This has also been called the "Stable Element". This was an imaginary platform or plane, which was created by the use of a gyroscope. If one recalls a gyroscope from childhood, the spinning wheel of the gyro tends to exert a force if one tries to rotate it in any direction. The force tends to keep the gyro in an orientation, which remains fixed relative to where it was when it started rotating. Thus, if we start a gyro rotating, and we move it we would not e force trying to send it back to the original position. If we have a gyro with three independent axes, we can measure movement in all three axes, namely pitch, roll, and yaw. If we put little sensors, called synchros, on each of the axes, we can measure the attempt to move them and we cane then control a platform or element to keep it in the same configuration it was in originally. This feedback type of system was used to create the Stable Platform or Stable Element.

3. Computer: The computer was at the heart of the fire control system. The computer aboard these vessels was an electromechanical system, which allowed for several functions:

- First, the computer would estimate a targets range, range rate and other key parameters and from these estimate where to send the shell.

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[15] Regarding the history of radar refer to Buderi, or Price, or McMahon, or Friedman, or Fisher or Hezlet; each of the authors provide some insight. The work of RV Jones is critical also in understanding this issue. The author worked with Eric Ackerman, who worked for Jones. Ackerman was the author's deputy while in Washington and the author has a slightly different view, of course from the British perspective. In addition the author worked in the remnants of what were the Rad Lab at MIT and is also influenced by many of the views there as well. The books referred to in this footnote have their own spins on this issue. In reality it appears that the Naval officers in battle were the ones to best understand applications and integration. The details of the design are in the MIT Rad Lab Series, Ridenour. The Navy documents are the US Navy Ordnance and Fire Control, Radar Electronics, Radar Systems, Fire Control and Radar. It was Wylie who saw that one could get lost just looking at all the PPI scopes and not obtain critical information and more importantly act upon that information, Furthermore integrating the radar information with other data as may be available over the TBS was critical.

[16] Clymer presents a simplified review of the mechanical and electro-mechanical systems. The US Navy Torpedo Fire Control document is an excellent overview of the torpedo side.

- Second, the computer would determine what the elements of the coordinate systems each gun was in which it was required to fire. Each gun was in pitch, roll and yaw, and it also has a powder load, air humidity, wind direction, and other factors. These would all be estimated based upon inputs.

- Third, the computer would calculate the time to fire and the angles for the guns to be in at that specific time so that the target could be hit with reasonable accuracy.

The computer was a brilliant design. The synchros used allowed for the conversion from mechanical to electrical and then from electrical back to mechanical. The "programming" of this computer was somewhat fixed because it was solely for use as a ballistics aiming device. The computer used for the torpedoes was all mechanical and in many ways it was even more ingenious.

The Director for the guns, located on top of the bridge or for the torpedoes, which was literally on top of the torpedo tubes, was an optical mechanical device, which could calculate range, range rate and similar target parameters. It required seeing the target. The radar could also be used in firing the guns but not the torpedoes.

From the Director one could determine where the target was in range, azimuth and elevation. In addition if the target was moving we could estimate its velocity in all three parts as well, namely range rate, azimuth rate and elevation rate. This was sent to the Computer. The job of the Computer was to now tell the Gun where to point and how to fire to hit the target. Thus the computer had three jobs.

- First, it had to know where the target was and where it would be. This job required that given the information from the Director it could project where the target would be when the gun fired so the gun would be pointing at the target. In a simple example if we had movement in just one direction, and we knew the distance at one time and the velocity, then we could tell where the target would be at some future time. We could assume that it takes two seconds to fire the gun, and that the target is moving at 300 mph, or 440 fps, we would then aim at 880 feet ahead of where it is now. However, it takes the shell a short while to get there as well, we have to factor that in as well. For example if the shell is going at 880 fps we then have to know where the target is not just two seconds from now but 2.5 seconds from now! All of these details must be kept by the Computer.

- Second it had to know where the gun was really pointing at the time of the firing. The gun was on the ship. The ship was moving, it was pitching, rolling and yawing. It was bouncing all over. The system knew where the Stable Platform was, by use of the gyros. The system then had to determine where the gun really was and more importantly where it would be when it fired the gun. Therefore the gun had to have its own gyro tracker and it had to relate its position to the Stable Platform.

- Third, the computer knowing where the target would be when the gun fired and where the gun was when the gun fired, it would have to tell the gun what azimuth, elevation and speed it had to be loaded at to hit the target. At that point the Computer fired the gun. Hopefully it would hit the target.

4.3   Weapons

The weapons on board the ship fell into four categories:

1. Sea Targets
2. Land Targets
3. Aircraft Targets
4. Submarine Targets

The land targets were hit using the 5" guns in most cases. They were tied into the Director and the guns were then targetd to specific land targets. The aircraft targets were hit using the 40mm and the 20mm cannons. They were very effective with these targets and could create a screen around the Destroyer and the vessels it was monitoring. The submarine targets were hit with depth charges.

The sea targets would be hit with guns or torpedoes. The Destroyer evolved from a torpedo ship and this was its earliest missing before the War. In World War II the torpedo function remained.

The fire control problem is thus seen to be extremely complex. It requires sophisticated understanding of the ballistics of shells, the multidimensional changes from one platform to another and the ability to operated a mechanical analog computer to make these calculations. It also requires the understanding of estimating and predicting the movement of complex targets such as attacking aircraft. It means that the fire control personnel must be able to "think " real time in multi dimensional space.

The fire control men and officers must have skills to do all of the technical tasks and to do them at a time when they are being attacked and if they are not successful in their work the result was death. The group of them were educated in high school, even the college educated officers were all too often liberal arts graduates, the technical grads were sent to more complex technical tasks. Yet they all had the strong educational base to handle these complex problems.

The first and largest gun was the 5". There were five of these guns, two fore and three aft. They could be controlled by the Computer or if the Computer was down they could be manually aimed. A gun crew fed the shells into the gun from below and the gun was manned internally. The gun, when under Computer control was fired remotely. There was a separate gun crew in the five gun mounts during General Quarters.

The next largest gun was the 40 mm guns. They could be used for sea, land or air. However they were intended primarily as anti aircraft weapons mainly. An example of one is shown in the Figure below. The sighting mechanism was somewhat complex and it was moved by powerful electric motors at its base. It took a gun crew of eight, mostly ammunition passers. One can see in the picture the pointers sight, which was aside the gun barrel.

Using the 40 mm to defend against aircraft meant filling the sky with flak, fragmented metal burst apart and meant to incapacitate any aircraft that went through it. A direct hit was near impossible, the aircraft moved at speed in excess of 300 mph and moved in directions, which had limited continuity so as to pick and follow a track. In addition the 40 mm was somewhat sluggish as a weapon to hit such fast moving targets.

The 20 mm anti aircraft guns are shown below. Like the 40 mm they were intended for air protection. However the gun crew was only half that of the 40 mm. It required only 4 men. The sighting was visual. A typical 20 mm is shown in the picture below.

These three types of guns were the total armament on a Destroyer.

Torpedoes were historically the mission of a Destroyer. There were two torpedo mounts on a Destroyer with five torpedoes in each mount. There were no spare torpedoes and the loading on the tubes was a fairly complex procedure. As shown in the Figure below, which is a fur tube mount from the USS Cassin Young, the tubes are mounted atop ships and could rotate in all directions. The torpedo is composed of about 500 pounds of explosive and on the Grant they were all configured for contact explosion. Namely they had to hit their target to explode.

The torpedoes were gyroscope controlled and their control was a sophisticated combination of manual sighting and homing on by means of the internal gyros. The torpedo was driven by a motor fueled by pure ethanol, alcohol, which had a pink hue and was called "Pink Lady". The alcohol was oxidized by means of compressed air or latter by using hydrogen peroxide, which generated oxygen. The torpedo once set on a course, held the course and depth by using the gyro for an initial course reference and using a pressure measuring device to maintain depth. This once a torpedo was launched it went in a certain fixed direction and at a certain fixed depth.

The torpedoes, the Mark 15, were 21" in diameter and 24 feet in length and carried about 500 to 800 pounds of an explosive called Torpex. Torpex was composed of 45% TNT, 37% RDX and 18% Aluminum. Torpex at the 500 pound load had the explosive power of 1,000 pounds of TNT. Thus on a single torpedo mount there was from 5,000 to 8,000 pounds of TNT in explosive power. A single hit here could be the death knell for a Destroyer.

The targeting of the torpedo can be performed via the Director. The target ship is moving in some direction relative to the Destroyer and it is moving at a certain speed. The Destroyer must the fire the torpedo so that when the torpedo

reaches a certain point the ship is also at the same point. Thus knowing the direction of the ship and its velocity one can determine what the line of movement the target is on. Also knowing the angle of the torpedo and its speed one gets another line. To get them to meet a certain set of equations must be equal. This process is performed by means of an elegant set of gears in the ranging and targeting device, which controls the torpedo.

There are a few studies, which depict the potential accuracy of the torpedo, but many of them relate to aircraft and submarines at closer range. As will be seen, if one looks at a battle condition of nighttime, long ranges, and fast moving ships, the effectiveness of torpedoes in that case is quite limited. One study by Morse and Kimball at MIT considered several attack patterns[17]. These were typically for in close attacks by submarines. If one were to extrapolate these numbers for the ranges used by Destroyers one would see that the chance of ever hitting a ship target was very small.

The following Chart does depict the hit probability for a certain configuration as a function of range and dependent on the number of torpedoes fires. At close range it is a cake walk. As the range increases the chance gets smaller and smaller. If you have three destroyers and each has five torpedoes, then with 15 torpedoes and at 6000 yards and with good targeting you get a high chance of one hit.

Torpedo Hit Probability
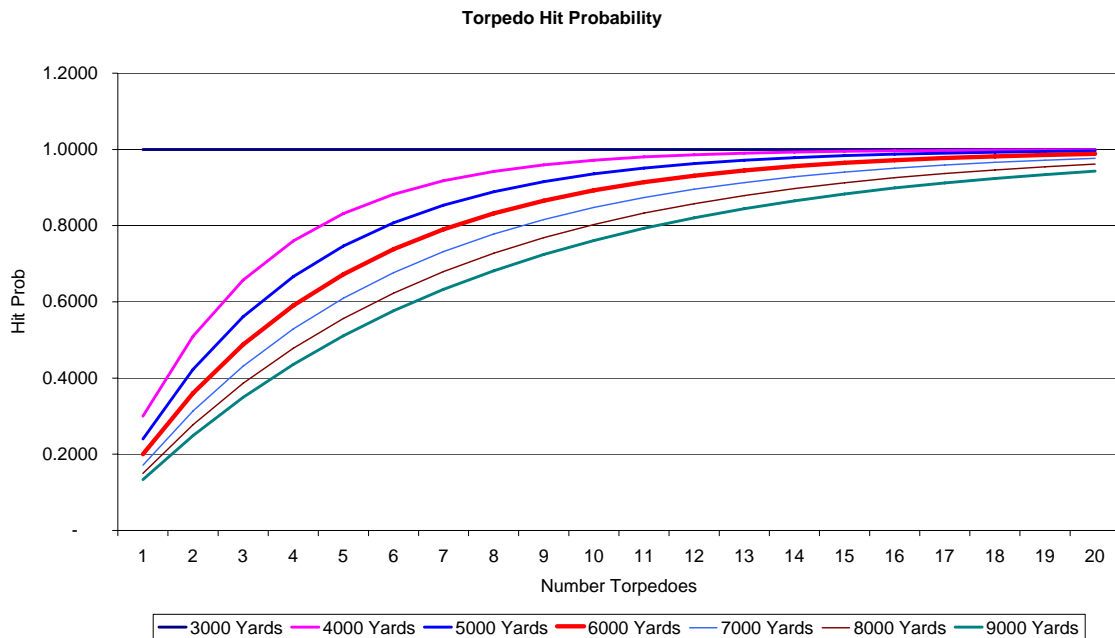
Figure 3 Torpedo Hit Probability versus Number Fired

The implications of this above analysis to the swarming approach are quite clear. Let us assume that a small swarm of destroyers, say three, can attack the enemy elements, in this case Admiral Nishimura's flagship the Yamamoto, and then if they can get within 6000 yards of the target 15 torpedoes should yield a 98% hit probability. Indeed this is what happened. The high hit probability was a direct result of the flexible deployment strategies on the part of the DESRONS as well as the ability to make changes on a fully distributed manner within each section, and finally the TBS allowed a fully inter-netted communications system. Also the accuracy of the Torpedo Director fire control mechanism allowed each ship to achieve substantially higher hit ratios per torpedo, they torpedoes were aimed and targeted and nut just judged to be on course.

There were two types of torpedo firing: (i) salvo firing where the torpedoes were all fired sequentially at the same direction and (ii) pattern firing where the torpedoes were fired at a determined angular offset. There are also several

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[17] See Morse and Kimball Operations Research, pp 114-122.

well known errors; (i) aiming error due to the failure to get to the center of the target and (ii) ballistic error which spreading of the torpedoes from the pattern as they go towards the target.

Simply put if the target is close and if one can get a good fix on the target and if the torpedoes go true and straight in the water then there may be a chance. Otherwise the facts speak differently. Submarines were the most successful with the torpedo, aircraft the second. Surface vessels especially the Destroyer were the least. This is strange since in many ways the Destroyer was designed and intended as a torpedo launching platform.

4.4   Communications

Communications of a ship was done in a variety of ways. One of the most developed and used in a battle action at the time of Surigao was the Talk Between Ships ("TBS") radio system. This was a VHF (60-80 MHz) low power system which perforce of its limited power was not readily intercepted, at least that was the idea since it was generally line of sight. This listening in or direction finding were not readily achievable with the use of TBS. In addition to this flags during daylight and high power directional flash lamps at night were also used. The lamp was a small hand held device, which used a Morse code for transmission and was highly directional. It could provide long distance communications at 10-30 words per minute and could cover a distance of 10,000 yards or more and would be generally secure of one knew where to send the message.

Other communications related systems were the ships VHF system, the direction finding systems, and the IFF (identity friend or foe) system. These systems were all dependent upon an active radio and antenna environment. IFF was key to many battles but it was almost secondary to the proper management of the CIC, and knowing who is to be where and when.

4.5   Control

The control element was the fifth and final element layer of the CCC system. It centered around the ability to communicate between ships in the attack group and to internal manage all of the flow of information and commands to deploy the weapons systems on board.

The radio system was just coming to its own in the War. In WW I there was limited Morse Code links but the radio in that war was secondary to the battle effort. It was for limited reporting and the concept of command, control and communications ("CCC") had not evolved. The CCC idea in World War II had now expanded into

The Combat Information Center on a Destroyer was a small and tightly outfitted room shown in the following Figure. The CIC collected all combat related information from all the sensors and then coordinated that information and directed the overall weapons deployment on a real time basis. The CIC worked hand in hand with the bridge, as a Destroyer went into action, the CIC would coordinate with the other ships in its group by means of ship to ship radio, not breaking radio silence, and using other signalling means and methods such as flags and lights. These inter ship means of communications were very low data rate channels but they had evolved over centuries into effective tactical ship to ship means of coordinating during times of battle. Instead of information overload the systems dealt only with the facts and responses necessary to effectively execute the battle.

The following three Figures depict the CIC as specified in Navy document by Wylie in 1943[18]. The first chart is an overview showing all of the elements of interface in a CIC.

These figures clearly depict the command, control, communications, computation and intelligence functions. The CIC and Wylie's effort to disseminate the concept and operations from the bottom up made for a major change in Naval Warfare. It was appreciated at the destroyer level and amongst the younger officers. The older officers oftentimes dismissed it leading to tragic consequences.

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[18] See US Navy, Combat Information Center, 1943.
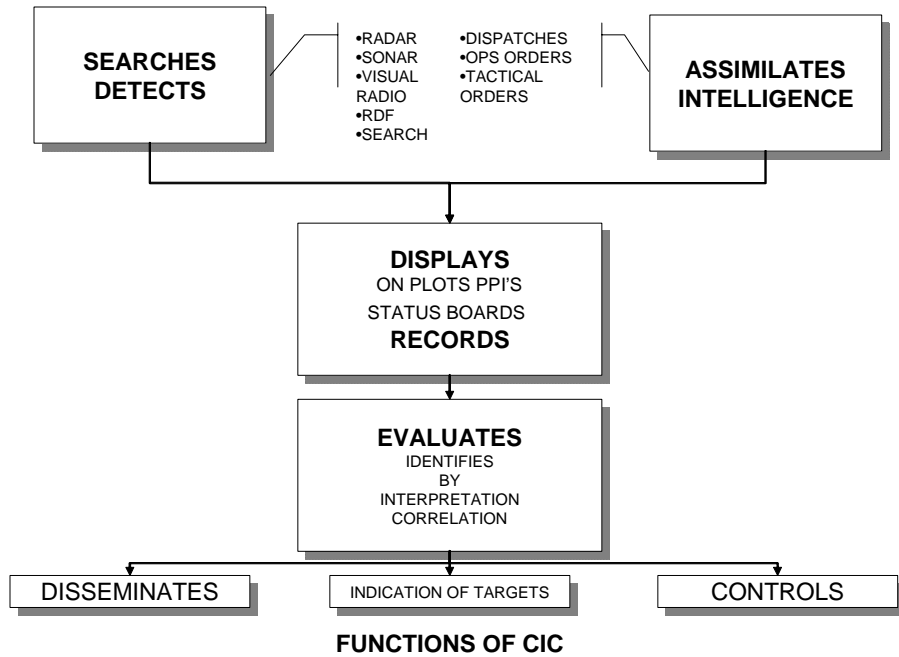
Figure 4 CIC Overall Architecture

The next Figure depicts the CIC as viewed internal to a ship. As expected it was integral. Also its use was evolving. The captain usually was at the bridge, ensuring the security of his ship. The Executive Officer was at the CIC in communications with the Captain. This became a critical relationship. In reality during a battle all command and control was effected at the CIC NOT the bridge. If the captain was at the bridge attempting to be captain as pre World War II CIC, he would just be a blind boat driver, not the captain of a war ship. The Captain must be hand in glove with the CIC. Destroyers understood this and since Wylie was a destroyer man, he viscerally understood this.
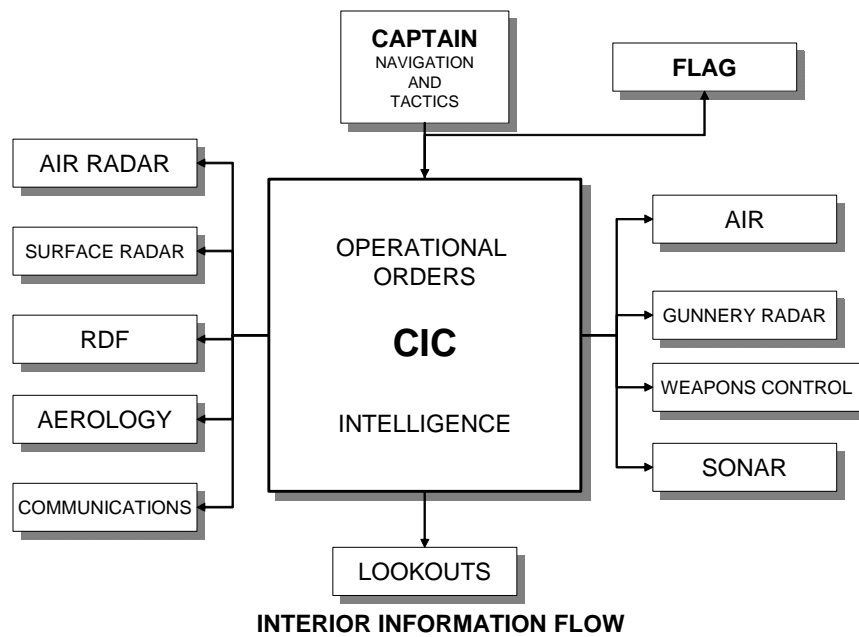
Figure 5 CIC On Ship Operations

The Figure below depicts the relationship between Flag and all the other elements. Flag functions via the CIC and all of his elements. It is highly distributed, it is NOT hierarchical.
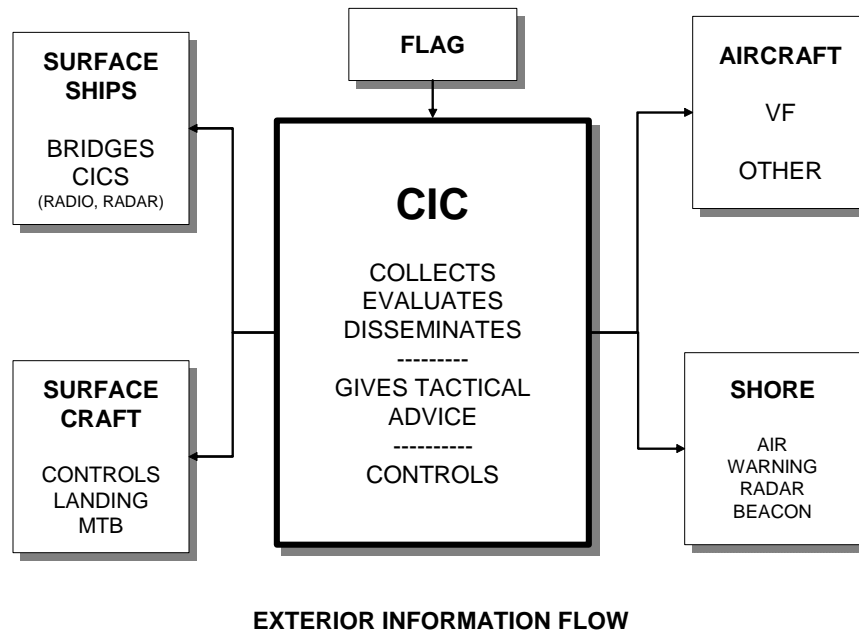
Figure 6 CIC Flag Operations

In modern warfare the use of the term, command, control, communications and intelligence (C^3I) has come to characterize how modern warfare takes into account in an integrated fashion all of the elements of the weapons platform to maximize the potential to achieve the desired goal while minimizing the risk to the humans on board. Such systems require well educated and trained members of the crew, both officers and enlisted men, and it requires the best in management skills to ensure that these activities are carried off without error during times of extreme duress. It is critical to understand this concept and how it was employed in the Destroyer fleet in World War II. It was the first time in history that Naval warfare combined high state of the art technology with well educated and trained crews. And in addition, the crews were all assembled and trained in record times, and had to act in a coordinated fashion not only within their own ships boundaries but also in large fleet actions. It can be seen when looking at the battles that the Grant was involved in that their very survival was a tribute to the system and to the training.

In summary the integrated CIC system of a Destroyer is shown graphically below. There are five layers in this system:

1. Sensors: These were the radar, sonar and Directors. These sensor elements detected targets and provided the information as to their range, azimuth, elevation, or bearing and depth.

2. Reference: The reference elements or elements were the gyros. In a ship, and in a ship attempting to achieve a hit on a moving target, it is essential to know both where you are and where the target is. The gyro based stable platforms or elements were critical to this mission.

3. Computer: The computer was a first. In prior wars at best one may have had ballistic plotting tables, where recalculated settings were used and then the his or miss approach was employed to zero in on a target. It allowed for evasion and also expended excessive amounts of ammunition. In the Destroyer environment of World War II the first real time computer allowed for real time targeting. The computer used the sensor data and employed the reference planes of the stable elements to calculate the required firing patterns of the guns.

4. Weapons: The weapons systems of a Destroyer were capable of dealing with land, air, sea and submarine targets. The computer then directed the guns for land, sea, and air targets. The submerged targets were still handles as somewhat of a hit or miss approach using depth charges. This of course has been eliminated in today's Destroyer fleet. The weapons were the 5" guns, the 40mm and the 20 mm weapons, the torpedoes, and the depth charges. They were used at times as an integrated weapons system, and at times individually. The Destroyer could handle submerged threats, surface threats, land threats as well as air threats, and do so in a simultaneous fashion.

5. CIC and Communications: The introduction of the CIC, Combat information Center, was a brilliant move at this time. Apart from the bridge and the control of the ship, the CIC was the heart of the weapons systems. It in many ways became the bridge for the weapons, whereas the classic bridge retained its role over the ship. The two could function almost independently. In aircraft carriers this separation occurred between the aircraft and the carrier itself, as ship.

5   THE BATTLE OF SURIGAO STRAIT

We now provide both an overview and detail on the Battle of Surigao Strait[19].

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[19] There are many books written on the Battle at Surigao and of Leyte in general. The two key references are Karig and Morison. There is the NY Times article written in December, 1944 which is a good reference of the Grant. Roscoe is excellent for details and more importantly as a general reference on destroyers. However Roscoe was written in the early 1950s and it reflects the view at the time. Thus the impact of the CIC does not come through. Ironically Roscoe does show a picture of the CIC of the Grant! The other general references are: 1. Cutler, 2. Falk, 3. Friedman, 4. Grant, 5. Horne, 6. Hornfischer, 7. Hoyt, 8. Marston, 9. Sauer, 10. Sears, 11. Smith, 12. Stewart, 13. Thomas, 14. Van der Vat, 15. Wilmott. There may be others but we have relied on these as well as ships documents and oral interviews and diaries. It is clear that there are always differences and discrepancies in the analysis of this battle. However, we have been able to collect minute by minute and location data for each of the principal ships and have performed our analysis accordingly. This is not a re-fighting of Surigao as much as its a use for the first time of a full C^4I system to Naval warfare.

MacArthur was determined to return to the Philippines. He had convinced Roosevelt, in a subtle but threatening way that if the US did not return it would become an issue in the 1944 Presidential Campaign. The Navy, in the view of Admiral King wanted to sidestep the Philippines and go for Formosa. MacArthur won the argument.

MacArthur was supported by Admiral Kinkaid, who headed the 7th Fleet, and as such reported to MacArthur directly. It was Kinkaid who would have the naval resources required for the landing.

In contrast, Halsey, who had the 3rd Fleet reported to Nimitz who in turn reported to King. In contrast MacArthur reported to Marshall. Both King and Marshall eventually reported to Roosevelt. Halsey was assigned to protect the landing and then at his discretion find and destroy the Japanese fleet, which still was a threat.

On October 20, 1944 MacArthur landed on Leyte, one of the middle islands in the Philippines. This was the day the General made his statement of having returned to the islands. The Grant was in a position to view that return. In fact, many of the crew were looking at the General as he landed. However, some of the crew were less than enthusiastic and decided to look elsewhere. The reasons for this seem hidden in history, in fact some of the dissidents amongst the Grant crew do not recall why they participated in this mild form of protest. MacArthur could not notice, since his attention was always in the photographers who were recording the deed.

 On that day, the harbor on the west side of Leyte was amass with ships, the 7th Fleet supporting the landing, landing craft, and the 3rd Fleet watching a form of guard duty. There were hundreds and hundreds of ships, and if one were close to the shore the ships appeared to go on forever. It was a sea of ships, destroyers, cruisers, battleships, carriers, support vessels, ships from everywhere, and men landing on the shore prepared to battle the Japanese on Leyte and then to move from island to island to regain the Philippines.

After the landing on the 20th both Halsey and Kinkaid remained off Leyte to see the remaining elements off-load and to secure the positions against Japanese attack. Leyte was bounded on the south by the Surigao Straight and below then the island of Mindanao, and to the north by the San Bernadino Straight and then the island of Luzon. The MacArthur strategy was to cut into the middle of the Philippines and work out, eventually gaining a foothold in the main northern island then recapture the capital.

However on the 22nd , intelligence arrived indicating that a fleet of the Japanese main forces was heading towards the Philippines. The submarines Darter and Dace sighted the fleet at that time west of the Philippines. Halsey however had orders from Nimitz to seek out and destroy the enemy, and he viewed these orders to supersede his support role for MacArthur and in turn Kinkaid. Kinkaid was concerned but there was a major communications problem between Halsey and Kinkaid, the only common leader was the President. This would prove the undoing of many in the next few days.

Kinkaid was a Vice Admiral at the time. Kinkaid had not done very well academically at Annapolis and thus his promotion chances were generally less than most of his peers, yet he was politically well connected. His brother in law had been Admiral Kimmel and this had helped his advancement. He advanced but at a slower pace and he was viewed as a plodder rather than a strategist such as Nimitz or Spruance or a warrior such as Halsey. As such he was an ideal match for what MacArthur wanted, namely someone who would be in MacArthur's chain of command and that of the NCO, Admiral King[20]. Kinkaid was ideal for this position. He became Commander of the 7th Fleet in November 1943.

Kinkaid had control over various groups in the 7th Fleet, almost 800 ships and vessels as part of the landing and support of the Philippines operations. One of these groups was under Rear Admiral Jesse Oldendorf.

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[20] See Wheeler, Kinkaid, pp. 344-346. Wheeler discusses reasons for the choice of Kinkaid and gives a brief overview of the strange reporting relationship.

Oldendorf in October 1944 commanded the group supporting the invasion and patrolling the Surigao Straight.[21] Unlike Kinkaid, Oldendorf was a quick thinker, and just one year younger than Kinkaid he could see how to use his attack forces to repel the Japanese attack. Oldendorf had been assigned to the 5th and 3rd Fleets under Spruance and Halsey respectively. He was seconded to Kinkaid for the invasion.

5.2   The People and the Organization

The forces assembled under Kinkaid included both the landing forces and a modicum of defense forces. The true fast carrier defense were under Halsey and the 5th fleet. Halsey had over 200 of the best ships fit and ready for fighting and he had all the carriers. Kinkaid had small landing support carriers, which were for the most part limited to assisting landing efforts with near shore support, and did not have the capability of the fleet carriers. In addition Kinkaid had the old battleships many of which had been rebuilt since their attack at Pearl Harbor in December 1941.

The Kinkaid organization appears as below. Rear Admiral Thomas Sprague was positioned off Leyte supporting the landing efforts with his small carrier support group. Oldendorf was assigned to secure the Surigao Straight with his battleships, cruisers and destroyers.
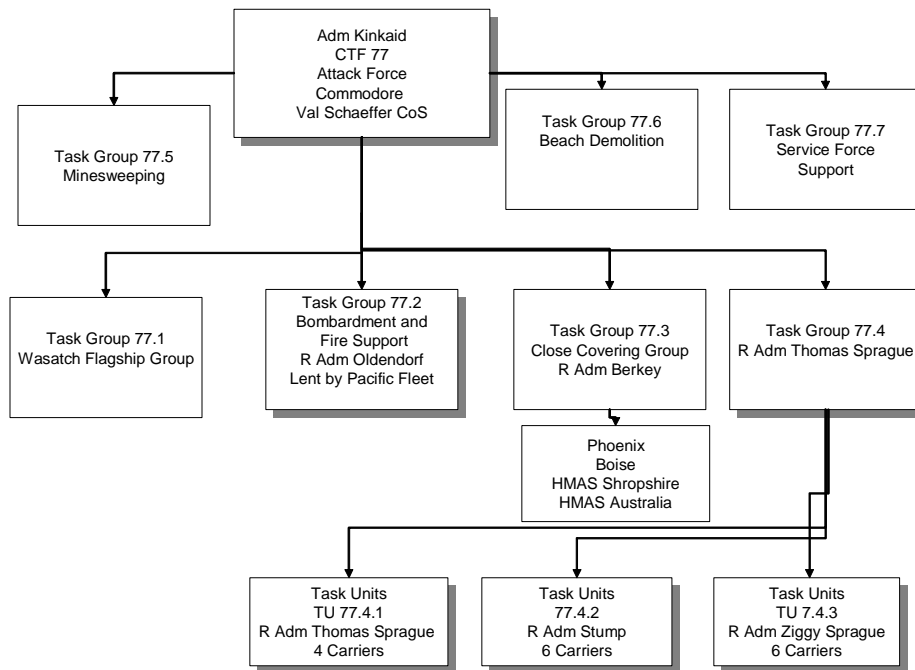
Figure 7 7th Fleet Organization

Kinkaid's organization on the staff side was considerable. The key members of this staff are shown below. His Chief of Staff was Commodore Val Schaeffer.

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[21] Oldendorf was promoted to Vice Admiral in December, commanded battleships in the landings at Lingayen, and was wounded during the Battle of Okinawa while on the *Pennsylvania* (BB-38).
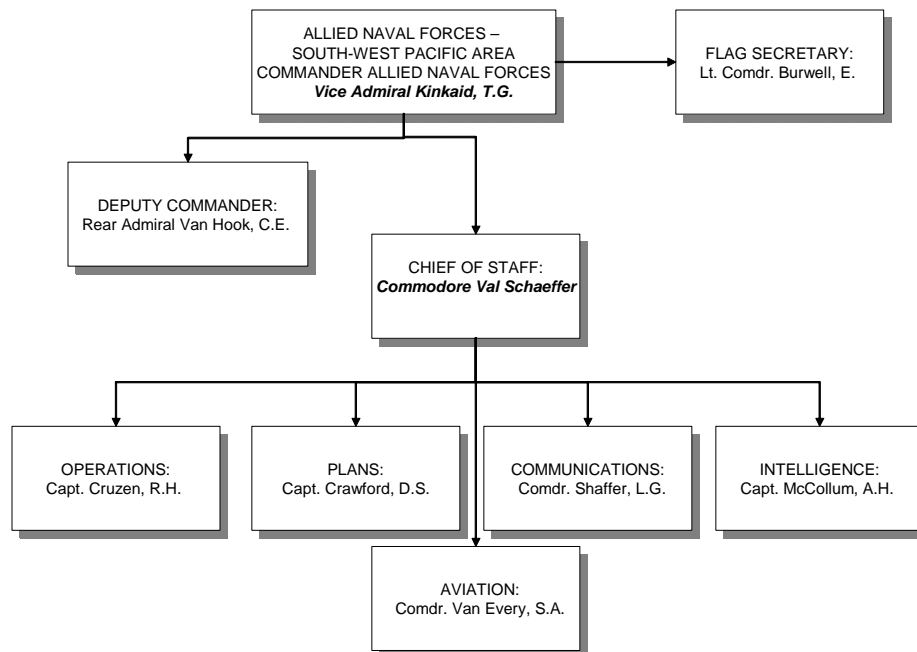
Figure 8 7th Fleet Staff

The actual assembly of forces for the battle at Surigao was as shown in the Figure below. Oldendorf had overwhelming force in battleships, cruisers, and destroyers as well as PT boats in support. The Denver reported to Rear Adm Hayler. The Grant was part of Capt. Smoot's DESRON 56. DESRON 56 would have the most perilous role in the attack and in fact it was the last three destroyer attacks by the Newcomb, Leary and Grant, which would be the most risk, and finally it was the Grant as the last of the last, which would have the maximum exposure to enemy fire. The plan going into the attack was clear to all of the commanding officers, the plan was stated quite simply:
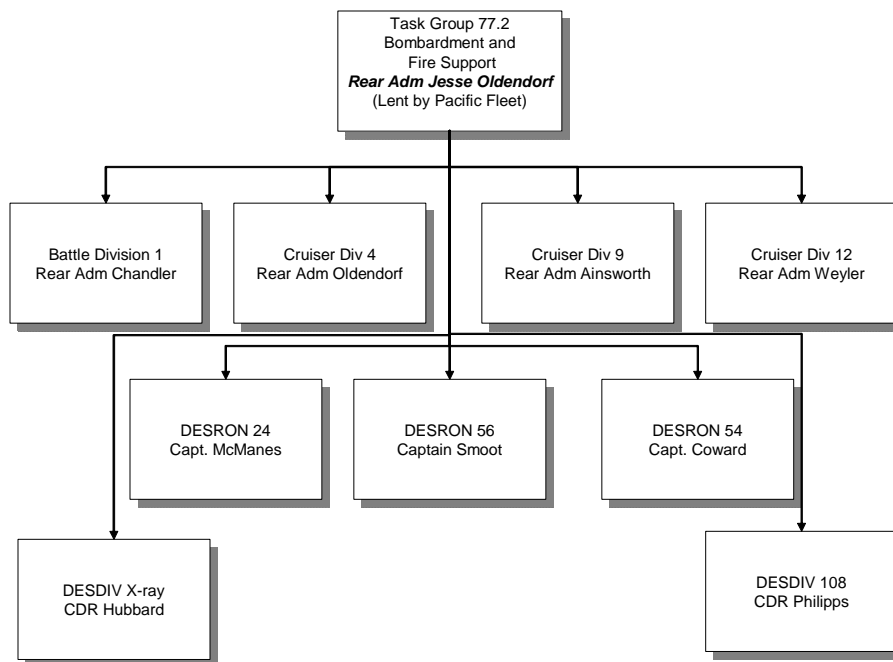
1. PT boats would engage the enemy once the enemy forces entered the straight. Although the PTs fighting power was at best minimal the PTs did provide early warning intelligence gathering units reporting up to Oldendorf.
2. The destroyers would attack from the sides, namely DESRONs 54 and 24 and then DESRON 56 would attack down the middle. In effect the destroyer attacks were true swarm attacks, small groups attacking as would advantageous and directing fire right at the enemy.
3. Once the destroyers had cleared the line of fire, the OTC, the officer in tactical command, namely Adm Oldendorf, would issue the command to fire upon targetd enemy ships to his larger ships, battleships and cruisers.[22]
4. Since the engagement would be at night, sightings would require radar, star shells would not be employed, and clear unambiguous targets of enemy vessels would be required before firing. In addition, since the destroyer attack was well know to all, and since each vessel had a CIC which would by definition be tracking both friendly and enemy vessels, free fire was not the order of the day. Commanders were advised to fire only on well defined targets. The Battleships did exactly that.

These are the simple rules of engagement, which Oldendorf had issued.

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[22] Officer in Tactical Command (DOD) In maritime usage, the senior officer present eligible to assume command, or the officer to whom the senior officer has delegated tactical command. Also called OTC.

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                        ┌─────────────────────────┐
                        │   Task Group 77.2       │
                        │   Bombardment and       │
                        │   Fire Support          │
                        │ Rear Adm Jesse Oldendorf │
                        │  (Lent by Pacific Fleet) │
                        └─────────────────────────┘
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Figure 9 7th Fleet Bombardment Group

However as will be seen, the Grant, at the end of the end of the destroyer attacks, was engaged with both Japanese fire as well as overwhelming friendly fire solely from the Denver. The question will be why, and given the statements of Kinkaid, who said what to whom and why?

5.3   The Forces

The Japanese had four elements in the attack on Leyte[23]. Two were to the south, one was thru San Bernadino to the north and one was a decoy to the north east. The latter one was to lure Halsey away and it performed that function well. It is not clear what the Japanese were trying to do to the south, since it was fragmented into two small groups and they were to face massive American and Australian naval forces under Oldendorf. However, the one going thru San Bernadino would become the true problem latter that day on the 25th of October.

To the south the first fleet approaching was under Nishimura. It consisted of the following ships and their armament[24].

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[23] See Morison, Leyte.

[24] Dull provides an excellent history of the IJN. The IJN web site is also useful for a ship by ship analysis. Thomas in his recent book gives a reversionary view from the perception of the Japanese. Thomas's view looks at the vision and good sense used by the Japanese and the mistakes of Halsey. Thomas in many ways does not see the strategic issues and the change that occurred, his view as many revisionists is the "last battle" rather than the first.

Table 2 Nishimura's Fleet

Ship	Type	Sunk	Armament
Yamagumo	DD	sunk	6 5", 28 25mm, 4 13mm
Asagumo	DD	sunk	6 5", 28 25mm, 4 13mm
Michishio	DD	sunk	6 5", 28 25mm, 4 13mm
Shigure	DD	damaged	5 5", 21 25mm, 4 13mm
Fuso	BB	3:09:00	12 14", 14 6", 8 5", 37 25mm
Yamishiro	BB	3:25:00	12 14", 14 6", 8 5", 37 25mm
Mogami	California	3:51:00	10 8", 8 5", 50 25mm

The second fleet behind Nishimura was Shima's fleet comprised of the following:

Table 3 Shima's Fleet

Ship	Type	Sunk	Armament
Nachi	California	No	10 8", 8 5", 50 25mm
Ashigara	California	No	10 8", 8 5", 50 25mm
Abukuma	CL	No	10 8", 8 5", 50 25mm
Akebono	DD	No	6 5", 28 25mm, 4 13mm
Kasumi	DD	No	6 5", 28 25mm, 4 13mm
Shiranuhi	DD	No	6 5", 28 25mm, 4 13mm
Wakaba	DD	No	6 5", 28 25mm, 4 13mm
Hatsushimo	DD	No	6 5", 28 25mm, 4 13mm
Hatsuharu	DD	No	6 5", 28 25mm, 4 13mm

Shima did not enter the Strait until Nishimura was already fatally hit and upon his assessment of the scale of the damage he quickly turned and fled. Thus the second set of ships as accounted for by Shim played little if any role in the main battle.

The forces available to Oldendorf included the following:

Table 4 Oldendorf's Group

Left Flank	*Battle Line*	*Right Flank*
R Adm Oldendorf	R Adm Heyler	R Adm Berkey
Chief Staff Cpt Richard Bates		
Heavy Cruisers	**Battleships**	**Light Cruisers**
Louisville	Mississippi	Phoenix
Portland	Maryland	Boise
Minneapolis	West Virginia	
	Tennessee	**Heavy Cruiser**
Light Cruisers	California	HMAS Shropshire
R Adm Hayley	Pennsylvania	
Denver		
Columbia		
	DESDIV X Ray	**DESRON 24**
Sec 1 DESRON 56	*CDR Hubbard*	*Capt McManes*
Capt Smoot	Claxton	Hutchins
Newcomb	Cony	Daly
Richard P Leary	Thorn	Bache
Albert W Grant	Aulick	HMAS Arunta
	Sigourney	Killen
Sec 2 DESDIV 112	Welles	Beale
Capt Conley		
Robinson		**DESRON 54**
Halford		*Capt Coward*
Bryant		Remey
		McGowan
		Melvin
Sec 3		Mertz
Cdr Boulware		
Heywood L Edwards		
Bennion		**DESDIV 108**
Leutze		*CDR Phillips*
		McDermut
		Monssen
		McNair

This was to be a clear battle between the limited forces of the Nishimura fleet and the overwhelming forces under Oldendorf. This was also a battle, which would test the old tactic of crossing the "T" with the battle line composed of the older battle ships and the cruisers and the new and innovative approach of using the destroyers not just to "soften" up the enemy but to seek to destroy them. This was to be a battle wherein the use of the CIC both at the senior command and the tactical command levels would be tested. With the exception of the Denver is worked superbly.

5.4   The Events of the October 25, 1944

The following is a recount on a minute by minute basis of the events on the early morning of 25 October 1944. These are based upon an agglomeration of historical records, first hand accounts and the works, which have been recorded since that time.

Oldendorf had been ordered to have his forces defend the Surigao Strait on the southern side of Leyte. Nishimura's forces were heading directly for the strait and behind him and coming from the north was Shima's forces. The main body led by Kurita was heading to the north side of Leyte through the San Bernadino Strait. That force would cause havoc latter in the day on the 25th. A small fleet led by Ozawa was a decoy, which would entangle Halsey in one of

his biggest mistakes, leaving the body of Kinkaid's forces to face Kurita off Samar Island, which lies to the east of Leyte.

The evening of the 24th was hot but initially clear. As midnight approached there was an overcast and some rain, the air was thick and the winds were light. The Surigao Strait was dark, in fact pitch black. Oldendorf assembled his forces in a classic formation, the six old battleships to the east, the farthest from the anticipated Japanese fleet, then the cruisers in front of the battleships, and then the destroyers as that flexible and distributed attack force as developed by Burke. The PT boats were waiting like mosquitoes to attack, with their fast speed and few torpedoes, they could pose a threat if there had been better vision. Unlike the destroyer torpedoes which had sophisticated directors for targeting the PT boats were ate best aim and fire, they were brave little boats which could be useful in certain circumstances but the darkness of this night would limit their contribution, the sophistication of the destroyer would be critical.

Oldendorf knew about Nishimura and he also knew that Shima and Kurita were out there as well. He had no idea as to how many enemy ships his forces would be facing. He was low on ammunition, at least twenty percent below what he should have had, and his shells were not all armor piercing, since he had been bombarding the shore and the shells he had were for the shore bombardment, not piercing the hulls of Japanese battleships. He was concerned that he would not have enough in the event of a prolonged battle. He had been advised of the reports from the submarines Darter and Dace, which had been monitoring some of the Japanese fleet, they were following them through the strait north of Palawan, one of the islands west of Leyte. However this was a limited sighting and both subs had even attacked the Japanese forces. Thus the enemy knew that they attack was not hidden and their arrival would be anticipated.
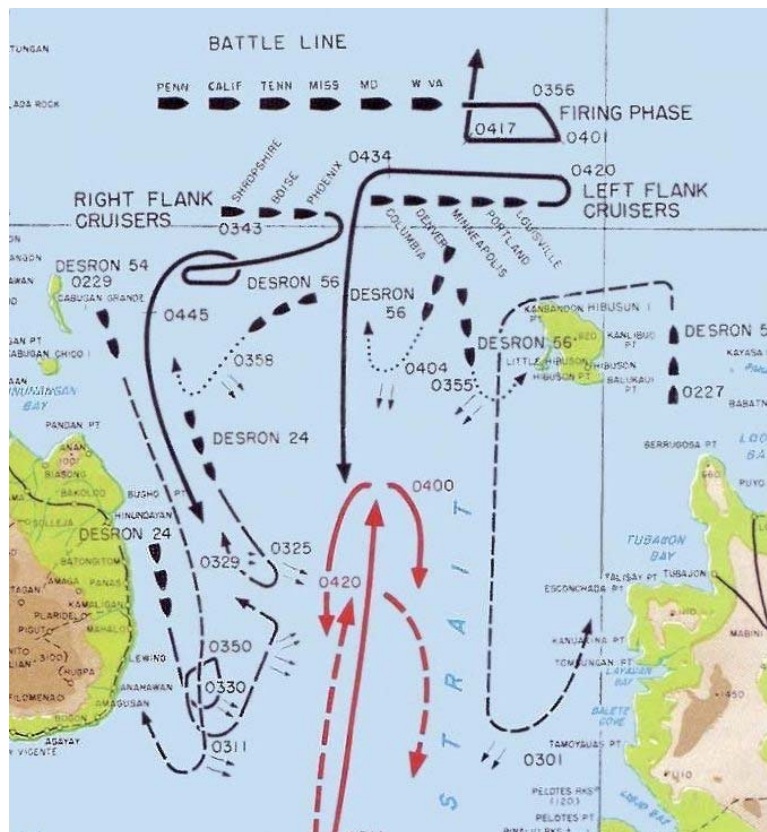

Figure 10 Battle Surigao Strait (From US Govt Documents)

The time from 03:51 through 04:09 are the critical periods of time. There are several key factors, which also must be recalled. Specifically:

1. Oldendorf had prepared a detailed battle plan. This included the use of the "T" formation and the use of destroyers in a swarm" like manner, which extended the strategies developed by Arleigh Burke eighteen month earlier. The use of all elements; destroyers, battleships and cruisers, required a clear understanding of who was to be where and when.

2. The CIC had evolved into a well accepted and fully operations part of any battle. The CIC was not the hub of any command and control effort and using the battle plan, using the radar and other external methods for target positioning, and using the plotting board techniques perfected by Burke and Wylie and his fellow destroyer men, of which Grant had been a part, the risk of friendly fire threats were to be minimized and hopefully eliminated.

3. The OTC, the Officer in Tactical Command, in the case of the Denver it was Oldendorf. The OTC was to issue the command to fire and to do so in accord with the established battle plan. The OTC command came at 03:51.

4. The radar systems were evolving and many of the battle line ships had Mark 8 systems, some like the Denver had older systems, the Mark 3. This would also cause a problem. The Mark 8 are higher frequency and has better target resolution, clutter control, and target ranging. The radar officer in the CIC would or should have known this.

The details now follow in six Phases[25]:

5.4.1   *Phase I: Early Warning and Swarm Attack by PT Boats*

Phase I is the entry and early intelligence phase. Here the PT boats to the west make sittings, make some futile attempts of attack but are primarily intelligence gathering units. We argue that contrary to many other authors who dismiss the PT boat as an attack tool, in the case of Surigao it is a excellent intelligence tool.

> 1:00 Nishimura advises Kurita at San Bernadino and Shima who was 35 to 40 miles astern that he would pass Panon at 01:30. This meant that he was soon to enter the strait. The island of Mindanao was to his south. He was hoping for cover of night. He was on the battleship Yamishiro.

> 1:07 PT 523 reports star shell from Nishimura 10 miles west Panon. The Japanese fire a shell to attempt to get visuals of the battle field. The Americans had more effective radar in this battle and thus had limited if no need for the star shells.

> 2:05 PT 134 fires at Nishimura force near Panon. This is the first contact between the Americans and the Japanese.

> 2:06 Captain Coward goes to General Quarters with DESRON 54. This will be the first destroyer squadron to attack. PT 490 fires torpedoes at leading Japanese destroyer and PT 491 fires at others. The PT boats were not successful in their attacks.

> 2:25 PT 327 sites Nishimura and his fleet and reports. Other Japanese boats are sighted by the PTs.

5.4.2   *Phase II: Swarm Attack by Destroyers*

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[25] We take this data from a variety of sources as referred to in the references as well as over two dozen interviews with the men on the ships as well as from their personal records, and Navy Battle Reports. These are summarized in the author's work, DD 649, to be published but available in pre print form from the author. In addition the work is from the reports as presented in Morison; Karig; Hoyt; Sauer; Cutler; Freidman; Wilmott; Hamill and his assessment of the Denver Log; Nisewaner and multiple communications; and Stewart. We have tried to create a consistent set of data and when there was a conflict we relied upon the Captain and XO of the Grant, namely Nisewaner and Hamill. As is all too frequent, secondary authors using secondary reports have frequently failed to present accurate or even consistent data.

Phase II is the beginning of the swarm attacks. The destroyers are working in total darkness. The Americans did not want to use star shells for lighting and relied solely upon their radar. The SG search radar was used and the Mark 4 radar on the destroyers for linking into the fire control system.

2:30 DESRON 54 starts moving. DESRON 54, with Capt Coward, starts run. Oldendorf sounds GQ for all his group.

2:40 DESRON 54 sites Japanese at 18 miles and notification of the Japanese being located is forwarded.

2:44 First Contact with enemy, Battle Line increases speed.

2:45 DESRON 54 sites Japanese at 15 miles, (at this point each 5 min. is 3 miles), speed 30 mph or 25 knots. DESRON 54 sends estimate of seven ships; 2 Battleships 1 Heavy Cruiser 4 Destroyers.

2:54 Remey et al detect Japanese to south at 7,500 yards

2:56 Shigure sees DESRON 54 at 4.3 miles……Phillips picks up Japanese at 29,700 yards on radar. Shigure sees destroyers. Shigure alerts Japanese fleet of DESRON 54.

2:57 DESRON 54 Coward's fires torpedoes Coward sends message to take first

2:58 DESRON 54 Melvin sites Nishimura's ships at 12,800 yards.

2:59 DESRON 54 fires remaining torpedoes. Destroyers Remey, McGowan, Monssen launch torpedoes at the oncoming fleet.

3:00 Destroyer McGowan begins attack on Fuso. Other Destroyers begin attack.

3:04 West Virginia's Mark 8 radar in its director picks up Japanese at 42,000 yds

3:05 DESRON 54 fired upon by 5" shells from Nishimura

3:08 DESRON 54 sees fire from target location

3:09 Fuso is hit by 2 torpedoes. The destroyers Monssen & McDermut fire torpedoes at Fuso. Fuso hits from Melvin et al 510 sec at 15 yds per sec, 7,650 yds Monssen and McDermut fire torpedoes Torpedo from the destroyer Melvin hits Fuso.

3:11 The destroyers McDermut and Monssen launch their torpedoes .

3:12 Searchlight flashes from south.

3:15 PT 134 torpedoes off Binit Point, no effects.

3:16 PT 137 fires torpedoes hitting radio room of light cruiser Abukuma

3:17 Australian destroyer Arunta is ordered to attack.

3:19 Yamagumo hit by torpedo from destroyer McDermut. The Fuso is also torpedoed .

3:20 Torpedo from destroyer Monssen hits Nishamura flagship Yamishiro

3:23 The Australian destroyer Arunta fires at Shigure in DESRON 24

3:25 DESRON 24 Killen launches 5 torpedoes at Yamishiro range 8,700 yards. Yamishiro hit by one or two torpedoes

3:30 Nishimura sends message after Michishio and Asagumo are disabled. Oldendorf gets message from PT boats sent at 0130 DESRON 54 McManes and ship DD Hutchins fires 5 torpedoes each, 15 total

3:33 Wheeler CIC radar contact 33,000 yds

3:35 DESRON 56 ordered to commence attack on the Japanese fleet. The destroyers are in three sections.

3:40 DESRON 24 fires on escaping Japanese destroyers Michishio and Asagumo McManess fires torpedoes on Michishio and Asagumo

3:45 DESRON 56 Conley reaches firing area

3:49 Admiral Berkey orders DESRON 24 to retire.

3:50 The Yamishiro and possibly the destroyers Moganmi and Shigure commence fire upon DESRON 56

5.4.3   Phase III: Battle Line Commences Firing

In Phase II the true action begins. DESRON 56 under Smoot begins its run. Again radar, especially the SG radars and the Mark radars on the battleships and cruisers were monitoring each destroyer on they plotting boards in each of their CICs. In addition they all were plugged in the TBS, which was active for all ships in the attack. Thus each CIC and in turn each ship captain was aware of the situation in the field of attack.

3:51 This is the beginning of the 18 minute period of activity on the Grant. The Grant, Leary and Newcomb were proceeding at 200° T at 27 knots, 31 mph or 45 feet per second or 15 yards per second. The ships in DESRON 56 were separated by 300 yards, or twenty seconds in time. The Grant was last in a column of three; Newcomb, Leary and then Grant. They were in the process of attacking the Yamishiro. At this time, Oldendorf, as OTC (Officer in Tactical Command), orders his cruisers to open fire at nearest target at 15,600 yards. Denver starts firing at alleged range of 15,800. Cruisers Louisville and Boise commence firing. Japanese open fire on Conley of DESRON 56. Total 3,100 shells fired. The Boise and Phoenix commence firing Yamiashiro was 22,800 from Battle line and 15,000 from Louisville, Oldendorf command as OTC to open fire

3:52 Phoenix and Boise start firing at range of 16,600 yards but Yamishiro moving at 30+ knots, 15 yards per sec, thus at time Denver fired it should have been at 17,700 yards not 15,800 yards. West Virginia fires at range 22,400 yards.

3:53 Weyler as OTC of his Battle Line, namely all the battleships, orders open fire at 22,800 yards, Battle line of the battleships appears to be 7,000 yards behind cruisers. Louisville and Boise also commence firing. Mogami hit by 2 shells. Radar contact 22,600 yds 20 sec 10,000 yds? West Virginia is the first battleship to open with its 16" guns.

3:54 DESRON 56 Conly commences firing torpedoes, all miss at 8300 to 9000 yards. Conley section No 2 fires 15 torpedoes at 8400-9000 yards. DESRON 56 Smoot commences torpedo firing.

3:55 Tennessee and California fire and get 69 and 63 rounds 14 " Armor Piercing Shells respectively. Mogami launches 4 torpedoes at 25,000 yards to Battleships and at 17,000 yards to Cruisers. Tennessee and California open fire.

3:56 Australian cruiser Shropshire fires on the oncoming Japanese fleet.

3:57 DESRON 56 Boulware fires at 7,800-8,000 yards at Shigure and Yamishiro. Two CL stop firing. Mississippi and Pennsylvania start to fire.

3:58 DESRON 24 Hutchins torpedoes hit Michishio and sinks immediately. DESRON 56 Sec No 3 fires at 7800-8000 yards and changes course to 270° T, going now due West.

3:59 Maryland started firing. Yamishiro turns left.

4:00 DESRON 56 Smoot evaluates radar via the CIC on the Newcomb to make certain it is the enemy and NOT Coward. Nachi passes floating section of Fuso. Shigure skipper begins to withdraw.

4:01 Yamishiro fires torpedoes at destroyers.

4:02 Oldendorf has Battle Line realign west. Mogami hit by Portland destroying bridge. After Mogami is hit the Battle Line ordered to realign.

4:04 DESRON 56 Smoot launches 15 torpedoes at 6200 yards to Yamishiro, five from each of the three destroyers; Newcomb, Leary, Grant. The Battle Line realigned at 19,700 range then the Grant, Newcomb and Leary fire. At this time the Denver action report indicates a report of a shift in their firing: *"Main Battery cease firing- shift target 165 T range 8000 yards"*

4:05 The Denver Captain receives a reply from the Denver CIC, which corrects the announced target bearing to *"Main battery director on target but target bears 172 T"*

4:06 The Denver captain, Captain Bledsoe, orders firing at what he perceives to be target despite CIC reports to the contrary with the command "*Main battery commence firing, 15 sec salvos full rudder contro*l." In the late 1990s Hamill writes his memoirs while at sea[26]. In this document Hamill states:

"....an ex Navy man who seeing our reunion sign in Ormand Beach at the hotel where we met in 1992, joined us and announced that he had been on DENVER the night we were hit. He reported having heard an exchange between the Captain on the bridge and Exec in CIC. DENVER's Captain (Bledsoe) on his bridge PPI Scope had spotted pips, which appeared to be destroyers, leaving the enemy formation in torpedo attack mode and headed on parallel track.

He (Bledsoe) told the Exec to take them under fire. The Exec opined that these were "Friendly" ships and that he would have to verify the IFF....... The Captain, according to our friendly sailor, shouted at the Exec. "Open fire that's an order!" The rest is history. .... Andy Nisewaner had been told that DENVER's skipper (Captain A. M. Bledsoe) and Admiral Kinkaid's Chief of Staff (Commodore Val Schaeffer) had been class mates, close friends and possibly roommates at the Naval Academy.

Thus we could easily be looking at a cover up by Kinkaid's Chief of Staff. Additionally, there's something wrong with a skipper who will fire one unauthorized shell seconds before another ship is to open fire so as to have the "honor" ... of firing the opening gun of the Philippine Campaign."

Captain Nisewaner is awarded the Navy Cross for his actions in Surigao.

However Capt Bledsoe is also awarded the Navy Cross at the same time for:

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[26] See Hamill memoirs.

"The Navy Cross is presented to Albert MacQueen Bledsoe, Captain, U.S. Navy, for extraordinary heroism as Commanding Officer of the cruiser, U.S.S. Denver, in her action against the enemy from 17 to 29 October 1944. During this time the U.S.S. Denver supported the landing of our forces on Dinagat, Suluan and Leyte Islands, and on __24 October participated in the defense of Leyte Gulf, which resulted in sinking of at least one enemy battleship, a cruiser and six destroyers.__ Through his professional skill and capable leadership, his vessel performed all missions assigned to her in a highly efficient manner and contributed materially to our success. His conduct throughout was in keeping with the highest traditions of the Navy of the United States."

It is not at all clear what Bledsoe did in the Denver to sink the ships. In fact, the entire Japanese fleet under Nishimura consisted of two old battle ships, one cruiser and only four destroyers. It was clear that Newcomb and Grant got the battleship, and thus crediting Bledsoe with this is not only a fallacy but commences the alleged cover-up[27].

5.4.4 Phase IV: Grant Takes Hits

The Grant is now hit. The first hits on the rear deck are from Japanese shells. However based upon crew reports the primary damage and deaths were due to the Denver hits. Fortunately the Denver was using Armor Piercing Shells, which went through the 5/8th inch thick hull. The main damage was a result of the Denver 6" shells hitting the high pressure steam lines and literally melting the Number 1 boiler room crew in their place. Oral interviews from the

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[27] In the Naval Institute book, PACIFIC WAR REMEMBERED, An Oral History Collection by John T. Mason Jr., Mr. Mason, a holder of a doctorate in theology, holds himself out as an oral historian, and in his view the oral historian merely records what someone says and then reports its verbatim. Mason's view is akin to what a Journalist does, but without journalistic standards and with no corroboration. Mason further assumes that he has no liability for reporting what utterance he records no matter what has been uttered to him. More importantly the Naval Institute takes no responsibility for such utterances. Oral History is notoriously in error and in many cases can be very self serving. As any historian know, as does any lawyer, physician or engineer, one must seek the truth, if it can be found. Mason as a theologian seems oblivious to this reality of professionalism.

Mason presents an oral history from Admiral Kinkaid, about fifteen years latter and twelve years before the Admiral's death. In this history Kinkaid accuses the Grant of not following orders. Nisewaner in a letter to Mason on 30 October 1989 states as follows:

"It is inevitable that there will be inaccuracies in the recollections of those who are asked to remember important and emotionally charged episodes from their lives and experiences. It is inevitable also that there cannot be full verification of statements and their content. Despite this, we are gravely concerned that apparently no effort was made to check the following paragraph from page 280 of your book __The Pacific War Remembered__ as, for posterity, it condemns Grant.

> *"The one thing that went wrong for us was during the attack by __Destroyer Squadron 54__, which was coming down from ahead. Its orders were clear enough. When the destroyers had fired their torpedoes they were to turn east and hug the shore on their way back north, so that _they would be clear of the gunfire from our battleships and of the Japanese gunfire. __For some reason or other one destroyer, the USS Grant, didn't comply__. She "-turned and went directly north, and she got in the line not only of Japanese gunfire but of ours. She was very badly shot up. It was quite remarkable that she didn't sink. She was eventually towed to the gulf with an enormous number of dead and wounded in her. But that was the only mistake among the screening vessels that I know of.""*

The quote from Kinkaid as stated by Mason is: "*__For some reason or other one destroyer, the USS Grant, didn't comply "__*. If one looks at the UCMJ one sees article 92, which states: "**16. Article 92— Failure to obey order or regulation** Any person subject to this chapter who—(1) violates or fails to obey any lawful general order or regulation; (2) having knowledge of any other lawful order issued by a member of the armed forces, which it is his duty to obey, fails to obey the order; or (3) is derelict in the performance of his duties; shall be punished as a court-martial may direct." Specifically failure to comply, read it as obey, is punishable under Article 92 and is a crime under the UCMJ. Thus Mason had accused Nisewaner of committing a crime under UCMJ Article 92, and since Nisewaner was never convicted of such a crime, since frankly none ever existed, then Kinkaid uttered a falsehood, and Mason as the publisher of the falsehood is liable per se for defamation of any and all the people he knowingly defamed. Mason's defense of his actions was that he was just recording what was said and as a historian he had not duty to ascertain the accuracy of what was said. If he were a journalist, and not a historian, there may be some defense, however he is holding himself out as an historian and as such has a much higher duty.

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one surviving crewman attests to this fact. It is also essential to note that Bledsoe as well as all others involved were on TBS and the CIC was in active use. Bledsoe seems to have ignored the CIC.

4:07 Grant turns 0° T, going directly North. Grant hit for the first time. From Hamill's log: "*0407 The first shell landed aft and exploded among empty powder cases stacked across the fantail. Thirty seconds later (0407 ½) several shells hit amidships and steam began to pour out of the forward stack. The forward fire rooms and engine rooms were out of commission.*" Hamill states*: "a considerable part of the damage GRANT sustained came from the eleven 4.7 shells from Shigure*" However eleven shells, 4.7, were apparently from the Shigure and thirteen were 6" shells from the Denver. The Denver shells were armor piercing shells, many of which did not explode but which severed the high pressure steam lines. The Denver shells kill Dr. Mathieu outright and one slams between the CIC and the bridge. The shells also hit the radio room and the No 1 Boiler. 34 men were killed and 94 were wounded. Based upon the pattern of Denver hits over half of the killed were due to the Denver. Gilbert, the Signalman on the Grant is ordered by Hamill to used the signal lamp to contact the battle line and inform them, Pennsylvania receives the signal, and replies, Oldendorf orders cease fire.

4:08 Denver command, Captain Bledsoe then orders "*Main battery ceased firing Word over TBS for ships to cease firing One of our own destroyers is being fired upon*". The Grants log reads: "*0408 ½ Additional shell hits began to riddle ship. Hit forward at waterline flooded forward storeroom and forward crews berthing compartment. Hitting 40 mm gun # 1 exploded 40 mm ammunition and started fire. Hit through starboard boat davit exploded killing ship's Doctor, Lieutenant Charles Akin Mathieu, 5 radiomen, and almost entire amidships repair party. Other hits in forward stack, one hit on port motor whale boat, one hit and low order explosion in galley. One hit in scullery room, one hit in after crews berthing compartment, and one additional hit in forward engine room. All lights, telephone communications, radars, and radios out of commission. Steering control shifted aft.*"

Phase V: Oldendorf Orders Cease Fire

The Grant send out a signal using its light. SM 1C Walter Gilbert sends this under order from the XO and Captain. The XO on the Grant was in the CIC and the Captain at the bridge. Both were working hand in glove. The signal sent and received by the Pennsylvania jus before it was to fire upon the Grant. The Pennsylvania via TBS immediately tells Oldendorf in his CIC on the Louisville who in turn uses the TBS to tell all ships in the Battle Line. This is proof of a highly effective and integrated communications network using redundant alternatives, the optical path. Oldendorf acts immediately and decisively. Oldendorf follows the successful adage for any Captain, "Act, don't think!"

4:09 Oldendorf issues a cease fire based on hitting the Grant. Yamishiro turns left again. Mississippi fires on Yamishiro.

4:11 Yamishiro hit, time elapsed since launch from DESRON 56 is 7 minutes, at 15 yards per sec, and distance being 6300 yards. It took 4 torpedo hits and Yamishiro hit by 2 torpedoes in side, claims it was Newcomb.

4:13 Leary sees torpedoes passing it towards Battle Line.

4:19 Oldendorf issues a resume firing after Grant is secured. Yamishiro explosion seen Yamishiro sinks

4:20 Grant is dead in the water.

4:24 2 Japanese cruisers fire torpedoes that go ashore.

4:25 Shima's second forces retreats.

4:27 "*Grant reports being damaged and dead in the water.*"

4:30 Mogami and Nachi collide.

5.4.5   Phase VI: Oldendorf Follows Fleet

The Grant is helped by the Newcomb and its fate is improved despite the loss of life. Now in Phase VI the draw of Oldendorf to follow the Japanese Fleet, what is left of Nishimura and Shima's proceeds. The question is why was he allowed to do this. Halsey had started to move north, Kinkaid knew it, it left San Bernadino open, and Oldendorf and his attack group would have been better used to reinforce the location at Samar. They were a mere 40-50 miles away at that time. Oldendorf was just drawn into a search and destroy mission, which took his assets down the wrong direction.

> 4:31 Oldendorf orders fleet south.
>
> 4:33 Oldendorf sees radar contacts and orders attack to the south.
>
> 4:43 Mogami and Nachi untangle and proceed.
>
> 4:51 Cruisers go down west side after Japanese.
>
> 5:20 Stern of Fuso disappears.
>
> 07:45 From Hamill's book the final part of the drama occurs in the morning: *"In an emotion packed effort, we transferred 38 men who were severely wounded to NEWCOMB where they would have more expertise and improved medical assistance. Sadly, a number of these men died later as a result of their wounds. One of those transferred was our Chief Radioman Wallace K. Carlson. As I had been Communication Officer prior to becoming Executive Officer, Wally (sometimes known as "Sparks") and I had worked together and had become close friends. As Wally was passed across to NEWCOMB on a stretcher, our eyes met. I was guiding the stretcher so that I was very close. I said, "We'll see you soon friend, Good Luck." Somehow the look in his eyes told me that it would not be so. He died shortly after transfer. I'll never forget that look."*

These are the facts by the minute that night. The only loss was to the Grant and most if not all of that due to the fire by the Denver, the actual Denver shells which were unexploded were removed on the 25th and 26th from the Grant. They had been armor piercing shells and the Grant was only 3/8th inch thick steel plate so the shell went through and ended up in water, never exploding. The Denver actions appear to be more than just gross incompetence. They actually appear to be a Captain fighting a World War I battle in a late World War II scenario.

Swarming worked, but one of the major risks of swarming is that friendly fire from incompetent field leaders can lead to death. This problem has not been faced head on. It seems even today as something the military all too frequently tries to hide.

6   CONCLUSIONS

Swarming is a tactic, which has proven its success. We have argued that one of the first true swarming battles using all of the elements characteristic of swarming was the Battle of Surigao Strait. It was the Battle of Salamis of our generation. We also argue that the Surigao battle was one, which may likely define swarming attacks and battles looking forward. Unlike what many say, it was not the last of the great sea battles. It was, we believe, the first of a truly new form of warfare. Namely it used a highly distributed attack force, in the dark of night, facilitated by an integrated collection of technologies, integrated by the use of the CIC, just months old in terms of implementation, and used a highly integrate, distributed and redundant communications mesh.

The key elements of the Surigao swarm success were as follows:

1. Clear Set of Goals: Total and abject destruction of the enemy was intended. There was no such concept of surgical strikes. The intent was annihilation. Delimiting the strike capability dramatically draws down the ability of the forces to achieve an ultimate victory.

2. Clear Action Strategy: Oldendorf was highly effective in articulating and executing the strategy. He gave Smoot all the leeway necessary to swarm the oncoming forces and then to clear the field for a follow up by the battle line. It was solely the arrogance of Bledsoe, which seems to have resulted in the American casualties.

3. Clear Plan B: Oldendorf had the ability to communicate and command in short order. The ability of the Grant to communicate by lamp to the Pennsylvania, having lost all of its radio to fire by the Denver, and then from the Pennsylvania to Oldendorf on the Louisville in seconds is a clear indication that Oldendorf and the CIC worked perfectly. The lingering question will always twofold: why did Kinkaid give Bledsoe a Navy Cross and why did Kinkaid not use Oldendorf in Samar[28]. Halsey's recriminations regarding Kinkaid may have more merit that the Old Admiral may have ever known[29].

Looking at this battle it may convey certain insight to future Navy planning. Currently the Navy has a set of fleets comprised of the following active and in process ships:

1. Carriers (CV): There are 11 carriers on record. including the George H. W. Bush. They form carrier groups.
2. Cruisers (CG): There are 22 cruisers on record.
3. Destroyers (DD and DDG): There are 56 DDG, guided missile destroyers of the Arleigh Burke Class.
4. Frigate (FFG): There are 30 Frigates currently in service.
5. Littoral Combat Ship (LCS): There is one LCS in test. The LCS is a swarming vehicle for close in or close to shore action.

For the most part the current Naval Fleet is a stand off and attack fleet. In many ways consistent with the WPO approach through Phase II. The LCS appears to be a hybrid PT boat with a destroyer, albeit with many other facilities. There is just one trial LCS at this time. The risk is that for example at the Battle of Leyte there were over 1,000 US ships, over 200 for Halsey and over 800 for Kinkaid. The entire US Fleet including the above is slightly more than 300. Thus any attempt to swarm would be impossible, there are just too few big platforms and not enough if any small ones.

The question that must be asked is what is the threat and how can the threat be dealt with. The key case perhaps if the USS Cole in Yemen. A micro swarm, two rubber boats managed significant damage. Current intelligence estimates states that Iran has developed a swarm strategy:

"The Iran navy has procured hundreds of fast patrol boats as part of what is believed to be a swarm strategy to overcome the firepower of U.S. cruisers and destroyers.... Under the purported Iranian concept, the FPBs would be armed with torpedoes and rockets that could be quickly fired from short range. The analysts said the radars of U.S. destroyers would be unable to detect small Iranian speedboats in the northern Gulf....These boats could be filled with explosives and rammed into U.S. surface vessels, the analysts said. They cited the success of an Al Qaida attack

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[28] Morison, Leyte, discusses in some details the issue of Kinkaid not using Oldendorf. Morison argues in Kinkaid's favor stating that; (i) Oldendorf was too far away, (ii) Oldendorf may have too little ammunition but here Morison hedges considerably, and (iii) Kurita just seems to leave so it becomes a moot point.

[29] Halsey, in his autobiography Halsey states on p. 220, "Then came the sixth dispatch at 0922....under attack....request support by heavy ships...(old battleships) low in ammunition" Halsey then continues: "Low in ammunition! Why hadn't Kinkaid let me know before?....I looked at the date-time....I realized this was the third message....what had delayed it. I have never learned." Halsey makes two excellent comments here. First, despite the Morison comment, Kinkaid was not prepared for options, his ships across the board were not adequately provisioned. Second, this shows that cross Fleet communications, all going back to Manus by VF coded messages and then rerouted, allowed for breaking and delaying of net communications at the highest level. At the low level it worked superbly but at the higher and more critical level it broke down. On pp. 226-227 Halsey attempts to deal with what he perceived of as his "mistake". It seems clear that he still harbored concerns as regards to Kinkaid. Thomas, Sea of Thunder, recounts the hostility between Kinkaid and Halsey. Halsey had relieved Kinkaid after the poor performance of the Battle of Santa Cruz Island off Guadalcanal in October 1942. Thomas states "Kinkaid was bitter about getting shoved aside, especially when Halsey refused to see him afterward." Part of the selection of Kinkaid as the head of the 7th Fleet was the hostility between Halsey and Kinkaid. MacArthur found this useful since it assured that two "old Navy buddies" would not talk behind the General's back.

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that crippled the USS Cole in Yemen in 2000....Over the past six weeks, the Iranian navy conducted two exercises in the northern Gulf designed to test the swarm strategy. The analysts could not assess the results of the exercises".[30]

Thus one threat is Iran and the Gulf Region. Another could be China. Others could be off the African Coast or even in South America along Venezuela or other similar countries. The costs of swarming are low, the benefits are high. The infrastructure and training are high, otherwise it defaults to a melee.

Finally, a swarm can be an offensive or defensive approach. Surigao was defensive. The Iranian threat is offensive. No matter which one anticipates it is critical that the logistics, the landscape, and the location be optimized. There are good swarm locations, Surigao and Salamis are both ideal as is the Iranian sea lanes and many other such locations. However, whether offensive or defensive, the current Naval strategy of so few ships and a stand off attack profile can be quite risky. Alternatives and options are essential.

The Battle of Surigao Strait was, in our opinion, the first of a truly technologically based swarming battle. It employed highly distributed, autonomous, and inter-netted attack elements, which went after an enemy attack forces and was highly successful. Although it did employ a "crossing the T" maneuver, it was primarily a swarm approach. The element of the CIC and its implementations and execution in the destroyer environment was exceptionally successful. The one failure was the firing of the Denver on the Grant. We have argued, from the historical record, that the fault for that was the Denver's Captain, Bledsoe. Further we argue that Admiral Kinkaid never understood what had transpired and, despite the fact that the Grant Captain received the Navy Cross, somehow, the Captain of the Denver received one also. These were the only two men to be awarded Navy Crosses in this Battle at Leyte. Perhaps Kinkaid was distracted by the Samar battle, perhaps there may be truth that classmates, Bledsoe and Schaeffer, who was Kinkaid's Chief of Staff, were close, perhaps many others such speculations. What is clear, however, is that Surigao showed that one could take a group of bright young men, given them the technological tools, show them how to use them, and that this group can effect a great victory.

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