



Fist of the Fleet Association

a non profit 501 (c) (19) military organization

NEWSLETTER

January 2015

Preserving the Past Providing for Today

Promoting the Future



WINTER EDITION

By: Jerry "Ricochet" Fritze



Left: Liaoning Right: J-15

Naval Aviation and military aviation news is just exploding worldwide. First, the Chinese are finding out just how difficult carrier operations can be; last year at least two aircraft and crews were lost on a training deployment on the Liaoning while they were testing and evaluating the J-15 "Flying Shark" which is expected to perform at least as well the F/A-18 Hornet. Still, best estimates put the Chinese at least a decade away from being as proficient as the US Navy.

Next, in March Japan is ready to commission the JS Izumo (DDH-183) which they classify as a "helicopter destroyer", and is their largest naval vessel since WWII. But, according to *The Japan Times*, "The Maritime Self-Defense Force is considering deploying fixed-wing unmanned reconnaissance aircraft that can take off from and land on destroyers." If the plan is approved, the MSDFs intend to research these operations extensively. Depending on its research, Japan might someday build an aircraft carrier equipped with fighter jets."

USS WASP CLASS

Length: 844 feet
Displacement: 40,500 tons



JS IZUMO CLASS

Length: 814 feet
Displacement: 30,000 tons



Also, this month France is sending its aircraft carrier to the Persian Gulf to serve a support role in the country's bombing campaign against ISIS in Iraq. The decision to deploy the Charles de Gaulle (pictured at left) was made before the terrorist attacks that shook the nation. The French defense minister J. Y. Le-Drain's said "ISIS must be wiped out," the deployment looks to be part of a long-term engagement in the Middle East for what is Europe's largest military force. "Thanks to the Charles de Gaulle we will have intelligence ... we may also conduct operations in Iraq," President François Hollande told personnel in the annual presidential address from aboard the 38,000-ton carrier.

And, if this isn't enough for you, the word is going around that our good friend Kim Jung Un is trying to convince our other good friend Vladimir Putin to sell him the Su-35 Super Flanker, considered by many to be one of the worlds preeminent multi-purpose advanced tactical fighters. Hey Boyos! This ain't your daddy's MiG-21, which you still happen to be flying! Even if Putin did cut lose these planes I'd estimate a 24-month training period for them to be come "proficient". PS: Putin is also trying to export these to South Korea, so don't tell Kim!

Mission Statement

Perpetuate the history of Naval Aviation Squadrons VT-17, VA-6B, VA-65, VA-25 and VFA-25,
Remember deceased veterans and comfort their survivors,
Conduct charitable and educational programs,
Foster and participate in activities of patriotic nature,
Assist current active squadron members, and
Provide assistance to family members in times of emergency.

www.fistofthefleet.org

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PRESIDENT'S MESSAGE

Fist 15 is set for this October 29th thru November 1st. As mentioned in our earlier newsletters, we will be staying at the Embassy Suites DFW North at Outdoor World in Grapevine, TX. A fact sheet with reunion information is included in this newsletter and will be on our website on the Reunion page. You can make your room reservations online using the link on the fact sheet, which takes you to our Fist of the Fleet Reunion site with the hotel or at the phone number listed on the fact sheet. There will also be a downloadable registration form available on the Fist website if you would rather mail a check to Chuck Webster, FOFA Treasurer. We will have the Fist website updated very soon for registration and payment of fees using PayPal for this year's reunion. There will also be a list of attendees who have registered for Fist 15. Make your plans now and I hope to see you in DFW this October for a great gathering of fellow Fists.

Regarding our FOFA Officer elections I am happy to announce that former VFA-25 CO John Leslie has agreed to serve as our new Vice President, which the BOD unanimously approved. Thank you John for stepping forward to serve the Association. John brings a unique quality in that he served in the squadron in both the A-7 Corsair II and F/A-18 Hornet days. Welcome to the BOD "Rat". This in turn means that former VP and VA-25 CO Warner Butler is leaving office after seven plus years of service to the membership. "WB" please accept our sincerest thank you on behalf of the Association to both you and Kathy (KB) for your advice, counsel and efforts to keep FOFA strong and growing.

Additionally Chuck Webster, FOFA Treasurer and Bob Schreiber, Public Relations have both agreed to serve their second terms of office, which the BOD unanimously approved. Thank you gentlemen for continuing your vital work for the membership. There is a message here that members need to realize now, that in the foreseeable future we are going to need participation from new names from our membership roster to serve as officers in order to keep this Association viable. I hope you will seriously consider serving your fellow Fist shipmates and move us forward in the future.

We are currently considering a redesign and upgrade of our Fist website and have received a reasonable bid which the FOFA BOD has approved. Work will begin soon in the development stage with website integration several months down the road. We will keep you advised.

2015 will no doubt be a challenging year for our active duty shipmates with VFA-25 as they prepare for their next deployment. Despite some of the foolishness in Washington we all know the real dangers that exist in today's world. Once again the tiny percentage of those who actually serve in our military and help protect our great nation, will be thrust into harms way against a growing and very dangerous adversary. As we go about our comfortable and somewhat safe daily activities,

please remember those who stand the watch on our behalf. God Bless each and every one of you that currently serve from those who served before you.

Gary Kerans

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Blue Angels Tour Dates

Mar 14 NAF El Centro CA	21-22 Melbourne FL
28/29 Tuscaloosa AL	
Apr 11/12 Beaufort SC	18/19 NAS Corpus Christi TX
25/26 Vidalia GA	
May 2/3 Barksdale AFB LA	9/10 Davenport IA
16/17 Westover ARB,MA	20/22 UNSA MD
23/24 Rochester NY	30/31 North Kingstown RI

SKIPPER'S CORNER

Fist of the Fleet:

I type this update from a hangar at NAS Oceana, where we have officially started work ups with our new air wing, CVW-7. For the last month we have been preparing for this air-to-air Strike Fighter Advanced Readiness Program detachment. It is here that we start the building block approach of employing the most current and advanced tactics in order to achieve maximum lethality prior to deployment. The detachment consists of two weeks here in Virginia, followed by two weeks of training in Key West. Unlike last spring's trip to Key West, where the amount of liberty was equal to or greater than the amount of work, this time around will be heavily weighted towards the professional side of our mission with significant emphasis placed on tactical execution and thorough preparation. Hopefully we can realize a little time to squeeze in some liberty as well.

This will be an exceptionally busy year for the FIST of the FLEET with multiple trips to NAS Fallon and USS HARRY S TRUMAN as we prepare for a full deployment later in the year. This will be the squadron's first deployment in three and half years and we have a full complement of eager pilots and Sailors ready to go. We have a fantastic squadron of dedicated men and women that I believe would make any squadron alumni proud.

We look forward to the challenges of 2015 and look forward to continued updates from the Association
Very respectfully,
FIST One



FROM THE COCKPIT By: LT Justin "Neuman" Reece

Strike Fighter Squadron TWO FIVE continues to maintain unprecedented levels of readiness as they transition from Carrier Air Wing Nine (CVW-9) to CVW-7. Over the past several months the squadron focused on carrier qualification and advanced air-to-air. Now, with the holiday season behind us, we shift our focus to a traditional work-ups cycle taking us to our Fall 2015 deployment in USS HARRY S. TRUMAN (CVN 75).

VFA-25 started the transition to CVW-7 in November 2014 when they took advantage of a unique training opportunity on the east coast. Although the official turnover did not occur until January 31, 2015, the squadron participated in a CVW-7 large force exercise launching four F/A-18E aircraft cross-country to operate from NAS Oceana's ramp. The seamless integration between east and west coast F/A-18 squadrons demonstrated our collective ability to successfully execute standardized fleet tactics with unfamiliar wingmen and airspace. Our pilots and our new air wing are excited to have our aircraft's unique capabilities available.

Although VFA-25 re-qualified almost all of their pilots in USS NIMITZ (CVN 68) in September 2014, we developed a plan to embark in USS JOHN C STENNIS (CVN 74) with the rest of CVW-9 for a deck certification and subsequent carrier qualification. The squadron performed Field Carrier Landing Practice (FCLP) from NAS Lemoore both day and night in preparation for the Southern California winter sea states. Training in the carrier environment is essential to the success of our young pilots and Sailors alike and each performed admirably. In addition to standard flight operations, VFA-25 participated in the certification process through taxi drills, simulated hydraulic failures, and the VX Carrier Suitability team using our aircraft for the Precision Approach Landing System (PALS) certification. The professional execution of squadron members proved instrumental in the completion of the deck certification and will bridge the gap to our next underway period in June 2015 in TRUMAN.

Following the holiday standdown, VFA-25 launched seven aircraft from NAS Lemoore to NAS Oceana marking the beginning of work-ups in preparation for our upcoming scheduled deployment. The stop in NAS Oceana is the first of four operational movements to complete the Strike Fighter Advanced Readiness Program (SFARP). Hosted by Strike Fighter Weapons School Atlantic (SFWSL), all squadron pilots received a refresher curriculum in academics and lectures followed by a few air-to-air missions prior to departing for NAS Key West the first week in February. The NAS Key West portion will last two weeks and represent the second operational movement dedicated to air-to-air execution. Then, in late March, the squadron will shift to air-to-surface execution with academics provided by Strike Fighter Weapons School Pacific (SFWSP) in Lemoore and finally the flight events in NAS Fallon for two weeks in late April.

Strike Fighter Squadron TWO FIVE continues to march through the work-up cycle sharpening their spear of tactical and professional execution in preparation for what will likely be a demanding operational deployment. The training cycle will consist of multiple detachments afloat and ashore from California, Virginia, Nevada, and Florida and will ensure the pilots and maintenance professionals are poised and ready to perform when called upon overseas just as they have done so many times before.



FIST OF THE FLEET ASSOCIATION NEWS

By: Chuck "Pooh" Webster

Financial: End of year monies in the Association's Navy Federal Credit Union accounts amount to \$343.98 in checking and \$27,213.93 in savings. Those numbers do not include any new payments recently received.

Membership: Roger Bechtel paid his annual dues. Thomas "Cognac" Hennessy, VA-25 '60-'62 paid his annual dues and is now a paid Life Member. Same applies to John Juan; paid enough to be a Life member so both will receive letters of acknowledgement. New life member is James O. Travis, VA-25 '72-'73.

Grants: Update: The grant check we wrote to AO-2 Remi Araque back in 11/19/2010, I dropped from the books as void and it will no longer show up in reports as being an outstanding un-cashed check.

FROM THE HANGAR DECK By: Command Master Chief Choy Lucero

Greetings Fist of the Fleet, past and present. I am Command Master Chief Choy Lucero and am proud to serve as Strike Fighter Squadron 25's CMC for the past two years. There is so much joy dedicating your life to the betterment of all Sailors from the newest Airmen in the Line Shack to the most senior officer assigned. We make a great team!

Originally from Quezon City, Philippines, I am a first tour CMC and continuing to adjust to squadron life as this is a first as well. Having spent the previous 25 years operating from ships, you could imagine this has been both challenging and rewarding. The opportunities we now enjoy as a relatively small, less than 200-member, squadron is immense. Few good things in life are not without difficulty along the way. What makes VFA-25 so special is that everyone from the CO on down take time out of their day to make this squadron and our families better tomorrow than they are today.

Our record retention and advancement rates stem from the following formula:

- **Be proud of our command and instill pride in every Sailor.** FIST Sailors know exactly what it means to work hard and deliver the best results in the air and on the ground. We take ownership of our aircraft, equipment, and spaces with a culture of being "inspection ready" at all times. At every Command Indoctrination, I discuss what it means to be proud of your squadron and its legacy. Of course, nothing is more impactful than our squadron chant/roar at the end of every squadron event! One team, one fight.
- **Have a questioning attitude and remain focused on the mission.** Every Sailor in this great squadron is encouraged to ask tough questions about processes, relationships, and maintenance actions in search of improvement. With improvement comes a reduction in risk and enhanced safety. We all understand that our mission hinges on our Sailors' attention to the small stuff, on the flight line and in our personal lives. I firmly believe our Sailors enjoy the high-level of motivation they do because of the support they receive at all levels in the chain of command. I am always humbled by their efforts.
- **Always promote teamwork.** We believe that the only way to truly accomplish the mission is to show each and every FIST Sailor how their individual job supports the great command direction and flight operation. For this reason, we place a premium on mastering our trade through qualifications on or ahead of timeline. We simply cannot afford to not have everyone operating at the best of their ability.
- **Slow and steady wins the race.** It takes just as much effort to do the job right the first time as it does to hurry and risk rework. Our team of expert maintainers and administrators have mastered this mantra and are well postured for our weapons and maintenance inspections coming up next quarter. Perfection may be difficult at best and often out of reach, however, as our rich history and current records indicate, we have the right Sailors with the right skills making good decisions each and every day.
- **Lead at every opportunity and do your best!** Part of our success is attributed to a growing Coalition of Sailors Against Destructive Decisions (CSADD) Chapter. This is a grass-roots program formed by junior Sailors, for junior Sailors. There is little command involvement beyond support with resourcing needs when required. Starting with just 6-8 personnel over a year ago, we now have over 20 involved making our squadron, base, and township even better through volunteerism and positive behaviors. Leadership at all levels is encouraged, especially when it involves Sailors taking care of Sailors.

I am humbled and thankful to the Fist of the Fleet Association President, Officers, and members for allowing me this opportunity to share some of our great squadron's successes. We are into the work-ups cycle now and will be challenged in a variety of ways. I am confident that we will perform here and on deployment as so many FISTS did before us. It's an honor to serve as your CMC. Best regards, Choy.



Have you paid your 2015 Dues?

Annual Dues: \$25/YR

Life Time Dues \$200

Mail dues to Financial Officer:

Chuck Webster 39224 132nd St. Bath SD 57427

Only Voting Members receive a copy of the Directory

Become a Voting Member!

Visit the Base Exchange at

www.fistofthefleet.org

DID YOU KNOW: NAVY, MILITARY AND OTHER INFORMATION

U.S. and India to Cooperate on Aircraft Carrier Technology By: Sam LaGrone
USNI: Jan 27, '15

U.S. and India will create a working group to share aircraft carrier technology and design, according to an agreement signed as part of President Obama's visit to the country. Included in a joint statement was a clause calling for the creation of a working group to "explore" carrier technology sharing but gave few details on the effort. It's unclear yet as to which U.S. agencies would participate.

Representatives with U.S. NavSysCom said the outline of the effort had not yet reached their office. The Navy's sole carrier builder, Huntington Ingalls Industries, referred USNI News to the Navy. In a statement SecDef Hagel said deeper defense cooperation, "will support stronger military-to-military engagement, including deeper maritime cooperation and increased opportunities in technology and trade." Even if the scope of the working group is still vague, partnering in any capacity with the U.S. on carrier development would be a boon to the Indian development of its internal carrier program.

India's first domestic carrier, the 40,000 ton INS *Vikrant*, has been plagued with both cost overruns and production delays and now could cost as much as \$4 billion and become operational in 2018, five years late. Some help could be directed toward helping India include nuclear power in its second homegrown carrier. In September, the head of India's naval design bureau said that nuclear power could still be an option in the second carrier, *Vishal*, currently in its conceptual design phase. Other American technology wants from the Indians could include aircraft carrier catapults.

Indian reports from 2013 said U.S. defense company General Atomics had briefed Indian officials on the EMALS, the next gen carrier catapult that will be used on the Ford-class (CVN-78) carriers. Other areas mentioned in the statement include development of four so-called pathfinder projects and the development of jet engine technology.

India fields several Russian designed ships, including its modified Kiev-class carrier, INS *Vikramaditya*, and an Akula-class nuclear attack sub. However Russia has performed poorly in regards to delivery dates for promised kit and cost overruns; and has been inconsistent with its technology development. In the last few years India has looked more to Western Europe and the U.S. for defense material buying Boeing P-8I maritime patrol aircraft and six French and Spanish designed Scorpène-class diesel-electric attack submarines. Part of India's desire to diversify its defense spending could be tied to China's own blue water naval expansion. In the last few years, China has both operated more and more in the Indian Ocean and tightened military and economic bonds with Russia, raising concerns with India's leadership



Artist's concept of Vikrant



Scorpène-class sub

The Secretary of the Navy confirmed the existence of an agreement between the Navy and Marine Corps to utilize the Bell-Boeing V-22 Osprey tilt-rotor as the Navy's replacement for the Northrop Grumman C-2A Greyhound as the utility aircraft for the Navy's carriers. The Navy is responsible for modifying these V-22s into an HV-22 configuration for the [carrier onboard delivery] (COD) mission," reads the document.

"The parties agree that subsequent documents will provide details on the concept of operations and milestones. Though no one would confirm the V-22 as the future COD, it was said its selection would mean a significant change in the concept of operations (CONOPS) for the aircraft. With the likely selection of the V-22 for the COD role, the largest outstanding question is how the aircraft will transport the F-135 engine for the F-35 Lightning II Joint Strike Fighter (JSF). "The high power module in the F-135 is a beast," Vice Adm. David Buss, commander Naval Air Forces, said in early 2014. The Navy was still working on the engine transportation problem with the MV-22.



C-2A Greyhound



V-22 Osprey

FIST 15 REUNION FACT SHEET

WHEN: Thursday October 29th thru Sunday November 1st

WHERE: Embassy Suites DFW North at Outdoor World, Grapevine, TX

WHAT: Schedule of events as follows: (Times may be updated later)

Thursday check in beginning at noon in the Big Bass Room 2nd floor.
Refreshments and libations provided. You provide the sea stories.

Dinner on your own Thursday evening at several nearby restaurants.

Friday morning we will head to the Lockheed/Martin factory in Fort Worth for a tour of the F-35 assembly line. Bus transportation provided from the hotel @ \$11 per person. Tour is free.

Friday evening 6:00 PM will be an informal reception with ample appetizers, carving stations and a cash bar. Dress casual.

Saturday morning is our FOFA Business meeting around 9:00 AM. Around 10:30-11:00 AM we will depart by bus to AT&T Cowboys Stadium in Arlington for a guided VIP tour of this fabulous property. Bus \$11 and tour \$20 per person.

Saturday evening 6:00 PM FOFA Banquet & Program. This will be a plated dinner with a cash bar. Dress is coat & tie or business casual.

Sunday check out and goodbyes.

Room rates are \$119 King Suite and \$129 Double Queen Suite. The hotel provides a full hot breakfast each morning and a complimentary cocktail hour each evening. Parking is free as is van transportation to and from DFW Airport. The hotel has provided us with their 2nd floor Big Bass Suite for use as our Ready Room. Additionally we will have a designated area on the 1st floor atrium for overflow when the RR is too crowded.

Make your hotel reservations online at: <https://aws.passkey.com/event/12612398/owner/76856/home>

Reservation via phone at 972 724-2600. Group is Fist of the Fleet Association-Navy Reunion Embassy Suites DFW North at Outdoor World 2401 Bass Pro Drive, Grapevine, TX 76051 972-724-2600

Registration for attending Fist 15 is set at \$135 for each voting member and each of their guests. Non-voting members will be \$145 each and each of their guests. You can pay these fees on the FOFA website and sign up for the buses and AT&T Stadium tour on the Base Exchange page. A registration form will be available on our website if you wish to mail a check to Chuck Webster, FOFA Treasurer at the address below.

Chuck Webster 39224 132nd St, Bath, SD 57247-5800

Call or email with questions: Gary Kerans, 928 925-5099, domeaz@me.com



THE EVOLUTION OF WARFARE: THE ROCKETS OF WWII AND KOREA

In the midst of WW II, adequate facilities were needed by the California Institute of Technology for test and evaluation of rockets. At the same time, the Navy needed a new proving ground for aviation ordnance. Caltech's Dr. Charles C. Lauritsen and then CDR Sherman E. Burroughs met and formed a pact to find a site that would meet both their needs. The Navy established China Lake as the Naval Ordnance Test Station (NOTS) in Nov 1943. Its mission was defined in a letter by the SecNav, "... a station having for its primary function the research, development and testing of weapons, and having additional function of furnishing primary training in the use of such weapons." Testing began within a month of the Station's formal establishment. The vast and sparsely populated desert with near perfect flying weather and practically unlimited visibility, proved an ideal location not only for test and evaluation activities, but also for a complete research and development establishment. Not long after this the Navy then established the Hawaiian Aircraft Rocket Training Unit at NAS Kahului.



NAS China Lake



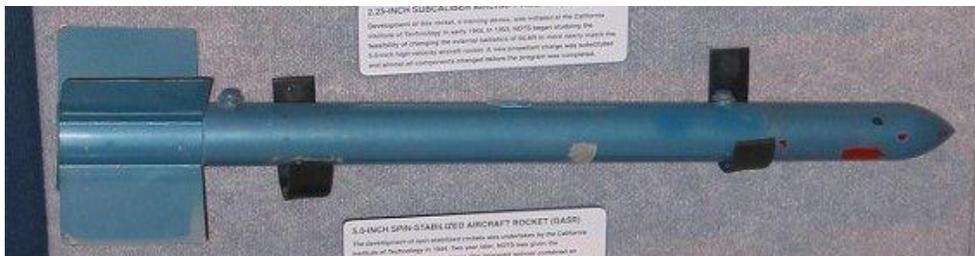
NAS Kahului

highly successful China Lake product; literally millions of the 2.75-inch Mighty Mouse and 5.0-inch Zuni have been fired in combat. Related work by China Lake includes the development of the BOMROC system and several rocket-assisted projectiles (RAPs); work on RAPs evolved over the years to include extended-range guided projectiles, such as the Antiradiation Projectile (ARP). China Lake's rocketry expertise--propulsion, warheads, airframes, aerodynamics, ballistics, launchers, fire-control, etc.--was also instrumental in establishing its guided missile programs

Air-launched rockets, solid propellants, fire-control systems, and rocket and guided missile T&E were NOTS' primary areas of effort in the 1940s, and in the late 1940s, NOTS began research on fire-control systems that evolved into the concept of the Sidewinder guided missile. During World War II, the Station played a role in the Manhattan Project as the site of "Project Camel," which developed non-nuclear explosive bomb components--a role that continued into the 1950s. Holy Moses, Tiny Tim, and a family of spin-stabilized barrage rockets were fielded while the Station was built. After the War, the Pasadena Annex was added to NOTS, bringing with it the torpedo-development program and other underwater-ordnance RDT&E efforts.

With the advent of the Korean conflict, NOTS rapidly gained cognizance over an even more extensive catalogue of rockets, missiles, and torpedoes and an array of guns, bombs, and fuzes. The Station sent the 6.5-inch tank-killing Ram rocket to the combat forces in Korea after only 28 days in development and testing, and the ensuing years saw the development and deployment of some of China Lake's most noted products, including the Weapon A, Mighty Mouse, and BOAR rockets; a series of torpedoes; new aircraft fire-control systems ("avionics" now); and, of course, the Sidewinder.

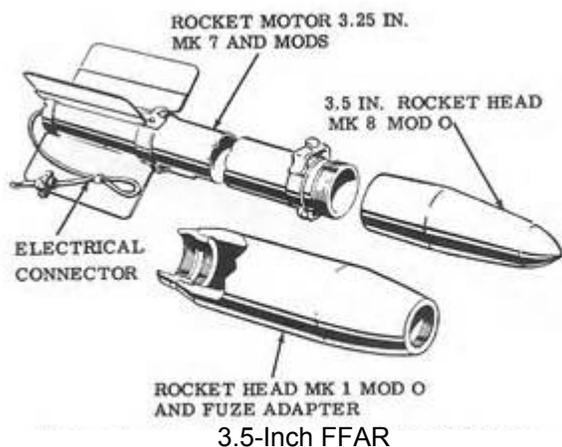
Aircraft rockets were China Lake's *raison d'etre* at its establishment. The early forward-firing aircraft rockets developed by the CalTech-NOTS team included the 3.5- and 5.0-Inch Aircraft Rockets; the 5.0-Inch High-Velocity Aircraft Rocket, Holy Moses; and the 11.75-inch Tiny Tim. Early China Lake products also included spin-stabilized bombardment rockets and special-purpose rockets that were used for everything from propelling line charges to sampling atomic clouds. Folding-fin aircraft rockets (FFARs) are another



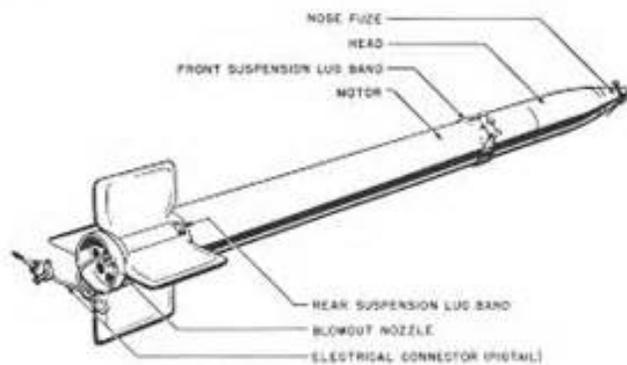
The 2.25-Inch SCAR (Sub-Caliber Aircraft Rocket) was a family of air-to-ground training rockets used for air-to-ground rocket firing practice by fighter-bomber pilots in the 2nd World War. The SCAR was developed by the National Defense Research Committee (NDRC) and the U.S. Navy's Bureau of Ordnance.

The rockets were similar to the 3.5-Inch and 5-Inch FFARs (Forward Firing Aircraft Rockets), but used a solid-propellant rocket motor of only 2.25-inch diameter (hence the "sub-caliber" name). By varying the amount of propellant, the flight characteristics of different FFAR types could be approximated.

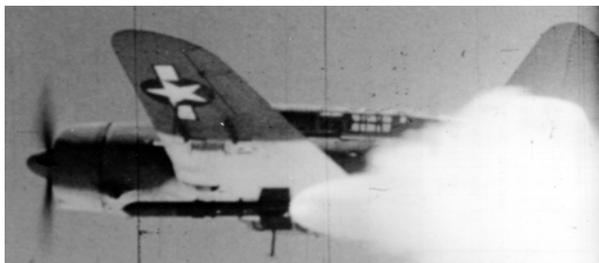
In late 1942, the Royal Air Force began to use air-launched rockets with some success in anti-submarine warfare (ASW). This eventually sparked the interest of the U.S. Navy, and in June 1943 a high-priority project was initiated to develop an air-to-ground rocket for use by fighters and light bombers. At that time, CalTech was already developing a new 3.25-inch solid rocket motor, and this was used as the basis of the Navy's ASW rocket. The result was a 3.5-inch diameter rocket stabilized by four tail fins. It was officially called the 3.5-Inch FFAR. The rocket had a solid steel warhead designed to pierce the pressure hull of submarines. When launched by torpedo bombers in a shallow dive, it achieved a velocity of about 1290 km/h (800 mph) and could penetrate a submarine's pressure hull even after traveling through 40 m (130 ft) of water.



3.5-Inch FFAR

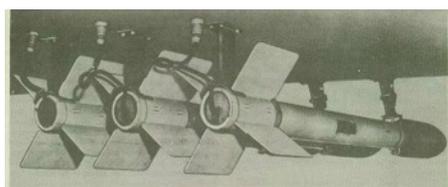


5-Inch HVAR



Tiny Tim firing from SB2C

The result was a rocket of 11.75 inches diameter, which eventually gained the nickname Tiny Tim. The apparently odd dimension was chosen; because it matched the diameter of the standard 500 lb. SAP bomb, which was used as the warhead, as well as the diameter of standard oil well steel tubing, which was used as the casing. The Tiny Tim was first fired from the ground in late Apr 1944, and the first air launch from an Avenger succeeded on 22 June that year. A rocket as large as Tiny Tim could not be launched from directly beneath the aircraft, because the blast would severely damage the latter. The NOTS tested two different launching methods. The first was a displacement launcher, which moved the rocket some feet below the aircraft's fuselage before ignition. However, this didn't work satisfactorily, and therefore a second method was developed, which eventually became standard. The rocket was simply dropped from the aircraft, and a lanyard extended between the latter and the weapon. When the lanyard was exhausted and the connection broke, the rocket was ignited. The solid-propellant rocket accelerated the fin-stabilized Tiny Tim to about 885 km/h (550 mph), and the effective range for the typical low-altitude launch was about 1500 m. By Dec 1944, the Tiny Tim was ready for deployment and pilots had been trained. The rocket could be fired from Corsair, Hellcat, Avenger and Helldiver aircraft. However, the weapon came effectively too late for use in World War 2, and was reportedly only used at Okinawa in small numbers (with unknown results). Tiny Tim was later used with some success during the Korean War, but was most likely removed from service soon after the end of that conflict.



NEXT TIME IN THE EVOLUTION OF WARFARE: THE TECHNOLOGY EXPLOSION AND VIETNAM

The 3.5-Inch FFAR entered service in late 1943, and the first submarine kill with the weapon occurred in Jan 1944. At first, the rocket was fired from underwing rail launchers, but these induced a high drag on the aircraft and were therefore eventually changed to "zero-length" launchers (two posts to which the rockets were attached). When fitted with an explosive warhead, the accuracy of the 3.5-Inch FFAR would have been good enough to be used against surface ships or land targets. However, a 3.5-inch warhead was too small to be effective, and therefore the 3.5-inch motor was fitted with a warhead of 5 inch diameter, leading to the 5-Inch FFAR.

The first air-launched 5-inch rocket of the U.S. Navy was a derivative of an earlier 3.5-inch FFAR, which was developed by the Navy from June 1943 as an aircraft-launched ASW rocket. The 3.5-inch FFAR was considered accurate enough for use against surface ships and land targets, but needed an explosive warhead for these missions. A 5-inch anti-aircraft shell was modified as a warhead for the 3.5-inch rocket motor. The resulting rocket was the 5-Inch FFAR, which entered service in Dec 1943. Because of the increased weight, the speed of the 5-inch FFAR was only 780 km/h (485 mph).

The 5-inch FFAR was also used from LSM(R) (Medium Landing Ship, Rocket) type vessels as an interim 5-inch beach bombardment rocket before the better-suited spin-stabilized 5-Inch HVSR (High-Velocity Spinner Rocket) became available.

Holy Moses HVAR

The 5-inch FFAR suffered from insufficient speed because of its small motor. Therefore the development of a larger rocket motor with 5-inch diameter was begun, and the first test firings occurred in Dec 1943. When fitted with the warhead of the 5-inch FFAR, the rocket achieved a velocity of 1530 km/h (950 mph), making it a very powerful weapon for its time. It was officially designated as 5-Inch HVAR (High-Velocity Aircraft Rocket), but often called *Holy Moses*. It became operational in Jul 1944, and was used by Army Air Force and Navy aircraft.

In early 1944, the U.S. Navy was in need of a powerful anti-ship weapon with some stand-off range to keep the attacking aircraft outside the range of heavy air defenses. The new fast fighter-bombers of that time couldn't drop torpedoes, and the existing rockets were not large enough to be useful against heavy shipping. In March, Caltech showed that a large caliber air-launched rocket was feasible, and the Navy subsequently ordered to develop such a weapon with the highest priority.