The Venezuelan Air Force Celebrates Seventy Years

(See page 2)
IN THIS ISSUE – JANUARY 1991

2
¡VIVA VENEZUELA!
Who Was Frank Boland?

10
STEP INTO MY OFFICE, PLEASE
Joe Bill Takes His Desk for a Spin

14
ATF
The YF-22 Pierces the Sky

16
VISTA/F-16
A Plane for All Reasons

20
A CONCISE HISTORY OF THE X-PLANE
X-Planes Explained by Expert Expositionist

28
EVENTS
Eventfulness at its Most Eventful

32
LETTERS

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ABOUT THE COVER
One of Venezuela’s many outstanding pilots, Major Valencia of Group 16, prepares for flight.
Photo by Lance Stout.
In 1912, a North American pilot named Frank Boland cranked up his 60-horsepower canvas and wood biplane and took to the skies over Caracas. His fifty-kilometer flight around the city ended with a soft landing in front of the presidential box at the El Paraíso race track. A band played. The crowd applauded wildly. Government officials motioned Boland to the presidential box, where they would talk more about what such a contraption could do for their country. When that talk ended, Venezuelan aviation history began.

¡VIVA VENEZUELA!
Boland’s exhibition sparked an interest in aviation that would eventually flame into a love affair. But it was an affair that had to wait several years. The world’s attention and resources focused on the war in Europe.

After the war, in 1920, Lt. Cosme Rennela of the Italian Air Force picked up where Boland left off. Rennela transported three aircraft, two French and one Italian, to Venezuela. He put on a few aerial exhibitions in Caracas and then flew his Harriot HD-1 west to Maracay, then the country’s political center. Rennela put his Harriot down on Maracay’s race track and went to work promoting his planes.

Rennela’s efforts renewed interest in aviation. The Venezuelan government bought the three planes from Rennela and immediately began plans for an aviation academy in Maracay, chosen for its clear skies and flat terrain. It was, according to official documents, “a hospitable nest to eagles for their first attempt to flap their wings at the sun.”

On 10 December 1920, the Military School of Aviation was solemnly declared operational. The date officially marks the beginning of Venezuela’s air force.

Much has happened in the last seventy years. Maracay’s race track, not long after Rennela landed there, was turned into an air field for training pilots. Today it is the home of Venezuela’s aviation museum. The museum’s grounds and freshly restored 1920-vintage hangar contain an impressive and international array of aircraft: American P-47 Thunderbolt, B-25J Mitchell, Stearman, B-5 Sikorsky helicopter, BT-13 Valiant, AT-11 Kansan, F-86F Sabre; British DeHavilland Dove, Vampire, Venom, and Canberra; Italian-built F-86K Sabre; and a rare French Breguet Bre 27-3.

As he escorts visitors through the museum, Col. Juan Flores, the curator, pauses a little longer at the planes that hold special meaning for him. In front of the F-86F Sabre, one of his favorites, he stops to make a point: “You can see by all these planes and the displays inside that France, Italy, Germany, England, the United States, and Canada have been important to our aviation history. But the lead roles in this history were always played by Venezuelans.”

One of the air force’s greatest achievements came in the early ’50s, when it took the technologically bold step of converting to an all-jet fighter force. By converting from P-47 Thunderbolts to British Vampires and Venoms, the VAF was the first air force in South America to make a complete transition to jet-powered fighters.

Trading props for jets may have been a bold move, but it was not rash. Jet engines, in fact, made sense. They offered increased performance and were actually less complex than piston engines. Furthermore, the air force would have to maintain and operate for its fighter fleet only one type of engine instead of two. “The transition from props to jets was perhaps our greatest challenge,” explained General Montserrat, the VAF’s commanding general. “Technological advances have always presented challenges. But our air force has always been confident that it could meet those challenges.”

The transition from props to jets turned out to be just one more milestone in a long road of success. This history is not neglected in Venezuela’s air academy. There it is part of the coursework that motivates new generations to take on new challenges. The academy itself has come a long way in its seventy years. Six members were in its first class of 1920; the academy now handles several hundred cadets. Still located in Maracay, it is one of the most modern facilities in America, north or south. The school

Our air force has always enjoyed tremendous public support and respect. Thousands of requests come in every year for entrance into the academy.

Commanding General
Domingo Montserrat

It has always taken more than ability to be successful as a pilot. Pilots can have the greatest abilities, but if they don’t have will power, determination, and dedication, they will never make it.

Inspector General
Roberto Griuber
A pilot graduates from our academy carrying two bags— one bag of luck, which is full when he graduates, and one bag of experience, which is almost empty. A successful pilot uses his luck to gain experience. If a pilot wastes his luck, uses it up without gaining experience, he will most likely fail.
is run by General Bernardo Thomas, who himself has a keen understanding of aviation history.

"Of course we teach our aviation history," Thomas said. "It is a very popular class with our cadets. I think it is very important to know your heritage, to know where you came from so you have a better understanding of where you want to go. After all, it is our future that most concerns us here."

For the cadets, that future begins every day before sunrise. In a huge courtyard surrounded by several of the school's training planes on static display, the students perform calisthenics. After breakfast, many head for one of the many sport facilities around the campus. Others head for class. "Our academics have improved considerably over the years," explained Thomas. "Not long ago, our graduates left here to pursue a specialty. Now those specialties are taught in our academy. Our graduates are leaving with a specialty."

"From its beginning, the air academy has maintained the highest standards of discipline, competency, and physical conditioning," continued Thomas. "By concentrating on these basics, we have always been, and will always be, prepared to face new challenges."

While the academy provides the basics, it is up to the students to make the best use of the basics. Inspector General Roberto Gruher made this point and then held out his fists as if clutching two bags. "Success," he said, "depends on maintaining an equilibrium. A pilot graduates from our academy carrying two bags – one bag of luck, which is full when he graduates, and one bag of experience, which is almost empty. A successful pilot uses his luck to gain experience. If a pilot wastes his luck, uses it up without gaining experience, he will most likely fail."

Col. Arturo Garcia is one of those pilots who managed to make the most of his luck. Today he is the commander of Venezuela's F-16 fighter squadron – Group 16. "To become a fighter pilot, that's the highest achievement for most students in the academy," explained Garcia. "But then you can understand that I am a little biased," Garcia grew up in a farming community in the plains of Venezuela. "When I was a young boy, I would run outside when I heard a plane. I would point to the sky and say 'some day I'll be up there.' Some dreams come true."

Garcia entered the academy never having flown in an airplane. "The first time I touched an aircraft, I had to fly it," Garcia said. "That first experience of leaving the ground is something that you carry forever."

Such experiences are not uncommon in the academy. Maximiliano Hernandez also left the ground for the first time in a Stearman as a cadet. "It was unforgettable," Hernandez said. "To be seated on the air, to see familiar objects from a completely unfamiliar perspective, to have that huge horizon in front of me, to feel the force of the air hitting me on my face and chest, to hear the engine roar as we performed maneuvers, those are the things that are still fresh in my memory forty years after that first flight."

Today, Commanding General (Ret) Hernandez reflects on his long career. He is most proud of the part he played in getting the F-16 for Venezuela. "It was a struggle," said Hernandez. "We had to convince our political and military leadership that we could maintain and operate such a sophisticated airplane. I'm very satisfied with the results."

Those results include an outstanding safety and maintenance record. Though it has operated the F-16 since 1983, the VAF has never had a major accident or lost an aircraft. Not long after the F-16s arrived, Venezuelan technicians

**Our academy has improved considerably through the years. It has kept pace with advances in technology and supplied our military aviation with the smartest and strongest graduates.**

Air Academy Director
General Bernardo Thomas

**Venezuela has always had a relatively small air force. What we lack in size, we make up for with versatility and skill. Our fighter pilots must perform both air-to-air and air-to-ground missions.**

Commanding General (Ret)
Carlos Finaud

**The history of our air force can be seen as a series of technological challenges that we have dealt with successfully. Many political leaders thought we met our match with the F-16; they said it was too advanced. I'm happy to report that our record remains intact.**

Commanding General (Ret)
Maximiliano Hernandez
assumed complete responsibility for maintaining the planes. "The transition to the F-16 was easy because we have qualified people," said Carlos Pinaud. "And we have qualified people because we have an excellent educational system. The technicians we sent to F-16 training in Fort Worth had already completed seven to ten years of technical training here in Venezuela."

Pinaud, who is a former commanding general of the VAF, played a major role in the program's inception. "I followed the development of the F-16 closely," he said. "When I read about the XF [export fighter] program in an Air Week article, I knew it was an opportunity to get the plane for our country. You see, we have always had a need for planes that could carry out a number of roles. The F-16 was the best choice."

The F-16 program is just another success story for the VAF. A look around the air base near Maracay at Palo Negro, where the F-16s are based, reveals many other success stories. C-130 transports take off regularly for destinations domestic and foreign. French Mirage IIICs rumble down the runway and into the sky to perform air defense and reconnaissance missions. A variety of helicopters keep silent at the base to a minimum.

In major cities, cab, buses, and private vehicles are plastered with aircraft stickers. Airplane T-shirts and posters appear everywhere, especially in Maracay - home of the country's air force. "Those are displays of the public acceptance of our air force," said Domingo Montserrat. "The general public is very proud of our achievements. As commanding general of the air force, I find these displays personally gratifying. Our air force plays an integral role in our society."

The relationship between military aviation and the general public has been close from the start. Venezuela's thriving commercial aviation industry has its roots in the military. In the '30s, the country's first commercial transport airline (Aeropostal Venezolana, which still operates today) consisted of former military aircraft. In the early years, military pilots flew the planes.

For geographic and demographic reasons, aviation plays a vital role in Venezuela's economy. Most of the country's population is near the coast in the north. Most of its natural resources are in the south. The regions are separated by mountains and tropical forests. Military transports continue serving outposts in the Amazon in the southern extremes of the country, where there are few roads.

"Today, the relationship between civil aviation and military aviation is better than ever," said Jose Vicente Zapata, former director of civil aviation in Venezuela. "We have common interests, and we work together on common goals."

"We are a resource-rich nation," explained Zapata. "We are one of the world's biggest producers of petroleum. We also have large mineral reserves. We are the richest nation in South America. Our biggest concern now is to make better use of our own resources, to become more self-sufficient."

Zapata believes that a strong commercial aviation industry is necessary for greater self-sufficiency. "The four branches of the military are generating a lot of business for our privately owned aircraft industry," said Zapata. "We are also benefiting from the experienced personnel who come to us from the military. Our military academies provide a first-rate technical education that can be put to use later in private industry. That too makes our country more secure and stronger."

Zapata runs a repair and maintenance facility for general aviation and light commercial aircraft. He is encouraged by the recent changes in his business. "We are getting more and more foreign customers for our work," he said. "And all of our work is now done by Venezuelan technicians. This has not always been true. In the past, we had to rely on foreign technicians. Then we required foreign training for our own technicians. Today, though we still receive help from other countries, we are training some of our own technicians."

"There are other signs of our country's success in commercial and general aviation," continued Zapata. "Ten years ago we didn't have a commuter airline. Today we have several. This is a good indication that we are doing the right things. Some day, we would like to manufacture our own airplanes. The steps we are taking now are leading us in that direction. And the relationship we have with the military will help get us there."

Historians aren't sure what attracted Frank Boland to Venezuela back in 1912. He may have been on a South American tour, enjoying the attention of crowds and making a little money on the way. He may have been an aerial evangelist, promoting the uses of manned flight. Whatever his intentions, his actions sparked a flame that still burns today. ■ EAH

To become a fighter pilot, that's the highest achievement for most students in the academy. To get there takes hard work, dedication, and determination.

Group 16 Commander Colonel Arturo Garcia

Commercial aviation and military aviation in Venezuela have always had common interests. I think our country's economic strength is tied to this relationship.

Former Director of Civil Aviation Jose Vicente Zapata
Step Into My Office, Please

By Joe Bill Dryden
Senior Experimental Test Pilot

Well, I guess I let the cat out of the bag about teaching an old dog new tricks in the last issue (Tricks Are Treats, October 1990). We were talking about the venerable F-16B#2, the second-oldest F-16 station wagon in existence and the oldest fully avionic-capable model F-16. Because some people think we make identical Fighting Falcons with cookie cutters, some suspect a subtle evolution, and still others try to keep up with imputed spectacular technological advancements, I wanted to tell you about specific changes in this one test aircraft to give you an idea

CODE ONE 11
of all the work and engineering genius that continually go into F-16s. Some of you particularly sharp-eyed fighter buffs have even asked me about the external changes you’ve noticed, so that’s why that discussion was limited to those changes on old B#2. Now I want to follow up with changes on the inside.

So, step into my office, please.

This is where it really gets interesting. F-16B#2 has bits and pieces of every F-16B/D ever made and a lot of pieces that have never been in another F-16. It is always a kick to get one of our visiting VIPs up to speed on just what he is looking at. Since the VIP would sometimes go in the front, we have had the engineering and maintenance folks duplicate many of the controls from the front seat that are not normally found in the back seat of a B model.

I can start the airplane from the back (there is a JFS switch) and/or shut it down normally with the throttle. (I would still need your help to get to the AB.) I can manually select the emergency power unit (EPU) from the back and/or tell if it is running. Although I can’t accomplish the check, I can monitor all the lights on the flight control test panel. In an effort to speed things along with some of the changes over to the OCU standard (the ones we thought would be needed in B#2), we put the data transfer cartridge (DTC) on the left in the back. The reason for that location is that there is not room in the front chair since that space is occupied by a 3/4-inch recorder. The space in the avionics bay that is normally occupied by the recorder is now taken up by a two-hour 1/2-inch VHS tape recorder.

The thinking is that the 3/4-inch format results in better quality pictures. So the guy in the front gets to change the cartridge every thirty minutes in flight if good pictures are desired. The only problem is that the installation was designed for a contortionist! You need a six-degree-of-freedom elbow in order to thread, open the door, remove and replace the cartridge, and then close the door. Needless to say I usually give the guest the option of just using the two-hour recorder in the belly. The instrument panel in the trunk is still pretty much production except that I can select the HUD view forward like the later two-holers. On the right and left side there are a couple panels for controlling the video recorders, turning neat systems like TERR-PROM on and off and controlling a nice system like ACTES. ACTES is a very useful tool for debriefing and acts very much like a self-contained ACMI range operation. You can use it on every local hop if you choose. Slick.

While I’m talking about the cockpits, I want to mention that we finally removed the Stencel seats and installed the ACES II seats like the production airplanes have. These seats are an interesting study as to how humans respond to real-world situations and not laboratory setups. How different seats in different airplanes feel to the pilot is the subject of an entire article in itself. Maybe I’ll get into that in the future.

The front cockpit is really different. Starting at the left aft you will notice that none of the “Falcon Rally” (mostly electrical) updates have been accomplished. So many of the electrical switches are different and you cannot directly check the condition of the flight control inverter batteries. Next you notice the flight control self-test panel looks a little different. Then you realize that the autopilot switches are also included on the panel. I think the only other F-16 left in this configuration is F-16B#1. B#1 is still at Edwards AFB doing yeoman service with high-angle-of-attack tests for two-seat F-16s. It is older than B#2 but never was equipped with all the avionic equipment, since it was intended to be a testbed for loads, stability and control, high angle of attack, etc.

Another subtle difference is that the air refueling and engine feed knob are reversed on the fuel panel. Furthermore, the air refueling switch is not a distinctive shape. The EPU switch is completely different, as it is still a knob and not a switch as in the production airplanes. It really is a potential trap, since not all of the interlocks are included as in the production airplanes.

The electrical panel really looks strange and takes some real study on your part until you are familiar with its operation. You would recognize the fire control nav panel but you would not be able to read many of the pushbuttons as they are all “well worn.” You can also get real lost going around the data knob dial as many things have been changed, added, or eliminated from the production rotary. This takes a lot of study before I would let you go on your own.

If you are really observant you will realize the engine control panel is longer than you remember and...SOMEONE STOLE THE MANUAL PITCH OVERRIDE SWITCH! When the airplane was first produced, the deep-stall possibility had not been predicted, as I have pointed out in various articles about the handling qualities of the F-16. As a result, the MPO switch is not in the normal location. The back seat has been changed so the switch is in the customary location but the seat in the pointy end of the airplane has the switch up on the left bulkhead.

UHF, radar, and IFP panels look normal, but, since the autopilot switches are in the rear, the left front side of the cockpit looks a little strange. So does the stores management set, since little items like selective jettison are still FD-4 configuration. C model WAC HUD is installed with the proper changes to the control panel, since the integrated control panel from the C/D is not necessary.

This is exactly like the HUD that is going in the late-model A and B we are presently producing. It would sure be a good idea to include them in the OCU and MLU upgrades for the A/Bs. At the base of the combining glass is the sending unit that serves to turn the NVGs on and off when you are trying to look at the FLIR picture on the HUD. It is a great idea that I have talked about in detail in earlier Code One issues.

There is the stick grip in both cockpits from a Block 25 C model to give us more switches to use with some of the systems test we are flying in the airplane.

There is a strange panel in the right front part of the front cockpit to allow the pilot to turn the video camera on the HUD on and off, and to select what is being displayed on the raster part of the HUD. This same panel allows the pilot to
select which system (either the HUD or the HMD) has priority when viewing the world straight ahead.

Since this is an FSD airplane, the Cat/I/III switch has been added as an afterthought on the right side of the cockpit (for you guys who worry about these sorts of things).

The panel for controlling the various head-steered FLIRs that we have been flying is located on the right side. In addition, if you didn’t notice it when you looked at the rear cockpit, you will see that there is one additional switch on the interior lighting panel to control the NVG lighting in the airplane. This is one additional area where the configuration has been changed several times. In an effort to develop “NVG-compatible lighting” we went through several different approaches to the problem. Many different types of filters were tried. Electroluminescent (gesundheit!) strips and/or flood lights went into and then out of the cockpit. Many different bezels over the faces of the instruments was another item we looked at. What the majority of them did was to simply add additional heat to the cockpit. We finally arrived at the solution I described earlier by providing a hands-on switch to the pilot so that he can turn all the incandescent lights off or on as he desires. I think too many people have the mistaken idea that if you provide a “NVG-compatible cockpit” the pilot will be able to read the cockpit instruments directly through the NVGs. Nothing could be further from the truth.

It is a physical impossibility to be able to read anything in the cockpit through the goggles. You must look under/around the goggles to see into the cockpit, which is easy to do with the “Cat’s Eyes” type of goggles but next to impossible with the ANVIS approach to NVGs.

There is one additional panel you might not recognize that we use to get power to the radar altimeter and the hard points on the inlet. Otherwise the rest of the right side is simply a rearrangement of the panels you are used to seeing except for that damnable 3/4-inch recorder leering out of the right rear corner of the cockpit.

Well...Did you remember all of that? There have been a lot of changes to B#2 as it has moved along. We have certainly learned a lot about what works and doesn’t work in the dark with B#2. All of our candidates for close air support have also been investigated with B#2. Furthermore we have done it in a lot less time and spent a lot less money than others. So, again, my hat’s off to the talented engineers, supply folks, and maintenance personnel who make my work fascinating – every time I step into the office. Check Six! ■
Although the world is changing fast, one thing remains constant: America must remain dominant in the sure-to-be-troubled skies of the 21st century. That’s why, just a little more than four years ago, thirty-five key people from Lockheed, Boeing, and General Dynamics got together in secret to plan a new fighter aircraft for the United States Air Force. You see the prototype of that new aircraft here, the result of that first meeting, engaging in rigorous tests as we go to press. The all-new Advanced Tactical Fighter meets or exceeds the requirements for a high degree of stealth, supercruise speeds without the use of afterburner, and total situation awareness.

Interestingly, since the Aeronautical Systems Division has chosen not to put YF-22 prototypes into USAF inventory, this aircraft carries tail number N22YF, a civilian experimental aircraft identification.
DIAL-A-PLANE

VISTA/F-16

As Quick-Change Artist

By Joe Stout

Imagine an airplane that can change itself in flight. It leaves the runway as an F-16D and flies to an assigned altitude. Then it’s an Advanced Tactical Fighter – let’s make that two Advanced Tactical Fighters. It cruises for a while as the F-23, then changes to the F-22. The next thing you know it’s an F/A-18. Finally, before landing, it becomes the X-30 National Aerospace Plane.
We know about multirole fighters, but this seems ridiculous. So how about an airplane that just thinks it can change itself in flight, and that makes its pilot think that too? The Variable Stability In-Flight Simulator Test Aircraft now being built here -- the VISTA/F-16 -- will be able to replicate the handling qualities of all the aircraft mentioned above, plus many others, for a virtually unlimited number of types. Software will make it possible to change from one to the other merely by pushing buttons.

For example, if a test pilot is working with control laws simulating the F-23 but wishes to compare them to something he remembers from flying the F-22, all he has to do is ask his backseater to tell the computer. Or he might say, "I once flew an airplane that did such and such. Can this machine do that?" The answer will almost always be yes.

The VISTA's true identity is a modified, Block 30 F-16D based on the airframe design of the Israel Air Force version, which incorporates a dorsal fairing running the length of the fuselage aft of the canopy and a lightweight landing gear derived from the Block 40 F-16C/D. The fairing houses most of the variable-stability equipment and test instrumentation. The lightweight gear will permit simulation of aircraft with higher landing sink rates than a standard F-16.

The aircraft is minus the gun system and some of the F-16's standard military electronics. It retains the advanced APG-68 radar and incorporates the Block 40 version's digital flight control computer and avionics suite.

The cockpit arrangement is unique among F-16s. The front seat is the simulation cockpit, to be occupied by the pilot flying the test. The rear cockpit is the primary flight control station. Its control priority will allow the backseater driver to take command and return the aircraft to normal F-16 behavior if the front-seat "experimental" pilot encounters problems.

Pilots of existing variable-stability aircraft call it "punching off," as opposed to punching out, when the rear-seat test conductor -- also called the safety pilot -- takes control.

The rear pilot also controls the variable-stability equipment and initiates its engagement or software selection during flight. The front cockpit is equipped with both a standard side stick and a removable, variable-feel center stick, for use depending on the type of aircraft being simulated. The front cockpit will eventually be equipped with a programmable HUD and other variable displays to further increase the realism of the simulation.

The variable-stability equipment suite is a complex mix of digital and analog electronics. "It's like a sophisticated autopilot, because it takes control of the airplane like an autopilot would, except that the pilot still makes manual inputs," explained Dr. Philip A. Reynolds, program manager for the variable-stability system that goes into the VISTA/F-16. Reynolds works at Arvin Calspan Corporation in Buffalo, New York, where the system is being developed.

The heart of the variable-stability system is three high-speed, flight-rated, 32-bit Hawk 32 computers manufactured by Boll. The key to the aircraft's unusual capability is a process called response-feedback stability augmentation, which changes the static and dynamic flight characteristics.

"All of this gear will measure how an F-16 would fly and force it to fly like the airplane being simulated," Reynolds said, making a complex chain of interfaces and safety interlocks sound simple.

Expressing the VISTA capabilities another way, he compared the VISTA/F-16 to "a ground simulator in the sky that produces all the required motions with none of the washout that you get in a motion-based ground simulator." (Motion washout or dampened response is notoriously unpopular with fighter pilots, which is one of the reasons General Dynamics chose visual-scene-only simulators for its engineering flight simulator laboratory.)

The VISTA/F-16's brain will be able to hold 200 different conventional aircraft types and ten experimental or "test" airplanes, such as the X-29 or X-30. The VISTA platform will be used in a variety of test scenarios: training for pilots at the Air Force and Navy test pilot schools, evaluation of control laws, preflight testing of developmental aircraft, correction of faults found in flight tests, and others.

General Dynamics is the prime and integrating contractor for the VISTA/F-16. We are currently completing assembly of the basic airframe and working on the necessary modifications. An engineering ground simulator is also being built. Most of the variable-stability equipment has been delivered and integrated in the simulator "hot bench" and cockpits in the division's Flight Simulation Facility, where software development and preflight tests will be completed.

Rollout of the aircraft is expected during the second quarter of 1991, with first flight planned in late summer.

Calspan currently operates three variable-stability aircraft -- a company-owned Lear 24, the NT-33A, and the Convair NC-131H. The VISTA/F-16 will replace the Air Force NT-33A, which has been in service since 1957 and has one computer with about one-tenth the capacity of the VISTA's. The one-of-a-kind NT-33A, a Lockheed T-33 derivative, was used recently to develop and evaluate the fix for flight control problems. The problems caused the crash of the first Swedish Gripen prototype in early 1989. The NT-33A was also used in YF-22 development.

The NC-131H Total In-Flight Simulator (TIFS) is a converted turboprop airplane that has been used to simulate a variety of aircraft for more than
twenty years. Major programs that employed the TIFS's services recently included preflight evaluations of the YF-23, B-2, and X-29.

The Air Force and Navy test pilot schools use the variable-stability airplanes extensively in familiarizing students with the handling qualities of different aircraft types. All test pilot school graduates in the last three decades have flown the aircraft.

Pilot Joe Sweeney flew variable-stability aircraft at the U.S. Navy Test Pilot School and for Calspan before joining General Dynamics. He said variable-stability aircraft are unequalled for teaching stability and control laws, developing flight control laws, and evaluating handling qualities.

"You can literally give a pilot or an engineer a physical look at an enormous amount of textbook-type material in a two-hour flight," he said. "Even more importantly, you can expose both student and project test pilots to potentially uncontrollable flying characteristics in a completely safe, exploratory manner.

"VISTA promises to greatly expand the performance envelope that the NT-33 presently offers for this instruction, research, and development," Sweeney said. "It will allow designers to be that much more sure of a new aircraft's handling qualities before the prototype or developmental version ever lifts off the ground."

"Imagine an airplane that can change itself in flight... before landing, it becomes the X-30 National Aerospace Plane."
A CONCISE HISTORY OF THE X-PLANE

By Jay Miller
The Bell X-1, nicknamed Glamorous Glennis, became the first manned aircraft to fly faster than the speed of sound and return its pilot safely to earth. The October 14, 1947, flight over Muroc, California, was a turning point in the history of aviation technology and the start of an exotic aircraft family that continues to generate offspring to this very day.

Encompassing no fewer than thirty-one basic designations and at least 258 individual specimens, this elite family of flying machines has served to expand the boundaries of flight into literally every conceivable corner of the envelope. Invariably hand-built and produced in very
limited numbers, the members of this group were, and still are, real pathfinders.

The complete histories of all X-designated aircraft would fill many volumes. They were not only the first aircraft to fly at super-sonic speeds, but also the first to utilize a variable-sweep wing in flight; the first to fly higher than 100,000, 200,000, and 300,000 feet; the first to use exotic alloy metals for primary structure; the first to test gimbaled jet and rocket engines; the first to use jet thrust for vertical-attitude flight; the first to fly three, four, five, and six times the speed of sound; the first to test control theories of boundary-layer airflow over an entire wing at transonic speeds; and the first to do an endless number of greater and lesser deeds - all for the enrichment and benefit of the aerospace sciences. The X-planes were the vehicles that trans-formed theory into hardware, and whose performance, in turn, led to new theoretical possibilities.

Here is a family portrait of all the X-planes and a brief summary of their characteristics and contributions.

Bell X-1
(flown from 1946-1958)
A total of six rocket-propelled X-1s were built, three first-generation and three second-generation aircraft. The first generation, which included the machine flown during the first supersonic flight, was designated simply X-1. The first two were almost identical; the third had a different windscreen and powerplant arrangement. The second-generation planes were larger and had redesigned cockpit windshields and canopies and were individually identified as the X-1A, X-1B, and X-1D. The X-1C, which was to have been a high-speed weapon system testbed, was not built. All six aircraft were used for high-speed/high-altitude research and were instrumental in expanding the boundaries of transonic aerodynamics and inertia coupling phenomena. The X-1 that broke the sound barrier is displayed at the National Air & Space Museum in Washington, D.C.; the X-1B is displayed at the USAF Museum in Dayton, Ohio.

Bell X-1E
(flown from 1955-1958)
The second of the first-generation X-1s was remanufactured into a new configuration with a completely new 4-percent-thickness/chord-ratio wing and other modifications. The plane was used to test thin airfoil sections at transonic and supersonic speeds. It is on display at NASA Dryden, Edwards AFB, California.

Bell X-2
(flown from 1952-1956)
Two rocket-propelled X-2s were built, but only the first survived long enough to enter the powered portion of the flight test program. This aircraft eventually became the first in the world to fly three times the speed of sound. During that history-making flight, it was lost to inertia coupling. The plane contributed to the study of high-speed aerodynamics, exotic (stainless steel and K-monet) alloys, and first-generation fly-by-wire flight controls. (The last were not used during actual flight tests.) No surviving examples.

Douglas X-3
(flown from 1952-1956)
Perhaps the most exotic-looking of the early X-planes, the jet-propelled X-3 (two originally were ordered but only one was completed) proved seriously underpowered and very difficult to fly. Hoped-for Mach 2-plus cruising speed proved far beyond the aircraft's real capabilities. After a test program at NACA, it was grounded. The plane was the first to use titanium in high-heat-sink structures (wings and empennage) and was also used to explore inertia coupling phenomena. The plane is displayed at Dayton.
Northrop X-4
(floated from 1948-1953)
Two of the diminutive jet-propelled X-4s were built and test-flown to explore transonic phenomena in tailless, swept-wing configurations. The planes were used to study flow-separation phenomena, transonic instability, Mach tuck, and related aerodynamic anomalies. One of the aircraft is displayed at Dayton; the other is being restored at the Air Force Academy in Colorado Springs, Colorado.

Convair X-6
(not built, but explored from 1951-1957)
Preceded by the NB-35H reactor systems testbed, the X-6s were to have been two highly modified B-36 bombers, each equipped with a nuclear reactor serving as the heat core for two nuclear jet engine configuration options. The aircraft were never completed because of numerous technological and environmental difficulties.

Bell X-5
(floated from 1951-1955)
Two jet-propelled X-5s were built and test-flown specifically to explore the attributes of variable-sweep wings. The second aircraft was lost during the flight test program when it entered a spin from which it could not recover. The plane contributed to the mechanical technology and aerodynamics of variable-sweep wings. The surviving aircraft is on display at Dayton.

Lockheed X-7
(floated from 1951-1960)
Unmanned ramjet-powered test vehicle optimized to explore high-speed flight and test systems, materials, and aerodynamic options. Vehicle was fully recoverable and reusable. Maximum speed achieved (which remains a record for conventional ramjets) was 2,881 mph. Surviving aircraft are on display at several locations around the United States.

Aerojet General X-8
(floated from 1947-1956, though the same basic design under different names continues to be floated to this very day)
Unmanned rocket-propelled research vehicle and sounding missile. Optimized to carry a huge variety of payloads to upper atmospheric and transatmospheric altitudes. Surviving samples are on display at locations around the United States and elsewhere.

Bell X-9 Shrike
(floated from 1950-1959)
Unmanned rocket-propelled scaled testbed for Bell GAM-63 Rascal air-launched cruise missile. Designed to test Rascal remote control systems but eventually proved successful enough to merit a study calling for its conversion to warhead-carrying weapon on its own. No surviving examples.
prove operational viability of basic Atlas design and associated reentry vehicles. No surviving examples.

**Ryan X-13**
*(flown from 1950-1958)*
Diminutive, jet-powered vertical-takeoff-and-landing testbed. Two of these successful, archetypal tail-sitting VTOL jet aircraft were built. Pioneered vectored thrust, high thrust-to-weight ratios, vertical attitude takeoff, and associated VTOL-related instrumentation. The program was successful, but failed to generate follow-on contracts. The first aircraft is on display at the San Diego Aerospace Museum; the second example is displayed at Dayton.

**Convair X-12**
*(flown from 1958-1959)*
Pre-production series Atlas-A intercontinental ballistic missile testbeds. Served to
Bell X-16
(not built, but explored from 1954-1956)
Cover designation for a highly classified high-altitude twin-jet-engine reconnaissance aircraft designed to fly with impunity in unfriendly airspace. Eventually superseded by Lockheed U-2. Program was cancelled before prototype completed.

Lockheed X-17
(flown from 1955-1957)
Designed to test blunt reentry vehicle test shapes for forthcoming intercontinental ballistic missiles. Multiple-rocket design permitted extremely high speeds to simulate reentry dynamics. At least one surviving example in storage at Davis-Monthan AFB (AMARC), Arizona.

Hiller X-18
(flown from 1959-1961)
Turboprop-powered VTOL transport testbed. Original full-scale tilt-wing design. Was world's largest VTOL aircraft at time of debut. Control system and related difficulties curtailed flight testing. The one aircraft was eventually scrapped.

Curtiss-Wright X-19
(flown from 1963-1965)
Turbine-powered VTOL transport testbed optimized to test theories of propeller side-force and associated lift options. Special propeller created to facilitate this investigation. Program cancelled following loss of first prototype. Second aircraft eventually scrapped prior to initiation of flight test program.

North American X-15
(flown from 1959-1968)
Perhaps the most successful single X-plane research program. Was first manned aircraft to reach Mach 4, Mach 5, and Mach 6; and was first manned aircraft to achieve altitudes of 200,000 and 300,000 feet. Explored metallurgy, structure, aerodynamics, propulsion, human physiology, and many other aspects of high-speed/high-altitude flight. Major contributor to space program. One aircraft lost in accident; one on display at Dayton; one aircraft on display at National Air & Space Museum.
**Boeing X-20 Dyna-Soar**  
(project cancelled during 1963 before first aircraft was completed)  
Boosted orbital glider, similar to today’s Space Shuttle, though considerably smaller. Optimized for military reconnaissance and bombing missions. Program cancelled partly in response to success of Project Mercury space capsule.

**Martin Marietta X-23**  
(flown from 1966-1967)  
Designed to test configurations, control systems, and ablative materials for hypersonic lifting-body-type reentry vehicles. Used Convair Atlas as launch vehicle. Three flights, two of which were successful. At least one surviving example on display at Dayton.

**Northrop X-21**  
(flown from 1963-1964)  
Two highly modified Douglas B-66s equipped with special laminar-flow-system-equipped wings. Technology proved viable, but impractical because of dust, insects, and other contaminants. Aircraft presently serve as targets on photo test range at Edwards AFB.

**Bell X-22**  
(flown from 1966-1984)  
Successful, ducted, propelled VTOL testbed. One aircraft lost in accident; second aircraft survived and presently is being stored for museum in Buffalo, New York, area.

**Martin Marietta X-24A/B**  
(flown from 1967-1975)  
X-24A conceived as a manned vehicle to explore the low-speed-flight characteristics of the maneuverable lifting body design; X-24B, which was modified X-24A, was designed to explore lifting body characteristics in transonic and supersonic parts of the envelope. An X-24C, with near-hypersonic capabilities, was proposed but never built. X-24B currently is displayed next to jet powered SV-5P (modified to look like X-24A) at Dayton.

**Benson X-25**  
(flown during 1968)  
Gyrocopter designs optimized to explore the parameters outlined in the Air Force’s Discretionary Descent Vehicle (DDV) program. Navy interest also explored. Basic concept was to build emergency egress system wherein the pilot could continue flight in gyrocopter-type ejection seat and land in safe territory. X-25A and X-25B are both at Dayton.

**Lockheed X-26A/B**  
(flown from 1967-1973)  
X-26A was basic Schweizer SGS 2-32 sailplane used by...
Navy for roll-coupling training of neophyte aviators; X-26B was Navy-assigned designation of two piston-engined QT-2PCs turned over by Lockheed and associated intelligence agencies/DoD, also for use in roll-coupling training. Original QT-2PC concept was for a quiet observation aircraft. One X-26A is thought still to be in use by Navy at Test Pilot School; surviving X-26B is on display at Fort Rucker.

**Lockheed X-27 Lancer**

(not built, but explored from 1961-1971)

Cover designation for a proposed advanced F-104 Starfighter derivative with high-wing and other major modifications. As CL-1200, found to be competitive with forthcoming F-15 program, so funding was denied and program died before prototype could be built.

**Pereira X-28 Osprey I**

(flown from 1970-1971)

Piston-engined homebuilt tested to explore the potential usefulness of a small, single-place seaplane for civil police patrol duties on canals and rivers of Southeast Asia. Program received no financial backing following completion. Aircraft currently displayed at U.S. Marine Corps Aviation Museum in Quantico, Virginia.

**Grumman X-29**

(flown from 1984 to present)

Forward-swept-wing technology testbed. Continues to explore fly-by-wire, composite construction, and related high-tech systems in high-performance, highly maneuverable airframe. First prototype presently in storage at Edwards AFB. Second prototype continues in flight test, also at Edwards.

**X-30**

(still under development)

Referred to somewhat generically as the National Aerospace Plane, this is a consortium effort by several major U.S. aerospace manufacturing concerns (including General Dynamics) to develop a true transatmospheric vehicle that can take off like a conventional aircraft, accelerate to orbital velocities, enter orbit, and eventually return, all without being encumbered by non-reusable booster rockets, fuel tanks, or related assemblies. To be powered by hydrogen-fueled supersonic combustion ramjets or related systems.

**Rockwell International/Messerschmitt Blohm X-31**

Designed to break the so-called stall-barrier, to permit close-in aerial combat beyond normal stall angles of attack. Aircraft is equipped with a vectorable exhaust, pitch-controlling canards, and a sophisticated fly-by-wire flight control system. Two aircraft, with the first delivered March of 1990.

The author, Jay Miller, owns Aerofax, Inc., a noted aviation book publishing company based in Grand Prairie, TX, which specializes in aircraft monographic histories. Miller wrote and produced *The X-Planes for Orion*, Books of New York. This book, from which this Code One article is derived, is considered the definitive history of the X-designated aircraft family.
Take the wire! During a recent deployment of the 183rd Tactical Fighter Group, Illinois Air National Guard, ten of the unit’s Civil Engineering Squadron personnel emplaced a BAK-12 mobile aircraft arresting system (MAAS) to ensure safe operation of their F-16 Fighting Falcons. Transported from Volk Field ANG Field Training Site, Wisconsin, to rural Quincy-Baldwin Airport in western Illinois, the BAK-12 provided a necessary margin of safety during 183rd bare-base force projection flight ops. Only two of these systems are available to the ANG. The other is located at Eglin AFB, Florida.

Following placement of the BAK-12 modules on each side of the runway and laying of the arresting cable between the units (it takes about an hour and a half), a 183rd TFG F-16 taxiing at approximately 95 knots hooked the cable to test the system’s ability to trap a speeding Falcon. Unlike the arresting “jerk” experienced by carrier pilots, the BAK-12 MAAS gently (but very firmly) spooled out its straps, bringing the fighter to a controlled stop.

BAK-12s are anchored by an array of stakes driven into the ground during setup, so each emplacement must be certified by actual aircraft engagement prior to initiation of sustained flight ops. A fully loaded Fighting Falcon is well within the gross weight limit of a properly planted BAK-12 system. F-16s and BAK-12s—what a team for forward area air operations from minimum-length runways.

From Bob Roskusk, a freelance writer in Fort Wayne, Indiana.
Farnborough Airshow. F-16 Test pilot (you can still call me Show Pilot, if you want to) Bland Smith and Chief Test Pilot Steve Barter wow record crowds in England with an all-new flight routine.

Desert Shield. F-16s and F-111s go to Saudi Arabia in support of Operation Desert Shield.

Indonesia. Indonesia takes delivery of the last four of its initial twelve F-16s.

NASP notes. Small wings and twin vertical tails are selected for the baseline configuration for the X-30. The baseline was derived from six configurations produced by General Dynamics, McDonnell Douglas, and Rockwell. (See back cover for artist concept.)
17 October '90

Dear Sir:

In July of this year the 177th was chosen to escort the Soviet MIG-29's on their historic air show tour of the USA. We escorted them from Kalamazoo, MI, to Rockford, IL, to Dayton OH, to Winnipeg, Canada.

This mission was truly a great honor for the unit, and a most enjoyable experience. This was a unique situation where our best fighter aircraft and the best Soviet aircraft flew side-by-side in a peaceful environment. We noted with great pride the excellence of the F-16 compared to the MIG. The Soviets greatly admired the F-16's excellent aerodynamic design, made possible by precision machining, excellent light weight due to high tech composite materials, and our superb engine performance made possible by a fan engine and exotic materials her section. All a tribute to American technology.

I am enclosing some of our photos from that historic mission in case you desire to include one of them in your fine magazine.

Best Wishes,

[Signature]

Col. VICKERS-HAUSEN
Group Commander

NEW JERSEY AIR NATIONAL GUARD
Headquarters, 177th Fighter Interceptor Group
Langley Road
ARMS, ACY 160
Pleasantville, N.J. (08232-8829)
Following friendly foes. New Jersey Air National Guard’s 177th Fighter Interceptor Group escorts a Soviet MiG-29 on its first airshow tour in the United States.

ATF first flight. YF-22 No. 1 – the designation for the General Dynamics/Lockheed/Boeing team’s General Electric-engine-powered version of the Advanced Tactical Fighter – completes its first flight. The first flight was from Lockheed’s factory in Palmdale, California, to Edwards AFB.

Another ATF first flight. The first flight of YF-22 No. 2, equipped with the Pratt & Whitney engine, takes it from Palmdale, California, to Edwards AFB. Two days later, the same plane completes two more flights.

Fast CAS demo in Syracuse. The 174th Tactical Fighter Wing of the Syracuse Air National Guard in New York demonstrates fast close air support with live fire power before Soviet Chief of General Staff.

Operation Sung Gung ’90. The 162nd Squadron of the Republic of Korea Air Force takes top honors in the top gun competition. The F-16 squadron also receives honors for best flight and for individual top gun pilot.

Aggressors decommission. The 64th Aggressor Squadron at Nellis AFB in Nevada decommissions. The squadron’s six F-16s are reassigned to the 4440th Tactical Fighter Training Group at Nellis.

F-111 DFCS test completed. FB-111A #68-254 heads home to Fort Worth after a successful flight test program in the desert at Edwards AFB. The plane completed 124 sorties during sixteen months to test the prototype digital flight control system. The digital Aardvark will be used in more tests in 1991 to integrate a standard flight data recorder for the USAF.
LETTERS

Writer, Reader, Wheeler-Dealer

As a long-time admirer of General Dynamics and its success as a global corporation, I was delighted to come across Code One Magazine some years ago. I make it a point to read every issue, because it tells not only what you guys are doing, but also keeps me informed about the aerospace industry. And, I love the historical stuff you do.

I was particularly impressed with your interview of Dr. Hans Mark. We are blessed with great educational institutions here in Texas, and Dr. Mark is a splendid spokesman. I share his hope and vision for the future. The future can be bright, as Ross Perot, Jr. said in your pages a while back.

But there is a lot of work to do. I have just finished a book in which I talk about what we must do to ensure our global competitiveness in the new, borderless global economy. I have completed business transactions in over sixty-seven nations in the last thirty years, and that experience was used as a base for observations about where we are going and to suggest ways for budding entrepreneurs to get there. In my book I used Code One as a reference, and talked about examples of “partnering to win” in the new world economy.

General Dynamics continues to lead the way in quality, international marketing, and innovative thinking. Code One Magazine is unlike anything I have ever seen come out of a multinational corporation, and I salute General Dynamics and you for a job well done.

Jack Enen, Jr.
Dallas

Editor’s note: Mr. Enen’s reference is to his new book, Venturing Abroad - International Business Expansion via Joint Ventures, published this month by Liberty Hall Press, a subsidiary of McGraw-Hill.

“War Stories” Revisited

I have just read “Top Knife” in the October issue of Code One. Dr. Bill Fridinger and his cohorts are to be commended for the effort in conceiving and bringing to fruition a fascinating program.

There are so many benefits from such a program. Not only does it permit the flight surgeon to better understand the stresses of flight, acquaint the flight surgeon with the real world of the fighter pilot, but enable the flight surgeon to eat, sleep, and live in the milieu of the fighter pilot. The latter aspect is usually only experienced in the combat setting.

It is the combat setting that proves the real worth of the flight surgeon. The most recent experience of this was demonstrated in Viet Nam. Our young flight surgeons performed admirably in Viet Nam, but few realized the value until the actual experience. Top Knife provides some of that same experience that will be valuable in any future conflict.

To live with and fly with fighter pilots is the only way to understand and be able to care for the flyer in a realistic way. Please insure that Dr. Fridinger receives my compliments, as he should from all that become aware of his innovative thinking and perseverance. He has made me homesick for the days I once knew living with an exciting group of flyers. My “war stories” have been revisited because of him. Code One should be commended for a great presentation.

George E. Schafer
Lt Gen USAF MC (Ret)
San Antonio, Texas

Twain Mark Letters

Just wanted to let you know that I thoroughly enjoyed your interview with Hans Michael Mark in the October issue. I am already looking forward to getting to know your next guest!

I also would like to compliment Mr. Ben Juarez on his impressive work. You must feel fortunate to have such a talented artist on your staff.

Ipek Ucuca Martinez
Turkish Liaison Office, F-16 SPO
Wright-Patterson AFB, Ohio

I just had the pleasure to see a copy of your publication Code One, which I found particularly interesting and appealing. I think this is a remarkable magazine and I would like to alert a few scientists and technologists to its existence.

Please accept my congratulations for your wonderful issue of Code One.

Herman Mark, Dean Emeritus
Polytechnic University
Brooklyn, New York

Welcome Aboard

It is a real pleasure to learn that you are beginning the fifth year of Code One Magazine. My colleagues and I convey our warm thanks to you and all your staff for your thoughtfulness, and seize this precious opportunity to ask you to write our name on the already long list of your customers and friends.

Amadou Ousmane Guitteye
National Civilian Aviation
Republic of Mali
Brave Bessie Remembered

There were a number of errors in the biography Bessie Coleman’s sister wrote after Brave Bessie’s death and several are repeated in “Above the Cotton Fields” in your October issue.

For instance, Checkerboard Field (not Aerodrome) was not Chicago’s Municipal Airport. Checkerboard, in Maywood, west of Chicago, was the airfield used by Lindbergh and where Jack Knight landed after his famous flight. Across the street, at Hines Veterans Hospital, is a building now used as a warehouse, but an incised, gold-filled sign still reads “Air Mail Service.”

Checkerboard Field, now part of the Cook County Forest Preserves, still is an airport, but for powered model airplanes. On weekends, the roar of the propeller planes still can be heard. Just north of the field, in Miller Meadows (named for a former CCFP commissioner), is a large boulder with a bronze plaque commemorating the many airmail pilots who flew from the area.

Rufus Hunt, an FAA employee at the Chicago Air Traffic Control Center, is the pilot who annually leads the planes which drop flowers over Bessie’s grave. You might note that Marion Coleman and others, including me, are promoting a new airmail stamp of Brave Bessie. We hope it will be issued during a Black History Week.

Enjoy reading your magazine, particularly the people features.

Marjorie M. Kriz
Evanston, Illinois

Editor’s note: Thanks for the details about the Windy City. So little about Bessie Coleman is in print (she is ignored altogether in most histories) that author Derouen acknowledged the difficulty before accepting the assignment.

Usefully Yours

Code One Magazine is useful to discharge the duties and responsibilities of aviation in general. The articles are of interest to flight safety inspectors and all are interested to receive the magazine without interruption.

Bekele Serbessa
Civil Aviation Authority
Ethiopia

Notes from the Middle East

For flight surgeons steeped in the lore of the F-16, your feature article in the October Code One was impressive. “Top Knife” emphasized what to us is well known: to fly it is to know it; to know it is to love it; and to love it is to take the best possible care of its pilots and their families and maintainers.

I was privileged to be a flight surgeon for four years at MacDill and flew just over 150 hours in the back seat of mostly B models. What those planes, and their pilots who flew me and answered my questions, taught me that the books, journals, and meetings didn’t and still don’t, was the difference between knowing and understanding. For a flight surgeon that understanding can be critical. For the pilot/patients, it may be more than just flying or grounding.

Dr. Bill Fridinger’s idea and your article highlighting his educational efforts deserve to be widely read among the F-16 flight surgeon community. The cover art was beautiful, the sort of picture I would like to see framed in my aero medical office.

If ever the first order priority for flying flight surgeons is questioned or needs re-emphasizing, your brief article on the Top Knife Program should silence any doubters. Thanks.

William G. Bartlett, Col,
USAF, MC, FS
Director Medical Services
United States Military Training
Riyadh, Saudi Arabia

We appreciate very much receiving your reputed periodical. Here at The Air Force Magazine, we regard Code One as a good source of information. It shall always have a prominent place in our library.

Saeed A. Almuttawa Alshahhi
The Air Force Magazine
Abu Dhabi
United Arab Emirates

Hungry Hierarchy Gulps First, Reads at Leisure

In my position as the HQ USAF representative to foreign F-16 customers, a majority of my business involves interaction with GDFW. Quite often, I am able to find answers to inquiries by talking with Mr. Scott Evers in Engineering. Recently, Scott and Joe Bill Dryden helped me on a night vision goggles project by sending me some particularly helpful articles from Code One.

My problem is this: ‘The Code One Magazines that come into the Pentagon by subscription are often “swallowed up” by the hierarchy before I can get my hands on them. If possible, I would like to have a direct subscription, as it always helps to be as “up to speed” as our foreign military sales customers about new development and testing efforts at General Dynamics.’

Robert A. Coe, Maj, USAF
Chief, F-16 International Programs
Wpns Br, Dir of Int’l Prgms
DCS/PR

Buck Passes, Finally Stops

Several months ago, while sitting in the Aircrew Life Support Shop of my AFR unit, I noticed Code One. As I read through it, I was impressed with the outstanding pictures that enhanced the attention-holding articles, along with a blend of humor and fact to make it a first-class publication.

I am interested in subscribing to this periodical but I am uncertain how to accomplish this. My phone calls to General Dynamics have resulted only in being passed from one person to the next, with no end result. I would be grateful if I were to receive the necessary information. Thank you for your assistance in this matter.

Phillip S. Hull
Canyon Lake, Texas

CODE ONE

We’d like to hear from you. Write Editor, Code One Magazine, Mail Zone 2055, General Dynamics, PO Box 748, Fort Worth, TX 76101.