

F.O. RIEK

*Chapter IX ****
FORWARD FROM THE FIFTIES

A History of Lockheed Aircraft Corporation

January 1958

**OF
MEN
AND
STARS**

Lockheed Spreads Its Wings...



TO GEORGIA:

When Korean War began, Air Force asked Lockheed to reactivate huge government aircraft facility at Marietta. Georgia Division's first general manager was James Carmichael, shown at right above with D. J. Haughton (left), assistant general manager, and Robert E. Gross.

United Nations forces did well early in the Korean War. In less than two months of strategic aerial bombardment the Far East Air Force reported it had "neutralized" practically all the enemy's major industrial targets. In September 1950 General Douglas MacArthur launched a daring amphibious invasion at Inchon that encircled North Korean combat forces. Quickly UN troops recaptured Seoul, moved into the North Korean capital of Pyongyang, and chased the Reds back to the Yalu River on the Chinese border.

Then in November, with shocking suddenness, the UN victory march stopped—and reeled back. Hordes of Communist Chinese whose Manchurian bases could not be touched by Allied bombs crossed the Yalu. By December the U.S. and its allies stood at the brink of catastrophe. Only by a Dunkirk-like evacuation at Hungnam did 250,000 UN troops, 140,000 of them Americans, escape a bloody trap. The Reds surged back into burning Pyongyang and again seized Seoul.

November, December, and January were dark months. Hope of a quick victory vanished. Prospects of thawing out the Cold War faded. MacArthur braced his line south of Seoul and fought tenacious delaying actions. No one knew where the Communists, flushed with success, might strike next. Strategists feared the Reds might light brush fires in Europe, Indo-China, or some other hot spot to dilute the free world's strength.

U. S. Faces Rearmament Task

There was ample cause for alarm. The enemy's ground and air equipment was high in quality and abundant in supply. Although piston-engine F-51 Mustangs, Lockheed's Shooting Stars, and F-84 Thunderjets performed valiantly, they couldn't match the Russian-built, swept-wing MIGs at high altitudes. Only by sending F-86 Sabrejets into action did the UN erase the Communist margin of air dominance.

Five years of peace after World War II had lulled America into complacency. Resolutely the nation faced the tremendous and costly task of quickly rebuilding its neglected arsenal. Defense appropriations



World's largest integrated airplane factory under one roof, Marietta plant has 76 acre floor space.



As part of Boeing-Douglas-Lockheed pool, Georgia Division's first B-47 bomber rolled out in 1952.



TO PALMDALE AND ONTARIO:

Korea-boosted jet volume spurred shift of jet work to Air Force's facility at Palmdale (above). At about same time Lockheed Aircraft Service opened new Ontario base.



rose sharply to step up the flow of conventional weapons and expand industry facilities and manpower.

Korean hostilities taught another fact: to cope with a foe that had not slackened its technological strides in the art of war, America needed weapons with far greater combat capabilities. This called for a vastly enlarged research and development program. Air Force and Navy research expenditures that had averaged \$164 million annually during World War II zoomed to \$662 million in 1951—and to almost a billion the following year.

Mobilization differed radically from that of 10 years earlier when the U.S. entered World War II. Accelerated defense production piled on top of the flow of civilian goods rather than cutting into output of refrigerators and clothing, new cars and TV sets. The government blueprinted a gradual buildup to 400 to 500 military planes a month within two years. Even that maximum was only five per cent of the peak World War II rate.

"We are neither at war full-out nor at peace full-out," Lockheed's Robert Gross explained at the time. "Our government has to plan how we can buy enough of the right weapons to protect us—without bankrupting the country and destroying the very forms we are trying to preserve."

But planes the U.S. had failed to order in 1947 and 1948 couldn't be delivered when needed in 1950 and 1951. Not until 1953 did aircraft ordered after the Korean War began go into operation. "Airplanes," Vice President Carl B. Squier commented, "can't be bought off the shelf like a can of sardines."

Lockheed Goes South

Late in 1950 the Air Force asked Lockheed to reopen the government plant at Marietta, Georgia, idle since World War II. The move marked a turning point in Lockheed's growth. Until the war ended Bell Aircraft had operated the 4½ million square foot factory, largest under one roof in the U.S. It had turned out nearly 700 Boeing-designed Superforts there as part of a B-29 production pool.

James V. Carmichael, who directed the Marietta program for Bell, became a Lockheed vice president and Georgia Division general manager. D. J. Haughton, who headed Lockheed's subsidiary Air-equipment and Aerol companies, transferred to Marietta as assistant general manager and became general manager a year later. In May 1952 Carmichael became a member of the board of directors and Haughton a vice president.

First phase of Lockheed's Marietta operation was to de-cocoon 120 wartime B-29s stored on a rattlesnake-infested field at Pyote, Texas and fly them to Georgia for modernization and immediate service in

Korea. But that program was only a warmup. The Air Force had a king-sized request. It asked Lockheed's Georgia plant to join Boeing and Douglas in mass-producing the Boeing-designed B-47 Stratojet bomber, a 600 mph dreadnought that was to play an increasingly important role in U.S. air strategy.

"The military picked Lockheed and Douglas to help Boeing on the B-47 job," one Lockheed executive recalled later, "because it remembered how well we worked as a team in producing B-17s required during World War II."

The nucleus of 150 employees sent from Burbank to Marietta in January 1951 swelled to a family of 10,000 within a year.

More Expansion Moves

The government's call for aircraft in ever-increasing quantity, with a simultaneously rising commercial market, brought other expansion. As more and more F-94 Starfighters and jet trainers took to the skies, Lockheed needed a supplemental field to share the production flight load at its plant at Van Nuys, California. Leasing 225 acres at the Palmdale airport, 55 miles from Burbank in the clear desert air of Antelope Valley—where nearly all-year flying weather is possible—the company built a \$400,000 flight station that began operations early in 1951.

Wisdom of this initial step showed two years later. A disabled T-33 on an Air Force acceptance flight crashed into a home while approaching the Van Nuys runway and fatally injured a housewife. The accident marred an outstanding safety record in the eight years of jet production flights at Van Nuys. It quickly led to a decision to transfer all production flight work on jet fighters and trainers to a \$30 million facility the Air Force was developing at Palmdale. Other aircraft firms later followed the Lockheed pattern by opening jet assembly and test plants away from the air traffic, smog, and encroaching residential tracts of the growing Los Angeles metropolitan area.

That urban congestion, plus the Korea-boosted volume of jet repair and modification and overloaded Burbank shop and flight line facilities of Lockheed Aircraft Service, sparked a search for a new LAS base that opened at Ontario, California in October 1952. Three years later LAS consolidated its California activities there.

LITTLE ZIPPER

Advanced "flying man" patented by Lockheed in 1952 proposed use of ducted fan as its propulsion source.



The F-104:

MISSILE WITH A MAN IN IT

Tony LeVier, first man to fly XF-104, posed in cockpit for dramatic head-on portrait.



When wraps came off F-104A in 1956, deadly fighter was twice as fast as previous combat craft.

These moves and others—including establishment of subassembly plants at Bakersfield, Beverly Hills, and later Maywood in California—expanded Lockheed's manufacturing facilities for stepped up defense requirements.

The company also quickly moved into leadership in developing radical new designs as the science of aviation—spurred by huge increases in the government's research appropriations—entered a cycle of incredibly rapid growth and change. With electrifying speed, as Korean fighting raged and defense budgets climbed, came breakthroughs in propulsion, firepower, guidance, and nuclear science.

The F-104: World's Fastest

Lockheed began plotting one breakthrough in 1951 when experience in Korea pointed up the need for a much lighter and faster combat plane. And its design leadership was never more impressively displayed than when the wraps came off an aeronautical bolt of lightning called the XF-104—the “missile with a man in it.” As the Air Force's F-104A Starfighter it has achieved speeds previously attained only by rocket propelled experimental craft.

“Every time the F-104 flies it breaks the so-called world's speed mark,” C. L. (Kelly) Johnson, who supervised design, said recently. “And it has flown



From left, F-104 design team: R. L. Thoren, Herman Salmon, C. L. Johnson, James Hong, W. P. Ralston.



A two-place tactical trainer version, the F-104B, hurtled into sky for the first time in early 1957.



Two Starfighter honors came in 1957. F-104 was only plane in Ike's inaugural parade, was featured (right) on air mail commemorative stamp.



to extreme altitudes on many occasions.”

Nobody talks more specifically than that about just how fast this ultrasonic manned weapon, now in quantity production, will travel full-out or how high it will climb. Its designers foresee only one limitation on the F-104's ultimate in speed. The plane is nudging into aviation's next frontier, the thermal barrier—where heat from air friction impairs structural strength.

As part of its aerial arsenal the F-104 incorporates the fantastic new Vulcan, a six-barreled 20 millimeter cannon with 10 times the wallop of World War II machine guns. It can carry air-to-air rockets and missiles, conventional and atomic bombs. With that striking power, Johnson declared, the F-104 "picks more punch per pound than any jet fighter ever built." The first production fighter equipped with boundary layer control, the Starfighter lands at speeds only slightly higher than a jet trainer. In the opinion of General Nathan F. Twining, former Air Force chief of staff, the F-104 is "the most advanced plane of its type ever developed."

Design work began in November 1952. Announcement of the contract came in September 1953. Five months later Tony LeVier flew the prototype. But America didn't get a look at the combat fighter that was about twice as fast as any previous operational aircraft until April 1956 when Lockheed and the Air Force staged a Hollywood-type preview at the Palm-dale jet center.

First View of Starfighter

What spectators saw as a huge curtain parted in the hangar was the result of thousands of design proposals and flight studies, wind tunnel evaluations, and tests of rocket models. They saw a straight, thin wing, its leading edge almost razor-sharp. It spanned an unbelievably short seven and a half feet from root to tip. They saw a General Electric J-79 engine delivering more thrust per pound than any other yet developed. They saw a T-shaped "flying tail." And they saw a pencil-thin fuselage.

Less than two months after the first production F-104A took to the skies, the Air Force in April 1956 ordered the F-104B, a two-place tactical fighter capable of flying combat missions as well as checking out pilots. But plans for a photo reconnaissance version, the RF-104, went by the boards when the Air Force, faced with a reduced budget, cancelled an 18-plane order early in 1957.

Lockheed's "Pogo Stick"

Early in 1951 the Navy named Lockheed and Convair co-winners of a competition for a prop-jet vertical rising plane—for years the dream of aviation engineers. Lockheed designed its proposal, the XFV-1, to fly straight up from a standing start on its tail, level off for high speed flight, and back down vertically to a pinpoint landing.

"The vertical riser was a great idea," Project Engineer Art Flock said. "It could have solved the long standing problem of protecting wartime convoys against air or sea attack. And it could have been valuable as a close support assault weapon."

Rigged with a temporary landing gear, the XFV-1 made successful in-the-air conversions from horizontal to vertical flight. Test Pilot Herman Salmon, who has flown everything from helicopters to jets, said piloting the craft was like "sitting in a slingshot." But at ground level the engine developed bugs and lacked necessary horsepower for safe operation. The XFV-1 never took off vertically. Neither Lockheed's nor Convair's project developed beyond prototype.

Hercules Wins Competition

Vastly more successful was another design competition winner, the versatile C-130 Hercules—first American transport designed for prop-jet power. It resulted from a Defense Department requirement for a fast, mobile carrier to rush men and materiel to combat areas quickly and cheaply. Responsible for its design development was Willis M. Hawkins, then chief preliminary design engineer.

Lockheed shaped the C-130 from scratch into what Johnson, then the California Division's chief engineer, called a "modern combination of the jeep, the truck, and the transport airplane." Its cavernous fuselage was to swallow 20 tons of equipment or airlift 92 combat-ready troops.

First scale model of the high wing monoplane was a contrast to the sleek streamlining of previous Lockheed planes. To fulfill its utilitarian missions engineers designed it squat, square, and rugged. Top company officials assembled in the office of Vice President Hall L. Hibbard to inspect the model. It was so radically different that no one could think of anything to say. Finally to break the silence Hibbard commented:

"Beautiful paint job, don't you think?"

As it turned out, the Hercules had far more than a beautiful paint job. "She's a real flying machine," reported the late Stanley Beltz after piloting the YC-130 prototype on its maiden flight in 1954. The plane's four Allison prop-jet engines lifted it off the Lockheed Air Terminal runway in only 850 feet.

While two YC-130s took shape at Burbank, Lockheed handed its Georgia Division the manufacturing assignment to provide production work to follow

UP SHE GOES

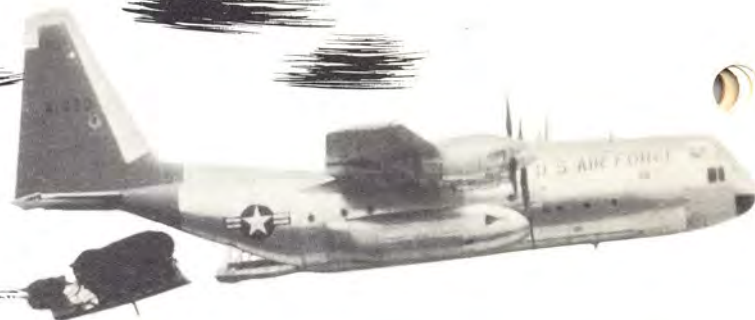
Lockheed built XFV-1 for Navy and flew vertical riser in 1954. But engine bugs kept craft from attaining desired performance goals.





The Labors of Hercules...

In quantity production at Georgia Division, C-130 Hercules proved worth as cargo, personnel carrier (right) in first year of operation. Inset above, A. C. Kotchian, Georgia Division's general manager.



Hercules can swallow 22 tons of cargo (above) and permits speedy straight-in loading. Below, C-130 took 92 combat-ready troops on 2000 mile mission.



Snow and ice don't hamper C-130 fitted with skis (above). In lower photo, "do everything" Hercules as an in-flight refueling tanker for jet fighters.



completion of the B-47 program. The first Georgia-built Hercules flew in April 1955, and deliveries to Tactical Air Command began late the following year. Quickly the plane proved its capabilities. Dollar value of Air Force C-130s delivered and on order totals \$630 million.

The Navy is testing the Hercules as an in-flight refueling tanker and combat transport. Congress has approved funds for the Coast Guard to make initial C-130 purchases. And in the first of what Lockheed expects will be substantial foreign sales the Royal Australian Air Force ordered 12 and support materials valued at \$35 million.

Another Winged Star that began during the Korean conflict was the T2V-1 SeaStar, first jet trainer ever ordered by the Navy for carrier-based navigational training. In October 1952 Lockheed

bought a T-33 jet trainer from the Air Force. It sank nearly \$1 million into modification that included an enlarged cockpit, improved visibility, and simplified escape mechanism. The new plane flew in December 1953.

Satisfied with the workhorse T-33, the Air Force displayed only academic interest. But the Navy decided the model might be developed into a carrier-based vehicle. Lockheed modified it and the Navy placed the first of a series of orders.

In just 135 working days after structural work began the first production T2V-1 rolled off the line. It was the first U.S. production plane equipped with boundary layer control—a system that blows compressed air over wing surfaces to improve lift and controllability. And its 97 mph landing speed was slowest of any jet.

While all this was going on, the Air Force kept under wraps another project with a challenging and exciting potential. Not until October 1953 did it permit disclosure that for four years Lockheed had been exploring principles of nuclear powered flight.

Early in 1956 the Air Force announced Lockheed would build and operate the nation's largest facility for nuclear aircraft research and for testing of radiation effects on components. Lockheed bought 10,000 acres of mountain land near Dawsonville, Georgia—about 50 miles northeast of its Marietta plant—and deeded it to the Air Force. The new \$13 million Georgia nuclear aircraft laboratory will begin operations in early 1959.

Nuclear Research Progress

The Georgia Division is seeking additional radiation test work. And Vice President A. C. Kotchian has disclosed plans for entering a new nuclear field, the design and manufacture of atomic reactors as a source of commercial and industrial power and heat.

Lockheed has taken still another exploratory step in nuclear science. In August 1957 it joined three other U.S. firms in studying possibilities of building and operating—with private capital—a comprehensive nuclear research center.

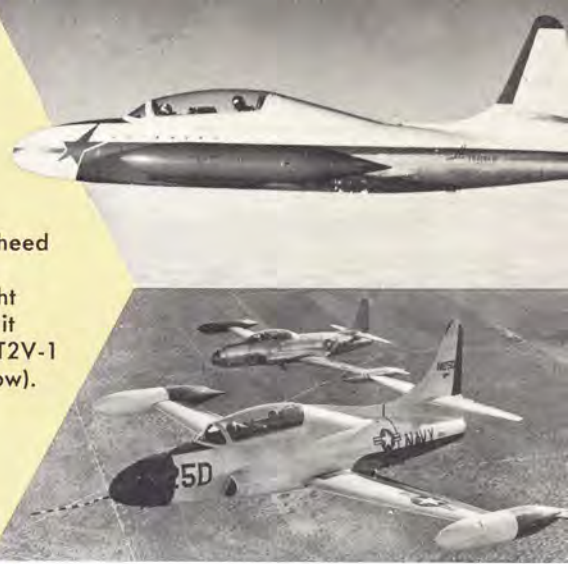
In the intensified development sparked by the Korean War, Lockheed nurtured other projects reflecting the new military emphasis on revolutionary weapons and missions. One is the jet-powered U-2, designed for high altitude meteorological research.

Its design began in mid-1954 under Johnson's direction. A prototype built in a phenomenally short time revealed capabilities that earned a contract for a number of these aircraft. The plane, Courtlandt Gross explained, was of conventional, single engine, straight wing design to permit routine flights above 50,000 foot altitude. The National Advisory Committee for Aeronautics, as well as the Air Force, found the U-2 a "good, economical flight platform for use in a joint test program for high altitude research with the Atomic Energy Commission."

The NACA announced it was using some U-2s to

FLEET TRAINER

In 1953 Lockheed flew new jet trainer at right above. From it grew Navy's T2V-1 SeaStar (below).



obtain data about gust conditions, the jet stream, and meteorological data at high altitude. The NACA said information thus compiled is valuable because "tomorrow's jet transports will be flying air routes girdling the earth...at altitudes much higher than presently used except by a few military aircraft."

The First "Flying Saucer"

Another strange-appearing flying machine is the WV2-E "flying saucer," a Lockheed-Navy project. This is the prototype for a possible follow-on to the Navy's WV-2 and Air Force RC-121 radar picket planes that serve as aerial outposts against surprise attack.

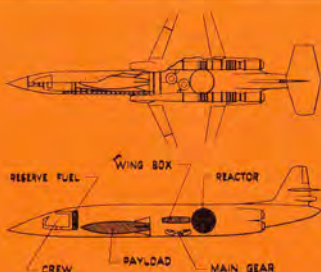
Like other Lockheed early warning models it has a Super Constellation airframe—but with a bizarre addition. Straddling the fuselage on a pylon aft of the wing is a discus-shaped structure over 30 feet in diameter that revolves and houses distance-measuring antenna. Flight tests since its first appearance in 1956 have demonstrated improved speed, maneuverability, and climb characteristics. And the plane has inspired a rash of flying saucer jokes.

Lockheed's rapid expansion and broadening nature of its business brought about major revisions in its internal organization in 1952. Lockheed had grown in 20 years into an industrial giant, one of the nation's

The Atomic Energy Search...

Lockheed is pushing research in the exciting field of atomic power for aircraft, missiles, industrial use. Left, nuclear powered plane sketch.

Company is speeding construction of Air Force nuclear testing facility in Georgia (center). Atom smasher at right is Missile Division equipment.



The U-2... and the Flying Saucer

Unusual Lockheed craft are Air Force's U-2 (upper photo), used for high altitude research, and Navy's WV2-E Super Connie with saucer-like radome designed as possible follow-on to WV-2, RC-121 radar picket planes.



100 largest corporations, spread from California to Georgia and New York.

Geographical distances and increasing planning and policy-making responsibilities, piled on top of day-to-day operating decisions, made a heavy management load. A clearer separation of functions, management believed, would lead to more effective guidance. Under the reorganization Courtlandt Gross became executive vice president. Vice President Squier took on additional duties of assistant to President Robert Gross. Giving increased recognition to growing importance of engineering, the company made Hall L. Hibbard, vice president-engineering, a member of its management policy committee along with the two Grosses and Vice Presidents Charles Barker, Jr. and Cyril Chappellet.

At the same time Lockheed established the California Division as a separate, integrated operating unit. But the new division had hardly begun operations when a disturbing development threatened its steady gains in military and commercial production.

In September, after unsuccessful negotiations began in June, leaders of Aeronautical Industrial Dis-

trict Lodge 727, International Association of Machinists, called a strike of its members at the California Division. The strike interrupted 15 years of peaceable relations.

"A great disappointment," Robert Gross termed it. Negotiations leading up to the strike had been complicated—for the first time since World War II—by government controls over wages and labor costs administered by a national agency. Principal areas of disagreement were wages and proposed compulsory union membership. The union's pay and benefit demands amounted to about 48 cents an hour. Lockheed, adhering to federal wage ceilings, offered an over-all increase of seven cents plus rate range adjustments. But it steadfastly refused to accept the compulsory union membership proposal. Although it would not object if all its represented employees chose to join the union voluntarily, Lockheed said, it "would not be a party to an agreement that would force employees to join."

The stoppage continued three weeks. It caused delays in deliveries of both commercial aircraft and badly needed F-94s, T-33 trainers, and P2V patrol bombers. These and similar delays at Douglas, strike-bound at the same time, caused grave federal concern. President Truman held the strikes were "interfering with progress of the national defense" and "jeopardizing the safety of the nation." On September 28 he asked the union and company to end the strike and resume negotiations in Washington. They reached an agreement in November.

More Management Changes

Lockheed's decentralization and internal reorganization continued for several years. Much of the active administration shifted to younger people. The company built a staff of product and market analysts who "look down the road—5, 10, 15 years—to see what's coming."

In 1956, contemplating a period of expanding and diversified operations, Lockheed carried out more changes and promotions to bring younger men into positions of top responsibility.

President for nearly 22 years, Robert Gross relinquished that position but remained as board chairman and chief executive officer. Courtlandt Gross moved from executive vice president to president. Vice President D. J. Haughton, Georgia Division general manager, returned to Burbank as executive vice president, and A. Carl Kotchian replaced him in Georgia. C. L. Johnson, sixth man to join Lockheed's engineering staff in 1933, became vice president for engineering and research. Other management changes came at the same time as part of over-all plans to adapt the company to future opportunities and challenges.

Connie Carries On...

Because first Constellation represented revolutionary advance in transport design, plane has proved ability to change and grow to meet ever brisker competition.



Compartments divided luxurious Model 1049C cabin at left above. At right, C. L. Johnson checked tip tank added to ocean-hopping 1049G to give longer range.

Three years after fighting began, a truce ended the Korean War in July 1953. By then Lockheed had passed peaks in production rates, hiring, plant improvement and expansion, and other programs necessary to fulfill nearly \$3 billion in military contracts placed after the war started. Company sales in 1953 soared to their highest in its history—\$816 million.

The armistice lessened the urgency of defense production. Lockheed faced ever sharper competition. Once again it had to live with smaller military budgets, shorter lead times and production runs, more frequent design changes, vastly improved performance, and more exacting customer requirements.

Lockheed vs. Douglas Race

Although military production lessened, the commercial market brightened. Passenger and cargo traffic soared after Korea. Afraid that needs of the armed forces might restrict production of airliners, carriers rushed orders for new equipment. The perennial race between Lockheed and Douglas quickened.

Both companies already had stretched the fuselages of their postwar transports. Now both took advantage of the superior power and efficiency of the Turbo Compound engine developed by the Navy and Wright Aeronautical. Lockheed had relied on Wright engines for its Constellations from the start and had gained experience with Turbo Compounds on its P2V Neptunes and military Super Constellations. Douglas dropped its traditional use of Pratt & Whitney engines for the new Wrights on its DC-7, which flew just three months after Lockheed's Turbo Compound Model 1049C took to the air.

Lockheed gained another advantage with a luxurious cabin, divided for the first time into compartments. Industrial designer Henry Dreyfuss helped



Quickly convertible for either passenger or cargo service, Model 1049H had first flight in late 1956. It has 150,000 pound gross weight, 17-20 ton payload.



Broad propellers and sleek nacelles are features of Navy's R7V-2 (above), Air Force's YC-121F Connies, prop-jet powered and capable of better than 400 mph.



Mighty 1649A Starliner shown above on first flight has 150 foot wing, 6000 mile range. Below, crowds welcomed Eisenhower when he arrived at Lockheed Air Terminal in presidential Connie, the Columbine III.



Electra: for the Jet Age

Guiding prop-jet Electra program are Project Engineer Lon Storey, Jr. (left) and Vice President Burt C. Monesmith, California Division general manager.



Fitted with four Allison Model 501 prop-jets, Electra lifted wheels during taxi test. Plane will carry 66 to 91 passengers, fly 400 mph.



Electra interior arrangements are as modern as jet age. Typical is Continental Sky Lounge that reflects advanced cabin design concept.

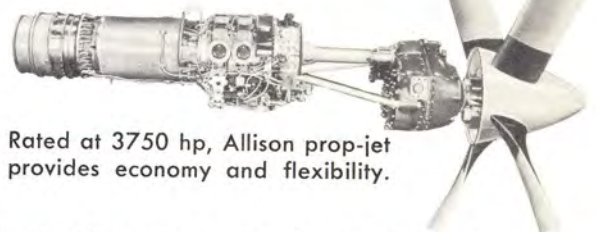


Beating competitive Boeing and other jets into air, Electra first flew December 6, 1957. It will go into commercial service in October.

Lockheed fashioned the 1049C cabin with wood paneling, diffused lighting, and decorative touches that achieved a new high in airliner beauty and comfort. Lockheed sold 48 to seven airlines.

Along came the 1049E, with greater takeoff weight. Most famous of this model is President Eisenhower's *Columbine III*, successor to a Douglas transport as a "flying White House." An improved Turbo Compound engine made possible the 1049G, with still heavier takeoff weight, better performance, optional wing tip tanks for increased range, and more cabin comfort. About the same time Lockheed introduced the 1049D, an all-cargo model with a 17 to 20 ton capacity that surpassed the DC-6A cargo plane in payload and performance. Later Lockheed modified it into the 1049H, quickly convertible for either cargo or passenger service.

Not to be outdone, Douglas redesigned the wing and again enlarged the fuselage for its DC-7C, promptly nicknamed the "Seven Seas." For the first time in a decade the DC series had gained a speed advantage over the Constellation on many routes, and it came close to matching the Lockheeds on nonstop North Atlantic crossings.



Rated at 3750 hp, Allison prop-jet provides economy and flexibility.

Again Connie rose to the challenge. Engineers designed a 150 foot wing, equal to the width of a football field and largest in span and area to grace any transport, and used more powerful Turbo Compound engines for the Model 1649A. With major advances in payload, range, and performance, this sky giant in the first few months of its commercial service in 1957 established new flight and passenger-appeal records. For the first time airline operators could complete regular east to west nonstop flights from European capitals to New York against strong west winter headwinds without sacrificing payload. And in November 1957 a Model 1649A Starliner, called the *Jetstream* by TWA, set a record for non-stop commercial flight—6000 miles over the Polar Route from San Francisco to London in 21 hours 49 minutes.

Fastest of all the Constellation family were two Navy R7V-2s and two Air Force C-121Fs. Converted to Pratt & Whitney T-34 prop-jet engines, they packed 21,000 hp and lifted a gross weight of 75 tons. These power plants boosted Connie's speed past the 400 mph mark. Their flights starting in September 1954 provided useful performance data when engineers chose prop-jet power plants for the company's jet age airliner, the new Electra.

The Jet Age Dawns

These design and performance improvements pushed piston-engine aircraft toward their ultimate in efficiency and reliability. Spurred by technological progress in aerodynamics and success of jets in military operations, airlines turned inevitably toward this new form of propulsion.

The British captured the early lead with advanced engine developments. The de Havilland Comet pure jet airliner set spectacular records as early as 1949, but suffered a series of disasters that indicated structural weakness. Airlines all over the world ordered scores of Vickers prop-jet Viscounts. Newspapers, congressmen, and foreigners alike criticized U.S. manufacturers for an apparent lag.

No Mourning for This Electra

Late in 1954 American Airlines announced a design competition for a turbine engine transport for short and medium range flights. Although Lockheed had invested several millions on seven years of jet transport studies, extensive prop-jet experience with the C-130 Hercules, XFV-1 vertical riser, and modified Super Constellations had demonstrated the economy and flexibility of this engine.

It entered the competition with an airframe designed for four 3750 hp Allison's of the type used on the C-130. The entry fit easily into existing traffic control, navigation, and airport facilities. It offered accommodations for 66 to 91 passengers. Engineers designed it to cruise above 400 mph and to operate profitably at ranges down to 100 miles and up to 2700 miles when required. Its weight and takeoff distance permitted service into more than 100 U.S. cities—and as many more abroad—whose airports could not handle larger, heavier pure jets.

All this added up to a pretty fair airplane. It won the American Airlines competition hands down—beating out British prop-jet proposals and converted U.S. piston entries. As usual, Douglas was the chief competitor with a new plane—but carrying a higher price tag. And naming the Lockheed winner was easy.

"We'll call it the Electra, of course," said Robert Gross.

There was no argument. More than 20 years before

Lockheed's founders had committed their slim resources to developing a small twin-engine monoplane. As the Model 10 Electra it flew to success and opened up domestic and foreign markets for the little company. Sentiment was a factor in naming the new Electra. But there was also confidence that, like its predecessor, it would help to advance the air age economy and become an important influence in Lockheed's future.

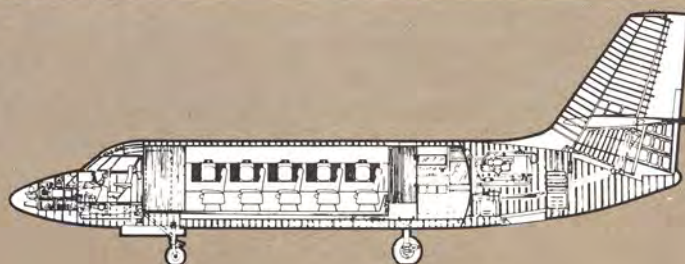
JetStar:

POWER-PACKED PURE JET

JetStar, a small pure jet utility trainer-transport, flew 241 days after design began. Developed for military use, prototype has two jet engines in pods on aft fuselage.



JetStar demonstrated spectacular rate of climb in test flight (above). Cutaway drawing below shows 500 mph jet's inboard profile, cabin arrangement.



LMSD ...

A black and white photograph showing the X-17 rocket launching vertically from a launch pad, with a large plume of smoke and fire at its base.

Missile Systems Division formed in 1953 earned Air Force "well done" with highly successful X-17 rocket.

A black and white photograph of the X-7 supersonic aircraft in flight, leaving a long, dark smoke trail behind it. The aircraft is angled upwards and to the right.

Important MSD project was supersonic X-7. Recovered by parachute, bird proved value as ram-jet test vehicle.

Losers in the American Airlines competition rushed ahead with other jet age aircraft. Boeing, Convair, and Douglas entered the lucrative market for speedy pure jets designed for long range air routes. Fairchild sold a prop-jet airliner for short feeder routes.

Lockheed's marketing organization, in the face of U.S. and British competition, has sold 144 Electras to 11 U.S. and overseas airlines serving all continents. It expects to sell at least as many more to continue production well into the 1960s. The \$300 million in Electra orders at year-end 1957 was the largest the company has ever had for a commercial model.

Two years after American signed its first contract for 35, President C. R. Smith reaffirmed his belief in wisdom of the purchase. "The Electra is a logical airplane for an important area of air transport operation," he declared. Eastern Airlines also played an active part in early Electra development and ordered 40.

Production began in December 1955. A rivalry developed among Boeing, Douglas, Convair, and Lockheed to see which would be first in the air with a production jet age transport. The Electra flew December 6, 1957, a couple of weeks ahead of the Boeing jet and months ahead of the others. After months of flight tests and CAA certification trials the Electra will enter airline service next October.

Lockheed's Newest—the JetStar

With the Electra well under way, Lockheed late in 1956 took a plunge into pure jet transports. The Air Force announced it was in the market for a small multi-engine jet utility transport-trainer to carry a crew of two and 10 passengers. In addition, Lockheed recognized the commercial potential of such a plane in the mushrooming area of business flying. Executive aircraft flew 5 million hours in 1956, a third more than all domestic airlines. And 20,000 business planes were in the air, 15 times the number of airliners.

Lockheed gambled \$6 million of its own funds that this market will continue to expand. It gave Johnson and his special projects staff the nod to build two prototypes for military evaluation.

He and his team set a rigid 34 week schedule from drawing board to flight. They began design work in January 1957 and had the new transport in the air September 4, two minutes ahead of the flight date set 241 days before. It was an almost exact smaller scale model of the Lockheed L-193 intercontinental jet transport designed but not built years earlier.

JetStar Goes to Georgia

The new JetStar had what Johnson called "the finest first flight we've ever made." It had swept wings with a 53 foot span and two British Orpheus jet engines mounted in pods on the aft fuselage. Production models can be offered with either two or four engines. They will cruise at better than 500 mph at 45,000 foot altitude and will have a range of approximately 2000 miles.

Lockheed's Georgia Division drew the job of selling and building the JetStar. Since Lockheed developed it to meet an Air Force requirement, the immediate task is to build a solid base of military orders. First of its type to fly, it is a year ahead of competitive models.

Still another Lockheed craft has a built-in potential—in the burgeoning field of air freight. This is the husky C-130 Hercules, that hauls tanks, jeeps, trucks, troops, and other materiel speedily and efficiently for the military. Armed with statistics foreseeing a tremendous increase in ton mile volume of air freight in the next 10 years, the Georgia Division in 1957 offered an adaptation of the improved C-130B to commercial users and launched a full sales effort.

As 1957 began no one foresaw that the year would develop what the Aircraft Industries Association president later called "almost incredible confusion." Aviation leaders including Lockheed management



Rugged workhorse for nation's missile development program, X-7 (left) streaked to new speed records. Center, typical parachute and nose spike landing.

Solar furnace is among test equipment developed by Missile Division to accelerate progress of Navy's top priority weapon, the solid-propellant Polaris.

looked toward an upward swing in sales volume and improving stability. Employment was rising. Industry backlogs neared an all time high, including \$2.5 billion in commercial orders—biggest in history.

But trouble lurked ahead. In the spring Major General David H. Baker of the Air Materiel Command analyzed the increasing complexity and costs of manned aircraft combat systems and the impact of "rapidly maturing" missile technology. In the future, he warned, the industry would provide smaller quantities of manned aircraft—and the cutback would reduce the number of prime contractors. He predicted that by 1960 Air Force producers would have as much as 50 million square feet of idle manufacturing space.

That was the beginning. Soon after came alarming word from the Pentagon. The military services were spending money faster than budgets permitted. Only by drastic cutbacks could expenditures be whipped back into line.

Financial Problems Develop

Then lightning struck. A wave of cutbacks, production stretchouts, and contract cancellations carved away backlogs that had looked so substantial only a few months earlier. Along with other firms, Lockheed's aircraft manufacturing and servicing divisions found themselves in the midst of abrupt changes. In five months they lost \$150 million in backlog through contract terminations.

On top of all this piled a financial squeeze. Desperately trying for further reductions in spending, the armed forces reduced progress payments to manufacturers, slashed overtime, and demanded lower overhead costs. It informed companies it would not be able to pay them all the money when due under terms of production contracts. That meant defense contractors had to cut deliveries even more or borrow hundreds of millions of dollars to finance a larger share of military programs. Later the Defense Depart-

ment eased these rigid ceilings, but Lockheed forecast additional borrowing from banks in 1958.

A downward trend in employment inevitably followed the cutbacks. From a peak of more than 62,000 in June 1957 the work force dropped to 50,000 as the year ended.

Paradoxically, 1957 registered the highest deliveries in Lockheed's history—more than \$900 million. More marked effect of the reduced spending for military aircraft was forecast for 1958, with deliveries down about 17 per cent from 1957.

Adding further confusion to 1957, the Russians stepped into the picture. Launching of two man-made satellites to circle the globe was a warning—for the third time in a generation—that the U.S. is not so secure as it had thought.

One authority called launching of the Sputniks the "Pearl Harbor of the Technological War." They jarred America out of the lethargy into which it had fallen after rising to the challenge of Korea. They focused attention as never before on the shifting emphasis toward the missile as the spearhead of a sweeping new approach to the science of flight.

Missile Development Begins

Although it used short range rockets in World War II, the U.S. didn't begin its hunt for a long range missile until 1944. Coincidentally in September of that same year a terrifying explosion rocked the Chiswick residential section in London. At first no one knew what caused it. There had been no droning airplane, no whistling bomb.

Soon the world learned the Nazis had fired the first large ballistic missile used in a war. It was the V-2, a 12 ton rocket that fell on its target from 50 miles up in the ionosphere at a speed too fast to be seen, heard, or intercepted.

The V-2s were remarkably successful. And they were forerunners of a whole new arsenal of pilotless weapons developed and refined in the 13 years since

Outstanding team of scientists, administrators, space flight specialists has contributed to MSD's rapid growth.



L. Eugene Root
Vice President,
General Manager



Herschel J. Brown
Ass't. Gen. Mgr.
Administration



Willis M. Hawkins
Ass't. Gen. Mgr.
Weapon Systems



L. N. Ridenour
Ass't. Gen. Mgr.
Chief Scientist

the first V-2 hit Chiswick and capable today of spanning oceans and continents.

Lockheed's interest in unmanned flight began 15 years before the V-2. In 1939, before Pearl Harbor, its subsidiary Vega Airplane Company won an Army Air Corps design competition and received a contract to build five small monoplanes. The winning proposal was simple, ingenious, and prophetic of what was to come.

It had a 23 foot wing span, 80 hp engine, top speed of 160 mph, and ceiling of 10,000 feet. In performance it represented no marked advance over designs of the day. But there was one major difference: it carried no pilot. Gyroscopic equipment kept it stable. Controlled by radio from the ground, the model was to be used as a pilotless aerial target. Higher wartime priorities did not allow continuing work in unmanned aircraft at that time.

In contrast to German progress during World War II, Allied development in the sophisticated area of the manless aircraft continued only slowly.

Lockheed Builds Jet Drones

Just before the war ended Lockheed proposed modifying an F-80 Shooting Star by installing remote control equipment. In May 1946 it received a contract to rework two F-80s into drones and a third into the controlling "mother" ship. With automatic pilots and telemetering equipment the QF-80 drones were guided from the rear cockpit of the "mother."

It seemed then that the F-80 might graduate into a guided missile not unlike today's subsonic, air-breathing Snark. But the Air Force was little interested. Lockheed, occupied with its varied airplane programs, didn't push the idea. Nor did it follow up on opportunities at war's end in 1945 to get contracts to develop an air-to-air missile.

"We didn't take them," Robert Gross declared later. "We were the only company with three modern ready-to-go airplanes—F-80, P2V, and Constellation. Now I know it was wrong, but then we decided we couldn't do everything."

Too, most Americans were slow to realize the potential of such new concepts. The war was over. The big job was to convert wartime industry back to civilian production. There was no real drive to speed development of missiles and other "ultimate" wea-

pons. The government even hesitated about going ahead with the hydrogen bomb. And it was not until 1951-52, when it found a hydrogen warhead could be made in small size, that it proceeded all-out on an intercontinental ballistic missile program.

Impact of this discovery, advancing technology, and lessons of Korea brought a rapid step-up in military appropriations and expenditures on missiles of all types. The \$21 million spent in 1951 on missile research, development, and production spurred to \$169 million the next year—and to almost \$300 million in 1953. The Air Force's ballistic missile project became what Major General Bernard A. Schriever, commander of the Ballistic Missile Division, Headquarters Air Research and Development Command, called "the largest military development program ever undertaken by this nation in peacetime."

Lockheed steadily improved its competence in electronics, unmanned aircraft, and applications of nuclear power. It adapted electronics into rocket firing, radar autopilot combinations that made the F-94C Starfire the deadliest all-weather fighter of its time. It developed submarine detecting devices in P2V Neptunes. It packed six tons of radar equipment into Super Constellation early warning planes. In 1946 preliminary design experts in what is now the California Division began work on a military project, the X-7 ram-jet test vehicle. That launched Lockheed's present broad missile program ranging from sophisticated weapons to a reconnaissance satellite.

Missile Division Formed

The project progressed rapidly. So encouraging were results and so huge the potential in this and other government missile programs that late in 1953 Lockheed took a far-reaching step. It formed the Missile Systems Division as a corporate entity.

Activities began in January 1954. The new division quickly outgrew quarters at the Burbank plant and moved to the 77 acre site at Van Nuys that had served as a production flight facility for Lockheed jets. Within a year the Missile Division's knowhow and capacity expanded enormously. Employment jumped from 250 to 1250.

At about the same time differences of opinion rose about basic administrative and operating policies in connection with design and development of un-



J. H. Carter
Weapon System
Manager



S. W. Burriss
Weapon System
Manager

manned weapons. Unable to reach agreement on the relative roles of research scientists and aeronautical engineers, two top level Lockheed missile managers left the company. They were Elwood R. Quesada, retired Air Force general, who resigned as vice president and Missile Division general manager, and Dr. Ernst H. Krause, director of research laboratories. Senior Vice President Hall L. Hibbard assumed Quesada's duties temporarily. Dr. Louis N. Ridenour, internationally known in nuclear physics, radar, and electronics, succeeded Dr. Krause. In November 1956 L. Eugene Root, Lockheed's corporate director of development planning, became a vice president and missiles general manager. Herschel J. Brown became assistant general manager for administration. And as 1958 began, D. J. Gribbon—formerly executive assistant to D. J. Haughton, Lockheed's executive vice president—became director of the Missile Division's manufacturing branch.

Missile Division Grows Rapidly

Supported by a \$1 million general research program, the division moved rapidly into more sophisticated work. By end of its second year it had outgrown the Van Nuys facility. Confident that the division would continue its astonishing growth and widening scope, Lockheed in November bought 275 acres at Sunnyvale, California. A few months later it leased 22½ acres at Stanford University in Palo Alto, seven miles north of Sunnyvale. On the two sites construction began on \$30 million worth of laboratory, experimental, research, and manufacturing buildings.

Early business centered about two important Air Force projects—the X-17 hypersonic ballistic missile and the X-7 to flight test ram-jet engines and other components. The X-17, a research rocket, has reached the highest speed ever achieved by an instrumented missile. General Schriever said its performance was "impressive" in helping solve critical problems of bringing intercontinental missiles back into the earth's atmosphere. Missile operations broadened to include test facilities at the Air Force Missile Development Center at Holloman Air Force base, Alamogordo, New Mexico, and the Air Force Missile Test Center at Patrick Air Force base, Cape Canaveral, Florida.



During 1956, its third year, the Missile Division recorded sales of \$53 million, doubled employment to about 4800, and added outstanding men in many fields. Its facilities spread to nearly a million square feet in use or under construction.

For the missile organization the future looked even brighter as 1957 began. The division took on its most important assignment by assuming duties of system manager and major contractor for the Navy's Polaris.

As its responsibilities broadened Root appointed John H. Carter, associate director of research, and Stanley W. Burriss, missile flight test engineer, as weapon systems managers. They coordinate, develop, and interpret the division's obligations under its two system management contracts, including the Polaris. Willis M. Hawkins, former California Division chief preliminary design engineer who had joined the Missile Division as director of engineering, filled the division's new post of assistant general manager for weapon systems. Dr. Ridenour became assistant general manager for research and development and later chief scientist.

A 1500 mile range fleet ballistic weapon, the Polaris is gaining top rank in America's growing new missile arsenal. It is unique in its use of a solid propellant. The Navy selected that power source to avoid problems in handling nitric acid, liquid oxygen, and other dangerous "wet" fuels aboard surface vessels and submarines from which the Polaris can be



Construction has begun on new \$3 million addition (above) to Missile Division's facilities in Bay area. Structure will house nerve centers of Navy Polaris development. Missile research center at Stanford University in Palo Alto is shown below.



launched. A solid propellant also is simpler, lighter, more reliable, and more quickly usable.

In recent months the Navy has been exploring ways to speed up the timetable and advance the operational target date for the Polaris.

Much of the Missile Division's activity must necessarily be deeply classified. Dr. Ridenour, research director, revealed late in 1957 that his scientists, using Lockheed's three million volt ion accelerator, are investigating missile propulsion through charged ions and other nuclear power plants. Other scientists are studying problems of radio and radar signals in outer space through use of a laboratory that recreates conditions as they exist hundreds of miles above the earth.

Lockheed's missile research and testing is battering back the perimeters of knowledge, wrenching basic laws and relationships from the universe. Applications of this knowledge, while primarily military at first, eventually will find their way into peacetime devices that will improve the accuracy of meteorology, climatology, and other sciences as well as man's navigation, transportation, communications, and power technology in both the earth's atmosphere and in space.

Through such efforts Lockheed is charting the same course of leadership in the Space Age as it has forged in aircraft during its first quarter century.

Our Next 25 Years

Through the nine chapters of *Of Men and Stars* Lockheed has told the story of its first 25 years. It has been a quarter century filled with courage and daring, losses and good fortune, heartaches and thrills, mistakes and successes. The company has never swerved from the philosophy of its founders adopted 25 years ago—to design, produce, and market the most advanced aviation products and services and maintain highest standards of integrity in all of its activities.

We hope you've enjoyed the series. And we hope that a complete set will become a treasured addition to your bookshelf at home. Your division public relations office can supply missing chapters.

In the world technological war and reappraisal of American defense and scientific progress, Lockheed and its people are prepared for whatever lies ahead. They have strengthened their foothold in the scientific community. They have kept pace with rapidly accelerating technological advances.

Few if any other aircraft companies can match Lockheed's diversified line of air products in use the world around. The original Model 10 Electra, the Lodestar, the graceful Constellation, the new Electra have attracted an important share of the always competitive commercial market. From our assembly lines have come a vast winged armada for the free world's defense. And now Lockheed has extended leadership to the incredibly sophisticated realm of the missile and the rocket, of speeds beyond sound and flights beyond the earth's friendly air.



Faith in America's future, increasing importance of aviation is unmistakably evidenced by R. E. Gross, shown with young grandson.

What of the years ahead? There could be no more appropriate way to conclude this account of Lockheed's first 25 years than in the words of the man who more than any other has guided the destiny of the company he did so much to found and build.

"There is a certain feeling of courage and hope when you work in the field of the air. You instinctively look up, not down. You look ahead, not back. You look ahead where the horizons are absolutely unlimited."

That's Robert Gross talking. He means what he says.