



# THE CHINA LAKER

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*Editor's note: The Dr. William B. McLean Laboratory at China Lake was dedicated on 8 October 2010. Scott O'Neil, the Executive Director of the Naval Air Warfare Center, Weapons Division, gave the keynote speech during the dedication ceremony. The speech is presented below.*

## Dr. William B. McLean Building Dedication

By Scott O'Neil

Thank you Admiral Winter. I too want to recognize and thank our distinguished guests for participating in this venerable ceremony. I want to thank the many people who have participated in planning, building, and positioning this great facility to support the war fighter of the future. I particularly want to thank Ruth Hogan and our BRAC team. They have not only worked with the Region on this particular project but they are continuing to work the Bureaucracy to keep all our BRAC efforts on track. Lastly, I want to acknowledge all of our past and present employees, this is for you. For the younger element of our workforce...look and listen with enthusiasm ... feel the spirit of Dr. William B. McLean. As, ADM Winter indicated: though we have a number of facilities dedications to go, this is the penultimate event of the BRAC improvements being made at our China lake site. This facility is named in honor of Dr. William B. McLean. In his service Dr. McLean made enormous and lasting impacts on our Navy and our Nation. He personified all of the core values that this NAWCWD stands for. It is right to name this facility after him.

I remember back when I was a kid in Bremerton, Washington in the late 50s there was a TV show on Saturday afternoon I loved to watch, it was called "You Asked For It". How many of you remember this show? For those who don't, the format was for kids from around the Country to write in questions; and, if selected, the show would answer that question. One episode I distinctly remember was a response to a question about a heat homing rocket. I watched that episode with great amazement... imagine an airplane shooting down another airplane with a rocket that homes on heat generated from the target... WOW! Fast forward about 14 years. It was 1973, I was a junior professional here at China Lake on my third tour...working on the Sidewinder servo control system in Salt Wells when one of the engineers I was working for asked me if I wanted to watch a test of AIM-9L Sidewinder, the newest version of that Heat Homing Rocket. Of course I did and with the enthusiasm of an 8 year old I went with him outside I looked to where he pointed in the sky... it seemed right over head...two airplanes engaged in battle, a white streak across the sky, a ball of fire, DOUBLE WOW!! I thought to myself I can work here, forever! ...who would have 'thunk' one day that kid, inspired by what he saw on a TV show, would be dedicating a building to the man who not only invented that heat homing rocket but also the whole concept of guided weaponry. All of the weapons we have in our Nation's arsenal...for sure all of the guided weapons that are displayed here owe their roots to Dr. Mclean.

Immediately after WWII many organizations were working on ways to improve our weaponry primarily to defend our cities from attacks by Soviet bombers. The main approach was to do what we were doing but only do it better...that is to improve the fire control systems that would more accurately direct our unguided rockets.

At the time, 1945, Dr. McLean was the Head of the Aviation Ordnance Division at China Lake. He was charged to develop those improved fire control techniques for Navy aircraft. Dr. McLean's analysis to develop requirements for such fire control systems unveiled the impracticality of this approach. Even with increased accuracy, to be effective very large numbers of rockets would need to be launched against a threat Bomber.

Rockets were effective against ground targets, but in the air-to-air role against a maneuverable aircraft they were just not acceptable. In this work he became convinced that the only way to solve the problem was to "put the fire control system in the missile, instead of the aircraft." And the rest is history. Dr McLean did not set out to design a guided missile – rather this idea erupted from his frustration trying to develop reliable, accurate aiming techniques for unguided air-to-air rockets.

Earlier during WWII his work at the Bureau of Standards made him aware of some technology ...lead sulfide photocells that could detect infrared radiation, heat. It was while travel to Boston in 1947 with some other China Lake engineers that Dr. McLean first sketched out his idea for a "target seeker." He bounced the idea off of his cohorts and back at the Lake he pursued his idea with his peers. Nine year later, after championing many technical challenges and overcoming even bigger problems ...the Navy bureaucracy...Sidewinder became operational. Today, after many ensuing upgrades, Sidewinder is still the free-world's preeminent short range air-to-air weapon. Dr. McLean saw the opportunity enabled by then-day technology. He fought doggedly to change the paradigm...to do something different and he changed the world.

This story is not one of a unique man. Bill McLean was a common, run-of-the-mill man...he was soft spoken, modest, humorous, technically competent, and very persistent in solving difficult problems. Such problems drove him and he pursued their solutions without rest. As, one of his cohorts (H.W. Pickering) said, "as a engineer and scientist he had the curiosity needed to ferret out the key factors in a problem, the wisdom to know what were the important elements in the solution, and the tenacity to stay with the problem until it was solved." He threw away paradigms that did not support his needs. He was an innovator at heart. His technical instincts were excellent and he was driven by simplicity. In short, Dr. McLean was a good engineer. But, he was also a good leader. He very rarely gave direct orders, he respected his peers and he had their respect in return, he listened, and provided clear direction when needed, he led by good example both personally and professionally. He loved a challenge and he was extremely stubborn if he thought he was right.

I want to talk briefly about simplicity as one of Dr McLean's engineering tenets. Bill knew that a guided missile had to be reliable. Its role in defending our Nation against Soviet bombers demanded this. Reliability follows simplicity in design which in turn stems from understanding. Dr. McLean spent 3 years considering possibilities, trading off the merits of various approaches, trying to determine methods of arrangement which would make the final design more acceptable to the user. From this pondering the answer slowly emerged: Dr. McLean reasoned the ability to self-guide toward a target must be combined with the simplicity and reliability associated with rockets...only a missile so designed would meet the needs of the user and also the objectives of the critics. Today, our weapons designers must rededicate their efforts to this tenet. In a digital world with electronics and sensors getting smaller and more capable it is easy to be trapped into seemingly elegant, complex designs. Instead, we need to listen to Dr. McLean, we need to take the time to ponder...to deeply understand the issues and approaches...and then deliberately design solutions that are direct and simple. Elegance in design is not founded in its complexity but rather in its simplicity.

Well, I have rambled enough...I have high hope for this Building...having it at the center of our China Lake campus is a persistent reminder of Dr. McLean and all he stood for...and I have high hopes for our future at Weapons Division. I truly believe and I see that the spirit of Dr. McLean is alive and well. We continue to put high value on many of his tenets...creativity and innovation, technical competence without arrogance, persistence in the face of adversity while remaining humble...like Dr McLean we are forward leaning for the Navy. This is keenly demonstrated by our many products that help our war fighters have advantage on today's battlefields...in many ways these have revolutionized how we have prosecuted this war. I am certain that Dr. McLean is smiling today. Thank you very much.

Excerpts of this speech were taken from Sidewinder: Creative Missile Development at China Lake by Ron Westrum, Sept. 1999

### WHALE OF A TALE

A little bit of naval history, what is called a genuine "sea story", is in this tale. It is very serious stuff but, also, is on the funny side. The Soviet Union used the AGI trawlers as intelligence collectors mainly in the signals intelligence and electronic intelligence collection activities around the world. Part of their intelligence mission tasking was to maintain close surveillance on U.S. Navy and allied nation naval activities and, wherever possible, harass those activities or create some sort of an international incident that would embarrass their target ships. In the Vietnam war their mission was mostly to collect intelligence and also to alert the North Vietnamese that U.S. Navy aircraft were launching and heading toward a target within Vietnam. Thus, the Vietnamese could activate their fire control radar and anti-air missile batteries, etc., and assume defensive measures. In the below incident the soviet trawler created a very hazardous situation for the naval fuel tanker pilot trying to land and he responded...very well.

Excellent "Sea Story!"

Vietnam 1967, A Whale Tale

The Russian "trawlers" (Russian AGI) with what looked like one thousand "fishing" antennas plied the Gulf of Tonkin on a daily basis...needless to say, it was a cat and mouse game to see what havoc they could expend towards our two carriers operating there 24 hours a day.

Since the U.S. government had proclaimed the waters of the Gulf of Tonkin three miles off the coast of North Vietnam and Hainan Island, People's Republic of China, to be international waters, American ships in the Gulf were bound to obey the international rules of the road for ocean navigation. This meant that if the Russian ship maneuvered herself into the path of an aircraft carrier where said Russian ship had the right of way, the carrier had to give way even if she was engaged in launching or recovering aircraft. The navigation officer was constantly trying to maneuver the ship so that the trawler wouldn't be able to get in position to abuse the rules of the road and gain the right of way. Sometimes he was successful in sucking the trawler out of position, but the room available for the ship to maneuver was limited by our on-station requirements, and sometimes the trawler was successful in interrupting our flight operations. The pilots of the air wing were strictly forbidden to take any action against the Russian ship, but on this day CDR John Wunche, the commanding officer of the heavy tanker KA-3B detachment, had finally had enough of the Russians' antics. John Wunche was a big man with bright red hair and a flaming red handlebar mustache. He was a frustrated fighter pilot whom fate and the Bureau of Naval Personnel had put into the cockpit of a former heavy bomber now employed as a carrier-based tanker. CDR Wunche flew the tanker like a fighter and frequently delighted the tactical pilots by rolling the "Whale," as we all called the KA-3B tanker, on completion of a tanker mission. Consequently John's nickname was "The Red Baron." On 21 July 1967 he proved just how appropriate that name was. The "Bonnie Dick" had nearly completed a recovery. The Russian trawler had been steaming at full speed to try to cut across our bow, and the bridge watch had been keeping a wary eye on the intruder. For a while it looked as if the Russian would be too late, and we would finish the recovery before having to give way to the trawler. But a couple of untimely bolters

extended the recovery time, and the Bon Homme Richard had to back down and change course to comply with the rules. The LSO hit the wave-off lights when the "Whale" was just a few yards from the ramp. John crammed on full power and sucked up the speed brakes for the go-around.

The "Bonnie Dick" began a sharp right turn to pass behind the Russian, causing the ship to list steeply, and there, dead ahead of John, was the Russian trawler. He couldn't resist. He leveled the "Whale" about a hundred feet off the water and roared across the mast of the trawler with all fuel dumps open like a crop duster spraying a field of boll weevils. The Russian disappeared in a heavy white cloud of jet fuel spray then reemerged with JP-4 jet fuel glistening from her superstructure and running lip-full in the scuppers. The Russian trawler immediately lost power as the ship's crew frantically tried to shut down anything that might generate a spark and ignite the fuel.

She was rolling dead in the water in the Bon Homme Richard's wake, the crew breaking out fire hoses to wash down the fuel, as we steamed out of sight completing the recovery of the Whale. The Red Baron was an instant hero to the entire ship's company.

### **WILLS AND TRUSTS**

The China Lake Museum Foundation now has a process by which you can include consideration of the Museum as a part of your will or estate. It is a fairly simple and straight forward process which involves adding a sentence stating your attention to your will or trust with an appropriate witness (not a Foundation officer or staff member). Please consider providing a gift to the China Lake Museum Foundation in your will and/or estate. Gifts can include monetary (fixed dollar amounts or percentage of residuary estate), property items, artifacts. Tax benefits can be realized through the reduction of the size of your taxable estate. Family needs are met first. Special instructions can be stated. Otherwise the donation will be applied to the general fund, which can be used to support new facilities, exhibits, operations and education initiatives. If you have any questions, please call the Foundation office. The process was provided courtesy of the law office of Steve Boster.

# PAVEKNIFE

The First Navy Combat Use of the Airborne Laser Designator

by *RADM Robert S. Owens, USN (Ret.)*

In mid-January 1973, I was as much surprised as pleased to receive this message from the Commander-in-Chief of the Pacific Fleet:

"FM CINCPACFLT

TO CTU SEVEN SEVEN PT SEVEN PT ONE

WELL DONE

1. I HAVE JUST REVIEWED YOUR HIGHLY SUCCESSFUL DAY OF BRIDGE BUSTING ON THE 15TH. THE DESTRUCTION OF 14 BRIDGES OF THE 15 ASSIGNED IS INDICATIVE OF A HIGH DEGREE OF EXPERTISE AND PROFESSIONALISM. THE CREWS OF BOTH DESIGNATOR AND DELIVERY AIRCRAFT HAVE PROVIDED US WITH A REMARKABLE DEMONSTRATION OF PAVEKNIFE/LGB WEAPON SYSTEM EFFECTIVENESS.
2. PLEASE CONVEY MY PERSONAL CONGRATULATIONS TO THE CREWS OF THE A6'S AND A7'S INVOLVED FOR THEIR OUTSTANDING PERFORMANCE. , WELL DONE.

ADMIRAL B.A CLAREY, COMMANDER IN CHIEF US PACIFIC FLEET.

Many may be unaware of the excellent guided bomb delivery system which provided the wherewithal to gain the success to merit the above message. This article will tell the story.

## Getting Started

Attack Squadron 145 was assigned to *USS Ranger* as a part of Carrier Air Wing Two. The ship was undergoing overhaul at Bremerton and the Air Wing was engaged in shore based training in preparation for SEASIA deployment in October 1972.

In the spring of 1972, President Nixon ordered a stepped up bombing effort to encourage the North Vietnamese leaders to reach an end-the-war settlement and get our POWs home. Efforts throughout the Navy were emphasizing a maximum effort in support of the new Linebacker II bombing campaign.

During the early Spring 1972, NAVAIRSYSCOM and OPNAV representatives identified the U.S. Air Force PAVEKNIFE Airborne Laser Designator as a system which could be incorporated into the A-6A Intruder aircraft. The PAVEKNIFE pod, loaded on a tactical aircraft's armament station, housed the laser electronics, a low-light TV camera and electronics stabilization. The A-6A installation included a TV screen in the cockpit for the B/N's use and the necessary hand-held controls to operate the system. The PAVEKNIFE system enabled an equipment operator to illuminate a target with laser energy. Target tracking functionality allowed the delivery aircraft complete freedom to reach an optimum bomb release position. Laser guided bomb (LGB) guidance sensors detected the laser energy reflected from the target and provided precise guidance to any selected target. The Air Force employed this system on F-4C's, operating out of Thailand, to knock down the very durable Than Hoa bridge during a previous bombing emphasis. In addition, the Air Force successfully used PAVEKNIFE in the Hanoi area to achieve "surgical strikes" on high priority targets. The PAVEKNIFE had an optical recording system which replayed the video seen during a bombing attack and could also be used to assess the PAVEKNIFE's own bomb damage as the aircraft was leaving its target after an attack. There was an audio track on the tape which also flawlessly recorded the aircrew's conversations during the attack. Later playing the tape recording of the bombing attack in Air Intelligence for bomb damage assessment (BDA) was an early success of the PAVEKNIFE.

The production schedule to install the PAVEKNIFE system on the A-6A was very tight. The initial contract turn-on occurred by telephone during March, 1972 specifying a deployable system aboard *Ranger* for her October departure. This six-month timeframe included all the requirements to make a Navy PAVEKNIFE ready for the rigorous at-sea combat environment expected. Three A-6A aircraft were configured, three crews trained, a space was carved out of the limited area aboard *Ranger* for pod storage and maintenance, technicians schooled, test equipment positioned aboard, spares loaded, a highly capable contractor technical representative hired (Bill Rohrer from Philco-Ford) and OPEVAL were all conducted prior to the ship's departure for WestPac. A minor miracle!

The *Ranger* arrived off South Vietnam December 8, 1972 for several days of Air Wing operations to polish the skills of the many players who would make the PAVEKNIFE Ship/Air Wing team perfect. This period provided a practice period for the aircraft crews to sharpen their performance, the ordnance men to determine optimum procedures for Laser Guided Bomb handling and loading, and to make RADM Wes McDonald's CarDiv 3 staff aware of the excellent capabilities inherent in the PAVEKNIFE system. A typical day's Air Plan scheduled one or two sorties for the PAVEKNIFE aircraft against specific targets in South Vietnam. Usually our target assignments included attacks on stream crossings, suspected troops in jungle locations, suspected truck parks or other equally non-challenging targets. The flights in South Vietnam allowed the squadron to train additional aircrews in the operation of the PAVEKNIFE system. Actually, it was very easy to use, and two hops were normally enough to teach the necessary skills for attacking a target with an LGB. The target videos collected were invaluable in devising attack techniques, assessing bomb damage and, primarily, demonstrating the highly accurate, versatile system which we had acquired. A concept of "one bomb, one bridge" took shape in our minds as *Ranger* moved north.

### ***A Fortunate Decision***

My choice to head up the squadron's PAVEKNIFE introduction was LCDR Pat Cornelius, the VA-145 Operations Officer. Pat previously completed tours with VX-5, VA-35 and the A-6 RAG. He was an outstanding, combat-experienced Naval Aviator. In addition, Pat and I selected as his assistants two naval flight officers, LTJG Harry A. "Bud" Jupin and LTJG Robert K. "Slick" Champney who were showing early promise as extremely capable naval flight officers. Pat organized the OPEVAL with typical effectiveness. Easily meeting the various requirements of the evaluation, cooperation among the myriad players was the order of the day. Representatives from OpNav, NavAirSysCom, ComNavAirPac, Naval Weapons Center, USS *Ranger* and contractor Philco-Ford combined efforts to provide the PAVEKNIFE to the *Ranger* on time for the combat deployment.

Pat and I flew the OPEVAL sorties with "Slick" and "Bud" as the laser designator operators. The actual flight experience with PAVEKNIFE was somewhat anticlimactic. The laser guided bombs continued to impact the target within the lethal fireball radius. With a CEP of five feet achieved during OPEVAL, we were convinced the Navy PAVEKNIFE would contribute in a large way to our upcoming combat tour off North Vietnam.

On *Ranger's* arrival off South Vietnam, LCDR Louis "Tim" Thomassy and LTJG Todd Cleland were trained to operate the PAVEKNIFE. These two airmen proved exceptionally alert and eagle-eyed when it came to employing the system to its utmost. Later on, Tim and Todd were on an Alpha strike in the Hanoi area. The weather was not cooperative and the Strike Leader ordered the strike aborted. Their bomb load was two 2,000-pound LDGP LGB's and they were carrying the PAVEKNIFE pod. In case of a weather abort, the strike leader briefed to select targets of opportunity in the Vinh area.

Tim and Todd navigated to the area and coasting in at about 18,000 feet, they decided to start down the river and see if they could see anything worth the bombs they carried. Todd visually spied a truck racing along a narrow road. Tim picked up the truck and noticed that out ahead of it was a bridge. They quickly prepared to take the truck and the bridge under attack with an LGB! A twofer.

Tim pulled the aircraft into a 4g turn toward the dive line holding the nose on the horizon as he approached the attack heading. Pulling the nose down toward the target, he rolled wings level toward the target in a fifty-degree dive. As he positioned the target at the 210 mil lead line on his bombsight, he called to Todd, "Target." Todd observed the target move into view near the aiming reticle on his TV display. He toggled the switch on his controller to uncage the TV camera in the PAVEKNIFE and reported "Target Tracking." Todd manually, and with rate-aiding tracking provided by the electronics, maintained the aiming reticle on the bridge target.

The delivery procedure required that Tim report to Todd when he was tracking toward a release point. When Tim did this, Todd switched on the laser transmitter. The system would now transmit laser energy onto the target. The reflection of this energy enabled the laser seeker on the front of the LGB to guide in on the laser energy maintained on the target by the bombardier. The system made a tape recording of all video seen through the TV and audio on the aircraft communications systems.

Todd reported "Lasing" which was Tim's final check before bomb release. Tim flew the plane to a point where the bomb would attain a ballistic trajectory impact on the target. The LGB guidance package ensured an accurate impact on target. In combat, enemy defensive pressures may cause pilots to achieve less accurate deliveries than experienced on stateside bombing ranges. This was the value of the PAVEKNIFE. The bomb only needed release in an elliptical cone or "basket" with an approximate radius of 2,500 feet at the release altitude and centered on the target at the bottom. The energy imparted by the delivery aircraft and the bomb's flight control system would fly the weapon to the reflected laser energy on the actual target aim point.

Tim rechecked his airspeed at 500+ knots true and his dive angle at 50 degrees. The altimeter was passing 11,000 feet. He watched through the bombsight as the target tracked toward the bomb release point. He pushed the bomb release button passing 10,000 feet when the target touched his bombsight aiming diamond. He pulled the stick back to start a 4g recovery and reported "Bomb's Away" to the B/N. Todd concentrated on maintaining the aiming reticle on the center of the bridge as Tim pulled the aircraft up and started a turn away from the dive line. Todd glimpsed the bomb appear in the TV display field of view just before impact. After the explosion, Todd maintained the reticle on the target area to collect his BDA. As the smoke blew away, Todd saw the bridge was gone and a large crater was rapidly filling with water. They returned to the ship and proceeded to IOIC to make their report.

Meanwhile, at an All Officer's Meeting, The ship's CO, CAPT Hank Glindeman, encouraged each of us to think about how each could contribute more to gaining an early satisfactory solution to the war effort. Watching Tim's video playback, I realized the potentially significant contribution available to us. With the accuracy afforded by PAVEKNIFE, why not try to close down the truck traffic between North and South Vietnam by destroying *all* of the bridges? We had enough LGBs on board *Ranger* to make a severe dent in the enemy's ability to move supplies to their troops in the South. What was necessary now, however, was gaining acceptance of using the PAVEKNIFE system to sever the transportation capabilities and gain approval up the line of higher authority.

I discussed the idea with the squadron Department Heads. Timing for such strikes would be critical. I wanted the initial strike to put an immediate restriction on enemy truck traffic movement. This would require a large number of aircraft and, with only two PAVEKNIFE pods, we would be severely limited in our ability to carry the complete strike out in the span of a single cycle. Complicating the issue was the availability of A-6s: we had seven UP bombers, two of which would carry the Pods. Two of the squadron's A-6A's could not be counted on in the near term due to combat damages. Mission planning began by considering the strike composition. The matured concept included sections of A-6's and A-7's loaded with LGBs and targeting designation being provided by the A-6A PAVEKNIFE aircraft.

**The Plan**

The "customer" A-6 and A-7 bomber aircraft carrying the LGBs received individual target assignments and would proceed to the target area after join-up. The two PAVEKNIFE aircraft launched first and proceeded without rendezvous to attack two bridges each before joining with our A-6 and A-7 "customers" for assigned bridge attacks. Widely separated targets isolated the separate aircraft during the attacks. I assigned two bridges to each aircraft scheduled in the strike. The PAVEKNIFE aircrew was responsible for targeting and in flight coordination as required to ensure success of the bomb deliveries. There were drawbacks from the standpoint of weapons delivery training. There had been no practice of the coordination which would be required to ensure the delivery pilot and the PAVEKNIFE aircrews were attacking the same target. This proved to be the most serious drawback and its importance was less than fully appreciated prior to the flight. We relied on verbal communication of target descriptions to try and ensure the "customer" aircraft and the A-6 PAVEKNIFE aircraft were attacking the same target. We elected to double cycle the designators to maximize the A-6 PAVEKNIFE on station time. During the second launch and recovery period, the PAVEKNIFE aircraft would inflight refuel and meet the oncoming sections of bombers at the assigned targets. We selected 1,000-pound bombs due to their high kill potential, less weight (could be returned back aboard), and better aerodynamics.

Following the planning, CDR Charlie Cellar, COMCARAIRWING TWO was briefed on the mission and permission was received to discuss the concept with the *Ranger* CO, Captain Glindeman. Following his approval, we quickly proceeded to brief the embarked COMCARGRU THREE staff and finally, RADM Wes McDonald approved our plan and arranged for me to brief CTF77, RADM Hutch Cooper.

RADM McDonald and I briefed RADM Cooper in the Admiral's Cabin aboard *Ranger* where we used the video play-back unit to show previous PAVEKNIFE strike results. It was important that CTF77 see the operation of the PAVEKNIFE from the operator's position to develop a full appreciation of the methodology employed and the equipment capabilities. The premier footage was the Tim Thomassy and Todd Cleland BDA of the highway "bridge" strike, which had instead wiped out one of the forbidden dikes and a NVN truck and crew. RADM Cooper often smoked cigars similar in size and shape to those enjoyed by Winston Churchill. As the video tape displayed the target becoming larger as the aircraft descended toward the release point, RADM Cooper, an attack pilot himself, moved to the edge of his seat. The video fidelity was so realistic he might have imagined himself sitting in the cockpit making the attack. As the bomb damage film rolled and Tim reported "bombs away" and began to pull up, it was customary for the bombardier-navigator (B/N) to shift to wide field of view to ensure maintaining the target within the reticle during pull out from the visual dive attack. RADM Cooper looked, visibly winced, inhaled strongly and seemed ready to swallow his big cigar. He exclaimed, "that's a DIKE!" My dream plan to knock down the NVN bridges was finished. Not only would there not be PAVEKNIFE missions, I could expect a quick trip to CONUS.

RADM McDonald quickly interjected to head off the inevitable. He discussed the visibility conditions and the appearance of a road over water as appearing to be a bridge from the attacking altitude. I emphasized our squadron briefing procedures which required a discussion of the Seventh Fleet rules of engagement before every flight. A second rerun of the tape from start to finish apparently provided RADM Cooper with sufficient justification to convince him that an honest mistake had occurred. After further discussions on the strike composition, selection of Route Package Two for the initial flight would permit us to work on the flight coordination, smooth out our attack procedures and carry the strike out in a relative benign environment.

At the close of the conversation, RADM Cooper turned to me and said, "Son, you've got a go on this one." Plans were firmed up with CTF77 Staff to select the most important bridge targets based on intelligence estimates of the traffic and observed areas of traffic intensity. We received final approval by message and the *Ranger* looked for an opening to put the mission on the Air Plan.

Disappointingly, the weather was not cooperative during this period. The December-January monsoon season created lower level clouds and intermittent rain showers throughout



the Route Packages. In addition, there was national tasking of higher priority targets in support of Linebacker II which necessitated maximum effort and required the aircraft for missions other than PAVEKNIFE strikes. Nevertheless, the *Ranger* continued to try and schedule the mission as often as possible. We suffered two days when weather over the Route Package was unsuitable for the high altitude dive attacks necessitating canceling the planned strike.

During this time, continued raids into the Hanoi/Haiphong areas were achieving the effects necessary to obtain meaningful agreements at the Peace talks. Finally, the peace representatives reached an accord whereby a truce could be declared. No truce date had yet been announced, but one was expected at any time. The six Navy carriers in the Gulf continued to conduct a maximum effort to help maintain the initiative which the negotiators in Paris had achieved. The PAVEKNIFE mission again appeared on the schedule January 15, 1973.

A million things needed doing before launch! Target assignments and preflight discussions would be necessary immediately. The MIG and TAR CAP pilots required additional briefings on positioning and overall mission coordination. The Search and Rescue CAP needed to understand the lengthy time our A-6 designator crews would be over the beach; usually a mission was a quick in-and-out dash. Today, we would be over hostile territory for over an hour during each cycle. And, the double cycle meant that *twice* as many people as usual would be involved. Suffice it to say, the professionalism of naval aviation successfully countered all of these coordination problems.

I was the Strike Mission Leader with B/N Jay Sherman in one of the PAVEKNIFE aircraft. Pat Cornelius and "Slick" Champney were in the other PAVEKNIFE designator. A6 wingmen included J. M. Lydiard and Gary Sims, John Smith and Bob Sutherlin and Mike Reilly and J. W. Henson. CDR Bruce Cargill, CO, VA-113 and CDR Ed Greathouse, CO, VA-25 led the two A-7 events. A4 wingmen included N. W. Blatt, Denny McGinn, J. S. Kraabel from VA-113 and H. W. Hartsell from VA-25.

The first cycle completed according to plan. As expected, there was some confusion over the actual targets on the ground when the first "buddy bombing" bomb did not guide to the designated target. The value of the video tape proved again during debriefs when a review correlated the designated targets with the actual targets. Greater verbal coordination prior to attack roll-in minimized this condition after the initial occurrence. The relatively benign defensive environment aided us in this regard greatly.

In a demonstration of the tactical adaptability of this system, a large multi-span steel and concrete railway bridge was spotted which had not been included in the briefing. I directed the "Blue Tail Fly" wingman to proceed away from his briefed target for this more lucrative aim point. I briefed him on the new coordinates copied from the A-6 weapon system so that the A-7 pilot could enter this information into his navigation/attack computer. We rendezvoused over the revised target and set up for the attack. I asked him to aim at the southern end of the bridge where it reached the shoreline. Bingo! The "one bomb, one bridge" goal achieved. The bridge structure fell down the embankment and into the river.

### ***More Tactical Flexibility***

As the bombers returned for landing, the A-6 PAVEKNIFE aircraft proceeded to the tanker rendezvous. During the air-to-air refueling, *Ranger* strike control ordered the PAVEKNIFE strike to "Covered" strike channel. A message announced the end of bombing north of 20 degrees north latitude. All of the second cycle targets were located in that vicinity! Radio discussions with RADM McDonald pointed out the flexibility that we had just experienced and included my recommendation that we proceed with the strike south of the bombing halt latitude. The PAVEKNIFE designator crews would act as airborne FAC's providing target of opportunity assignments to the bombers. This was approved. The first two A-7 bombers checked in on time and a quick briefing explained the new rules. I coordinated with my wingman to maintain a geographical separation and he used secondary strike control, as briefed, to conduct his operations. There were difficulties locating suitable targets since the majority of prime targets were now off limits, but, there were still some good aim points available – fortunately.

Upon returning to the ship, the euphoria associated with successfully dropping 14 bridges, achieving two primary route cuts, and demonstrating the soundness of a new, innovative tactic was overshadowed by the cessation of the bombing up north and success of Peace Talks. But the events of that day were sweet going-away presents which members of Air Wing 2 and Ranger delivered to Ho and his friends. What was even better, we knew we could complete the plan to decimate the enemy's bridge structure in less than a week's time using a combination of laser guided bombs, air wing coordination and skillful naval aviators dedicated to getting the job done if it ever became necessary.

The PAVEKNIFE system later saw service with units deployed to the Med and West-Pac. The system was retired when the A-6E TRAM, with an included laser designator, introduced into the Fleet.

**Note that the U.S. Naval Museum of Armament and Technology has one of the surviving PAVEKNIFE pods on display in the south display room. A second PAVEKNIFE is planned to be displayed at the Smithsonian in the near future.**

## ***Please Support Your Museum Foundation***

*Help preserve and display the irreplaceable legacy of technology and weaponry for Naval aviation's defense of our Nation. The rich record of China Lake's achievements, past and present, is a vital part of our Nation's heritage.*

**Membership Fees and Donations**  
are the life blood of our Museum operations and growth.  
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**Agency 13086**

*(Note: New agency number. The old number was 5021)*

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