SIGNAL DELTA

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The WHY and WHEN of CANASTA
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The WHY and WHEN of CANASTA

By Scott Smith

The official radio call-sign for the **FIST of the FLEET** has been '**CANASTA**' for many years. Sometime ago the squadron started using just 'FIST' but reverted back to 'CANASTA'. Good thing too. Nobody wants a call-sign that might be confused with missed, as in "where did that bomb go?" The burning question on everybody's mind is when did the squadron first start using the **CANASTA** call-sign and what was used previously? I will try to answer these questions in as many words as possible.

For recent immigrants to this planet, be advised that canasta is a two-deck card-game that developed in Uruguay about 1947. It was the most popular card game in Argentina in 1948 and was introduced into the United States in 1949. By 1951, there were more than 30-million Americans regularly playing the game. No doubt some of these players took short breaks to fly airplanes or catch a few winks. I was one of those 30-million, but now only remember how to spell canasta.

In July 1948, VA-65 (later VA-25) was part of CVG-6. LCDR BUTLER and then CDR HANLEY were the commanding officers before February 1950. CDR PHILLIPS assumed command of the squadron in February 1950. The Korean War started on June 25, 1950. In August 1950, the squadron left NAAS Oceana for NAS Alameda, becoming part of a "revised" CVG-2 that embarked in USS BOXER (CV-21) on August 24, 1950 and headed for the Korean peninsula. Most likely, one of these three skippers selected the call sign. LCDR BUTLER (1947-1948) can be eliminated because the game of canasta was unknown in the United States during his tour. CDR HANLEY (1948-1950) probably had little time to learn the game during his tour, but he can't be eliminated. The most likely candidate is CDR PHILLIPS.

However, CDR Hanley was responsible for the present-day squadron patch and title "Fist of the Fleet" in 1949.

The answer to the second question, what call sign was used before CANASTA. There were some unofficial call-signs used during WW-II, but mostly from shore bases. In 1943, VT-17 used the call sign HOBO, with derivatives of that life-style for various actions in the air. In 1949, many pilots stilled used a generic call-sign. For instance, a Corsair pilot might identify himself as Fox 23, while an Avenger pilot might use Tare 55. During WW-II, the mission often carried a specific call-sign. For instance, a two-plane fighter CAP might be designated Red-1. Strike aircraft also had call-signs that often changed from day-to-day. Maybe that was to confuse the Japanese into thinking we had more than a hand-full of squadrons.

Before 1943, single-piloted aircraft had only a single frequency HF transmitter. Obviously, good radio discipline was essential when a couple-dozen fighters were using the same frequency. Strike aircraft could shift between a few HF frequencies. The SBD and TBD had a radio operator/gunner, skilled at tuning the HF transmitter to a different frequency. The Avenger and Helldiver had a multi-channel HF transmitter, so the pilot could shift between strike and fighter frequencies. The main problem with the HF equipment was it could sometimes be heard in Tokyo, but not by the carrier 100 miles away.

Even before the Battle of Midway, the Navy was aware of the communication problems in fleet aircraft. Radar and ship-board fighter-directors put new demands on existing communications. Early in 1943, fighter aircraft began using the ARC-5 four-channel VHF (100-156 MHz). This equipment operated on line-of-sight and had many advantages over HF equipment, but four channels were inadequate. The ARC-1 VHF came along in mid-1944.

By late 1944, all carrier aircraft were using the ARC-1, a ten-channel VHF (100-156 MHz) transceiver. The frequencies of these crystal-controlled channels were not easily changed. Each carrier had a set of frequencies, with a couple of task force channels reserved for coordinated strikes. There were simply no channels left for a squadron-common. Some shore-based carrier aircraft continued to use this equipment into the early 1950s.

The installation of VHF transceivers during WW-II was in addition to exiting HF radio equipment. Most carrier aircraft designed after WW-II had only VHF (or UHF) radio equipment.

The ARC-27, a 1725 channel UHF transceiver (225-400 MHz), began appearing in new aircraft during 1948. Generic call signs probably persisted for a time while ARC-27s were installed in older fleet aircraft. Generally, the conversion process began when a ship became "mated" with a particular Air Group for a scheduled deployment. Obviously, the ship and embarked aircraft required compatible communications equipment. The ARC-27 wiring was installed in overhauled aircraft and the equipment installed later by the squadron.

When I reported to VC-33 in July 1952, only a few training aircraft still had VHF transceivers. Fleet aircraft had all converted to UHF transceivers between 1948 and 1952. Many squadrons got new aircraft in those days. New jets appeared almost as frequently as new movies at the local drive-in movie theater. Somebody figured safety could be improved if every squadron had a base-radio, with a private frequency to help with emergencies. It was amazing how many ARC-27s were totally destroyed in an aircraft accident, but later repaired. These “stricken” ARC-27s become a squadron base-radio.

The **FIST of the FLEET** didn't have time to play many card games after July 1950. Yet the game of canasta wasn't known in the United States before 1949 and the ARC-27 was installed in navy aircraft about the same time. Therefore, the window for call-sign selection was probably from mid-1949 to mid-1950.

The mostly likely proponent of the **CANASTA** call sign would be a new officer who previously had time to learn the game, but with the "muscle" to get it done. Who better than the new skipper, CDR PHILLIPS? **CANASTA** also fits with the tail-letter "C", then used by CVG-6, while "M" was used by CVG-2. The selection of **CANASTA** after August 1950 is unlikely.

This is all supposition since my first deployment was in late 1952. By then, the ARC-27, squadron call signs, squadron-common frequency, and the game of Canasta were facts of life. I recall playing lots of canasta and even bought a mechanical card-shuffler while visiting Barcelona.

The squadron-common frequency was probably changed when VA-65 became VA-25 in July 1959 (CDR JOHN W. FAIRBANKS, CO). As I recall, we used 325.0 MHz as squadron common during the 1960s in both A-1s and A-7s. It would be "spooky" if this frequency had been assigned before the change in designation.

I used to wonder who needed a radio with 1725 channels (ARC-27). Then along came the A-7 with a 3500-channel ARC-51. The A-7 was about twice fast as the A-1 so it needed twice as many radio channels – right? Now I wonder if the dual-mission F/A-18 has stereo.

In summary, squadrons used generic or unofficial signs before their ARC-27 installation. Afterwards, squadrons could select an official call-sign, within some practical limits. In this case, I believe CDR PHILLIPS selected the CANASTA call sign. If anyone has some really accurate information, please let me know.

The Last SPAD - CANASTA 405
By Scott Smith

VA-25’s last SPAD, NL-405 (BuNo 135300) proudly sits center stage, with her nose held high, in the west wing at the National Museum of Naval Aviation. She is surrounded by many famous aircraft from early biplanes to super-sonic jets. BuNo 135300 has a history of her own, thanks to some research by HILL GOODSPEED, Museum Historian.

Clean at last, thank God I’m clean at last!

There were 713 AD-6/AD-7 aircraft of a total of 3,180 SPADs that rolled off the Douglas assembly line. BuNo 135300 was accepted by the Navy on June 28, 1954. The last (BuNo 142081), came off the assembly line on 18 February 1957.

BuNo 135300 spent a brief period with FASRON 12 before being assigned to **VA-55** (WARHORSES) in July 1954. Painted Navy blue, her first cruise was aboard *USS PHILIPPINE SEA (CVA-47)* between April-November 1955.

VA-55 began service in WW-II as VT-5 flying TBMs from *USS YORKTOWN (CV-10)*. This squadron then flew ADs during the Korean War from *USS VALLEY FORGE (CV-45)* and *USS PRINCETON (CV-37)*. The squadron flew A-4s during the Vietnam War from *USS TICONDEROGA (CVA-14), USS RANGER (CVA-61), USS CONSTELLATION (CVA-64)* and *USS HANCOCK (CVA-19)*. This squadron was disestablished in 1975. A second VA-55 was established in 1983 and disestablished in 1991.

BuNo 135300 was then overhauled at NAS Alameda, spent another brief period with FASRON 12 before being assigned to **VA-115** in June 1957. Painted gull grey, she deployed aboard *USS SHANGRI-LA (CVA-38)* in March 1958 and joined in the face-off over Quemoy and Matsu Islands.

VA-115 began service in WW-II as VT-11 flying Avengers from shore and latter from *USS HORNET (CV-12)*. The squadron became VA-115 in July 1948. This squadron flew ADs from *PHILIPPINE SEA* during the Korean War and A-1s from *USS KITTY HAWK (CVA-63)* and *HANCOCK* during the early Vietnam War. VA-115 transitioned to A-6s and deployed aboard *USS MIDWAY (CVA-41)* for the remainder of the Vietnam War, but now flies Hornets. Originally known as the ARABS, they now have the PC name of EAGLES.

LCDR FREDRICK L. "Dick" ASHWORTH was VT-11's first CO. Later, CDR ASHWORTH became involved in the nuclear weapons program and was the weaponeer for the second atomic bomb drop. In September 1948, he became the XO of the first Heavy Attack squadron (VC-5) and then the CO of VC-6.

After VA-115 returned in late-1958, BuNo 135300 was mothballed at NAF Litchfield Park. She returned to the fleet in August 1962, before becoming an A-1H in September 1962.

BuNo 135300 next served with **VA-145** (SWORDSMEN) and deployed aboard *CONSTELLATION* in February 1963, one of the last 'peacetime' cruises before the Vietnam War.

VA-145 began service as the recalled Reserve squadron VA-702 in July 1950 flying ADs from *USS BOXER (CV-21)* and *USS KEARSARGE (CV-33)*, becoming VA-145 in February 1953. This squadron flew A-1s from *CONSTELLATION* and *USS INTREPID (CVS-11)* during the early Vietnam War, then transitioned to A-6s and flew from *USS ENTERPRISE (CVAN-65)* and *USS RANGER (CVA-61)* for the remainder of the Vietnam War and disestablished in October 1993.

BuNo 135300 was again overhauled and assigned to **VA-25** in July 1964, but for some reason her combat flights during the 1965 deployment aboard *MIDWAY* were not recorded. VA-25 commenced combat operations over Vietnam on April 10, 1965. NL-405 had a close call during June 1965 when she dodged Mig-17s.

BuNo 135300 was next assigned to **VA-52** (KNIGHTRIDERS) and made the 1966-1967 deployment aboard *TICONDEROGA*. Her next combat mission was a 4.8-hour Rescap on November 11, 1966.

VA-52 began service as the recalled reserve squadron VF-884 in July 1950 flying F4U-4s from *BOXER* and *KEARSARGE*. This squadron was redesignated VF-144 in February 1953, and then received AD-6s to became VA-52 in 1959. After the *TICONDEROGA* combat cruise, VA-52 transitioned to A-6s and flew from *USS CORAL SEA (CVA-43)* and *KITTY HAWK* for the remainder of the Vietnam War and disestablished in March 1995.

BuNo 135300 returned to **VA-25** and was back on the line less than four months after *TICONDEROGA* returned to CONUS. Finally, on February 20, 1968, (then) LTJG TED HILL flew BuNo 135300 on a Rescap for a downed USAF F-4 crew and assisted embattled Marines along the DMZ. LTJG HILL landed at 0736 (local time) ending the last SPAD combat mission for the Navy. *CORAL SEA* steamed north and returned to CONUS where Navy SPADs was officially retired on April 10, 1968.

All totaled, BuNo 135300 flew 219 combat missions in 769.9 hours during the Vietnam War. The average hours per sortie (3.5-hrs) attests to the stamina of both the aircraft and her pilots. Appropriately, LTJG HILL ferried BuNo 135300 from NAS Lemoore to NAS Pensacola.

A few Fat-SPADs remained service and VA-176 had a few single-seaters on their flight line after April 1968, but the A1H/Js never again flew from a carrier. Of course, SPADs ably served with the USAF and VNAF long after the Navy retired them.

BuNo 135300 was fourteen years old when she retired, young compared to some aircraft in service. She had low hours (4,400-hrs) while many SPADs received reinforced wings to extend their life beyond 5,000-hours. She was little different in appearance from the original BT2D/AD-1 designed by Ed Heinemann in 1944. The first SPAD, designated an XBT2D-1, flew four months ahead of schedule on March 18, 1945. Fifteen months later, the first AD-1 made its maiden flight. The rest is history.

Remember, the atomic bombs were dropped on Japan in August 1945. Few people knew about the bombs, so future combat operations had to plan for conventional warfare. Most experts figured the battle for Japan's main islands might take another two years. Several new aircraft were being prepared to fight that last battle.

It is extremely unusual for any aircraft to still fly combat missions over twenty years after conception, especially one with a piston engine in the Jet age. The SPADs drew blood and were bloodied in two full-scale wars and was fully prepared to fight WW-III. Besides the plane's design, credit must be given to the guys who kept them pieced together long after spare parts were dumped on the surplus market, and the skill (insanity?) of many fine pilots, without whom the SPAD would be just another airplane.

THE REAL SPAD

By Scott Smith

The Douglas AD/A-1 Skyraider was originally called the Able Dog (WW-II phonetic alphabet) and later, sometime after the Korean War, it became the SPAD, from the WW-I aircraft flown by Eddie Rickenbacker. Nobody seemed to call it the Skyraider – except the Douglas Aircraft Company.

A latter-day SPAD aboard *USS Midway*, circa 1965

Actually, SPAD is an acronym for the French company that made the WW-I aircraft – Société Pour L'Aviation et ses Déruvés. The original company, Société Pour Les Appareils Deperdussin, was nearly bankrupt before the War. Acquired by Louis Blériot, the name was changed, but the initials remained the same.

> You might guess what the French words mean, but who knows what the French really meant?

The SPAD XIII was an improvement on its predecessor, with a more powerful engine, making it faster than its contemporaries – the Sopwith Camel and Fokker D.VII. It was rugged, but maneuverability was inferior, especially at low speeds. It had poor gliding characteristics and a sharp stall made it difficult for novice pilots to land safely. These are certainly not the characteristics of the SPAD that I knew and loved! The only real similarity is that it was a single-engine tail-dragger.

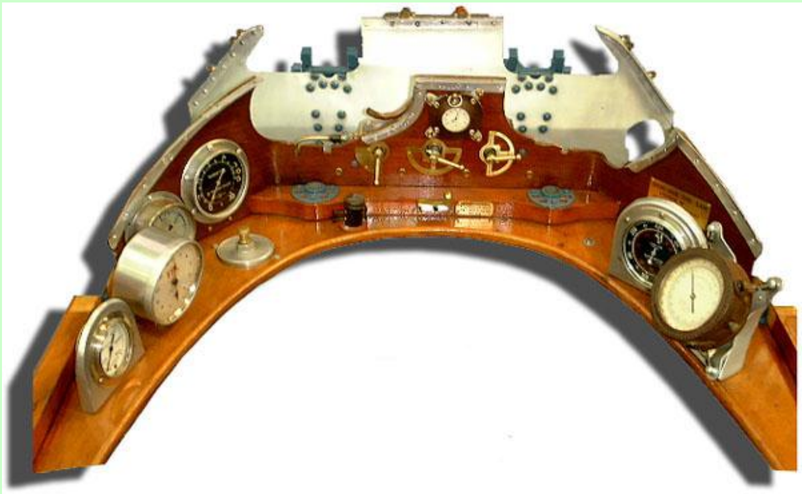
S.XIII with the 94th Aero Pursuit Squadron – somewhere in France, circa 1917

The SPAD Company built 8,472 aircraft, starting with the model S.VII in 1916, and cancelled orders for 10,000 more when the War ended in 1918. The model S.XIII, which Rickenbacker flew with the 94th Aero Pursuit Squadron, came out in 1917 and was still in service with the US Army in 1920. This model had the following specifications:

Length: 20’-8”	Engine: 220 HP
Wingspan: 26’-7”	Max speed: 121 knots
Height 7’-9”	Service ceiling: 21,815’
Wing area: 227 sqft	Rate of climb: 384 ft/min
Empty wt: 1,245 lbs	Endurance: 2 hours
Max T.O. wt: 1,863 lbs	Two.303 Vickers guns with 400 rounds each.

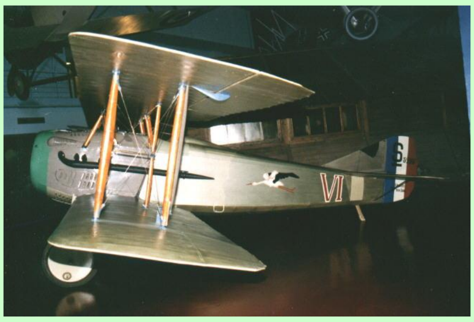
These dimensions indicate a tiny aircraft – even smaller than the T-34. Although the wing area was 126% of the T-34. the plane’s maximum take-off weight was 81% of the Skyraider’s internal fuel capacity (2,280 lbs). Climbing the S. XIII to its service ceiling probably required well over an hour in an open cockpit – without oxygen or cockpit heat!

Its tiny radar signature made the S.XIII superior to some modern jets. In fact there is no record of the plane ever being detected by radar (radar didn’t exist then).



SPAD XIII instrument panel

Modern pilots might look for a quill-pen holder and ink-well on the neatly varnished cockpit panel. The original SPAD had no radio, gyros, or even a turn-and-bank indicator. A piece of string attached to the cowling probably served as a slip-indicator. The primary flight instrument appears to be a pocket watch. A gimbaled magnetic compass was mounted to the left of the pilot’s seat. Engine instruments are on the far left, but the black-faced instrument is probably the altimeter. The black-faced instrument on the right is the airspeed indicator. The fuel gage is between the rudder pedals. Definitely a VFR-only aircraft!



LeBourget, Paris France

Museum in Brussels, Belgium

THE GREAT TORPEDO SCANDAL OF WW II

By Scott Smith

Besides the Japanese, the United States Navy had some other problems fighting the Pacific War. One of the more significant was what has been termed the Great Torpedo Scandal. The genesis of this scandal was improperly testing torpedoes before the War. It grew into a scandal when the torpedo experts denied there was a problem, blaming instead the fleet crews. Historian Paul Schratz said he "…was only one of many frustrated submariners who thought it a violation of New Mexico scenery to test the A-bomb at Alamogordo when the naval torpedo station (at Newport) was available."

The Japanese, on the other hand, worked hard to develop excellent torpedoes as the “equalizer” weapon against the larger American fleet. The early Type 91 aerial torpedo had a speed of 41 knots and range of 2,000-meters, with a maximum launch speed of 260-knots. The later versions had larger warheads, higher launch speeds, but had a range of only 1,500-meters. The Type 95 submarine torpedo had an even larger warhead, making 49-knots with a range of 9,000-meters.

The American Mk-13 aerial torpedo was inferior to the Japanese in all respects. Even the fuse gave us trouble.

Both the American and Japanese torpedoes were steam-powered. The main difference being the Japanese used pure oxygen and kerosene, while the Americans used alcohol and compressed air. Pure oxygen was more dangerous to handle, but it gave an edge to the Japanese torpedoes in range and speed. Moreover, the American torpedoes left a trail of bubbles a blind-man could follow. In one instance, a Japanese pilot saw a torpedo wake and saved his ship by crashing his aircraft into the American torpedo.

American torpedoes were fueled with methanol, a toxic form of alcohol. However, someone discovered the toxic additives were removed by filtering through bread. Thus, torpedo juice sometimes "disappeared" from torpedoes in storage. However, improper filtering could still cause blindness or death.

There were a wide variety of torpedoes in service during WW-II. Unfortunately, the United States torpedoes were near the worst:

Surface ship

	Japanese	US	German	British
Name	Type 93 (1)*	Mark 15	G7a T1	Mark IX
Range/max. speed (yd/kt)	22,000/50	6,000/45	6,560/44	11,000/41
Max. range/speed (yd/kt)	43,700/38	15,000/27	15,300/30	15,000/35
Warhead (lb)	1,080	825	661	725
Propulsion	O_2 /kerosene	Air/alcohol	Air/decalin	Air/shale oil
Diameter (in)	24	21	21	21
Length (in)	354	288	276	287
Weight (lb)	5,952	3,841	3,369	3,732

*Known as the 'Long Lance'.

Submarine

	Japanese	US	German	British
Name	Type 95 (1)	Mark 14	G7e T2	Mark VIII
Range/max. speed (yd/kt)	9,850/51	4,500/46	–	5,000/46
Max. range/speed (yd/kt)	13,100/47	9,000/31	5,470/30	7,000/41
Warhead (lb)	893	643	661	805
Propulsion	O_2 /kerosene	Air/alcohol	Electric	Air/shale oil
Diameter (in)	21	21	21	21
Length (in)	282	246	276	259
Weight (lb)	3,671	3,280	3,534	3,452

Airborne

	Japanese	US	German	British
Name	Type 91 (2)	Mark 13	F5b	Mark XII
Range/max. speed (yd/kt)	2,200/43	6,300/34	2,200/40	1,500/40
Warhead (lb)	452	600	551	388
Propulsion	Air/kerosene	Air/alcohol	Air/decalin	Air/shale oil
Diameter (in)	17.7	22.4	17.7	17.7
Length (in)	216	161	203	195
Weight	1,841	2,216	1,790	1,548
Drop speed (kt)	260	110	150	150
Drop height (ft)	33-165	50	100-130	200

The short answer to this scandal was the Great Depression, when little money was available especially for the military. Promotions came to those administrators who saved money. The complete answer was probably more complicated. The following is a little history of the period before the War:

In 1905, a radio-controlled torpedo was proposed, but rejected by the Navy. It was then sold to the Japanese. In 1912, Sperry successfully demonstrated a gyro-compass with remote repeaters. An auto-pilot (Iron Mike) was demonstrated on 25 March 1914, but the Navy was reluctant to use the equipment.

In 1915, the Navy began development of a pilot-less bomber. The first successful flight of a radio-controlled aircraft was conducted. Further development was dormant until 1936 when the CNO expressed an urgent need for radio-controlled aerial targets (drones). On 17 February 1937, the Naval Research Laboratory (NRL) successfully operated a drone, with safety pilot, at a distance of 25 miles. On 23 December 1937, the NRL successfully operated a pilot-less drone, which were used for target practice in 1938.

On 23 August 1918, a radio-controlled vessel was demonstrated. In 1925, there was a successful run of a submerged radio-controlled torpedo. The Navy acquired the rights to this device in 1932.

In 1939, the NRL designed and developed a radio altimeter – a necessary element in the development of any pilot-less aircraft.

In 1940, the Bureau of Aeronautics (BuAer) directed the development of an aerial torpedo that flew just clear of the water and was controlled by an aircraft about 1.5-miles astern. On 15 August 1941, the Bureau of Ordnance (BuOrd) suggested an all-out effort to develop a guided missile, later called an assault drone. On 18 April 1941, BuAer advised on the progress on drones and radar for guidance. On 1 August 1941, NRL reported 47 of 50 simulated air-borne torpedo attacks were successful.

In 1942, the CNO directed tests to determine characteristics of an assault drone and tactics. BuAer directed the procurement of 200 expendable assault drones. The Naval Aircraft Factory was directed to study the control of assault drones from surface vessels and submarines using radar. The Vice CNO increased the procurement of assault drones from 200 to 1,000. On 29 June 1942, BuAer requested a 50% cut in the procurement due to an overloaded aircraft industry. The assault drone was then called Project Option, and the 50% cut was approved by the CNO. A radar "sniffer" was developed by RCA to detect surface targets.

In March 1944, Project Option was cutback and changed to a combat test program. Further development of this weapon was not needed in view of the limited Japanese ships remaining.

It appears progress in development of the assault drone (aerial torpedo) held such promise as to negate further testing and development of the conventional aerial torpedo. However, there is no way of knowing how much the personnel responsible for torpedo development knew of the highly classified Project Option or if this influenced their actions.

Before World War II, the Newport Naval Torpedo Station (NTS) was the only group responsible for design, development, production, and testing of torpedoes. The three torpedoes in production used many common components, although each was slightly different. Besides the slower speed, 1943 tests of the Mk 13 aerial torpedo resulted in only 31% satisfactory runs. However, the biggest problem with the Mk 13 was its limiting launch parameters (below 100-feet and 100-knots).

Failures were noted with the Mk 14 torpedo early in 1942 as reported by the first returning submarine war patrols. These same problems also affected the other torpedoes. One problem was traced to the Mk 6 combined contact and magnetic influence exploder – basically the torpedo fuse. This exploder was tested only once, after which the highly classified Mk 6 was locked away for security reasons. The Mk 5 contact exploder was installed in the Mk 14 and Mk 15 torpedoes until after Pearl Harbor. The Mk 13 torpedo retained the Mk 4 exploder, similar to the Mk 5, throughout the war.

It is necessary to understand the problems with the Mk 6 exploder because it "hid" other problems until later, delaying correction of multiple problems until 1944. Since the Mk 13 torpedo still had the Mk 4 exploder, its problems weren't even suspected until after the Battle of Midway.

During the first six months of 1942, some 132 TBD Devastator sorties were launched with torpedoes. For various reasons, only 95 of these aircraft dropped their torpedoes, resulting in 10 confirmed hits on four ships, two of which sunk. These few successes were with coordinated attacks during the Battle of Coral Sea. At the Battle of Midway, only 42% of the torpedo aircraft even got to the drop point, but with zero hits (detonations). Of the 76 TBD aircraft in the Pacific theater, only 17 remained after the Battle of Midway. It took some time before people realized there were problems with the MK-13 torpedoes, not just the old and slow TBD.

Some additional torpedoes were launched from aircraft based at Midway Island – all without success. *SARATOGA* did not participate in the Battle of Midway and her torpedo squadron held the majority of remaining TBDs.

The best way to sink a ship is to detonate an explosive device directly below the keel. Most war-ships have elaborate compartmentation and torpedo armor on the sides, but minimal protection on the bottom. The magnetic influence exploder was designed to detonate under the keel. This device measured the Earth's natural magnetic field, like a flux-gate compass. Near a steel ship, the magnetic field is distorted and this is what caused the torpedo fuse to detonate. The torpedo was set to run a few feet below the keel of the target ship.

Unfortunately, the strength of the Earth's vertical (dip) and horizontal magnetic field is not uniform worldwide, but this might not have been well-known in the 1930s. The vertical component is about 60° near Newport, but gets shallower and weaker with distance from the magnetic North Pole. Thus, the single test in northern waters failed to consider the weaker magnetic field in the South Pacific. While this fuse problem was being resolved, submarine skippers switched to the contact detonator only to discover new problems.

> The magnetic influence exploder was also used in magnetic mines. To defeat this threat, military vessels used a set of electro-magnetic coils within the hull to cancel the magnetic distortion of the Earth's magnetic field near the ship – called de-gaussing.

One of these new problems was the depth controller that afflicted all three torpedo versions. Setting the torpedo depth for the impact fuse often resulted in the torpedo running under the ship. It was eventually determined this problem was caused by measuring water pressure (depth) too near the nose of the torpedo. Basically, the folks at Newport had calibrated the torpedo depth in a static condition, without considering the actual hydrodynamic pressures along the outside of the torpedo.

Pressure differences occur from water movement around the torpedo body, like an aircraft wing, and these differences become larger with higher speeds. Maximum pressure is at the nose of the torpedo, and then the pressure goes slightly negative as the water moves past the nose to the torpedo body. Pressure is more-or-less steady along the body and then drops again near the tail. The solution was to move the depth sensor further aft, near mid-body.

It took a direct order from the CNO to force the NTS to perform torpedo depth tests that verified the earlier tests performed by the operating force. Running up to 11' deeper than set, some torpedoes simply went under the target ship, which might have made the earlier influence fuse problem worse. While this problem was being corrected, depth-setting corrections were issued to compensate for this error. The Mk 13 was the slowest torpedo and had the smallest correction.

Finally, it was realized that the contact fuse in the Mk 4 and Mk 5 exploders also had a defect. Some contact fused torpedoes obviously hit their target, but failed to detonate. This flaw was eventually traced to the firing-pin not hitting the percussion cap with sufficient force, and this was also related to torpedo speed.

> At least one Japanese ship went home with a dud torpedo stuck in its side.

At torpedo impact, the high deceleration forces created excess friction as the steel pin slid through the firing-pin track, slowing the pin's movement. The cure was easy – replace the heavy steel pin with one made from aluminum. Less weight meant less friction during deceleration.

> The initial aluminum firing-pins were hand-made from the propellers of Japanese aircraft downed on 7 December.

Another part of this problem was the torpedo's impact deceleration. A 90º impact caused the greatest deceleration, which decreased at shallower angles so the fuse sometimes worked. It is unknown if the slower Mk 13 had this problem, but firing-pins were replaced in all torpedoes.

MK-13 torpedo failures continued into 1943. On 11 November 1943, during VT-17's strike on Rabaul, none of the squadron's torpedoes detonated. By early 1944, TBF squadrons had ceased using torpedoes and were skip-bombing ships with considerable success.

> Skip-bombing is a low-altitude horizontal bombing run used only against merchant ships. The bomb sometime used a time-delay fuse and is released early, allowing it to skip on the water surface before striking the ship. The bomb's horizontal velocity is decreased upon each impact with the water, providing more escape distance for the aircraft. Ideally, the bomb would hit the ship's hull and sink, detonating against the hull a few feet underwater.

The original Mk-13 torpedo required a maximum of 100-feet and 100-knots at launch. This was not difficult to achieve during training, but made the aircraft extremely vulnerable during combat.

CalTech became involved in 1943, building a 300'-long launch tube into a reservoir near Pasadena. It soon became obvious that realistic launch speeds damaged the fins and propellers, and sometimes the internal components of the torpedo. Heat-treating the propeller blades and welding a 10"-wide ring to the fins solved the external damage from higher launch speeds.

Tests also indicated the torpedo boiler started producing steam on launch. Without a water load, a higher launch altitude could cause the turbine to over-speed and disintegrate before water entry. This problem was solved with an inertia device that delayed boiler operation until the torpedo decelerated upon entering the water.

The interim solution used improvised plywood nose-cap and tail fins. The plywood broke-away on impact, but added directional stability after launch and "softened" the torpedo's water impact. The torpedo "innards", including the steering gyro and the depth hydrostat could be damaged by high water impact forces.

Modified Mk-13 torpedo being loaded in Wasp aircraft, circa 1944

The final solution was the MK-13-1A "ringtail" torpedo. This torpedo could be released up to 800-feet and 280 knots. These torpedoes began arriving at fleet units in late 1944 and some were used during the Battle of Leyte Gulf. VT-17 used them successful against the Japanese Battleship *YAMOTO* on 7 April 1945, with four hits against *YAMOTO* and sinking a destroyer.

Since the *YAMATO* sinking, aerial torpedoes have been used only once – by VA-195 against the Hwachon Dam in Korea on 1 May 1951. The only aerial torpedoes used today are against submarines.

Incidentally, the assault drone was finally used against by-passed Japanese near Bougainville, beginning in September 1944 These TDR-1 drones were guided by a control-pilot watching a primitive TV-screen in a trailing AVENGER. Of the 46 drones expended, 37 reached their target area and about 21 successfully struck their targets.

The TDR-1 had a 48' wingspan, were powered by two 220-HP engines and could cruise at 125 knots carrying a weapon. The one in the **left** photograph carried a torpedo in an early demonstration flight. The one in the **right** photograph carried a live 2,000-lb bomb, but collapsed a nose-gear on takeoff. The last of the 200 production TDR-1s is on display at the Naval Aviation Museum in Pensacola.

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