Naval Aviation Planning A Retrospective View

(and some lessons for 1995)

By George A. Spangenberg

When I was asked to participate in an effort which would, among other things, attempt to forecast future trends in naval aviation from now until 1995, my immediate reaction was extremely negative; and for a variety of reasons. Long range planning was never a favorite assignment of mine since I had never found any "Long Range Plan" (LRP) to be useful enough to justify the effort required to produce it. This low opinion of LRP's is shared by many.

I remember, for example, a Chief, BuAer deploring, while ordering, the production of a BuAer Long Range Plan which had been requested (or directed) by higher authority. History has shown that we had better concentrate our efforts on *short range* plans — with which we have had more than enough trouble.

It also seemed to me that any significant variance between future predictions in the "Gold Book" with those in the current Navy Aviation Plan could not be tolerated. Dissent against programs officially supported by the Navy has not exactly been encouraged by the ANA. The reasoning behind the policy of "no dead hands on the tiller" by retired naval aviators in ANA is understandable. However, in my opinion, I believe that a voice of reasoned dissent, on occasion, might prove useful and serve the needs of naval aviation in the long run.

I had been involved in situations in years past when the official Navy had to go along with directions issued from above under conditions which, to my mind, seemed close to blackmail, — as for example, "Support the XYZ or you will lose a carrier in your budget submission", or "Take the ABC or you'll get nothing".

Rather than looking into the future and trying to predict where naval aviation is headed from its base of today, it might be more instructive to consider what today's forces might have been if some of yesterday's plans had been treated differently. Perhaps, in this way, some visibility about 1995 might result. Moreover, a retrospective look might show some of the hazards involved by those now attempting to provide the weapons of the future and also provide some insight as to responsibility for some of our shortfalls. From a personal viewpoint, I would hope that such a review might convince those still fighting the Battle of the Potomac that my generation of the naval air development bureaucracy was not really as incompetent as many of the operators in the fleet believed us to be.

I recall a long conversation several years ago with an officer on his first Washington assignment just after his tour as a carrier skipper. He was appalled at the aircraft development program which not only contained no projects which offered solutions to the operational problems he knew to exist, but did contain some which promised to aggravate the situation. That conversation did not change the development program, but it did alert that officer to the circumstances which had produced it, and gave him some confidence that many of the officers and civilians with whom he was to work for the next couple of years shared his obvious frustration.

This retrospective look at naval aircraft is purely a personal one as I viewed it from my position as a civilian in BuAer, BuWeps and NavAir from 1939 until 1973, involved to a greater or lesser degree in all the aircraft and missile developments during that period. My view of the world may not agree with many of my former superiors and subordinates (remember the fable about the elephant and the blind men?), but I believe it to be reasonably accurate from a factual, if not judgmental, standpoint. My bias in favor of the way we used to develop aircraft in the "good old days" and against today's overmanaged, overstudied and incredibly long development cycles is well known. My bias against the need for an OSD is also well known — and probably will be evident before I finish this piece.

With that prelude, let me review some of naval aviation's development and planning past, starting in the 1950's and concentrating on the fighter and attack programs which had a significant effect on the direction of naval aviation.

At the beginning of that decade, our carriers deployed with both "day" and "all weather" fighter squadrons, as well as "light" and "heavy" attack aircraft. The F8U-1, our first supersonic fighter, was begun in 1953 as a day fighter replacement for the F9F and F2H series. The program originated in controversy over differences of opinion as to whether supersonic performance was worth the penalties of size, weight, complexity and cost. That debate, (remarkably similar to another repeated years later between advocates of a "light weight fighter" or a "fully capable fighter") was won initially by the subsonic design backers when the "Invitation to Bid" letter (forerunner of today's RFP) included a *subsonic* speed requirement.

Fortunately for naval aviation, that requirement was changed soon after issuance, and all proposals were submitted for supersonic designs. At the time, the Air Force had already begun its supersonic "Century Series" aircraft, the F-100 through F-104. If the Navy had deferred accepting the supersonic challenge, it is likely that Navy carriers and carrier aviation would have been judged incapable of competing successfully against a first line threat. The Tailhook Navy might have faded away.

The supersonic controversy was internal to the Navy and the proper decision between the alternative design approaches was finally made. The F8U-1 airplane was initially armed with four 20 mm guns and/or a pack of 60–2 inch air-air-rockets. (Collision course rocketry proved so inaccurate that the rocket option was dropped prior to production. When the supersonic design was first put

under contract, the Navy estimated the airplane would have a radius of action of 500 nautical miles on internal fuel and would achieve a maximum speed of Mach 1.4. (In fact, the speed estimate was bettered and the "legs" of the airplane proved adequate in the fleet throughout its years of active service).

The next step in fighter development called for a supersonic replacement for the all-weather types. Although this step eventually produced the highly regarded F-4 "Phantom", it started in anything but a well planned manner. At the time, McDonnell Aircraft could see the end of the production run of the F3H "Demon" approaching and offered a series of improved models hoping to continue as the principal supplier of all weather fighters without experiencing the hazards of an industry wide design competition, which would have been held in 1955. The timing of a competition was dictated by the development status of a new generation of engines, including thhe J75 and J79, suitable for single and twin engine all weather fighter designs, respectively. The contractor was successful in his strategy when he was awarded a letter contract for his model, "F3H-G".

Several months later, when the contract was definitized, the airplane had become the "AH-1". This was a single place, twin J65 engined design armed with 4–20 mm guns, an "attack" airplane of a type not previously found in any long or short range plans, published or unpublished. A year later, in 1955, a major reconfiguration decision was reached to make the airplane into its well known two place, twin J79 engined arrangement armed with four Sparrows, and with the F4H-1 designation. Early in its development program, the airplane was estimated, by the Navy, to have a maximum speed above Mach 2.0 (limited by the engine design speed a figure later raised), a radius on internal fuel of 435 nautical miles, and an attack radius with a 2000 lb. store of 750 nautical miles, with partially filled external tanks. With the exception of McDonnell, few would consider this program as ideal from a planning standpoint. At the time, the probability seemed high that a competition would produce an even better design.

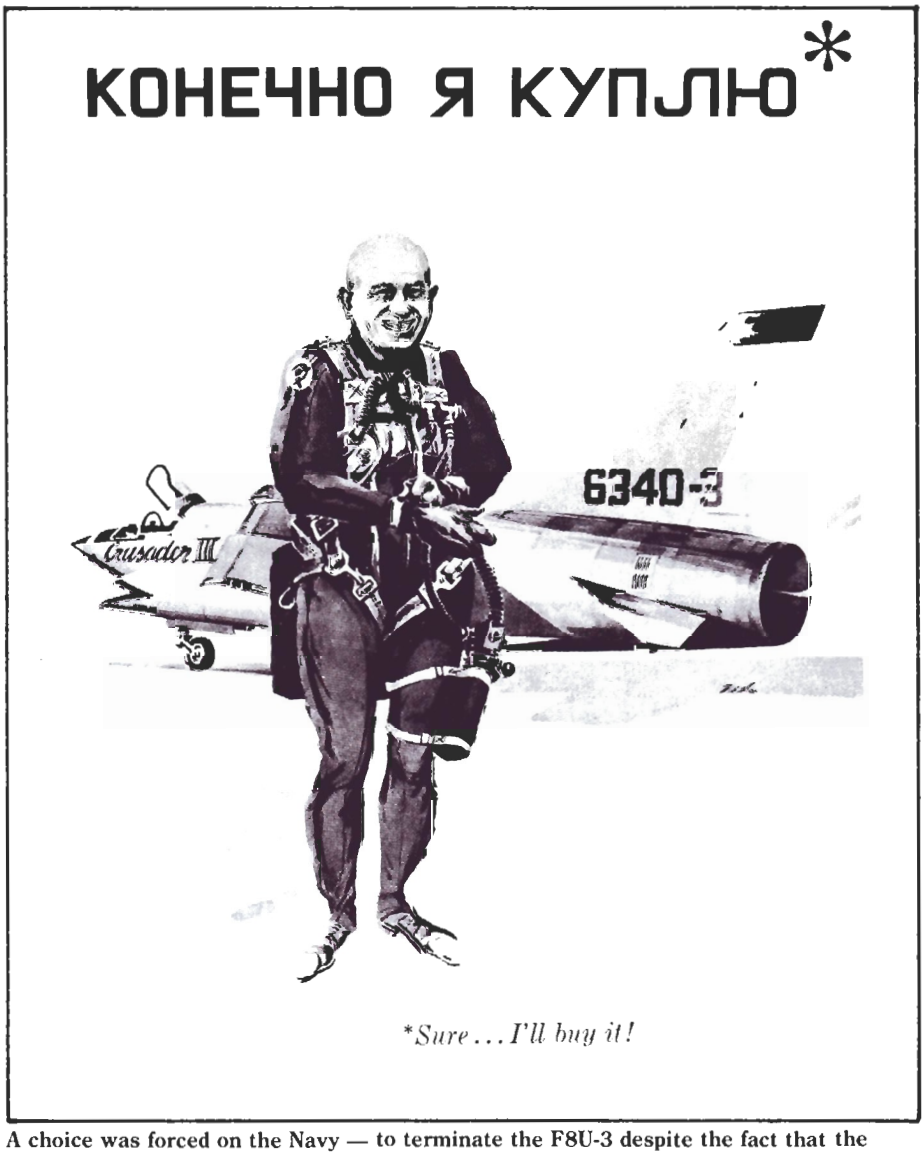
By the time of the F-4 reconfiguration, however, a consensus had been reached on the necessity of moving from guns to all weather missiles as primary armament if our fighters were to deal effectively with the expected threat. But no agreement existed on whether a two man crew was necessaryy for the mission.

With the F-8 day fighter design progressing very well, the contractor, Vought, was requested to submit a proposal for an all weather version of that airplane, utilizing the same basic aerodynamic configuration. This led to the F8U-3 contract in 1956 for a single place, single J75 engined design armed with three Sparrows. The radar and fire control system of the F-4 was used in a single place modification.

Up until that time, our aircraft carriers had always deployed with two fighter types aboard, each powered with a different engine. The necessity for this practice was to prevent leaving the carrier undefended if either the airplane or its engine was grounded. This rationale was used by the Navy when the Congress in 1957 sought to eliminate either the F4H or F8U-3 production program on grounds of unnecessary duplication.

A year's delay was granted to allow flight testing of the two designs, but in 1958 a choice was forced on the Navy — to terminate the F8U-3 despite the fact that the program had been highly successful, and was actually better relative to its F-4 competition than when it began. The F8U-3 was faster, more maneuverable, had better flying qualities, cost 20% less and had more range on internal fuel than did the F-4 with a 600 gal. tank.

The decision to select the McDonnell F-4 was reached primarily on the two vs. one man crew issue. It was generally accepted that a single pilot could do the job *most* of the time, but the two-man crew could do it better *all of the time,* with an advantage that widened with the severity of the threat. Thus, it was stated at the time that the day of the single seat fighter was over in the Navy and that none should be considered in the future. That design decision held for the next fifteen years, until the F-18 program returned to the



A choice was forced on the Navy — to terminate the F8U-3 despite the fact that the program had been highly successful.

one pilot, one plane philosophy.

While the competition just discussed was being waged, concern was growing over the ability of the carrier to defend itself against the predicted threats. Conventional deck launched fighters had too little time available to make successful intercepts against supersonic bombers launching air-to-surface missiles. In considering the same type of bomber threat, the Air Force has elected to build a Mach 3.0 interceptor equipped with a single shot fire control system and a moderately long range missile for the Continental Air Defense System. That design never reached production as a fighter but was produced in a reconnaissance version known as the SR-71.

This approach was really not available to the Navy since the aircraft's size and characteristics were well beyond those which our carriers could accommodate. The Navy solution to the problem came out of a large scale (at the time) operational analysis effort called RAFAD, which compared all the alternatives for fleet air defense. The study showed clearly that the most effective, and most cost effective solution against high level threats, was to launch long range missiles from relatively low performance and inexpensive aircraft on Combat Air Patrol (CAP) stations. This type of system was several times more effective than the F-4/Sparrow system.

From these study results came the "Eagle/Missileer" program. The EAGLE, a nominal 100 mile range, two stage missile with command mid-course guidance, together with its fire control system, was started with Bendix in 1958. When its development appeared successful, the "MISSILEER" competition was held and the Douglas F6D put under contract in 1960. The F6D was a two place, side by side, subsonic, 50,000 lb. airplane powered with two TF30 turbo fan engines. It carried a five foot diameter antenna in its nose and was capable of remaining on a 150 mile CAP station for five hours.

The concept of EAGLE/MISSILEER was then, and may still be, the most cost effective method of providing a point defense against high performance threats. However, there are some obvious disadvantages to a system of this type, since it really needs a high performance complementary system to handle the "other fighter roles" (OFR), a fact which was not emphasized in the justification process.

It is ironic that the Eagle/Missileer program, one of the more completely planned and I believe, the first to have been justified by quantitative operational analysis (cost effectiveness) was cancelled in its entirety by the incoming administration of Secretary of Defense, Robert McNamara, which made operational analysis its hallmark (at least in its public statements). The original OSD decision to stop the Eagle/Missileer development was made on a superficial basis, predicated on the belief (unsupported by operational analysis) that only one advanced fighter had to be developed to meet the needs of both the Air Force and Navy against the common enemy.

At that time, in early 1961, the U.S. Air Force was about to issue an RFP for procurement of their TFX (Tactical Fighter Experimental) after a few years of studies. By Navy classification, the TFX would have been an "attack" airplane, since its primary mission was the delivery of a nuclear weapon on a Low-Low-High mission profile. The original Air Force requirement document called for an 800 nautical mile mission consisting of a 400 mile subsonic cruise at sea level, followed by a Mach 1.2 supersonic dash for 400 miles, weapon delivery, then climb to altitude and cruise home. In the time period under discussion, the 400 mile dash distance had been reduced to 200 miles "minimum", with the higher figure continued as a goal. Air-to-air requirements were rudimentary — guns and Sidewinders — presumably intended for self-defense.

It would be hard to imagine less likely candidates for standardization and development as a multi-service fighter than the Navy's air-to-air, straight wing, non-afterburning, subsonic, carrier based, moderate strength F6D and the U.S. Air Force air-to-ground, variable sweep, afterburning, supersonic, land-based, high strength TFX.

Nevertheless, in early 1961, OSD directed the Air Force and Navy to do just that — and for good measure, to also perform ground support for the Army.

Since the "Missileer" was completely unsuitable for the Air Force mission, the Navy undertook a study of its own "TFX", a version which might do a reasonable job of fleet air defense, and which also could perform a reasonable strike mission.

Thus, a 50,000 lb. gross weight limit was established to permit operations from all carriers, CVA-19 and better. The Navy TFX was to be a supersonic, variable sweep design carrying six moderately long range, 1,000 lb. missiles for the Navy CAP mission with a time on station of better than three hours; and which could perform the Air Force strike mission at about 550 miles — including a 100 mile dash at Mach 1.0.

On their part, the Air Force proposed a 63,000 lb. design to meet their requirements (800 mile radius, Mach. 1.2, dash for 200 miles) which could carry 5,000 lb. of missiles and remain on station for 4.8 hours for the Navy. The 83 foot length of the airplane was to be accommodated by "suitable carrier modifications".

Neither proposed solution was acceptable to the other service. OSD, nevertheless, ordered the program to continue, with the Air Force assigned development responsibility. After two more months of fruitless negotiations, both services recommended that each be allowed to proceed with its own "TFX", with maximum cooperation and information exchange between the separate programs. OSD responded by ordering the services to issue an RFP for a single design meeting the minimum requirements of each service within a set of specified guidelines.

The task given the services by this order was clearly impossible of achievement. No single airplane could meet the technical requirements which had been outlined.

Thus began the most frustrating, expensive and useless seven years in naval air development history. No realistic planning, short or long range, could be accomplished when the OSD decision makers refused to accept what the Navy regarded as absolute technical fact.

The TFX source selection, conducted under U.S. Air Force rules, ran through four rounds. It ended when OSD reversed the military's recommendations to buy the Boeing design and OSD directed instead that the contract be awarded to General Dynamics. According to Navy estimates, neither of the designs was capable of meeting the combined set of requirements, with the largest shortfall occurring in the ability of the designs to meet the Air Force Low-Low-High mission. The General Dynamics design was rated "acceptable" in meeting Navy carrier requirements (CVA-59 and better), but had no margin for growth. A major concern to the Navy was what would happen when the contractor and Air Force found out what its F-111A radius really was, since only major changes could correct the problem, and these would impact carrier suitability of the Navy's F-111B, making it unacceptable.

The predicted result did happen, and

to a far greater degree than anticipated.

By mid-1963, six months after contract award, investigations later showed that empty weight had increased by almost 20%, and drag levels were up considerably.

In early 1965, in a complete reevaluation effort, the Navy found the F-111B unacceptable and recommended the program be suspended until corrective changes could be found. That recommendation was repeated and rejected regularly for the next few years — until 1968 when Congress refused to appropriate further funds for the airplane.

The Navy "B" version of the F-111, if it could have met its contractual guarantees, would have been a satisfactory replacement for the F-4 according to studies conducted both before and after contract award. The airplane carried six Phoenix missiles and the multi-shot AWG-9 fire control systems (both begun with Hughes after the demise of EAGLE/MISSILEER) and they had a guaranteed CAP station time of 4.0 hours. For the fleet air defense mission, the system with Phoenix missiles was rated as several times better than the F-4. When carrying Sparrows, the paper F-111B airplane was also rated significantly higher in the "Other Fighter Roles" (OFR). However, since the Navy never believed that the guarantees could be met, the study results had little meaning.

When the F111-B's weight and performance characteristics became further degraded during development, features needed for all roles other than Fleet Air Defense (FAD) were gradually eliminated, restricting the F-111B finally to only that mission, and making it necessary to plan on another fighter to do the vital OFR mission.

A full scale carrier complement optimization study was then conducted under the assumption that one squadron of F-111B's would be assigned to each carrier for FAD. With this constraint, a plan for a multi-purpose VFAX design evolved, with three squadrons of VFAX replacing one fighter and two light attack squadrons.

This 1960's VFAX concept was a two place, twin-engines, variable sweep design which bettered in all respects the characteristics of the F-4 as a fighter and the A-7 as an attack airplane. New technology engines and a new weapon system were required to meet these goals in a design about the size and weight of the F-4. VFAX became part of the Navy's plan for the future, until the F-111B proved itself unusable eliminating the constraint which had justified it.

The final step in the developments of the F-111B period was what proved to be a real solution to the carrier fighter problem. In essence, this was done by adding Phoenix and AWG-9 to VFAX, thereby completing the circle, nearly returning to where we had been in 1961 with the "Navy TFX". Still another "Fighter Study" was completed showing that VFX, as it was called, was more effective and more cost effective than the F-111B plus F-4, VFAX, or other alternatives. After a competition, VFX became the F-14 Tomcat when a contract was awarded to Grumman in early 1970.

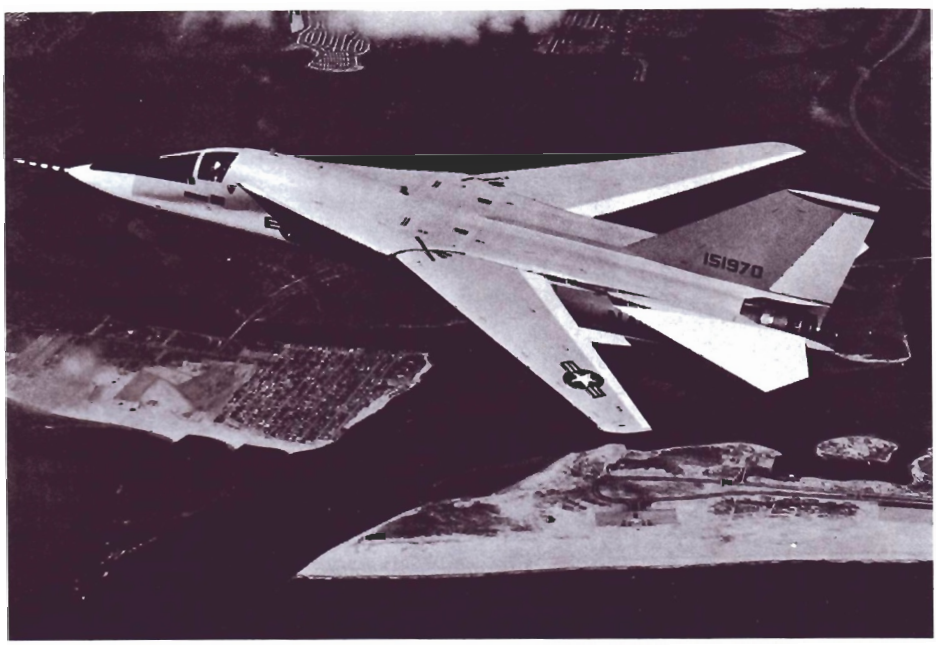
The F-14 was planned as a three model program — F-14A, F-14B and F-14C — the F-14A would be powered with TF30 engines, the F-14B would have new technology engines [then under joint development for the "VFX" (F-14) and "FX" (F-15)]; and finally the F-14C with an upgraded avionic system providing an all-weather attack and reconnaissance capability.

The original contract called for six Research and Development airplanes followed by fixed price ceiling options for 463 production aircraft, produced at a nominal rate of eight per month. Each production lot could be varied by ±50%, giving contractual coverage for quantities from about 230 to 800 airplanes. Replacement of all Navy and Marine F-4's (the intent at the time), required 716 production aircraft, not including attrition. Deliveries of the F-14B with its improved engines were to start with the 68th production airplane.

The F-14's design mission was in the air superiority role carrying four Sparrows on a fighter escort mission. A radius of 565 miles using internal fuel was estimated by the Navy. The FAD mission was treated as an overload, carrying six Phoenix missiles and external fuel. An attack capability carrying a wide variety of conventional stores with a visual delivery accuracy equal to the A-7E was also provided for in the basic design.

As is now well known, the original plans have not been realized despite a very successful technical development. The F-14 production rate was held below the nominal level, the F-14B never reached production, and the F-14C avionic development was cancelled.

Despite initial approval by OSD and the Congress, critics surfaced almost immediately. Cost was the dominant issue, although the advocates of light weight, simple solutions were also in evidence. Most of the real cost problems which developed within a few years could be traced directly to the contract, a tight and complex one, which provided an opportunity for gross misunderstandings, misconceptions and misrepresentations. At the time of the competition, the Navy had estimated that Grumman would exceed his costs on the development portion of the contract, incurring a loss of about $100 million. That magnitude of loss was considered bearable. The fixed price ceiling options for the 463 production airplanes were considered reasonable by the Navy and should have resulted in some profit for the contractor — but only if the airplanes were produced at the eight per



TFX—General Dynamics/Grumman Navy YF111B.

month rate (or greater) specified for use in making the estimate.

However, the formula included in the contract for establishing the prices of each lot when produced at a lower rate, seriously underestimated the increased costs involved. The discrepancy was known to the Navy *before* contract award, and the contractor informed that "he might have a problem" with the variable lot option clause. When Grumman signified acceptance of this clause, without change from his proposal, the issue was closed. (Telling a manufacturer that he should increase his proposed price was not a policy followed by our negotiators.) When OSD and the Congress failed to fund the program at the planned production rate, holding it instead to the minimum production level covered in the contract, Grumman was put into a loss situation which he could not tolerate.

Unfortunately, the facts relating to this dilemma were not widely known. As a result, negotiations were mishandled, particularly at the OSD and Congressional level.

In retrospect, the Navy would have been much better off without the variable lot provision in the contract, which made it easy to cut the quantity in each lot without losing contractual coverage — and particularly when the increase in unit price was so low. (Ironically, the variable quantity option had its origins in Navy aircraft development contracts to solve just the opposite problem. During A-7 production, when the Navy sought to increase the quantity of the last lot covered in the original contract, the contractor quoted a higher unit price for the additional aircraft. This made it very difficult to obtain approval of the change in the Congress since a lower unit price would normally have been expected. In this case, it was obvious to those familiar with all the facts that the contract prices were below actual costs.)

After negotiations between the government and contractor for exercising the Lot IV option in the F-14 contract escalated to the DepSecDef level, that official directed the Navy to seek an alternative to the F-14 and to study a carrier based version of the U.S. Air Force's F-15. At about the same time, the OSD initiated a "Prototype Program", which its advocates claimed would solve nearly all problems associated with government aircraft development and procurement — increasing technical capability, reducing costs and incidentally eliminating cost overrun problems. Light weight fighters were selected by OSD to become a part of the Air Force prototype program, and added more confusion to the overall fighter picture. Studies conducted at the time within the Navy showed that light weight fighters had no place on a carrier and that an F-15 Navy version was unattractive. Such a carrier version carrying Sparrows was 10% more costly and much less capable than the F-14. The Air Force, through whom F-15 data had to be obtained, advised that a Phoenix carrying version was impracticable within the time and resources available.

Despite each study turning out negatively, the OSD continued to press for a lower cost alternative to the F-14 and gradually forced on the Navy their version of a high-low mix concept. Nearly everyone conceded that an F-14/Phoenix capability was necessary to handle severe threats, but that lesser threats could be handled by cheaper aircraft. Although the concept of big trucks for big loads and little trucks for little loads in the transportation industry had merit in some cases, the extension of the concept to fighter squadron mixes on aircraft carriers was not one of them.

Through 1973, the Navy fought off the proposals for light weight fighters, low cost alternatives, and F-15 modifications to keep F-14 procurement on track — although running late — to replace all the F-4's. Every study showed that there was no lower cost alternative available if the alternative was to be better than the airplane it was replacing. In fact, new aircraft with less than F-4 capability were more costly than the F-4 itself. In mid-1973, Congress finally agreed with the Navy, ending a series of schemes originated in OSD and largely directed and managed by the Deputy Secretary of Defense.

In 1974 OSD and Congress renewed their pressure, in the name of economy, to restrict F-14 procurement to about half that called for in the original plan. The Navy responded to the demand for a lower cost alternative by offering an improved performance F-14 stripped of the Phoenix system, but with provisions retained to install it later. As expected, this recommendation was rejected, but an alternate proposal was accepted — to investigate a lighter weight, lower unit cost (note the word "unit"), multi-mission aircraft which could serve to replace some F-4's and eventually also to replace A-7's in the light attack role.

Thus, the VFAX concept was rediscovered, although in a much less capable version than the original. Congress then further complicated the issue by directing that any Navy lightweight fighter be a version of the one selected by the Air Force from their YF-16 and YF-17 competition. (The Air Force embraced the production of lightweight fighters for their inventory after they were offered the program by OSD as additive to their planed F-15 program, and not as a substitute for a portion of it). The Navy evaluated proposals for carrier versions of the F-16 and F-17, selected the latter, and redesignated it as the F-18. OSD and congressional approval followed, despite the Air Force selection of the F-16. The Navy, in a "TacAir Study" justified the VFAX concept in much the same manner as the 1960's VFAX. Various alternative carrier complements were studied observing a constraint of only one F-14A squadron per carrier, thus avoiding a comparison with what should have been the base case, viz., two F-14 squadrons and two A-7 squadrons.

Of the alternatives reported, a mix of three F-18 squadrons with one F-14 squadron was adjudged the best. An unpublished NavAir analysis conducted at about the same time showed that a mix of F-14's and A-6's, and no A-7's, was the best combination, and the F-14, A-6, and A-7 mix was better than any involving a new VFAX.

In the Congressional hearings of the 1976 defense budget held in late 1975, the F-18 program was strongly supported by the Deputy Secretary of Defense while the Navy — damning with faint praise — justified the design as a *useful* fighter, complementary to the F-14, and *suitable* as an attack airplane with better performance than the A-7 and with *adequate* range and store carrying ability. Life cycle costs over a 15 year period were shown to be slightly lower for "Alternative II" (a mix of 224 F-14's, 202 A-7's, and 800 F-18's) than for "Alternative 1A", (a mix of 744 F-14's, 186 A-7's, and 275 VALX's, the latter an undefined new light attack).

The decision to proceed with the F-18 program was a difficult one for most (I believe) of my generation in naval aviation to accept. It appeared to be more a part of an OSD plan for the future rather than that of the Navy, which seemed to accept it on a "better than nothing" basis. To those of us in the loyal opposition, (i.e. "loyal" to the Navy and in "opposition" to most of OSD's aircraft decisions), the design was the first intentional backward step in capability programmed by Naval aviation. The improvements in maintainability, reliability and overall readiness, associated with advances in avionic state of the art, could not offset

the performance degradation as a fighter from the 1958 F4H/F8U-3 levels, nor the loss in attack payload/range and store carrying capability from the levels required in the competition to replace the A-4. On the positive side, of course, one might note that the Marine aviation support of the program was easier to accept. F/A-18 replacement of F-4/A-4 squadrons did not entail such a loss in capability.

Let us now turn to the attack field, where the Navy's development record is simpler and appears less affected by outside influences. The A-4, our first jet light attack was started in 1952 after several years of trying to find an adequate replacement for the reciprocating engined A-1's. Turboprop designs, probably in the long range plans of the time, were generally unattractive, but the engine state of the art made it difficult to design a carrier based jet attack airplane with enough capability to warrant development. "Heinemann's Hot Rod" — a name applied much later — solved the problem although by compromise on store carrying flexibility. At initiation, the Navy estimated a 400 mile attack radius on internal fuel with a 1000 lb. store. Toward the end of the 1950's, a swept wing version of the airplane, designated A4D-3, was started to improve its capabilities, but budgetary limitations forced cancellation shortly after its start.

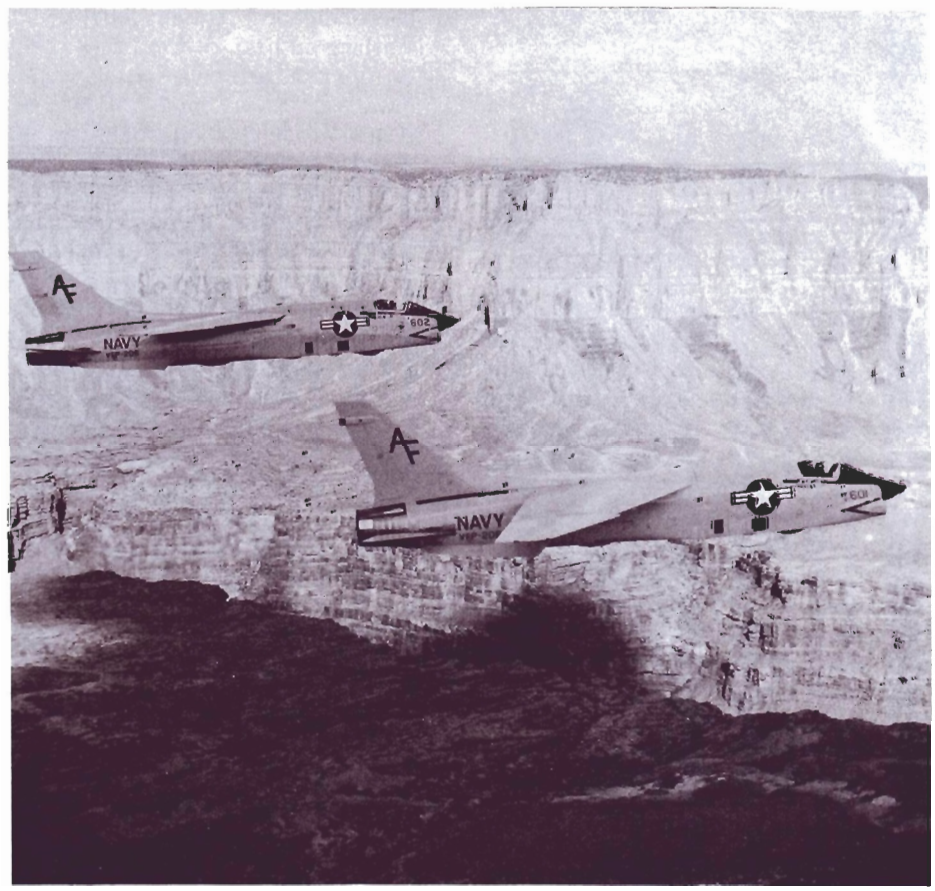
The A3J (A-5) program was started in 1956 after a couple of years of unsolicited attack proposals from North American Aviation. Initially the design, then called NAGPAW, was for a low level, twin engine, subsonic attack airplane, which evolved into a supersonic, nuclear weapon carrier with a linear bomb bay, which could be considered as an A-3 replacement.

The program may have been important when it was necessary to show that the Navy had a supersonic nuclear strike capability — but its evolution was a closely held negotiation between the contractor and a few Navy planners. The design saw service primarily as the RA-5C in a reconnaissance version for which there had been a long standing military requirement, but for a much longer ranged vehicle. Overall, the planning for this model was pretty much ad hoc.

The next airplane in the attack scene was the long-lived A-6, started in 1957 primarily as a short take off and landing (STOL) airplane for the Marines. OSD approval for the program was held up until the Navy defined a secondary, long range attack mission and included the model in its plans for the future. At initiation, the design close support mission called for an endurance of one hour at sea level at a radius of 300 miles following a short take off (STO) with two–1,000 lb. stores, using partial fuel. For the Navy, the airplane had an estimated radius of 900 nautical miles with two external tanks and a single 2,000 lb. store, or a radius all at sea level, of 730 miles with four tanks. The short take off requirement of the Marines necessitated excellent low speed performance, while the Navy requirement demanded an efficient cruise arrangement; which combined to give the airplane its margin for growth and an unprecedently long production life (although at a rate so low that it can hardly qualify as "production"). Not even the longest of the long range plans contemplated the A-6's production longevity, which will probably continue until the mission requires — or the state of the art permits — a supersonic capability for our all weather attack airplanes.

By the end of the decade, the A-4 was reaching its limit in capability. A number of possible replacement designs were studied. These provided data to a formal "Sea Based Strike Study" which served to quantify the need for a greater light attack capability, and to gain the McNamara regime's approval for a "VAX" competition. The VAX was to retrieve the ground support mission dropped from TFX as well as to provide a replacement for the A-4. The competition was limited to modifications of existing airplanes in order to reduce the R&D effort and to permit use of production funds for development.

The winner of the competition, the A-7, was derived from the F-8 although in actuality it was almost a completely new detail design. In rough terms, the A-7 payload/range characteristics were double those of the A-4, while offering a much greater flexibility in store carrying capability. A fixed price development contract with fixed price options for a total of about 200 aircraft was awarded to Vought in 1964 after rejustifying the selection of a contractor to OSD by another operational analysis. At the time of contract award, the Navy estimated the radius of the airplane to be 635 miles, in-



F8U Crusader – The Vought A7 Corsair II was a derivative.

cluding a 200 mile run-in at sea level on internal fuel while carrying 12 mk 81 bombs; or 815 miles on the standard high-low-high profile with 6 mk 81 stores — also on internal fuel. Airplane development was highly successful with the achievement of fleet introduction within three years of contract award. Furthermore, production continued at a reasonable rate (150 per year or better) for five years before any cut back. When started, only the airframe and engine improvements over the A-4 were programmed, but the weapon system was brought up to the state of the art a few years later (but only after OSD forced the Air Force to join in the development). Once started, the A-7 probably followed its plans more closely than any of the programs I have discussed.

A high performance attack aircraft system study was conducted in the Naval Air Systems Command in 1970. That study presented a series of possible supersonic attack aircraft designs from near term to long term. The near term design was approximately equivalent to an A-7 with some aerodynamic improvements and with an afterburning engine. Payload/range capability of the A-7 was to be held with afterburning thrust used in the combat portion of the radius problem and Sidewinders carried for "self-protection". The project was dropped when the airplane snowballed in weight as the range, speed and strength requirements interacted. Supersonic performance appeared to offer too little advantage in reduced vulnerability to either ground defenses or to enemy fighters to offset the disadvantages of increased weight, cost, and IR signature. I suppose the long standing difference of opinion which has existed between the concept of strike fighters operating alone (Air Force) and pure attack aircraft escorted by fighters (Navy) will probably continue.

One cannot ignore the effect on naval aviation of changes made in the ship side of the Navy. There are a number of examples which come to mind. The decision to eliminate the anti-submarine warfare (CVS) carriers had an obvious effect on the numbers of S-3's needed in the active forces. But there were other effects. If this change had been anticipated, the design constraints imposed by that class of ships would not have been necessary allowing the design of a far more versatile ASW, carrier capable aircraft. A COD version of that airplane would have been easier, as would other special purpose types considered and eliminated because of the degree of modification required. The disruption in aircraft planning caused by introduction of concepts such as the "Sea Control Ship", or "V/STOL carriers" is significant, particularly when they seem to appear out of the blue.

So what does this discussion of the last 34 years of carrier based VF and VA programs, and my own experience in the Washington naval aviation bureaucracy offer those planning for the future? Although Santayana's axiom that "Those who fail to heed history are doomed to repeat it" is widely quoted, it is also widely ignored. We avoid repeating our own mistakes, but find it difficult to persuade others to avoid them. However, a few observations:

1. The record of initial plans being followed by the Navy is poor, while the record of OSD in changing plans for the worse is evident.

2. The aircraft programs controlled by the Navy came close to meeting the Navy's own technical projections. Without exception, all designs increased in weight and all suffered a decrease in range/radius/endurance. Planners must recognize these facts of life.

3. A companion thought to the above is that the "standard" range/radius/endurance figures generated in Washington bear no fixed relationship to operational capabilities. Some "standard" radius problems give answers which approximate those obtained in realistic fleet usage, but most give decidedly overstated results.

4. Planners immediately after World War II set a goal of 600 miles for its future carrier based strike groups. Realistically, we achieved about half that goal with the F-4/A-4 mix and hoped to reach about 500 miles with the F-14/A-7 mix. With the world's fixed geography and increased threat performance, today's planners should seek no lower goal.

5. Planners must guard against the ever present, grossly optimistic, speculative theorists who offer projects so attractive that they get adopted despite warnings from the Navy's technical community. The XFV-12A is the most striking example in the recent past, but the V/STOL A and B programs are not far behind. As a corollary, planners should insure the competency of their technical community.

6. There was merit in the original plans for the F-14B and F-14C looking toward an avionic system which could handle both all weather VF and VA missions in an airplane with adequate range to do both jobs. The attack mission, raising a realistic radius problem, is the more demanding and still probably prevents attainment of the long time goal of one basic airplane to do all the VF and VA missions.

7. As the threat against the fleet gets more severe, a MISSILEER concept may again become attractive. If so, a multi-mission airplane combining AEW, ASW, COD, and Tanker with MISSILEER is a realistic possibility.

In concludion, we all recognize the degree of gamemanship required in today's political environment to get new programs started and worthwhile ones continued, but the planners must keep in mind that the real goal is to win the next war, when and if it occurs. That challenge is tougher than ever. ■

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