Webkeeper's Notes: In 1959, Bill Beckett & K. P. Rice were developing a lightly armed reconnaissance aircraft that could provide close air support to troops on the ground and also be used in counter-insurgency operations. To properly support the ground troops, the aircraft needed to be small enough to operate from roads; be able to use 'on hand' fuels; be simple enough to be maintained under adverse field conditions; and be tough enough to land on whatever terrain was available. The aircraft needed to be versatile - so it could fly far enough - fast enough - and carry enough - to perform it's assigned mission.

And so the OV-10A "Bronco" was born...

OV-10 Story
Innovation vs. The "System"

W.H. BECKETT K.P. RICE M.E. KING

THE OV-10 STORY: INNOVATION vs. "THE SYSTEM"

Background

At the end of WWII the era of boom and zoom had arrived for military aviation with mushroom clouds, jet speeds and an independent Air Force. Korea soon showed the continuing necessity for ground troops and old fashioned Close Air Support (CAS), but the Army was impotent against the Air Force's preoccupation with jets, and in the late '50's hadn't developed it's rotary-wing substitute. Naval Aviation was competing with the new Air Force for nuclear roles in order to maintain its very existence. The Marines still advertised CAS, but were following the Air Force lead and justified the transition to jets on the basis of speed, bomb load and nukes (eg: "One A-4 equaled three Corsairs on the basis of 'productivity'").

Having flown CAS with Corsairs in WWII and Korea, qualified in jets and served a tour in ANGLICO, the organization that provided Marine ground-based Forward Air Controllers, I was concerned by these developments. I wasn't against progress, I loved flying jets, but I knew that they had severe limitations when it came to real CAS. In 1960 I was based at El Toro in California and talked about this with K.P. Rice, an old friend whom had "helped" build a Goodyear formula racing plane back in '49. I pointed out that even though the A-4 jet was a bomber it only had three store stations: centerline for a nuclear weapon and two wing stations for drop tanks. This made it very limited for CAS applications.

K.P.'s response was action. He designed and built the first "multi-carriage" bomb rack. He was based nearby at China Lake in VX-5 where they supported that sort of independent action. This rack allowed six bombs to be carried on any station that could handle the weight. K.P. did the engineering and welded it up with the help from a sailor. It worked! The first racks were out in plan form to the operating Navy while BUWEPS was still not convinced it was even possible. Soon even the Air Force adopted multi-carriage racks, and the rhetoric supporting jets with massive loads increased.

The multi-carriage racks definitely added to our conventional strike capability, but jets, even with lots of bombs, couldn't provide really effective CAS. The official definition of CAS was, "Air support…integrated with the ground scheme of maneuver." This meant that it had to be there when it was needed, and close enough to distinguish the enemy, the situation and friendly troops. The jets were too big, too expensive and too centrally controlled to be properly responsive, and their speed was so high that they couldn't find, let alone hit, CAS targets. Something else was

needed to go after the fleeing and elusive targets that are often so close to friendly troops that discrimination becomes a major factor.

Discussion of these drawbacks with K.P. again elicited a positive response, "OK, let's design an airplane to do the right job." This sounded like an interesting challenge so we set out to design a specialized CAS airplane. We met several times a week (he now lived just down the block from me). I proposed tactical "wants" and K.P. would indicate the associated feasibility and the trade-offs. After about six months of very lively discussion we finally came up with a design.

Initial Design

We aimed at two general goals: First to cover the lower end of the performance envelope for the capabilities that had made WWII CAS so effective, but which had been lost with the advent of jets; And second, to apply recently available technology for operations near the supported troops and a major improvement in synergy.

To cover the low end, WWII performance, I asked for a plane that could dive bomb like a Stuka or an SBD, maneuver like an SNJ/AT-6, and was as fast and strong as a Corsair. To be able to operate with supported troops, I asked for a small, easily supported and relatively inexpensive airplane, able to land and take off near a typical Battalion CP. For this requirement we came up with a wingspan limited to 20ft and a landing gear tread of 6.5ft for operating from roads, short take off and landing for small fields, and a backup seaplane capability. We aimed at the use of ground ordnance and communications to save weight, size and logistics without compromising (and possibly improving) close-in effectiveness. I also asked for ordnance near the centerline for accuracy, the best possible visibility, a seat for an observer and a small bomb bay for tactical flexibility.

I got these requirements from various sources. The dive bombing was based on my experience with the utility of this tactic and the notable results that had been achieved by aircraft like the Stuka and SBD. The AT-6 maneuverability was based on observation of Air Force airborne forward controllers (FACs) flying this type in Korea. My experience with the Corsair had impressed me with the value of its speed and strength for survivability against ground fire, and its ability to go fast or slow as the situation required, had been very effective. The P-38 had demonstrated the advantage of centerline guns for accuracy. Visibility and a back seat were needed for target acquisition and situational awareness. The bomb bay derived from the experiences of a Marine TBF torpedo bomber squadron during the Okinawa campaign (they flew almost three times as much as the fighter-bombers because their bomb-bays were in demand for so many "special" missions). The use of ground type ordnance was based on the fact that these weapons were tailored to their targets and should provide the maximum effect for their weight and logistic cost.

This was asking for a lot and, as experience ultimately showed, was essentially impossible in a normal "system" airplane. We were not designing a normal system airplane, however, and as we made our trade-offs we gave up a lot of what was standard because it wasn't absolutely required for the mission. This included things like ejection seats; aviation type navigation and communication equipment; and especially the single engine performance, fuel and equipment requirements associated with airways instrument flight.

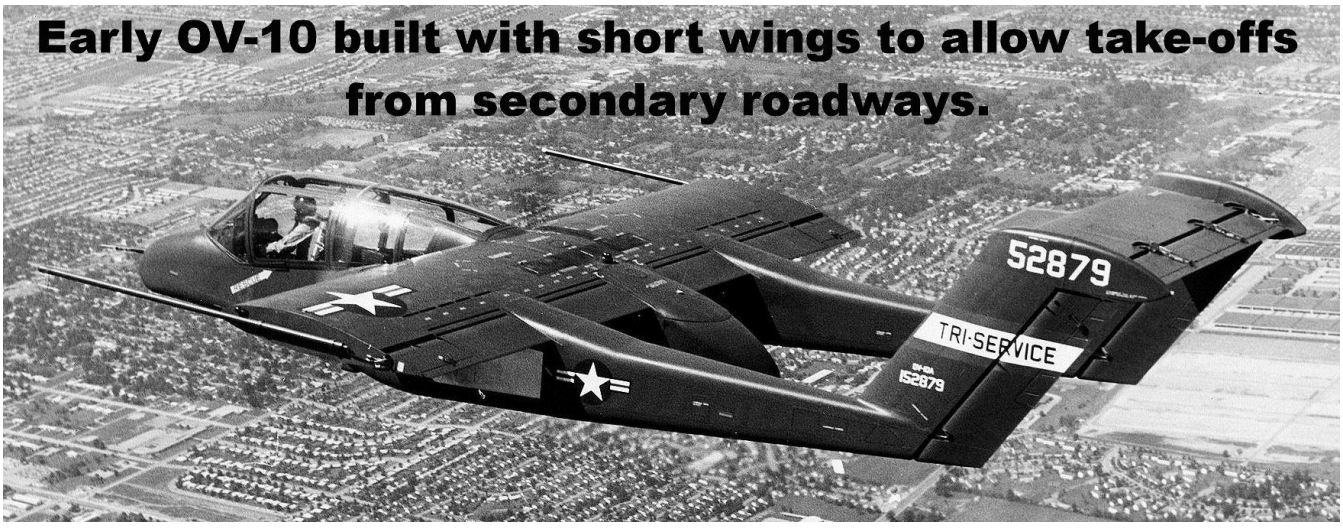
The design we came up with was definitely not "normal," but it could hopefully do tactically useful jobs that nothing else could do. To be able to operate near the supported troops it was small, with a wingspan of only 20ft and a tread of 6.5ft. to allow operations from dirt roads where even helicopters were restricted. It could take off and land over a 50ft. obstacle in only 500ft. and was to use ground ordnance and communications. The additional flexibility of water-based operations with retractable floats was also considered feasible. It had two turbo-prop engines in a twin boom

configuration which allowed both internal and external ordnance carriage near the centerline. Weight empty was 330lbs; for STOL operations the weight was 5800lbs. and for runway operations the weight went up to 6600lbs. For "low end" performance top speed at sea level was between 265kts and 285kts depending on the load, and the stall speed was around 40kts. It had two seats, good air-to-air and air-to-ground visibility and a canopy that could be opened in flight for better visibility at night. It also featured 400lbs of armor and could pull up to 10 "G." It had taken a long six months, but we thought that the design was feasible, and that if built, could support revolutionary advances in CAS.

The next step was for me to write up the concept[1] and for K.P. to double check his engineering. I wrote a small booklet outlining the concept which we started passing around to get comments. K.P. had contacts at Douglas, Ryan and Convair, who checked his design and found it feasible and "interesting," but of course no one was interested in supporting it or taking it on as a private venture. The only really positive response came from K.P.'s acquaintances at China Lake, the technical director, Dr. Bill McLean of Sidewinder fame, Frank Knemyer and Knute Ward, the latter both heads of large departments. By this time K.P. figured that the only way to get the airplane right was to build it ourselves. This was unprecedented, but he had built that racer back in '49, and the multi-carriage bomb racks just recently. After many visits and briefings China Lake agreed to fund us as necessary, provided we showed progress. We were in the airplane building business.

Trying to build a prototype

Trying to make a "home built" military aircraft seems at first to be totally ridiculous. However, as events subsequently showed, this was the only way to get certain characteristics which were highly desirable from a tactical standpoint, but which could not even be considered by the conventional establishment. Examples include the requirement for a 20ft wingspan in order to take-off and land on back roads; visibility oriented to flexible ground attack and air-to-air defense; strength (10"G") so that a pilot would not have to constrain his tactics; use of ground-type ordnance and communications which could provide exceptional logistic and tactical advantages; a seaplane capability for operating in areas like the Vietnam delta; and a bomb bay for a variety of tactically proven uses. The only way to get such capabilities was to build a prototype to demonstrate the tactical advantages we visualized.



[1] Marine Light Attack Aircraft, L2VMA

It is worth noting that once our concept got into the hostile Navy "system," none of the designers gave more than lip service to most of the tactical advantages we were aiming at. Ryan, who came up with the most responsive design (and some innovative ideas of their own) unfortunately didn't even bid in the end. The rest were all constrained by the nature and documentary requirements of the "system" and the Federal Acquisition Regulations (FAR). In the end we didn't get what we wanted. However, the idea of demonstrating a prototype was the only way it might have been done.

Our build-it project gave us access to a wide variety of new developments and associated technology. We also hoped to tap the expertise of prospective "user," pilots, mechanics, ordnance men, etc. to refine and improve our design as we proceeded with the building. The idea here was to get inputs from these "users" early-on, before the design was set in concrete by contracts and specifications. We got a lot of good ideas, both technical and operational.

We started the actual construction in K.P.'s garage. The construction was to be of fiberglass sandwich and we made a plaster mold of the fuselage which we covered with fiberglass. This would serve as a mock-up initially and we would add end grain balsa and another layer of fiberglass later to finish the sandwich structure. This naturally took up a large portion of K.P.'s garage, so the raw material: plaster, fiberglass, plywood, balsa, etc. was stored in my garage. I often wondered how a Navy Supply Officer would react, if he saw all this "Government Property" delivered to a private residence.

Fiberglass and other "composite" materials were new to aviation at that time and while K.P. already knew that he wanted a fiberglass and end grain balsa sandwich construction, he also checked out what the major companies were doing. It is interesting to note that back in '61 Boeing was already quite advanced in "stealth" technology using slab sided triangular airframe shapes and fiberglass to reduce radar return. A Lockheed subcontractor had developed some interesting three dimensional weave fiberglass that, properly cored and soaked in epoxy resin, made an effective truss cross section for a very light, stiff radome structure which they used on the EC-121 Constellation, the forerunner of AWACS. Piper had made some wings for the AT-6 out of fiberglass which were both lighter and stronger than the original aluminum. However, other than these three, while there might have been good ideas out there, industry was slow in applying them, probably due to the constraints of the "system." Now they are used almost universally to achieve otherwise unavailable characteristics in aircraft.

In addition to the new technology, experience was also informative. For example, once we got the fuselage shaped, we needed to provide things like seats, controls and similar fittings. To this end we went back to the big aircraft boneyard at China Lake. One of our first acquisitions by this method was the rudder pedals. Rudder pedals would seem to be a rather mundane subject without much variation, but our experience provided an interesting comparison between two old time favorites. We got our first set of pedals out of a Grumman F6F. It took about five minutes and we had a good set of adjustable pedals that were light and simple. We couldn't find another good F6F, so we took our second set of pedals from a Douglas AD. The AD pedals were at least twice as heavy, took up four times as much scarce space behind the instrument panel, and were at least ten times as complicated (and expensive). Having flown both airplanes, I can attest that there was **no** advantage from the additional weight and complexity of the AD pedals. On the other hand this did highlight a type of "gold plating" growth that we had to avoid at all costs.

When we looked into the possibility of using ground type ordnance we found that there were aviation type fuses that were perfectly compatible with both 81mm and 4.2in mortar rounds. Thus, if we wanted a lot of small "bombs," we could use mortar rounds to provide illumination, white phosphorus attack or screening, or high explosive. Our favorite, essentially "ideal" ground weapon for our airplane was the 106mm recoilless rifle. This weapon was a lot more accurate that the

equivalent aerial weapon, the five inch rocket, and a single round only weighed 40lbs as opposed to about 100lbs for a rocket. The problem was that the 106 was a single shot weapon and we wanted more shots.

At this time I was also the Small Airfield for Tactical Support (SATS) project officer for a desert test at Twenty-Nine Palms. In this capacity I often visited Harvey Aluminum, the company that made the new matting for our runways and taxiways. Harvey also had an exceptional R&D organization which had developed a variety of interesting products from rocket implanted earth anchors, to advanced fuses and even the first aluminum beer cans. On one visit I happened to mention something about the desirability of an automatic recoilless rifle. They immediately showed me **two** working prototypes and introduced me to Dr. Musser who had patented the first recoilless rifles during WWII. This put the recoilless rifle back in the concept more strongly than ever. We even took one of the prototypes to Camp Pendleton where the Marines demonstrated it to a group of scientists from China Lake. It worked beautifully and was very impressive. Dr Musser indicated that with a modest change to the nozzle, the weapon could be made suitable for operations from a twin boom aircraft like the one we proposed.

Our project gave a look at another R&D development just coming to fruition at the time, low light level TV, (LLLTV). This provided a way to see in the dark. Four of us got to ride around the El Toro area one night in a Beechcraft to see how it worked. We could see roads, parked vehicles and buildings with the LLLTV that were otherwise invisible in the haze and smog. There was some blooming when headlights were encountered, but overall, the pilots that tried this were impressed. However, we noted that while it provided exceptional advantages at low speeds, we didn't think it would be much good above 140kts. It is an interesting commentary on the "system" that McNamara's DOD first put it on Air Force supersonic bombers. It wasn't until about ten years later that we got the equivalent infra red imaging capability on the OV-10**D** model.

Recognizing that in trying to build something outside the "system" we needed all the help we could get. KP sought assistance from some of the large aircraft manufacturers. We first went to Douglas. They had reviewed our design for feasibility and gave it an official OK. KP then proposed that they support us with engineering to give us more credibility. In return we would keep them abreast of all developments so that they would be in the best possible position when (if) the project got to the point of competitive proposals. They considered our offer for a couple of weeks and then decided that they could not afford the investment. (Their VP of advanced engineering later lamented that they could have had a sure thing.) The FARs restriction on agencies that participated in defining requirements from bidding on hardware was no doubt also a consideration.

Convair and Ryan reacted similarly, interested, but no direct help. Meanwhile, the mock-up was starting to crowd the garage and it was time to think about the wings which wouldn't fit in the garage. Also, we wanted as much input as possible from pilots who were to fly the plane and the ordnance men and mechanics who were going to service it. The time had come to move onto the base. We took over an empty super Quonset in the Special Weapons Training Unit compound where KP was assigned at the time. We soon attracted the interest of a lot of pilots and also mechanics and ordnance men.

It was interesting to me that the younger pilots, up through the rank of captain, were very enthusiastic. The older aviators, while never really opposing the project, grew more wary and less enthusiastic directly in proportion to their rank. The younger pilots could see that it would be much more "fun" flying such a plane that the jets which, while getting faster, etc., were too constrained to be much fun. (Along this line many pilots avoided helicopters, if possible, but once assigned, found flying them more interesting than jets.)

In March '61, I was assigned temporarily to the I.G. for an inspection of the First Marine Division at Camp Pendleton. This gave me as unprecedented opportunity to find out what the potential "customers" would think of our project. The "Grunts" were not only polite and willing to listen, many were enthusiastic. I was able to discuss the subject with almost all of the Regimental and Battalion staffs, and all were in favor of such support. The Division Artillery Officer thought that the idea of having both artillery and air support available in the same place would make for better utilization of both. Just about everyone thought that the idea of a dedicated support aircraft was great, but although they wished me luck, didn't think we could make it happen.

The tactical concepts were holding up and even getting refined by these critiques and the prototype was proceeding. We had considered a couple of other engines, but settled on the Pratt and Whitney Canada, PT-6 as the best bet at the time. We were assured that China Lake would get us a pair of engines at no cost when the time came for installation. Things were going well. However, we were now on the base and protocol demanded that the General commanding the base be informed. This turned out to be a problem.

When briefed on our activity the General was definitely not pleased. His concern was that he had no authority to support such a project and could not justify the expenditure for electricity and possibly other utilities associated with it. As I remember, he had no comments pro or con about the project per-se. We eventually resolved the problem by getting a Supply Officer from China Lake to call the Station Logistics Officer (G-4), formally request that the Station support our project, and assure him that China Lake would provide the necessary funds, (The Station G-4 told me that it would cost more to find out these costs that the costs themselves, but the general was reassured.)

Another humorous aspect of the project was revealed not long after when we were told one day that an Army Colonel was at the main gate and wanted to see us. Neither of us knew any Army officers, let alone Colonels, but we weren't proud, we would talk to anyone. At the gate we picked up Colonel Williams. He was from the staff of DDR&E at the Pentagon. It seemed that rumors of our activity had reached all the way back to the Pentagon indicating that we had completed a new airplane which had phenomenal (really unbelievable) performance and was flying all over the West Coast. Rather than call, he had been sent to find out what was going on and told to physically put his hand on the aircraft.

We all had a great laugh after we briefed him on our project. He was a rising star in Army Aviation (he was promoted to two stars and head of Army Aviation subsequently) and not only seemed to approve, but took an interest in our project. He had considerable experience flying the Grumman OV-1, and added greatly to our operational concepts with descriptions of his experiences and technique with this twin engine turboprop.

We thought that things were proceeding rather well at this point, but two problems which we hadn't thought much about came up that effectively slowed our "build:" program. First BUWEPS learned of China Lake's funding of our project and told them to cease and desist right now. As Adm. Schoech told KP, "When Navy airplanes are built, we build them." China Lake was still willing to help with funding, but getting the two engines at $350,000 would be difficult as well as going directly against an order. KP figured that we could still get P&W to bail us engines, if they thought we had a viable aircraft, but we decided to sit down and rethink the building problem.

Selling through the "system"

Since demonstrating the concept had failed, we now had to try to convince enough of the right people in the "system" to get an official program started. We commenced by briefing anyone who would listen. Notable were Ryan who had a very good design early on, and Convair, where Jim Fink later started early and convinced his management to start building even before the formal RFP.

In one of our first briefings we made the pitch to, of all people, John Foster and Edward Teller of Livermore Labs (they were on the President's Scientific Advisory Panel). KP's connections and aggressiveness were working again.

Next, KP contacted Al Blackburn, a former North American and Marine Corps test pilot whom he had known at Patuxent River. Al had left the Marine Corps and was working in the Tactical Air Warfare Program office at DDR&E. After KP called him about the problem, Al called Col. Marion Carl at HQMC and got KP a set of temporary orders to DOD Research and Engineering (DDR&E) to jointly start what nine months later became the official DOD counter-insurgency (COIN) aircraft program. Thus began a saga of operating without a home out of a briefcase.

Al was well liked in general at the Pentagon and he took KP and his briefcase on a truly broad-brush support building tour of just about everybody of importance, both civilian and military. Unfortunately, a couple of months later Al committed professional hari-kari by criticizing McNamara's jamming the TFX program down Air Force/Navy throats. He left a few days later and KP decided that having the Navy develop the aircraft was the lesser of many evils despite warnings from Dr. Wakelin, Assistant Secretary of the Navy for R&D, that they would overcomplicate the aircraft (which, of course they did).

At this time International Security Affairs (ISA) controlled the Military Assistance Program (MAP) for DOD, and was interested in procuring a COIN aircraft for MAP. Also, the Army was looking for a replacement for its OV-1 Mohawk. KP soon put these requirements together with our "Light Attack" concept for the Marines and sent a letter, signed by Harold Brown, head of DDR&E to the Assistant Secretaries of the Army, Air Force and Navy outlining a "Light Armed Reconnaissance Aircraft (LARA), for the COIN program.

This LARA program was the start of what would eventually evolve into the OV-10. Since only aircraft in-being could be purchased by MAP, it was decided that Advanced Research Projects Agency (ARPA) under DOD would provide the initial funds and specifications. The Harold Brown letter dated 20 Dec '62 outlined the COIN program and formed a steering committee to guide program definition. The Steering Committee consisted of:

J.H.Wakelin, Jr. Asst. Sec. Nav., R&D (chairman);Dr. J McLucas, Dep. Dir. (tact Warfare); Brig. Gen. W.B. Kyle, USMC, DCS, R&D; R.C. Phelps, Remote Area Conflict, ARPA; Dr. H. Brown, Director DDR&E; M/G R. H. Weinike, ret. ARPA; Dr. S. Perry, Asst Dir. DDR&E; Dr. Alexander Flax, Asst. Sec. USAF, R&D; Lt. Col. R.L. McDaniel, USA OCRD.

The 20 Dec. letter also contained the following guidance, "DDR&E envisions this program to be a pilot project to reverse existing tendencies to long development time, high costs, and increased complexity now present in the development of new weapon systems. The reversal in this case is made possible by the inherent nature of the COIN airplane requirement that stresses simplicity on order to be utilized by the indigenous forces of MAP countries."

KP had started with a bang and continued a wild life of high level briefings and politics for the next couple of years. Operating out of Dr. McLucas' office in DDR&E, (Tactical Warfare Systems) he had almost unlimited access, considerable authority (assumed), and was subject to very little oversight. His reporting senior was B/Gen Hochmuth (HQMC R&D), but KP saw him only occasionally, (when he wanted something—like a formal Marine "requirement").

He soon became very familiar with Pentagon politics and had many interesting and revealing encounters. In one meeting he set up, representatives of the various services were asked to specify their interest in the project. First, the Air Force: "No interest"; next the Marines: "Yes, around 75 aircraft"; Navy: "No interest"; Army: "Yes, about 100 aircraft, if the Marines/Navy run

the program." At that point the Air Force representative interjected, "If the Army gets 100, we want 200."

This was the hey-day of McNamara's "cost-effectiveness" and the Pentagon was full of "whiz kid" operations analysis. From what I could tell as a mostly distant observer, the idea of operations analysis as used by McNamara was effectually a gimmick that enabled decision makers to avoid responsibility. With enough "studies" a decision maker could justify anything, and as McNamara has admitted, often did.

These studies were often impressive in size and in the credentials of the authors (always academic, never military), but usually had little real substance. One I particularly remember that was used to support the Air Force position in favor of jets as opposed to concepts like the OV-10, was WESEG-32. It weighed about five pounds in two volumes. In the end is said, "…all things equal, the faster an airplane attacks the less chance of being hit." This oversimplification, presented in mind numbing prolixity, supported the Air Force desire for big, fast aircraft, but neglected much more important tactical considerations like the effects of maneuver, surprise, flexibility, shooting back and accuracy.

In order to counter this sort of thing, KP always went to conferences with more material than anyone else (his briefcases often weighed over 40lbs). In addition to the applicable engineering and "study" material which he was usually one-up on, I provided him with arguments from history and experience. Along this line he distributed, for example, many copies of "Stuka Pilot" by H. Rudel, a German dive bomber who flew over 2500 missions in WWII and who espoused tactics similar to those we wanted to exploit with LARA.

I was now mostly "out of the loop," but continued to pitch the concept in articles (Marine Corps Gazette and AIAA) and giving briefings whenever KP set me up (eg: IDA, Navy PG School, Monterey, CAN).

By June '63 there was agreement between DDR&E and a reluctant Navy to proceed with program definition. How this happened is interesting. The Navy didn't want to spend any money in a non-Navy aircraft office and had assigned Captain Al Morton to drive the cost of development out of sight. KP had been pushing for $6 million and had done his best to keep this goal in sight, although he had limited capability to influence industry responses to the Navy's complex RFP. On decision day, half the Pentagon was gathered to hear Captain Morton's briefing in Dr. Brown's office. The captain threw in a few muted remarks about the ridiculous notion of a $6 million estimate and concluded his briefing with a triumphant statement that the initial six aircraft would cost $15 million to develop. He fully expected objections. In contrast, Harold Brown kicked back in his chair and laughed uproariously saying, "Only $15 million, that's great, let's do it."

So much for Captain Morton's coup de grace. This was in June '63. BUWEPS was directed to issue a Request For Proposals (RFP) about Sept. '63. The Army was directed to develop the Position Fixing Navigation System (PFNS), that located individual infantry men, and the Air Force was directed to develop the Low Light Level TV (LLLTV) to allow pilots to see in the dark in conjunction with the LARA program. The use of fiberglass was also indicated.

In August '63, as a result of KP's contacts with Gen. Hochmuth, I got orders to Quantico, and presumably the Development Center there, where I could participate in the program. As it turned out, I was assigned to the Education Center instead and Gen. Hochmuth wouldn't intervene to change it. I was in Washington, close to the action, but still on the outside.

It was at this stage of the game that the way the "system" drove programs to calculated mediocrity started becoming more apparent. First, there was the "requirement." The rules

forbade the requirement from specifying **how** to do something, it could only indicate the end desired. Also, neither KP nor I had any direct input to the actual SOR. Thus, the 20ft wingspan and 6.5ft tread needed to operate from back roads near supported troops were specified as short take off and landing (STOL) from rough fields and a "short" wingspan. As a result none of the companies that responded even tried to meet the goal of operating from roads. They did all respond to the short wingspan, rough field and STOL requirements, however. The typical approach was to take the width of a standard fuselage, add clearance for the propellers, add the diameter of the propellers and then add a few feet for the ailerons. This resulted in a span of 30-34ft. Since anything over about 23ft was useless for the tactical objective, and the optimum span was about 40ft, they all paid a steep price and got nothing for it. (They all ignored the 6.5ft tread.) Quoting from the winner's (north American) internal planning at the time, the characteristics to be stressed (taken from SYSCOM's evaluation criteria) were:

- Take off and landing distance
- Loiter time and endurance
- Max. speed
- Ferry range

This was only one way the concept was twisted. Another element was the obvious, but of course unstated, opposition of both the Air Force and Navy BUWEPS, the systems command that was charged with its development. The Air Force got into the program after the RFP primarily to control, and ultimately do away with the concept and pushed for an aircraft with a limited Forward Air Controller (FAC) role that wouldn't compete with their centrally controlled jet fighter. BUWEPS opposed it because they hadn't originated it. They felt that they were best qualified to tell the "user" what he should have. (This attitude later infuriated a Marine general and got the V/STOL "Harrier" program started over their objection.)

The Air Force was able to add about 1000lbs of electronics to the no longer simple aircraft system, ostensibly to support the limited FAC role. BUWEPS set out early to specify the aircraft to failure starting with an unprecedented requirement to demonstrate operations from two specially constructed runways with different frequency sine wave undulations. No other vehicle could negotiate these runways at more than 10-13mph. This added another unnecessary 1000lbs, but in the end the airplane met the requirement (even though the pilot couldn't).

These developments also illustrate that the "system" will almost always accommodate **additions**, but **never** can anything be taken out. This is why all weapons grow in weight, complexity and price; and if something smaller is desired, you have to start over. Another rule in DOD procurement is that smaller and cheaper never justifies more numbers. You can never replace an expensive, complex system with more numbers of a simpler system.

All of the contractors that responded to the RFP in March '64 were aware of the politics involved and played the game of guessing who was the real customer (eg: the DOD, the Air Force, BUWEPS, the Marines, etc.), but BUWEPS was recognized as in charge of the evaluation. The proposals all tried to be light, simple and cheap, but with impressive payload, speed and weapon capabilities – all things to everyone, but nothing innovative enough to be considered radical or risky. As Beech pointed out later in a protest, they also lied about their design speed.

Nine companies submitted bids: Beech, Douglas, Convair, Goodyear, Helio, Hiller, Lockheed, Martin and North American. Ryan, one of our earlier contacts, had what I thought was a particularly good design, but declined to bid. Beech, Douglas and Lockheed had conventional single fuselage designs. Goodyear had an interesting design with a short wing and high mounted engines. Helio proposed a modification of their twin engine utility transport which was rejected early. Hiller, Convair, Martin and North American all had the twin boom configuration that KP had been pushing to eventually accommodate a recoilless rifle. Convair was notable because they were

already building their entry. The Martin entry had an interesting inverted "V" tail design which featured exhaust gasses from the engines ducted through the booms to the "blown" ruddervator. North American, the ultimate winner, had a straightforward twin boom configuration and a notable helicopter-like canopy to promote visibility.

North American was selected as the winner and in October received a contract for seven prototypes. Meanwhile, the Convair "Charger" which had been corporately funded, was rolled out in September and had its first flight in November. Despite this competition from a "real" as opposed to a "paper" airplane the decision was not changed, but Convair did get a limited flight test contract which gave them a last ditch chance at further competition. Unfortunately, Convair's efforts evaporated when a Navy pilot lost the aircraft due to gross pilot error on 19 October, '65.

Built as a prototype, the Convair Model 48 "Charger" was flown and modified during the LARA competition. It crashed due to pilot error in October of 1965.

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The "system" had finally come up with a contract for prototypes. The purpose of prototypes was to demonstrate the selected design and determine what changes, if any, should be made before a decision was made for production. In order to get some tactical thinking back into the program KP and I came up with the idea of an All Service Evaluation Group (ASEG). I wrote the initial charter for the group and included everything I could wish for, if I got the job. KP got it officially approved and implemented.

The ASEG had pilots from the Marines, Navy, Air Force and Army and was assigned a mix of aircraft that could be used to explore the widest variety of tactics and techniques. In addition to YOV-10s they had a Stearman bi-plane, a North American SNJ trainer, a Douglas AD dive bomber and a Grumman OV-1 Mohawk turboprop Army reconnaissance type. Also, all the assigned pilots received a special low altitude navigation course from crop dusters at Ohio State which emphasized the difference between skimming the treetops and flying consistently below treetops. We didn't expect the YOV-10 to be perfect, but we hoped that the ASEG would demonstrate all its possibilities and maybe come up with some new potentials.

The YOV-10, Product of the "System"

The original concept of a small, simple aircraft that could operate close to the supported troops had been almost completely eviscerated by the "system." The ability to operate from roads (20ft span and 6.5 tread) had been ignored, and performance compromised by the short 30ft span, the extra 1000lbs for the rough field landing gear and another 1000lbs of electronics. The "light, simple" airplane also had a full complement of instruments, ejection seats and seven external store stations. The concept of using ground ordnance and a bomb bay had been ignored, although it did have provisions for four M-60 machine guns. In spite of this growth (almost double the size and weight of our home-built), the YOV-10 still had great potential. It would not achieve the advantages of integration with the ground scheme of maneuver, but it did have capabilities at the low end of the performance envelope that were still valuable and unique.

I retired from the Marine Corps in June '65, and went to work for North American just before the YOV-10's first flight. Mostly cut out of the loop my last years in the Corps, I was now back on the program, working for the contractor. My job was to sell the airplane, and in order to do that, I had to evaluate what we had and come up with a new operational concept to exploit it. It wasn't that hard. The "system" had done its best, but we still had a plane with unique and valuable characteristics.

The first order of business was to get the wingspan increased to 40 ft and remove the disabilities in handling and performance that derived from the now meaning less, short wingspan requirement. This was not as easy as it should have been. However, with KP pushing from the DOD and me working from the sales angle from inside, we finally got a fix for the wing, increasing the span to 40ft. (I found out later that a 34ft wing with a Hoerner wingtip could have done the job just as well, and much cheaper, but the company made more money with the expensive modification.)

Next, since the YOV-10 was definitely not a LARA, I had to come up with a realistic operational concept to exploit what it could do – and it could do plenty. It not only had performance covering the low end of the envelope where jets were particularly deficient, it was a natural for helicopter escort and anti-helicopter operations. (Note that at this time there were no armed helicopters.)

Unfortunately, the ASEG, which I had hoped would demonstrate the unique tactical advantages of the airplane, especially to the Air Force, failed to come up with much. Instead of picking up their charter and experimenting with techniques to exploit forward operations, helicopter escort, anti-helicopter operations, improved target acquisition, accuracy and closer coordination with ground troops, the ASEG mostly duplicated test functions already covered at Patuxent River and China Lake. The only new thing they came up with was the technique for dropping parachutists out of the cargo bay. The Marines later did use this technique fairly extensively.

An additional aspect of the MCNamara "system" was revealed as the negotiations to finalize the production configuration neared completion. First, both KP, who best knew what was wanted and M.E. King, the NAA designer who bet knew what could be done, were both specifically barred from even being in the Washington area during the deliberations. Any input by either of them was

anathema. This left the field to the real decision makers, the bureaucrats on one side and the company lawyers and "bean counters" on the other. Anything not already funded such as the wing extension, had to be paid for. On the other hand, things like speed which was already negotiated with penalty clauses for non-performance, were decided by a combination of lawyers (What can we get away with?), and "bean counters" (Is it cheaper to meet the spec. or pay the penalty?). Although, there were some "cleanup fixes," the "user" and the taxpayer were not really considered.

The Air Force position that the OV-10 was only good for forward air control grew stronger, and then dominant. McNamara's ton/mile efficiency criteria and the Air Force's insistence on "central control" overrode all the user input aimed at improving the synergy of air and ground operations. When the first production OV-10A with a 40ft wingspan and a few other improvements such as larger (715hp) engines, angled sponsons and tail fillets was cleared for production in early '68, the airplane had great tactical capabilities, but was already severely limited in its applications by politics. The largest hang up the Tactical Air Command had with respect to the OV-10 was the "Line." Above the line were the combat airplanes, of which TAC could have 4,000. Below the line were the supporting and light, usually commercial airplanes, which were not controlled. If the OV-10 was denied a combat function, it did not count toward the limit. However, if they were armed and allowed use of their weaponry, they had to be counted in the 4,000 total and would replace F-4s on a one to one basis.

The OV-10A: Into Service and Action

Deliveries of the production OV10As started in February, '68, first to the Marine's VMO-5 at Camp Pendleton, California, and then to the Air Force's 4409th CCTS at Hurlburt Field, Eglin AFB, Florida. Five months later the first OV-10As had been deployed to Vietnam.

The initial six aircraft used by the Marines were flown to Vietnam after having been delivered to the Philippines on an aircraft carrier. Just two hours after the ferry flights across the South China Sea to VMO-2 at Marble Mountain, the first OV-10A "Bronco" went into action – a two hour reconnaissance mission in support of Marines just south of the demilitarized zone. Within six weeks this first six plane contingent had amassed 500 combat hours, almost 250 missions and was averaging 100% utilization.

The first Air Force OV-10as were disassembled, crated and flown to Bien Hoa in C-133 transports. Uncrating and reassembly was accomplished in five days. These aircraft were assigned to the 19th Tactical Air Support Squadron (TASS) to be evaluated under the "Combat Bronco" program. They were soon doing very effective airborne forward air control (FAC) work.

Toward the end of '68 Admiral Zumwalt obtained some of the Marine's Broncos to support his Riverine and SEAL forces in the Delta. Assigned to Light Attack Squadron 4 (VAL-4), these Navy "Black Ponies" operated from Vung Tau and Binh Thuy. They operated on a waiver from the JCS under which the USAF would not dispute the trespass on their assignment. The waiver limited the OV-10As to 2.75 white phosphorus and once in a while high explosive 2.75 inch rockets along with their 7.62mm machine guns, 7.62mm mini gun pods and occasionally 20mm gun pods on the centerline. After a costly accident on the carrier "Constellation," the entire Navy inventory of 5 inch Zuni rockets were transferred to the VAL-4 OV-10 squadron and these were used to good effect. The waiver, however, denied all free fall ordnance such that bombs and adapted weapons of all types were forbidden. However, also by default, the Black Ponies were assigned CBU-55 fuel-air cluster bombs. Since the CBU-55 was worthless for close air support when dropped from any usual jet aircraft speed and altitude, only the OV-10As could deliver them low and slow enough to have any value.

These operations quickly confirmed that the Bronco was an excellent weapons platform. The Marines also demonstrated the aircraft's unique effectiveness in reconnaissance, artillery and naval gunfire spotting, FAC airborne, light attack and helicopter escort. In addition they demonstrated the capability to lay a tactical smoke screen so successfully that it took much longer than planned to get the demo aircraft back to the States. The users didn't want to let it go. This is a capability that has had great value historically, yet in Vietnam we had no other capability that this OV-10. Jets couldn't get low enough an helicopters were unstable. Today, we have no such capability at all.

The Air Force avoided weapon delivery as much as possible and confined its Broncos to mainly FAC work, initially not even allowing the use of its machine guns. This restriction was later lifted, but the Air Force Broncos were never allowed to explore any missions except FAC. It turned out that the 1000lb electronic suite that the Air Force had added in development to add weight and discredit the plane backfired. In combat, the FAC pilots expanded their role and became essentially very successful airborne command posts. Their pilots made the Air Force Bronco a success in spite of the machinations of HQ. They published a report, "Combat Dragon," that praised the aircraft lavishly, and asked for more and broader mission assignments. It was suppressed, however a book, written by an Air Force FAC, "A Lonely Kind of War," tells the real story very well. He used every capability the aircraft had, even the fuselage cavity to rescue a patrol surrounded by VC in Laos.

The Navy "Black Ponies," operating side by side with their own armed helicopters, demonstrated that the OV-1) could get to the target much faster than helicopters, and they often accomplished emergency missions hours before the centrally controlled jets arrived – much to the consternation of the Air Force. The Black Ponies weren't as restricted as the other services and probably got the most out of the aircraft. Even they were very limited in the ordnance they had available, mostly five inch rockets and machine guns, sometimes a 20mm pod (which KP had built at China Lake on his second tour there). Bombs, napalm, ground ordnance in a bomb bay or the recoilless rifle, could have added much to their already exemplary effectiveness.

In spite of these successful operations in three services, the light attack component was overshadowed more and more by the Air Force's opposition to anything that would give the "Grunts" on the ground anything airborne except what was left over after Air Force priorities were met. This eventually forced the Army into the development of the armed helicopter as the only way it could get the timely and dependable support needed.

Ii is interesting to note here that Army doctrine in the late '60s viewed the helicopter as a means of transport. As such, it was not a fighting vehicle and, for a time, the Army forbade any armament on helicopters. This policy was overtaken by events in Vietnam when tactical necessity forced field expedient armed helicopters. The Marines soon followed suit (for a while Marine helicopters only flew, if Army "gun ships" were available for escort.) Since the Army, although barred by the Air Force from fixed-wing support, did have helicopters, the armed helicopter was the inevitable solution. Thus the development of the armed helicopter, not only for the Army and Marines who followed their lead, but for practically every Army of consequence in the world. In spite of the fact that practically everything an attack helicopter could do, could be done cheaper and better with a fixed wing aircraft of proper design, Air Force politics overruled it.

Back at North American I continued to push the unique close support capabilities of the airplane, now to foreign air forces in addition to our own. I soon realized that the biggest obstacle to sales was politics and that, ridiculous as it sounds, the OV-10 was perceived as a threat to the jets. Before I could even discuss OV-10 capabilities in CAS, etc, I had to make a better case for jets. This was true for every air force I approached, and I approached a lot of them.

The problem can best be illustrated by the experience of Marine Aviation, the initial backer of the OV-10. As soon as the OV-10 achieved a degree of success in Vietnam, the Marines were asked to trade some of their F-4s for OV-10s. The F-4s would go to the Navy which needed more fighters, and the Marines would get more OV-10s for close support, which the Marines advertised they wanted. The Marine Commandant, Gen. Shoup actually went along with this proposal, but it was later turned down by the Navy CNO, Adm. Burke. Vadm. Pirie, DCNO Air actually wrote the letter (as I discovered in a private conversation with him much later). He recognized that if the Navy could provide the fighters needed by the Marines, there was no need for organic Marine Air at all. If the Marines than had no air of their own, what was the difference between them and the Army? Why not do away with the Marines altogether? This was no joke and there is no doubt that the Air Force and Army would have used this argument in DOD. In the end, Marines owe their very existence to Adm. Pirie, but few realize it.

The interesting thing is that this line of reasoning was essentially universal. Everywhere I went, to get the OV-10 even considered, I first had to protect the "F-4." Eventually, we sold the OV-10 to some countries where "COIN" operations were especially applicable such as Venezuela, Indonesia and Thailand. In addition, Germany bought some for target towing and even came up with a modification in which they added a jet engine for added speed on selected missions.

Other countries were interested, but were constrained by still more political considerations. For example, the Canadian Air Force actually liked the concept. They were heavy into peacekeeping at the time and the OV-10's military/utility characteristics would have been particularly appropriate. However, their budget was used-up procuring F-5s which the Air Force despised, but had been pushed politically in both Canada and the US.

Spain provided a similar example. After a very successful trip to Venezuela with a company team that worked directly with their air force, we proposed the same thing to the Spanish air force. This idea was reinforced by the fact that an OV-10 was flying to the Paris Air Show at the time and was scheduled to stop at Rota Air Base on the way. The Spanish air force answer was a polite, "Not only no, but hell no." Seeking the cause of this unexpected reaction, we later found out that previously they had welcomed such a team from Northrop to evaluate the F-5. When the Spanish air force rejected the F-5 after this evaluation, Northrop sold it anyway through political connections involving the US DOD, the King of Belgium and Franco. They were, understandably, taking no chances of a repeat.

In spite of such politics, the OV-10 was eventually also procured for the air forces of Morocco, Philippines, Columbia and Korea. In addition to the earlier buys by Venezuela, Indonesia, Thailand and Germany, together with the USAF, USMC and USN, the OV-10 eventually served in eleven air forces.

Through the late '60s a variety of improvements were proposed by North American including a transport version, proposals for a Harvey designed recoilless rifle, a bomb bay for ground and aviation ordnance, infra red suppressors for protection against missiles, side firing guns (like the c-47 "Puff the Magic Dragon"), loudspeakers for psy-warfare and a smoke screen capability. Also, the newly developed fuel-air explosive bombs which are many times more powerful than the conventional type were demonstrated in the OV-10. The only items that made it to Vietnam were the infra red shield, the smoke generator and the fuel-air explosive, CBU-55. I don't know what the evaluation was on the infra red shield, but, as noted earlier, the smoke generator was received enthusiastically by the users – so much so that they wouldn't return the test aircraft for months. None of these items made it into regular use.

It is interesting to note here that defense oriented industry was even less willing to fund demonstrators than the government. For example, North American has a full scale mock-up of

their transport version in '65 and most of their competitors had at least designs and brochures. However, none of them would risk the money to actually build a demo aircraft. Eventually, a cheaper, but less capable, similarly configured aircraft, the Shorts "Skyvan" took over this significant market niche with only moderate competition from a similarly configured Israeli Aircraft Industries offering.

The only real "improvement" that got onto production was the OV-10D Night Observation Gun-ship (NOGS) which had bigger (1000hp) engines and advanced night vision devices coupled to a 20mm cannon in a remotely controlled turret. (You can always get bigger and more complex.) While the turret was later dropped after a landing accident, similar systems were put on helicopter gun-ships.

In '69, I left North American to join KP at China Lake where he headed a new group pushing advanced aircraft systems. Mixed in with a number of missile, weapon and aircraft projects we tried again to get the recoilless rifle airborne. At the time, Piper was pushing a modified P-51 for roles similar to the OV-10. Their "Enforcer" modification had a much more powerful (and lighter) turboprop engine, lots of armor and impressive speed and maneuverability. A retired Air Force colonel who knew KP was heading the project and had also become a believer in the recoilless rifle. It was through this program that we finally got a recoilless rifle fired from an aircraft.

In the event, an Army P-51, supported for maintenance and parts by the Air Force, was flown from a naval base (China Lake) by a Marine pilot for the demonstration. The recoilless rifles were unmodified infantry weapons and were mounted on the wingtips to obviate any problems with back-blast. The test went off rather well, and, although not a test of accuracy, the pilot, Maj. Pippa, reported that the rounds went right where they were pointed.

Unfortunately, the people selling the Enforcer not only bucked Air Force policy, they also infuriated some of the top brass with their sales tactics. This resulted in letters from the Chief of Staff, USAF to the Chief of Naval Operations and then down the chain of command to the CO of the Naval Weapons Center, China Lake, to the effect that **no** more tests, or even mention of this aircraft would be tolerated. That was the end of the Enforcer.

In spite of this, we did, finally , get a feasibility test of the recoilless rifle on the OV-10. A standard, unmodified infantry type recoilless rifle was mounted on the centerline of an OV-10A. The OV-10 was then hoisted into the air by a crane and the rifle fired remotely. The gun fired appropriately, but the back-blast and shock wave from the unmodified nozzle slightly damaged the rudder trim tabs. I considered this quite a success considering the fact that a modified nozzle, like that suggested by Dr. Musser, together with the flight speed of the aircraft would take care of the problem on any production installation. Even without these obvious modifications, a slight beef-up of the trim tabs would have taken care of the problem. Nonetheless, the damaged trim tabs were used as a basis for ending all further tests.

Conclusion

The original concept of the early '60s was first stopped, and then highly modified by the "System," losing the capability to operate with the troops in the process. In spite of opposition by both the Air Force hierarchy and the Navy's SUSCOM, the OV-10A still uniquely covered the low end of the performance envelope and served with distinction in Vietnam with the Marines, Air Force and Navy. It was sold to eight foreign air forces, continued in US service through "Desert Storm" and is still (2003) in use in Korea, the Philippines, Indonesia, Venezuela and Columbia. In addition, the OV-10 has seen service with NASA, BATF the Bureau of Land Management and as spotters for fire bombers. Not bad for an airplane that was opposed by both the Air Force hierarchy and the Navy SYSCOM.

There is no doubt that, if the needs and desires of the "customer" of CAS, the infantry, were heeded – and the biases and politics of the Air Force HQ and the Navy's SYSCOM could somehow be bypasses, our overall military capabilities could be greatly improved. Today, more than ever, we need to be able to provide timely, decisive support to the troops on the ground. Granted, "air superiority" and "strike" capabilities are very important. However, in the long run, it is usually the guy on the ground who finishes the job and we also need to support him accordingly.

The Air Force, while always giving lip-service to such support, has always opposed it as much as they could in both procurement and practice. All their "CAS" is centrally controlled and the ground commander, except for plans approved days in advance all the way up to three or four star level, can never really rely on it. As a result, CAS is seldom, as the official definition indicates it should be, "integrated with the ground scheme of maneuver." In addition, the operating concept of the aircraft currently doing "close support" has them flying more than two miles high and totally dependent on long range electronic sensors for target acquisition and guided weapons for accuracy. This is fine when it works, but even when it works, this "CAS" fails to exploit the capabilities that historically made CAS so effective. Today, bombers, fighters, artillery and naval gunfire are all effective, but they are all stand-off systems. I am not against this technology, but I have to ask the question, "What happens when it doesn't work?" The recent success in Iraq will undoubtedly mute this question, but it will still be there.

In WWII, CAS integrated with the ground scheme of maneuver (especially Guderian's Panzers, supported by von Richtofen's Stukas) showed how decisive such combined action could be. Our original "home-built" was designed to demonstrate the possibility of improving even on this by operating directly with the supported troops. We never got to demonstrate these advantages, but the OV-10 did demonstrate that, even operating from bases at a distance from the supported unit, visual target acquisition, the ability to discriminate between friend and foe and close-in accurate firepower are still not only desirable, but sometimes decisive.

The other lesson from this exercise is that our engineering community has no shortage of good ideas and if properly directed, can build almost anything. The problem is direction. The system has to be set up so that the user, not the bureaucrats and lawyers provide more essential direction.