



Fist of the Fleet Association

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

NEWSLETTER

July 2015

Preserving the Past Providing for Today
Promoting the Future



SUMMER EDITION

By: Jerry "Ricochet" Fritze

Service and Sacrifice



You may recall last year I injured my foot and tore it up pretty good. Well, recently I had the opportunity to observe close-hand, and interact with, the doctors, nurses and technicians at their work as I underwent the surgery to repair the damage. Later that night I had one of those moments and I began to think on the terms "service" and "sacrifice", and "every-day heroes." I think the term "Hero" has become so overused that it no longer carries its original meaning, and I don't believe in the every-day hero because if *everyone* is a Hero then *no one* is. These people, daily, along with first responders such as police, fire, EMTs, and teachers, pastors and other clerics, work in their chosen professions providing services such as health care, education, safety and comfort to those in need specifically and all others generally. Nothing they do through the course of a normal day is heroic, nor legendary, epic, of mythic proportions or otherwise worthy of that very high recognition. They are, however, noble and compassionate beyond understanding and comprehension. They are the true service providers: working for the betterment of mankind, and very often saving us from our own stupidity. We never hear about them unless something tragic happens. Occasionally they may find themselves by circumstance being required to act with the very highest traditions of valor under fire, but most of them will continue to perform their jobs with a passion that too often goes unrecognized. You don't get a medal for showing up every day, and the vast majority of these people will be forever unknown to the rest of the world. So the next time you're in hospital or at the clinic take the hand of your nurse or doctor and look them straight in the eye and say "Thank you for your service." I guarantee you will make their day a whole lot better, and seeing them smile will be reward enough.

Whenever someone walks up to me and says "Thank you for your service" I'm left with the impression that I was doing nothing more than delivering their mail, and many times it comes off as more of an apology than sincere gratitude. The vast majority of them have no idea what it takes to keep them free, and in truth they don't want to know. They don't want to know about the blood, the sweat, and all the little secrets about what happens when you put on the uniform. So let's clear it up right now. To "serve" in the military you are required to sacrifice. We sacrificed a good deal of our individuality and personal freedoms to be part of a team. Many sacrificed their lives, limbs or other body parts. Some sacrificed their families or their sobriety, and still others their sanity and their own personal belief systems and moral codes; and all of us, every single one of us sacrificed the days of our youth so we could stand on that wall and stare down the world. Years ago at a reunion some guy came up to us and said "I'd like to thank you for your service". Rich Payne leaned over and said "If he knew the truth he'd probably want his money back". We roared with laughter but I have never heard a more honest assessment from a veteran. So the next time someone stops you in the street and starts to say "Thank you for..." stop them right there, correct them, and tell them to say sacrifice; because that's the reality. And each one of us, alone, must judge for ourselves if the rewards were worth the efforts.

The new Association website is progressing quite well; some of us have had a sneak peak at the work being done by Julie Chalker. It has an outstanding look and feel and I think everyone will be extremely pleased with the end result. A few more short summer months and we will all gather again for our reunion in Dallas, There are more than enough unique activities planned this go 'round, hope to see many of you there!

~Ricochet~

www.fistofthefleet.org

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.**

PAGE 1

PRESIDENT'S MESSAGE

Summer is rolling along and it brings us closer to our Fist 15 Reunion in Dallas. As of this writing we have 47 rooms reserved in our block and 63 people registered with the Association to attend. My best count based on the rooms reserved is 25 people have not currently registered to attend Fist 15, but have hotel reservations. I will send an email to each member that has not yet registered as a reminder. We need to know soon so I can finalize buses to Lockheed and reservations at AT&T Stadium. We are limited to 75 people for the Lockheed/Martin tour on Friday, but currently only have 52 signed up so there is plenty of room. We also will need a closer total count to arrange the catering though we have a bit more time for that. In all it appears Fist 15 will be well attended and another great gathering of friends and shipmates. Be sure to check the Fist website under Reunion for the latest attendance list so you'll know who is coming. You can also verify whether you are registered to attend and the specific events you signed up for.

Speaking of websites our new site is very close to being finished. It has a fresh updated look and I think you will enjoy viewing it. Bob Schreiber, Al Gorthy and myself have been working with Julie Chalker to finalize the design with several new graphics and ease of navigation. We will let everyone know via email when the new site is active which should be sometime in August. We all owe Nita Kison a great debt of gratitude for all her efforts designing our current site that has served us well these many years. Many of the ideas she used have also been incorporated in the new site.

We are still waiting for a final determination by the IRS on our retroactive reinstatement of our tax-free status. Based on the 90-day window they mentioned we should hopefully hear something in August.

We will soon bestow the third LTJG Harry D. Jones Award for Excellence when the squadron senior leadership determines this year's Junior Officer recipient. They no doubt have several worthy candidates to choose from. The squadron has been very busy with multiple work-up deployments in preparation for their eventual deployment aboard USS Harry S. Truman (CVN 75) later this year. Please take time to read the enclosed articles from the squadron. Each of them will make you very proud to be associated with the young men and women that carry on the traditions of Fist of the Fleet. Regarding the Harry Jones Award I would like to solicit donations from the membership in support of this annual award. As a reminder the award consists of a \$500 grant to the selected Junior Officer and the cost of the individual plaque and nameplate for a total of around \$600 annually. I know our tax-free status is in limbo, but we still need to fund this award each year. Thank you.

I know the membership joins me in congratulating CDR Chad "Decaf" Gerber on his assumption as Commanding Officer of VFA-25 this past May. Also FOFA extends a hardy welcome aboard to CDR Winston Scott II who joins the squadron as XO. We wish you both the very best as you lead the finest squadron in the US Navy and look forward to our continuing liaison with our active duty shipmates.

Gary "Dome" Kerans



Blue Angels Tour Dates

Jul 04/05 Eau Claire WI	11 Pensacola Beach FL
18/19 Hillsboro OR	25/26 Fargo ND
Aug 01/02 Seattle WA	05/16 Chicago IL
22/23 Kansas City MO	29/30 Ypsilanti MI
Sep 01/02 Atlantic City NJ	05/06 Brunswick ME
12/13 Ft Worth TX	19/20 NAS Oceana VA
26/27 Naval Base Ventura County CA	

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SKIPPER'S CORNER

FIST of the FLEET,

Every member of this great organization has shown what teamwork, dedication, and commitment to a common cause can yield. As this band of brothers continues to refine its tactics and procedures, VFA-25 has led CVW-7 from the front in advancements, qualifications, program management, and tactical execution. Special thanks to CDR "Frosty" Snowden for his leadership in preparing the squadron for this moment in our work-up cycle and what will be a successful deployment.

No matter the environment, afloat or ashore, the squadron's innate ability to meet all challenges head on and produce impeccable results is awe inspiring. After three full years, VFA-25 embarked USS HARRY S. TRUMAN (CVN 75) with an entire air wing as part of Tailored Ships Training

Availability (TSTA). Over the nearly four week afloat detachment, the squadron lost only one sortie in 226 scheduled – and that was due to a non-aircraft issue! This doesn't happen by accident. Understanding the mission, being professionals in our trade, and having a questioning attitude about everything is our recipe for success.

Perhaps the greatest challenge this quarter was moving the entire squadron from the ship to NAS Fallon for Air Wing Det in just four work days! It was during this same period that the maintenance professionals knocked out three phase inspections, changed a fuel cell, built a 9th aircraft, completed all of the post-carrier inspections, and launched 9 full-mission capable aircraft to Fallon. I am sure the readership understand the amazing effort this took.

There continues to be a lot of consternation in the Pacific, Middle East, and Africa. The Fist of the Fleet will wrap up the work cycle in TRUMAN this September and make us available for any and all tasking as we head across the Atlantic. I am truly humbled to be the 68th Skipper in this squadron's rich history and even more grateful for what the Fist of the Fleet Association does for my Sailors, past and present.

With great respect,
FIST ONE

FROM THE COCKPIT By: LT Stephen "Scooby" Yoo

Fist of the Fleet,

The last time you heard from the Fistles was during the air-to-surface Strike Fighter Advanced Readiness Program (SFARP) detachment at NAS Fallon, NV. Since its completion, the squadron has maintained a high ops-tempo schedule preparing for deployment later this year. Shortly following air-to-surface SFARP, VFA-25 completed Tailored Ship's Training Availability (TSTA) underway period onboard the USS Harry S. Truman (CVN 75) and is currently on detachment to Fallon again to complete the Air Wing Training syllabus.

The Fist of the Fleet has enjoyed success across all of our detachments over the past several months. Thanks to an all hands effort from the maintenance department, administration department and operations department, air-to-surface SFARP went extremely well in April. Squadron pilots were equipped with the appropriate resources and proved capable of efficiently putting bombs on target, on time, during modern battlefield simulations in the Fallon Range Training Complex (FRTC).

Following the return from NAS Fallon, the squadron had a few short weeks to conduct unit level training and begin practicing for carrier operations before taking eight jets across the country to complete TSTA aboard the TRUMAN. All members of the squadron were quickly indoctrinated into shipboard operations and adapted to the unique challenges associated with life on the ship. Under the guidance of Commander, Carrier Air Wing 7 (CVW-7), flight operations quickly ramped up and squadron pilots found themselves carrying many different ordnance load-outs while conducting a wide variety of missions. Some of those missions included setting and launching alert aircraft, opposed air-to-air missions and close air support (CAS). There were twelve Large Force Strikes conducted as well, further integrating VFA-25 into the air wing team. Maintaining a 99.6% sortie completion rate, 225 of 226, the Fist of the Fleet played a vital role in the air wing's success during this important workup detachment.

Following TSTA, the jets had only one week between flying off TRUMAN until once again landing in Fallon. The Fist maintenance team worked selflessly around the clock to ensure that the aircraft that had just endured extensive shipboard operations were ready for transit, and full mission capable. Arriving in Fallon, the squadron quickly began the Air Wing Training syllabus. While pilots participated in pre-deployment lectures, the maintenance team conducted flight operations getting the Naval Aviation Warfighting Development Center (NAWDC, formerly Naval Strike and Air Warfare Center (NSAWC)) in support of the instructor staff. Also during the first week, VFA-25 conducted many unit level training events to include bombing and strafing, smart weapons employment, penetration weapons employment and close air support. From there, the Fist team continued to integrate into CVW-7 by conducting numerous, complex large force strikes utilizing the unmatched training environment the FRTC has to offer.

Over the last few months, VFA-25 has matured into a cohesive team able to efficiently and successfully complete any mission. As the work-up cycle continues, The Fist of the Fleet will undoubtedly surpass all standards for excellence and raise the bar in tactical execution. We are primed and ready for a triumphant combat deployment!



FROM THE HANGAR DECK

FIST of the FLEET,

Command Master Chief Henderson here and I am two months into my first aviation tour with VFA-25. My background is from the Surface Navy, but I could not be happier to be a Fistie. As a former Fire Controlman, I have been humbled by the amount of dedication and ownership taken by the Sailors of this command. The pride displayed here is unlike any I've seen in my 24 years of naval service, and the commitment and effort put forth to ensure the jets stay flying has been nothing less than amazing.

We are currently in the middle of a work-up cycle and our schedule has us extremely busy as we march towards our upcoming deployment. We recently came off a successful TSTA boat detachment aboard the USS Harry S. Truman in Norfolk, VA, and are now taking on large force exercises during Air Wing Fallon Det. We have many new Sailors who have checked into the command over the last several months. As they meet the chain of command and their shipmates and get settled into their shops, they quickly realize VFA-25 sets the standard on how an aviation squadron performs and that the team strives to raise the bar every day, during every evolution as we continue to be the best at what we do. The drum beat from the deck plate never changes as these Sailors persevere from detachment to detachment understanding what it takes to move all of our personnel, tools and equipment - whether it be cross country to Virginia or just a few hours away to Fallon. They never lose sight of what is important, which is the preparation of our jets to fly, so the pilots can train the way they fight and fight the way they train. The enthusiasm will continue during COMPTUEX in September, which will be the last detachment before a well-deserved POM stand-down. The excitement is building for many of our Sailors, including those who will be making their first deployment at the end of the year. The stand-down will give them a chance to spend time with family and friends and recharge prior to hitting the deck plates hard again for seven months. There is no doubt, we will be ready to meet our mission of putting fused ordnance on target, on time, the first time if called upon to do so.

You would all be very proud, as I am, of the fantastic work happening on the deck plates. The loyalty, dedication, and hard work that takes place never goes unnoticed as we have recently made two new Senior Chiefs, four First Class, and several new Second and Third Class Petty Officers. We have also had a plethora of Sailors earn their Enlisted Aviation Warfare Specialist (EAWS) pins. Currently, we are anxiously awaiting the Chief Petty Officer results, which should be out by the end of July or first week of August. The Fist of the Fleet has a history of doing great things, so we thank you for laying the ground work for our success. The impressive performance by each and every Sailor on the deck plates here in VFA-25 is the key to our success as we continue to prove why we truly are, and always have been, one of the best squadron's in the Navy and definitely the best on the west coast!

With the utmost respect,
CMDCM Claude "Hendu" Henderson



FIST sailors watch as aircraft assigned to CVW 7 fly above the Truman during a missile launching exercise. Truman is conducting TSTA off the east coast. TSTA is the first combined training event of a ship's inter-deployment training cycle that tests and evaluates shipboard drills, including general quarters, damage control, medical and firefighting



FIST sailors observe a missile exercise from a Squadron Hornet on the flight deck of the Truman. Upon successful completion of TSTA, Truman will be considered proficient in all mission areas. (U.S. Navy photos by Mass Communication Specialist 3rd Class M. M.) Gillan/Released)

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

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DID YOU KNOW: NAVY, MILITARY AND OTHER INFORMATION



The Navy's EA-6B Prowler electronic warfare jet flew its last active duty flight and officially decommissioned at the Museum of Flight in Seattle. The Navy hosted a formal sunset ceremony at Naval Air Station Whidbey Island on June 27, where the final jets from Electronic Attack Squadron VAQ-134 flew away from their home station for the last time.

The Northrop Grumman-built jet, which entered the fleet in 1971, is being replaced by the Boeing EA-18G Growler. The Growler is built on a F/A-18E/F

Super Hornet frame and has both an electronic attack suite and the APG-79 active electronically scanned array (AESA) radar. The Prowler that landed at the museum will go on permanent display there, which curator Dan Hagedorn said in a statement will be the first electronic warfare aircraft at the museum. "It is the missing piece that fills our story of modern military aviation," he said. "Prowlers have been used since the Vietnam War, and their capability to suppress enemy air defenses is still formidable. This plane will not only compliment our older military jets on exhibit, but speak for the current state-of-the-art as well."

VAQ-134 returned from its last carrier deployment in November, after conducting missions against Islamic State targets in Iraq and Syria from the carrier USS *George H.W. Bush* (CVN-77). The Growler platform was first delivered to Whidbey Island in 2008 and reached initial operational capability in 2009. Electronic attack squadrons have been transitioning to the new platform ever since. With the Prowlers exiting the fleet, Congress is still deciding what to do with electronic attack missions. The Navy has said it has purchased enough Growlers to cover its own electronic attack mission set but would like to buy more to meet joint force requirements. Lawmakers are still working through the Fiscal Year 2016 defense spending process and have not made final decisions about whether to fund additional Growlers. The additional capabilities of the Growler are key to the Navy's emerging Naval Integrated Fire Control Counter Air.



New Life for an Old Warrior



Embraer president Jackson Schneider officially delivers the first modernized Skyhawk to Admiral Eduardo Bacellar Leal Ferreira, commander of the Brazilian Navy.

The first of 12 completely modernized A-4 Skyhawk fighters has been delivered to the Brazilian Navy by Embraer Defense & Security. The McDonnell Douglas A-4 Skyhawk, which Brazil designates the AF-1, is a subsonic intercept and attack aircraft. The aircraft are receiving new navigation, weapons, power, tactical communications and sensor systems, plus computers and multi-mode radar. Embraer said the new equipment, along with the structural work that was performed, will enable the aircraft to remain operational until 2025.

"This is the first contract for systems integration that we have signed with the Brazilian Navy and, therefore, is a landmark in our relations," said Jackson Schneider, president and chief executive officer of Embraer Defense & Security. "The modernization of the AF-1 was a significant technological challenge, since it is a platform that we did not develop. Nevertheless, with the support

and competence of the staff of the Brazilian Navy, we were able to deliver a solution that fully meets the operational needs of our client in demonstration of our commitment to the Navy's projects." The Brazilian Navy Operates both single and double-seat variants of the aircraft.

FIST OF THE FLEET ASSOCIATION MID-YEAR FINANCIAL REPORT

The financial health of the Association is on solid ground. As of 1 June 2015, the Association has a balance of \$27,874.03 in savings and \$4,467.33 in checking with the Navy Federal Credit Union.

One of the main indicators of the Association's financial health and stability is the continued growth of its dues paying and new life members. This number increased during the first six months of 2015 with eight new life members and fourteen annual members paying their dues. New Life Members: James Travis, John Pettitt, Gregory Peairs, Rick Hutchens, Bob Glennon, David Frahm, James Matheson Jr., and Harry Hartsell. Annual Members that renewed or joined for the first time are: Mike Penn, Stephen Thompson, John Juan, Steve Casteletere, Craig Bechtel, Thomas Hennessy, Robert Jordan, Laurence Woodbury, Charles Thom III, Dale Mills, Richard Harkey, Ken Crowder, John Jordan and Hershel Pryor.

With the registration of 56 members and guests for Fist '15 our income has increased these last couple of months. However, those funds will be used come October to pay the reunion expenses. We already deposited \$800 to ensure transportation for the tours. Our third annual Ltjg Harry Jones Award will be presented soon and recognized at Fist '15. To date we have not received any additional donations for that award. The other major expenses this spring were printing and mailing of the directory and the cost covering our web page. A total of \$723.31 was spent for the directory and newsletter printing. Initial website development expense was \$685 and \$553.63 was paid to GoDaddy to secure our domains and hosting well into 2018. A check of \$850 was sent to the IRS to cover the cost of filing the necessary 990EZ returns and information to hopefully reinstate our tax-free status.

During 2015 the educational fund has collected contributions of \$280, but the Association has not received any requests for an Educational Grant from the squadron, which has been very busy with workups on the east coast. Chuck "Pooh" Webster

DEPARTURE NOTIFICATION

It is with sadness that we note the passing of Mary Greathouse, wife of former Fist of The Fleet Commanding Officer Ed Greathouse. A letter of condolence on behalf of the Association was sent to Ed.



6 MAY 2015

Dear Skipper Greathouse,

On behalf of the Fist of the Fleet Association, I send our deepest condolences after recently learning of Mary's passing. Many say that our Chief Petty Officers are the backbone of the Navy, but I believe it to be true that it is our spouses who give us that support and strength. We cannot be fully effective as Naval Officers and leaders without their sacrifices and support, and I am sure that Mary was one of the greatest at that undertaking.

I am proud to say I was fortunate enough to have followed you ten years later as an XO and CO of the Fist of the Fleet (1983-86). You were XO when I made an emergency landing in Yuma in 1972 as a nugget VA-97 Warhawk, and I have admired your leadership since that meeting. You had the full respect of your cadre of pilots, several of whom I had flown with in VA-122, and that has impressed me to this day.

SINCERELY
John Leslie



THE EVOLUTION OF WARFARE: THE TECHNOLOGY EXPLOSION AND VIETNAM: PART 2

The **AGM-62 Walleye** was an un-powered TV-guided glide bomb of the U.S. Navy, which was temporarily designated as a guided missile. Walleye was to provide the pilots of strike aircraft with a fire-and-forget high-precision air-to-ground weapon, i.e. the aircraft should be able to turn away as soon as the weapon was launched. controlled by four large wings with trailing-edge control surfaces. In the nose it had a TV camera, which transmitted its image to a screen in the launching aircraft. When the pilot had acquired a target on this image, he "locked" the image and released the weapon. The guidance system then continually matched the current TV image with the locked one, and corrected the course of the missile to compensate any deviations. Power for the TV and other systems was provided by a ram-air turbine driven by a small propeller in the missile's tail. The TV-guidance system proved to be quite successful when used against targets which stood out clearly against the background, but capability to remain locked on low-contrast targets was decidedly unsatisfactory. The relatively light-weight 374 kg (825 lb) MK 58 linear shaped-charge warhead also meant, that only a direct hit was really effective. The maximum range of the glide bomb depended of course heavily on launch altitude, but minimum range for all *Walleye* versions is generally given as 1.8 km. The small warhead of the original *Walleye* was useless against many hardened or large high value targets,. Therefore the *Walleye II* had a larger body with a 2000 lb MK 87 linear shaped-charge warhead, and much larger fins for further extended glide range.



With the Extended Range Data Link (ERDL) modification the *Walleye* was equipped with a two-way datalink, and the launch aircraft was equipped with an underwing data-link pod. The pilot could now launch the *Walleye* out of visual range of the target, turn away, watch the bomb's TV camera image, which was transmitted via the data-link, and lock-on to the target at any convenient moment. It was even possible to control the weapon from a different aircraft than that which launched the *Walleye*, and because of the limited number of data-link pods available, it was actually standard practice for one pod-equipped aircraft to guide *Walleyes* dropped by several attack aircraft (not simultaneously, though).

The **Bullpup** was the first successful guided tactical air-to-ground missile of the U.S. Navy and the USAF. Although it had severe limitations, it was produced in very large numbers.

Development of the *Bullpup* was initiated by the U.S. Navy in 1953, when an operational requirement was issued for a short-range air-to-ground guided missile. The two primary goals were to give the ground-attack aircraft a standoff missile to avoid prolonged exposure to enemy groundfire, and to increase the chances of destroying targets which are hard to hit with free-fall bombs (like e.g. bridges). It was a relatively small missile with a 113 kg (250 lb) warhead, which was optically tracked and manually guided by the pilot. The first successful air launch occurred in June 1955 models. In April 1959 the *Bullpup* production version entered U.S. Navy fleet service.



The ASM-N-7 was a roll- with a simple derivative of a standard 250 lb bomb as warhead. After visual identification of the target, the pilot launched the missile, and used two small flares at the back of the missile to track its flightpath. Using a small control stick to transmit radio commands to the *Bullpup*, he manually guided the missile to its target. This system was extremely simple, and therefore the *Bullpup* could be used with almost every aircraft. Of course, this simple manual guidance principle also had severe drawbacks, the main one being that the aircraft, the missile, and the target essentially had to remain in a straight line.

The *Bullpup B* was a significantly enlarged version. It had a 1000 lb warhead in a larger body section, enlarged wings, and a new engine of much higher thrust, and became operational in 1964.

The **AGM-45 Shrike** was the first dedicated air-to-surface ARM (Anti-Radiation Missile) of the U.S. armed forces. It was used in very large numbers by the USAF and the U.S. Navy, until being replaced by the AGM-88 *HARM*. Development of the *Shrike* began at the Naval Weapons Center in 1958. The missile was intended to counter the threat of the then new Soviet SA-2 *Guideline* SAM system by homing on the emissions of the SA-2's "Fan Song" guidance radar. The *Shrike* was based on the airframe of the *Sparrow III* missile, but had a larger warhead, smaller rocket motor, and smaller tail fins. It entered service with the Navy in 1965.



The AGM-45A was used in combat by many different types of tactical aircraft in South East Asia, including the A-4, A-6, A-7, F-4, and F-105G. It was controlled in flight by its forward cruciform wings. It could use three different blast-fragmentation warheads, the 67.5 kg (149 lb) MK 5 MOD 0 and MK 86 MOD 0, and the 66.6 kg (147 lb) WAU-8/B, and employed a dual-mode (proximity and impact) fuse.

The original mode of operation was to send the *Shrike* on a lofted trajectory (for maximum range) towards a suspected SAM site. As soon as the missile had passed its peak altitude and started to come down, its seeker would detect the site's radar emission and home on it. Although it was used at least with some success in the Vietnam conflict, the AGM-45 had a number of serious operational drawbacks. Most importantly, the seeker was tuned to a fixed frequency range, so whenever the enemy deployed a new radar operating on a different frequency, a new seeker variant for *Shrike* had to be developed. This led to a long line of sub-variants of the AGM-45, and of course meant that the mission planners had to know in advance which types of threat radars would be encountered. A second problem was that the seeker was not gimbaled and had a fixed and rather limited field of view, so that the *Shrike* had to be aligned almost perfectly towards the radar emitter to detect it.

The third limitation of the AGM-45 was its lack of any kind of on-board target memory. When the SAM site shut its radar down any missiles already fired would lose lock, and go ballistic. However, the *Shrike* could be considered semi-successful in that case, because without radar, the SAMs couldn't guide either.

The AGM-45A-2 had a seeker tuned to a different frequency band and introduced a white phosphorus target marker in the warhead to mark the impact point. The AGM-45A-3 (as well as all later variants) employed angle gating to prioritize the target. Field modification of the guidance unit enabled the *Shrike* to be used in line-of-sight attacks. The attack aircraft could dive straight towards the SAM site with an activated AGM-45, which would be fired automatically as soon as the seeker picked up a radar emission. The designation AGM-45B applied to *Shrike* missiles with modified warhead and motor, introduced in the early 70's. The AGM-45B had significantly increased maximum range (high-altitude lofted trajectory) from 16 km to 40 km.

The **AGM-78 Standard ARM** (Anti-Radiation Missile) was a development of the RIM-66 *Standard* ship-borne air-defense missile. It supplemented the AGM-45 *Shrike*, until the latter was replaced by the AGM-88 *HARM*. In 1966, it had become clear that the AGM-45 *Shrike* was far from the ideal anti-radiation missile, its main problems being the limited range, small warhead, and unflexible seeker. General Dynamics then developed an air-launched ARM variant of the successful RIM-66 missile. The AGM-78A production version became operational with the USAF and U.S. Navy in early 1968.



The original AGM-78A-1 was nothing more than an air-launched variant of the RIM-66A, fitted with the anti-radar seeker of the AGM-45A-3A. It added a BDA (Bomb Damage Assessment) capability, and an SDU-6/B red phosphorus target marker to mark the target for further strikes. In addition to the longer range and bigger warhead, another advantage over the *Shrike* was the gimballed seeker of the AGM-78, which permitted a wider range of maneuvers for the launching aircraft. However, the AGM-78 was also much more expensive than the AGM-45, and could therefore not completely replace the latter. The carrier aircraft for the AGM-78A was the A-6B/E using the LAU-77/A.

In 1969 the improved AGM-78B was to become the most important variant. It featured a new broadband seeker enabling usage against many different types of targets without the need to pre-select a seeker. It also had a simple memory circuit, so that it could home on a previously locked target even after emitter shut-down. The final version was the AGM-78D-2, built between 1973 and 1976. It featured greater digital reliability, an active optical fuse, and a new 100 kg (223 lb) blast-fragmentation warhead. More than 3000 AGM-78 missiles of all versions were built.



MK 16 Zuni FFAR (Folding-Fin Aircraft Rocket)

In the early '50s, the Naval Ordnance Test Station China Lake began to develop a new 5-inch rocket to replace the *Holy Moses* HVAR. The new rocket used folding fins to allow efficient carriage in streamlined multi-tube launch pods. The rocket, known as *Zuni* 5-inch FFAR (Folding-Fin Aircraft Rocket), was designed as a modular system, and allowed the use of different types of warhead and fuse. Options included general-purpose and shaped-charged warheads, point-detonation, delayed-action and proximity fuses. The latter option was intended for air-to-air application, but *Zuni* was almost exclusively used as an air-to-ground weapon. For a list of current warheads, see section on the MK 71 motor below. The *Zuni* FFAR was approved for production in 1957 and quickly replaced

the earlier HVARs. Although a number of different launchers were tested with *Zuni*, the rocket was eventually deployed primarily in four-tube pods of the LAU-10/A series. The exact length and weight of the *Zuni* depends on the warhead, but typical values are 2.79 m (110 in) and 48.5 kg (107 lb), respectively.

Designation Note: No formal designations are allocated to all-up 5-inch *Zuni* rockets. Instead, the rocket type is generally identified by the designation of the motor assembly, which is the main body of the rocket and includes nozzle and fins. The original production *Zuni* motor is designated MK 16, and the ultimate variant is the MK 16 MOD 3. The various warheads are typically usable with all available motors, and are presumably often fitted to the rockets in the field only briefly before actual use. Therefore it was apparently deemed unnecessary to assign MK/MOD designations to every specific combination of rocket and payload. In fact, the original edition of the current designation system for rockets and missiles explicitly excluded unguided line-of-sight rockets from the system.

MK 71 Zuni

The current 5-inch *Zuni* rockets use the MK 71 motor. It uses a smoke-less propellant and has a completely new nozzle/fin assembly. The latter has four wrap-around type fins, and therefore the MK 71 is sometimes called a WAFAR (Wrap-Around Fin Aerial Rocket) instead of an FFAR. The actual diameter of the MK 71 is quoted as 130 mm (5.12 in). The MK 71 MOD 0 began to replace the MK 16 in June 1971, but was soon superseded by the MK 71 MOD 1, which entered full production in September 1973. The MK 71 MOD 1 is the only *Zuni* motor currently in use, and is a HERO (Hazards of Electromagnetic Radiation to Ordnance) safe modification of the MOD 0. The MK 71 rockets are fired from LAU-10C/A and LAU-10D/A 4-tube pods, the earlier launcher versions (through LAU-10B/A) being incompatible with the new motor. The LAU-10C/A is for shore-based use only, because it lacks the thermal protection coating of the -10D/A.

NEXT TIME IN THE EVOLUTION OF WARFARE: AIR TO AIR MISSILES OF VIETNAM

VT-17

VA-6B

VA-65

VA-25

VFA-25

PAGE 8