

USAF's Korean War experiences produced a new generation of combat flyers and aircraft. One byproduct is today's F-104 Starfighter, record-setting follow-on to the F-86 of Korean fame. Here a top jet ace of the Korean air war, recalling the lessons of MIG Alley, cites the F-104 as . . .



Above, the F-104, a "new approach to a superiority fighter" that resulted from Korean fighting.

A FIGHTER PILOT'S AIRPLANE

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ON DECEMBER 18, 1950, an F-86 Sabrejet in its first combat over Korea shot down a Russian-built MIG-15. The North American jet which, at the time, held the official world speed record of 670.981 miles an hour, was the best air-superiority fighter possessed by the free world during that period.

We can certainly be thankful that we had this machine in our inventory, for we would have fared rather badly trying to fight MIG-15s with F-51s, F-80s, and F-84s.

However, by way of contrast, today's F-104 Starfighter is the only airplane in history that has simultaneously held all three official world's records—speed, altitude, and rate of climb. We have, in other words, come some distance since the day of the Sabre. I will here attempt to analyze the aircraft concerned from a fighter pilot's viewpoint.

Much has been written and said in comparing the performance capabilities of the F-86 and the MIG-15. Certainly most fighter pilots felt that the MIG was a higher-performance airplane above 30,000 feet. Only in the latter stages of the Korean War, when we received the F-86F, could we raise this altitude factor to 35,000 feet.

However, this increase in ceiling was offset by the fact that when we did receive the F model, most of our initial contacts with the MIG were above 40,000 feet. To say the least, it was both highly impressive and yet extremely depressing to see a MIG pilot loop his aircraft at 51,000 when we could barely stay in the air at that altitude. I am certainly not trying to downgrade the fighting qualities of the F-86; it had many advantages over the MIG—in fire control, range, diving ability, and ruggedness—all of them vitally important in the business of shooting down airplanes.

The Sabre was certainly a credit to its designers and manufacturers, but the fact remains, the MIG could outperform the F-86 at any altitude, except in a dive, and was a better fighting machine at the higher altitudes. The answer, of course, to our huge success over the MIG lay in the aggressiveness, discipline, training, and leadership of the USAF fighter pilot. We've all heard the phrase "guts will take the place of skill" in fighter combat. This is true. Nevertheless, superior aircraft performance can take the place of both. If you can fly higher and faster than your opponent and want to get the job done badly enough, then you're going to win.

Under the outstanding leadership of World War II flyers such as Brig. Gen. (then Colonel) John C. Meyer, Col. Glenn T. Eagleston, Col. Francis S. Gabreski, Col. Walker M. Mahurin, and Col. James K. Johnson, we adapted both ourselves and our training from World War II tactics and experiences to the 700-mile-per-hour capability of the F-86.

Always, aircraft performance was a primary factor in deciding the tactics to be used. This was especially true during the last six months of the war when most of the fighting was carried out on the MIG pilot's terms, since many of the initial contacts were made above 45,000 feet.

The original fire-control system of the F-86 was one of our greatest deficiencies. We had a World War II gunsight and World War II guns. Hitting a MIG at angles off of more than fifteen degrees and range of 1,500 feet was nearly impossible with the short firing time available in high-speed jet combat. Our primary advantage was the high rate of fire of the .50-caliber gun, even though the destructive power of our ammu-

an alternate hydraulic system. Weight conservation was not a primary consideration in designing systems and parts.

You will get a variety of opinions from fighter pilots on the subject of safety gadgets, and the resultant weight penalty, but the one fact remains, the greatest safety factor in combat is a superior performing airplane.

As in the case of Spitfires during the Battle of Britain, F-86s were fighting against heavy odds in Korea. Approximately 800 MIGs were based in Manchuria and China. The Soviet Union had supplied China with more sweptwing fighters than the United States had even produced. It was common to encounter 150 or more MIG-15s twice a day against no more than thirty-two Sabres. The 4th Fighter Wing, with a World War II record of 1,016% enemy aircraft destroyed, had fought steadily rising odds, eventually reaching as high as ten to one. When the 51st Fighter Wing converted to the F-86, these odds dropped to seven to one.

Korea was a valuable training ground. Many of our



An F-86 Sabrejet scores a kill on a Russian-built MIG-15 in air war over Korea. In many ways, the MIG was superior to the best that the free world could send into the air during the Korean War. But USAF pilots and the Sabres they flew racked up top-heavy score against Reds despite odds, other factors.

nition could not compare, projectile for projectile, with the 37-mm and 23-mm cannon shell of the enemy.

The later acquisition of the radar gunsight in the F-86 was probably the greatest single improvement of the airplane during the Korean War. Expert gunners such as Lt. Col. Vermont Garrison and Maj. Manuel J. Fernandez could hit a MIG at 3,000 feet and high angles off with the radar gunsight, and the shooting problem was also considerably lessened for the more inexperienced pilot.

Probably the MIG airplane's greatest deficiency was the lack of an effective fire-control system. The superior flying performance was considerably offset by this problem. Its slow-firing, long-range cannon proved very effective against the B-29s, for which it was designed, but it proved less effective against fighters when split-second accuracy was required. Most pilots preferred the F-86 armament but generally agreed that we needed a fast-firing cannon with enough destructive power to make it possible for one hit to do the job. Except for the gunsight itself then, we fought the Korean War with World War II armament.

Safety equipment in the F-86 imposed a weight penalty in combat. However, our pilots believed that we had a better fighting airplane, considering all aspects, even though we were outperformed. The weight of the MIG airplane remained light through elimination of unnecessary weight. The MIG had armor plate, an ejection seat, and a German high-speed ribbon parachute. In addition to these conventional safety features, the Sabre had an emergency fuel system and



Colonel Jabara became the first jet ace in history in the skies over Korea at the controls of a F-86. At war's close he was a triple jet ace, one of the world's top pilots.

pilots were getting their first taste of combat. Eleven of the initial 4th Fighter Wing aces were in World War II, but even the "old pros" had not received the necessary training to stay proficient. Targets and ranges for adequate gunnery training were not available in the States. Some of the younger pilots fired their guns for the first time on actual combat missions.

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Recommendations for training in gunnery and high-speed tactics were sent back to Stateside units and to the USAF Weapons School. The need for more as well as better training was apparent. As Korean veterans filtered home for instructor duties, training programs were changed to incorporate the newly acquired lessons. Eventually, replacement fighter pilots were an excellently trained group.

Experienced pilots, however, wanted a new approach to a superiority fighter. There were many grumblings about our disadvantages, from Korean returnees, especially in regard to aircraft performance. The late Gen. Hoyt S. Vandenberg personally heard these tales of woe.

He was quite upset that his fighter pilots could not fly higher and faster than the Communists. He had personally directed the accelerated development and procurement of the radar gunsight. General Vandenberg now gathered together an experienced group of fighter pilots and discussed with them the requirements which they felt were necessary to produce the finest fighter we could envision, a "fighter pilot's airplane."

Lockheed Aircraft Corp. stepped up to meet the challenge. The year was 1951. The need was for a lightweight, high-performance fighter. It was to be light, fast, easy to fly, and simple to maintain. It would provide a Mach 2 superiority weapon, have flexibility of armament and mission without major airframe modification, and be a weapon suitable for global or brush-fire wars.

The single-place, supersonic F-104 Starfighter was the result. On February 27, 1954, the first prototype became airborne on a high-speed taxi run at Edwards AFB, Calif., followed by a flight on March 4, 1954.

Lockheed experience with the X-7 ramjet, together with wind-tunnel tests, and studies of various wing plans revealed that an airplane with Mach 2 speeds coupled with a high thrust-to-weight ratio, required a thin, short wing. Being light, short, thin, and strong, the wing inherently helped boost the F-104 to ultrasonic speeds. Boundary layer control was developed to reduce landing speed. This was accomplished by directing high-velocity compressed air from the engine into the wing and out over the upper surface of the trailing-edge flap. Acting like vanes of air, these streams smooth the airflow over the wing and hold it to the

wing surface. The resulting increase in lift decreased the landing speed by as much as twenty miles per hour.

In the early period of jet engine development, greater thrust meant larger, heavier engines. A big engine was not a guarantee of maximum speed since thrust gained in this manner can easily be more than offset by a weight penalty and the accompanying increase in drag. The need had therefore become critical for a small but powerful jet engine. General Electric met this requirement with their J79, a high-thrust, low-weight, axial-flow engine. While the J79 is not the highest thrust engine produced by American manufacturers, it is unprecedented in its thrust-to-weight ratio.

Lockheed armament engineers tested the M-61 Vulcan cannon, and recommended it as the best match for the performance predicted of the F-104. The Vulcan, named after the Roman god of fire, had borrowed two design features from the famous old Gatling gun. Each has a rotating cluster of barrels and is externally driven. This became the world's fastest firing gun, blasting some 6,000 rounds of 20-mm ammunition per minute, ten times the power of World War II machine guns.

The infrared guided missile was also in an advanced stage of development. The Starfighter was designed to carry both. Conceived and developed by scientists at the Naval Ordnance Test Station, China Lake, Calif., the GAR-8 (guided aerial rocket) Sidewinder is a homing missile, guided by an infrared heat-seeking device.

ADC interceptors carry one Sidewinder on each wingtip. The Vulcan gun actually becomes a secondary system because of the capabilities of the GAR-8 missile.

One of the most marked improvements in the F-104 as a superiority fighter is the search radar capability. Without a focal point in space, targets are difficult to see at high altitudes. The radar system in the F-104 detects the target, measures range, and steers the fighter into position for a missile attack on a source of heat.

The radar capability gives us the means of converting head-on or beam detection into curve of pursuit firing attacks—a capability we've never had before, and one that would pay off enormously in combat.

In designing the cockpit, fighter pilots and Lockheed engineers worked together to attain efficiency, simplicity, safety. The design turned out so well that the

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Lt. Col. James Johnson, USAF, who today commands the 337th Fighter-Interceptor Squadron, ADC at Westover AFB, Mass., can look back on a distinguished air combat record. He won his wings in 1943, and during World War II flew 108 combat missions in the European theater, earning "kill" credits against five and a half enemy craft in the air and four on the ground. He became the first US jet ace during the Korean War, earning a "kill" total of fifteen MIGs in two separate combat tours, assigned to the second tour at his own request. During World War II, he received the Distinguished Flying Cross with one Oak Leaf Cluster and the Air Medal with eighteen Oak Leaf Clusters. In Korea, he earned the Distinguished Service Cross with cluster and another Oak Leaf Cluster to add to his DFC.





Sleek Sabrejets lift off the runway on high-altitude combat patrol during Korean War. Without the F-86, the United Nations forces would have been hard-pressed to take on Russian-built planes flown by Communist pilots.

Right, the F-104 Starfighter, a world record holder in three categories at present. Starfighter was flown to Formosa to strengthen the free world's hand in 1958 crisis on that island. It is a multimission, top-performance plane.



F-104 pilot really feels as if he were part of the machine.

Systems throughout the airplane were designed with the idea that for a given pound of additional weight of a part, the airplane increases ten pounds over-all. The nonproductive pound requires additional strength and weight in all supporting structures, plus additional fuel for range.

The easier a fighter is to maintain, the more combat capability achieved by a given number of maintenance personnel. The F-104 was designed to meet in-commission requirements in combat. The ability to fly and fight when needed is the reason-for-being of any combat airplane.

Keynoting ease of maintenance features, all major systems are located in easy-to-reach service bays. With the service center concept, systems are so placed that they can be worked on simultaneously by technicians and ground maintenance personnel. Time required for carrying out separate maintenance, as well as mission turn-arounds, is cut to a minimum.

Fighter pilots must be aggressive, with good judgment, to be effective in aerial combat. They are trained to be professionals. Graduates of the advanced flying schools proceed directly to F-104 squadrons. The F-104B, a two-place version, permits the instructor pilot to exercise close supervision.

The transition and combat crew training program is monitored for the purpose of standardizing procedures and observing techniques. A high level of instrument proficiency is maintained with the advantage of the two-place fighter. Weapons Training Centers enable the pilot to train and fire the weapon on airborne targets. This results in a trained and disciplined pilot, capable of fulfilling his mission.

Ten years have brought changes in ground-control-intercept capability. The initial stages in Korea proved ground radar stations to be of little value because of

equipment limitations. The Sabres flew a combat tactical formation in mutual support. In the area of the Yalu River only traces of radar returns were available.

Often a train of unknowns would be called out indicating that a large formation of MIGs was proceeding south. However, the radar coverage was not adequate for close-control intercepts on these aircraft. The ground direction centers had the capability of controlling twelve airplanes. As higher speeds and altitudes were attained, control facilities were inadequate. As intermediate advancement, the GPA 37 radar improved control of interceptors three to one over manual control.

Subsequent to the delivery of the first F-104s to the Air Defense Command on February 20, 1958, the F-104C became a member of the Tactical Air Command. A type of F-104 is now scheduled to make its appearance in 1960 with the West German Air Force. Canada, Japan, and the Netherlands have also contracted for the "Super" Starfighter. It is an improved and advanced single-seat multimission fighter for twenty-four-hour defense in any kind of weather.

In flight test the F-104 has proven its capability to carry rockets, missiles, the gun, atomic bombs, and other nuclear weaponry.

The F-104 carries its own intelligence. Having this nonmechanized advantage over missiles, it anticipates error, completes the mission, and returns to fight again.

Conceived initially to fill the need for a high-performance day fighter, the Starfighter's design flexibility, I believe, lends itself to a multimission aircraft—day fighter, all-weather interceptor, fighter-bomber, or nuclear weapon platform. In my opinion the F-104 has the potential to fulfill all missions in the fighter field.

During the Formosa crisis of 1958, probably for the first time in the history of American military aviation, fighter pilots were equipped with an airplane that was better in every respect than equipment possessed by a potential enemy. It was a wonderful feeling.—END