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The Naval Air War over Vietnam

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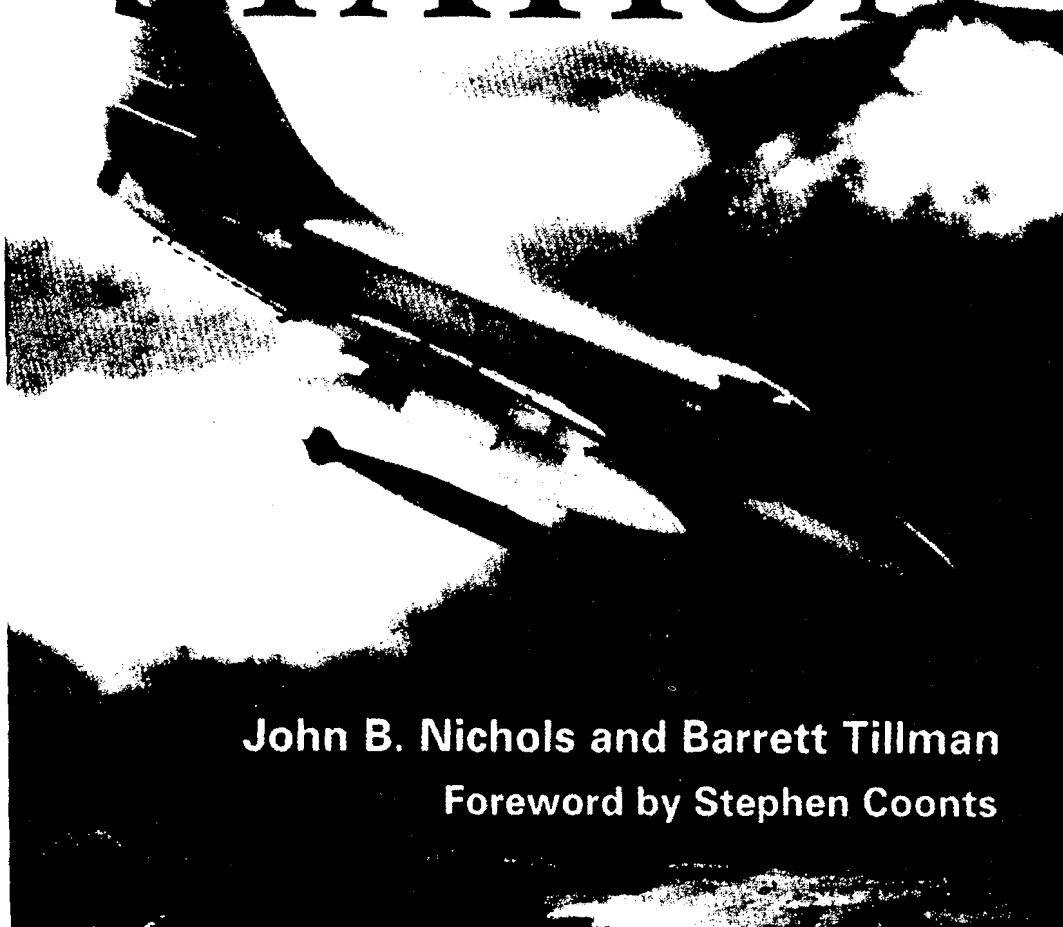

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ECM: THE ELECTRON WAR

He who wins by deception deserves no less credit than he who wins by force.

—Nicolo Machiavelli

Electronic warfare came of age during the late 1960s. Events in Southeast Asia and the Middle East proved that modern air combat required electronic countermeasures (ECM) and even counter-countermeasures (ECCM) for both offense and defense.

Electronic warfare (EW) had matured in World War II, when it was used primarily in antisubmarine and night-fighter operations in the Atlantic–European theater. Germany and the Allies exchanged the technological lead throughout the war. Both the German U-boat campaign and the British night-bombing offensive depended in large part upon the electronic advantage. Advances in centimetric radar and in detecting or jamming sensors and communications set a precedent for the future.

The unique wrinkle over North Vietnam was the surface-to-air missile. Because SAMs dictated strike warfare tactics, defeating or confusing missile scanning and guidance became paramount. Not only equipment, but technique and doctrine constantly evolved on both sides.

The U.S. Navy entered the war with one aircraft devoted to ECM. The propeller-driven Douglas EA-1 Skyraider had seen combat in Korea, when AD-5Ws and -5Qs represented the top of the line. Following the 1962 designation change, they became the EA-1E and -1F, respectively.

Another Douglas product, the big twin-jet Skywarrior, also served in the ECM role from 1968. But the vintage "Spads"—prop-driven Skyraiders—remained carrier aviation's premier EW aircraft for quite some time.

The "Electric Spads" (EA-1Fs) flew with a pilot, a commissioned aircrewman known as a naval flight officer or NFO, and two enlisted men as ECM operators. The airframes and avionics were 1950s construction, featuring vacuum-tube technology and manual operation. By mid-1965 the fleet contained twenty-one EA-1Fs and "Fat Spad" -1E models on the East Coast with VAW-33, and seven AirPac birds in VAW-13. Greater need in the Tonkin Gulf, however, resulted in the West Coast detachments taking twenty EA-1s by 1967.[1]

Even so, this was a very small number of platforms for so valuable a mission. Consequently, VAW-13 operated a forward-based unit at Cubi Point in the Philippines. Each "det" consisted of two planes and crews, with ten to twelve maintenance personnel. Ideally, a combat-experienced pilot was teamed with a "nugget" NFO, or vice-versa.

The ECM crews lived a gypsy life in WestPac. They rotated up and back from Cubi—eight hundred miles from Yankee Station—on thirty-day tours, regardless of changes in carriers. It wasn't unusual for a VAW-13 detachment to fly from six carriers in six months.

Standard "armament" for the EA-1F consisted of two sensors, two jammers, and often two chaff dispensers. Full 20mm loads were carried, but they were seldom used as there were plenty of "straight" A-1s to work ResCAPs and fly strikes. Although the ECM gear was antiquated by 1960s standards, it was effective when employed by skilled, experienced aircrewmen. Thorough knowledge and a delicate, almost artistic, touch were necessary to make the equipment work well.

Under any but ideal circumstances, optimum jamming range was twenty to twenty-five miles, though nearly twice that distance was possible. Consequently, ECM coverage of strikes was usually conducted three to four miles offshore after

1965. A *Midway* EA-1F was clobbered by AAA in April of that year, and the valuable ECM birds were kept out of harm's way as much as possible thereafter.

As a result, the Electric Spads concentrated on covering ingress and egress points for the strike groups. During Alpha operations, two to four EA-1s were airborne constantly, with individual crews double- or triple-cycling to cover multiple strikes. Thus, while an F-4 or A-6 was usually back aboard ninety minutes after launch, the Skyraiders often logged three to five hours per sortie, sometimes more.

Because the jammers were directional, EA-1s had to fly directly toward or away from the enemy radar for best results. Usually fifteen to twenty miles out, the Skyraider pilot began a slow inbound descent at 110 knots. Recalls one pilot: "I liked to start at 8,000 to 10,000 feet and descend to 4,000 or 5,000 as I got closer to the site, often with gear and flaps down. Then I'd apply climb power, pulling up gear and flaps, and let the torque roll the aircraft inverted. I'd split-S, which put me on a reciprocal, with optimum jamming. This little maneuver also could help screw up any possible sharp-shooting SAM operator."[2]

With the standard two EW aircraft airborne, and each carrying two jammers, up to four radars could be neutralized simultaneously. The electronic spectrum was usually represented, from the lower S band to the highest X band. In-between was the L band, generally employed in gunlaying radar. But the Spads carried passive receivers for each band, which showed "grass" across the bottom of the screen.

When a radar site came up for a look, the ECM operator saw a line peak on his scope, which indicated the enemy frequency. The airman then turned to a second scope with the telltale source dot in the center of a compass rose. A lobe about the dot showed the relative bearing, with the radiating transmitter's location known by the center of the lobe. Although there was no range indication on the scope, experienced operators could often provide accurate estimates based on image and signal strength.

Having identified an active radar, the ECM operator returned to his first scope. The magnetrons in external pods were tunable across an arc, but they worked best straight-on, hence the direct descent at 500 feet per minute toward the

site. The electronic warrior manually tuned his jammer to superimpose the image over the spike on his screen. When the jammers were activated, they turned the opposition's radar scope to snow.

The North Vietnamese soon learned to tune their spikes up and down the band, seeking enough clear time to allow a firing solution for guns or missiles. But adept operators could match the enemy's tuning efforts, keeping the jammer on the laterally moving spike. It became a cat-and-mouse game, involving not only skill but guile. Each player tried to anticipate his opponent's likely moves, with the advantage favoring the jammer. He didn't have to completely overpower the enemy transmitter; all he had to do was disrupt operations long enough for the bombers to get in and out.

If the jamming aircraft were singled out for unwelcome attention, the ECM crew played with the radar for as long as prudence allowed. The descent inbound was timed to arrive at about 2,500 feet when the operator could no longer "break the lock." The aircraft then was vulnerable to a SAM launch.

Against more powerful land-based transmitters, the airborne sets were unable to compete at closer ranges—say four to six miles, if they got that close at all. Consequently, the EA-1 pilot told his crewmen to let him know when they could no longer break the radar lock. At that point the pilot retracted his wheels and flaps, applied full power, and torque-rolled to the left in a split-S. This maneuver lost about 1,500 feet, taking the Skyraider below the briefed 2,500-foot minimum effective range of the SA-2. Recovering on a reciprocal heading, the Spad pilot added power, climbing into a chandelle to perhaps 5,000 feet heading outbound. Airspeed seldom exceeded 110 knots, which afforded adequate control of the aircraft. The evolution was repeated as often as necessary. Then the jamming aircraft orbited well offshore until the next strike went in.

One VAW-13 flier shook up his former squadronmates in the fall of 1967. Detached to Eglin Air Force Base, Florida, the NFO observed tests of SA-2s captured by the Israelis during the June war. He was astonished to learn that minimum effective altitude was closer to 1,500 feet, and he hastily posted a letter to that effect. This revelation, coming via unofficial routing, was received with some chagrin. But the

"zappers" adjusted their safe altitudes and continued providing ECM support in the Tonkin Gulf.

Another means of blinding radars was metallic chaff: aluminum strips cut to various lengths corresponding to known radar frequencies. Chaff originated early in World War II and was called "window" by the RAF. It had limitations. When the airplane dropped chaff, the frequency band was clogged with false targets, but because the chaff could not move forward with the plane, its protection was short-lived. The dispensing aircraft, and those flying through the area, quickly outpaced the area where the strips drifted to earth.

In naval warfare, chaff was intended for uses other than covering strike groups. Chaff could shield ships from electronic detection, for example. Fleet exercises showed that cruising disposition for a typical task force could be covered by three layers of aircraft: chaff-dispensing EA-1s at 10,000 feet; EF-10 Skyknights at 15,000; and EA-3s or air force EB-66s at 20,000. The Douglas aircraft were capable of obscuring ships from electronic location as long as the chaff remained airborne, which was a considerable period because of its light weight.

The Skywarrior first appeared in an ECM role in 1958 with delivery of the A3D-2Qs. Twenty-five were built, crewed by seven men including four EW operators. These big birds were redesignated EA-3Bs in 1962 and in 1968 were joined by thirty-nine multipurpose EKA-3Bs. These latter electronic-tanker variants were seldom regarded as satisfactory. Tanking was the "Whale's" main contribution to the Tonkin Gulf Yacht Club, and the addition of ECM packages to the tankers only denigrated the plane's primary role.

Furthermore, there were too few A-3s as it was. They were the largest airplanes operated from carriers, and most *Essex*-class ships, for example, embarked only two. Few in number and with an important mission, A-3s weren't risked over the beach. Only one was lost to enemy action in the North Vietnam arena, when it strayed over the Chinese border and was shot down by MiGs.

The EA-3s were operated by VAW-13 detachments, as stopgaps while we awaited the new generation EW aircraft. The navy had let a contract in 1966 for what became the EA-6B, Grumman's ECM version of the Intruder. Some twenty-

seven EA-6As, modified from conventional Intruders, were produced for the Marine Corps, and they retained some strike potential. The EA-6B, however, was essentially a different airplane—devoted solely to electronic warfare.

While paving the way for the Prowler, the EKA-3s served two purposes: they tested new avionics and electronics; and they afforded ECM operators combat experience. But the Litton equipment installed in EKA-3 testbeds reportedly gave serious trouble early in the program, and Electric Spads had to fill in the gaps aboard some ships.[3]

Maintenance crews seized upon this situation to indulge in some merriment. Aboard the *Coral Sea*, somebody went to work with a stencil. It wasn't long before deckhands and aircrew began noticing a neatly stenciled, official-looking logo on some of the Zappers' Skyraiders, in anticipation of more Electric Whales. Under the horizontal stabilizer, right where the navy paint specs called for such things, was "Simulated EKA-3." Another said, "On loan from the Smithsonian Institution."

When the EA-6B entered squadron service in January 1971, it was evaluated by VAQ-132 at NAS Whidbey Island, Washington. The Scorpions already had experience with EKA-3Bs in the *Coral Sea*, *Ranger*, *Enterprise*, and *America*. One-Thirty-Two made the Prowler's first combat cruise with Air Wing 8 in *America*, arriving in the Tonkin Gulf in July 1972. This was only six months before U.S. air operations ended over North Vietnam, but it was enough to show the Prowler's promise.

EA-6Bs carried a four-man crew: a pilot and three NFOs. The right-front seat was occupied by an officer responsible for navigation, communications, defensive ECM, and chaff. The rear two seats were for ECM operators, each covering half the electronic spectrum.

The Prowler was a quantum leap in electronic warfare. Its advanced sensors and jammers, most of which were automated, allowed greater standoff capability. Hard-core Skyraider operators, however, insisted they could do just as well with their vacuum-tube equipment and manual tuning before EA-1s disappeared from Yankee Station in 1968. But there was no denying the EA-6B offered options previously unavailable. With automatic tuning, multichannel/multisite capabil-

ity and omnidirectional equipment, the ECM war escalated to new levels.

And the twin-jet Prowler could haul a bigger load. Some EA-1F pilots recall being told that they were not to jettison their ECM pods in event of engine trouble. The avionics were more valuable than the airplane, so there was no point bringing back the Spad minus its underwing stores! The EA-6B suffered a fearsome loss rate to operational causes, something which cannot be said of the Skyraider. Apparently there was nothing wrong with the Prowler itself. But it was generally flown by pilots with relatively little experience, and the airplane was usually bigger and heavier than anything they'd flown previously.

Regardless of the ECM platform—Skyraider, Skywarrior, or Prowler—the effect was much the same. Successful jamming forced SAM batteries to fire ballistically, without benefit of radar guidance. Jamming could also interfere with the North Vietnamese fighter-direction network, a bonus. Communist air doctrine called for ground-controlled intercepts, and if the controller was unable to talk to his pilots, the system broke down.

With regard to their fighter-direction network, the opposition could be cagey. Often when we identified a fighter-direction channel, the North Vietnamese played tape-recordings on that frequency while actually directing over another.

All tactical aircraft operating over the North were supposed to have their own electronic countermeasures, or at least warning of tracking. Beginning in the summer of 1966, most navy aircraft had the ALQ-51, aimed at the Fansong B radar. Chaff and infrared dispensers were seldom available before 1969. Even then, there were never enough black boxes or dispensers for training. Precombat information often consisted of little more than listening to tapes of the electronic warbles that indicated enemy radar scanning and tracking. The shortage of ECM gear was critical. A carrier leaving Yankee Station occasionally had to pass its black boxes to the relieving ship so the new air wing would have enough to go round.

Through it all, the name of the game was information. Constant surveillance was conducted by electronic intelligence-gathering (Elint) aircraft: big EC-121 Constella-

tions from Thailand, EB-66s from South Vietnam, and Task Force 77's E-1s and E-2s in the Gulf. Elint activities picked up in early 1968 and remained at high levels thereafter.

By the end of 1969 the opposition's Fansong radar had been modified for earlier arming of SAMs, which in turn allowed a lower engagement altitude. This occurred during the four-year hiatus in Rolling Thunder. During that time only reconnaissance sorties were flown over the North, though the much-publicized "protective reaction" strikes occurred throughout 1971. While the bombing had ended Up North, such forays at least permitted aviators to keep an eye on electronic warfare developments and make adjustments as necessary.

The navy's strike and fighter aircraft underwent a complete metamorphosis in the ECM realm during the war. For at least the first three years the large majority of carrier planes flying over the beach were electronically naked. This was caused by the navy procurement policy, which emphasized obtaining "platforms" in preference to systems. It may have made economic sense in peacetime, but in wartime it was false economy. The opposition matured rapidly Up North, and Task Force 77 aircrews frequently were vulnerable to enemy radar scanning and tracking.

To deal with this unacceptable situation, naval aviation robbed Atlantic Peter to pay Pacific Paul. East Coast squadrons were nearly stripped of radars and ECM black boxes to supply the air wings deploying to the Tonkin Gulf. It was a risky move. The Sixth Fleet in the Mediterranean, within reach of Europe, Africa, and the Middle East, has traditionally been of greatest strategic importance since World War II; there would have been hell to pay if even a moderate threat had arisen in that arena.

The electronic deficit was finally made good. By 1969 or thereabouts the decision makers had recognized ECM procurement as critical, and measures were taken. With black boxes such as the ALQ-94, tactical aviators could defeat SAM fusing and even knew on their radarscopes the direction of the threat. This, in addition to the heart-pounding audio warning of a low-warble/high-warble tone which distinguished scanning radar from tracking, provided adequate warning. Knowing when a SAM was aimed at your aircraft made a big differ-

ence, and frequently we could break the missile's lock with chaff dispensers.

As we entered the last year of aerial activity over North Vietnam, new gadgets appeared on both sides. SA-3s were reported active in January 1972, and the chief of the Soviet Air Force visited Hanoi in March. Apparently the Russians indoctrinated their acolytes in new techniques during this period, for multiple SA-2 engagements were reported thereafter, featuring track-on-jam and optical tracking. They also adopted high-low engagement tactics in an attempt to trap evading aircraft that dived to lower levels.

Two episodes from Air Wing 9 will illustrate the increased threat level from SAMs, as well as improved jamming capabilities. Both episodes occurred on 10 May 1972 and concerned pilots from the *Constellation* who had shot down MiGs earlier in the day.

Lieutenant Randy Cunningham and Lieutenant (jg) Bill Driscoll of VF-96 had killed three MiG-17s in a frantic hassle near Haiphong. They disengaged, joined by another Falcon F-4J, and headed outbound, climbing through 22,000 feet. At that point Randy heard an urgent call, "SAM, SAM, SAM! Nam Dinh!"[4]

There was no electronic indication of a launch, and the F-4's ECM gear had worked as advertised so far. But Randy glanced to starboard and, sure enough, a SAM was closing rapidly on his airplane.

Beginning a break into the missile, Randy saw the SAM explode. He felt the concussion, banked to port, and rolled out. His instruments showed normal, and he accelerated northeastward. Then the Phantom pitched into a nose-high roll. Randy got it under control, noting he'd lost his primary hydraulic system. By then the backup system was losing pressure, and the utility gauge was fluctuating. The stricken F-4 rolled again, and Randy lost all doubt as to the seriousness of his situation. The only control he maintained was with power and rudder.

Alternately using afterburner to bring his nose up and rudder to roll the nose down, Randy kept the burning fighter headed for the water. He briefly spoke with Driscoll, confirming that they would stay with the airplane as long as possible. Bailout over that area of the North meant certain capture.

At the mouth of the Red River, the Phantom exploded, its tail blowing off and the rest of the plane dropping into a violent flat spin. The pilot and radar operator ejected, landing just offshore and within range of smallarms. They drew sporadic gunfire, but, providentially, two marine helicopters from the USS *Okinawa* arrived to rescue them.

At the time it was assumed Cunningham and Driscoll's ECM gear had failed. With knowledge acquired since then, it is more likely the missile that tagged their F-4J was guided electro-optically. Only that one was fired, contrary to usual practice, and that piece of information further supports the optically guided theory.

Late that same afternoon VF-92 launched an F-4J as escort to an A-7E Iron Hand. The Phantom pilot was Lieutenant Curt Dosé, who had begun the day's MiG slaying when he dropped a 21 almost in Kep's traffic pattern. Curt had mounted an 8mm movie camera on his instrument panel, but he was too busy to turn it on during his supersonic chase through the weeds. This time, however, he had the camera running as he entered the target area.

Haze, limiting visibility, prevented early detection of the SAM launches. Curt glimpsed a missile emerging from the murk and wracked his aircraft into an evasive turn—then he saw two more in close trail headed directly for him. He knew SAMs were command- as well as proximity-fused and these were too close too fast. There was no time even to eject. He was resigned to dying at that instant.

But he didn't. Nothing happened. All three missiles continued their ballistic path to oblivion. Later, two frames of movie film showed the SAMs close aboard, passing narrowly in front of the F-4.

When he got back aboard the *Connie,* Curt Dosé looked up the EA-3B detachment. He was told the Prowlers had monitored twenty SAMs in the air at that moment—too many to jam all tracking or guidance frequencies. So the alert ECM operators quickly switched their efforts to the detonation frequencies, with total success.

Curt paid off his debt in true fighter-pilot tradition. He gave the electronic warriors a full case of Jack Daniels.[5]

The last word in electronic warfare came from the opposition, less than five months before the cessation of air opera-

tions Up North. In mid-September a large SAM knocked down an F-4 despite all efforts to defeat it. Code-named "Fat Black," it was a new kid on the SAM block and it seemed immune to jamming. Although it took out the Phantom, the marine crew ejected safely and was rescued.

In the years since Vietnam, EW aircraft have further increased in importance. Today, because of their effectiveness, ECM birds would be priority targets in a shooting war. As Ernie Pyle said of aircraft carriers in World War II, it's a precarious honor, but a proud one.