AIA planes

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BOYER IMPATIENT WITH PLANE BOTTLENECKS

New Fighters For Late 1950's Must Be Designed Now

The supersonic military fighters that will defend America in the late 1950's must be created *today*—or they will never be built in time.

From the day a jet fighter design is conceived to the day the first production aircraft is completed is ordinarily about 48 months, during which the design progresses through hundreds of thousands of vital operations—and through highly complex design, development testing and engineering phases.

Granting uninterrupted production routine, the aircraft on a designer's drawing board today can exist only in mock-up stage one year from today. In 24 months, experimental models can be in production. By 1954, tooling, jigs and fixtures can be ordered and building of the plane's detail parts begun.

The 'Facts of Life'

Not until the summer of 1954 can the final assemblies be produced.

And not until late fall of 1955 can the first production fighter be flown for final acceptance by the Air Force.

These are the "Facts of Life" on creation of the precision-engineered aircraft required for aerial defense in an atomic age. During these 48 months, thousands of complex engineering problems must be solved, development must progress, materials must be secured, experimental models must be tested and machine tools must be procured.

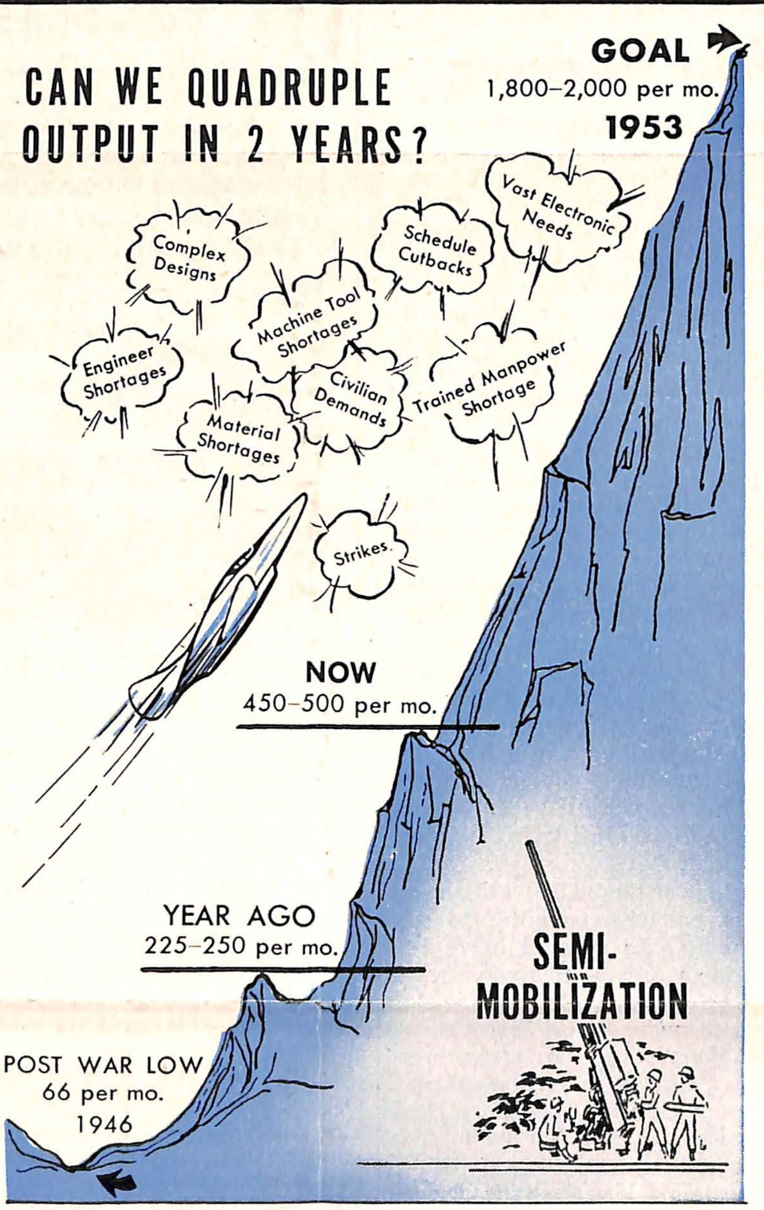
16 Months to Start Building

The "time-span" story of one typical fighter, with the normal time required for each operation, follows substantially this pattern:

Design phase—During the first year, the fighter branch of the military service asks manufacturers to submit proposals for a fighter. The contractor prepares quotations (four months), submits them to the Air Force (two weeks), and the Air Force studies design and quotation proposal, then awards a design contract (three months). The manufacturer starts design engineering, development and research and construction of test models, and construction of a mock-up, including engine, hydraulic lines, controls, etc., (nine months).

(See "TIME SPAN," Page 3)

Obstacles Threaten Aircraft Goals



From 9,100 planes a month in March, 1944, the U.S. aircraft industry nosedived to 66 per month in 1946 after most military orders were cancelled. To regain momentum, after the industry was brought to a near-halt by lack of national policy on air power, is a far tougher problem than World War II expansion when there was no competition with civilian economy for materials, manpower and tools.

"PLANES" Source: Aircraft Goals, ODM Quarterly Report, Oct. 1951.

Half of Plane's Cost Now Goes for Electronics

A wide range of manufacturers are required to produce today's complex airplane because of the new accents in design and equipment. A decade ago, 85% to 90% of the cost of an airplane was represented in the airframe, engine and propeller. Today, only about 50% of the design and the cost is expended on airframe and engine.

Today's planes have such devices as automatic fire control systems, tracking systems, radar systems, air refueling systems and other electronic gear which account for half the cost. A particular 1944 plane carried 1,000 pounds of electronic items; its counterpart now has 5,000 pounds.

Materials Must Fit Schedules, Not Vice-Versa

Written especially for Planes

By

Harold R. Boyer

Chairman, Aircraft Production Board
Defense Production Administration

We are not going to produce as many completed military aircraft as we had hoped in the next year. Shortages of metals and of aircraft engines, which have been slowed in turn by machine tool shortages, are responsible. Airframe production is being rescheduled to fit more exactly the actual deliveries of engines, thus forestalling any possibility of being forced to accept airframes without engines in attempting to achieve unrealistic production schedules.

Boyer

This is a condition which both the Government and the aircraft industry are struggling mightily to rectify, but the fact remains that without enough materials and tools, it is impossible to produce at top speed. Not only are available machine tools and certain strategic metals and alloys inadequate to supply all military needs, but the nation is committed to a policy of keeping our civilian economy healthy at the same time that we are endeavoring to rebuild our air power. It is trying to achieve this balance — in superimposing rearmament on a reasonable civilian production — that contributes toward our present difficulties.

In the broad program of building up our military strength, the aircraft industry of the U. S. during the past year and a half met the challenge by doubling its rate of output and increasing its potential capacity in a base-broadening program comparable to the early days of World War II.

Next Nine Months Critical

Mobilization goals call for deliveries of aircraft to rise, within the next two years, to four times the present rate. This means that from the neighborhood of 450 to 500 airplanes a month we must reach a level of 1,800 to 2,000 per

(See "BOYER," Page 4)

PLANES

Planes is published by the Aircraft Industries Association of America, Inc., the national trade association of the manufacturers of military, transport, and personal aircraft, helicopters, flying missiles and their accessories, instruments and components.

The purpose of *Planes* is to:

Foster a better public understanding of Air Power and the requirements essential to preservation of American leadership in the air;

Illustrate and explain the special problems of the aircraft industry and its vital role in our national security.

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Manpower—Aircraft Production's Big Barrier

By DeWitt C. Ramsey (Admiral, U.S.N., Ret.)
President, Aircraft Industries Association

Any sudden expansion of facilities and production in the aircraft industry is naturally attended by many difficult problems. Currently, shortages of machine tools and materials are the prime headaches, and aircraft schedules have had to be readjusted as a result.

But of all the difficulties facing the industry today, certainly one of the most formidable is manpower. And the worst is yet to come. It is a problem that will require strong and intelligent action if it is to be solved, and if it is not solved it is foreseen as the factor which will most retard the attainment of our production objectives.

There is little public knowledge or interest in aircraft manpower problems as yet, largely because no frantic calls have gone out for armies of employees. Rosie the Riveter is still in her kitchen. Production has not approached a peak, and large general-employment calls probably will not go out until mid-1952 or later. Moreover, for run-of-the-mill jobs, mechanics from other industries can be fitted quite well into aircraft work. The real problem is in engineers and skilled technicians.

The shortage of engineers is the most serious problem. Not only are there far fewer engineers than the industry needs to fulfill its commitments, but the number of engineering graduates from aeronautical courses in the colleges and universities is diminishing alarmingly each year. Where 50,000 men were graduated from these courses in 1949 and again in 1950, only 38,000 were graduated in 1951, and it is estimated that there will be only 26,000 in 1952, 20,000 in 1953 and 17,000 in 1954.

Aggravating this situation is the fact that of the 38,000 1951 engineering graduates, 30 per cent were immediately committed to the Armed Services, and all aircraft companies have suffered losses because many engineers who were enlisted in the organized reserve were called up for duty.

This situation would have been bad even under World War II conditions, but it is crucial today. Modern military aircraft are many times more complex than those of the last war. On the average, they cost three times as much as World War II counterparts. They have electronics systems that are far more complicated and weigh up to five times as much as planes of six years ago.

As a result, the engineering requirements of today's advanced military craft are far, far greater. For example, where in 1943 only one out of every twenty-two aircraft employees was an engineering employee, the ratio today is one to eight. Or, to put it differently, it required only 414 engineering hours to build each unit of an initial order of a fighter type in 1941-42, where today it requires over 3,300 engineering hours.

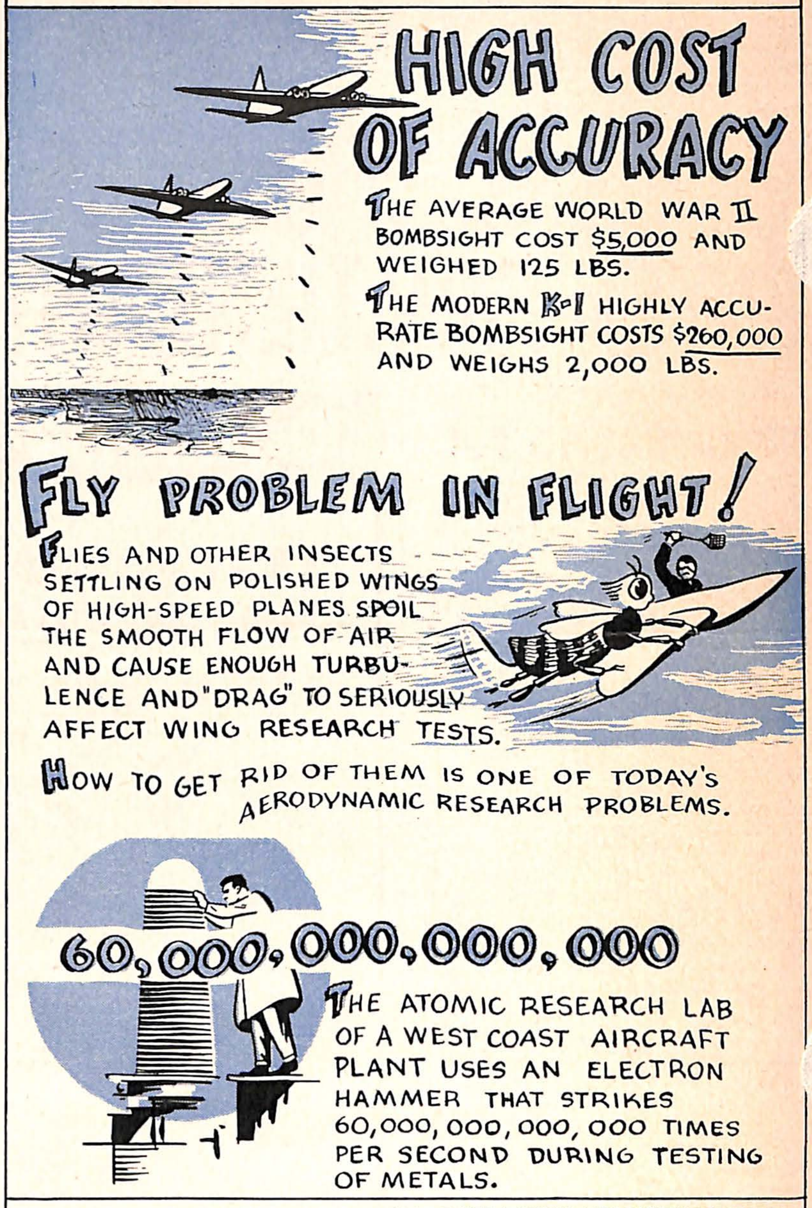
Also becoming more and more serious is the shortage of skilled mechanics and technical workers. Training of additional personnel for these tasks may take a year or two, where training for ordinary factory jobs is comparatively short. By way of example, in World War II radar and electronics mechanics numbered only about one out of a thousand employees; today they number one out of twenty-four.

Thus it becomes obvious that both our industry and the Armed Services face a task of encouraging student interest in aeronautical engineering, including students presently pursuing other engineering studies; of training new personnel, and of conserving and protecting the industry's present engineering and technical resources.

While it is true that the full impact of the manpower situation will not be felt for a year or two, it must be realized that remedial action must be taken now. When the real pinch is felt, it will be too late, because both college and company educational programs are matters of years, not weeks or months.

If the solution is not found soon, this could easily become the major obstacle to high-production goals of military aircraft.

PLANE VIEWS



BY AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA

Assembling Aircraft Materials Takes Twice as Long as Building the Plane

It takes longer these days for an aircraft manufacturer to round up the thousands of components and basic materials that go into a modern warplane.

One typical patrol bomber, for example, has over 137,000 parts—and each of these parts has an individual production and procurement time.

To gather all these parts from widely-separated sources of supply and to funnel them into a production line takes approximately twice as long as it does to "build" the plane in the aircraft factory.

Typical of the lengthened lead times between order and delivery are these figures on some of the basic raw materials that go into all military warplanes:

Materials	*Today*	*June, 1950*
Special bearings	11 months	6 months
Aluminum bar & rod	6 months	3 months
Aluminum forgings	11 months	4 months
Aluminum sheet	5 months	4 months
Aluminum wire	6 months	3 months
Stainless sheet	5 months	3 months

Military orders for electronic and communications equipment for the first two years after Korea will total about $7,600,000,000 — equal to three-fourths the amount spent for such equipment during all of World War II.

Typical example of aircraft subcontracting: A Pittsburgh plant getting ready to make enameled steel household sinks converted its equipment to produce magnesium castings instead.

Air Quotes

"The industrial base for the Air Force expansion has been laid. . . . However, three Hard Facts will control the progress of the expansion program from this point on.

McCone

"Hard Fact Number One is the shortage of machine tools. . . . I venture to say that we won't hear the end of the machine tool problem for another two years. . . .

"Hard Fact Number Two relates to the intensifying shortage of certain critical materials. . . . The difficulty arises primarily from the fact that the defense program must still compete, all too often to its disadvantage, with the civilian demand for prime materials. . . . If the country is to have adequate air power, the control and allocation of critical materials must cut deeper than is presently the case. . . .

"Hard Fact Number Three: the current wave of strikes and work stoppages. . . These constitute an obstacle to defense production as formidable as that of the machine tool and critical materials shortages. . . .

"Clearly as regards defense production we have arrived at another of those periods of decision. . . . My experience within the military establishment has convinced me beyond all doubt that the military and civilian authorities . . . are right in their belief that our security now rests primarily upon air power. If this view is sound now, it is certain to be even more markedly so in the future, for the speed and reach of the airplane make it the logical means of delivery for the weapons of vast power that science promises soon to put into our hands."—*John A. McCone, Oct. 12, 1951, upon completing his assignment as Under Secretary of the Air Force.*

Time and Money Saved In Making Jet Engines

A new method of producing compressor blade masters for jet engines has been perfected by the engine division of one of the leading aircraft companies. It is one of the significant strides in the continuing program of the aircraft industry to develop better, faster and cheaper methods.

This new method reduces the cost of a single compressor blade master from more than $4,000 to approximately $100. It also reduces the time required from nearly six months to three working days. A single experimental jet engine requires more than 2,000 compressor blades of varied shapes.

The new device utilizes an electronic contour follower linked to a standard jig borer. A photo-electric eye scans a cross-sectional metal drawing, resulting in a faithful reproduction of the air foil contour in the metal blank from which the master compressor blade is made.

TIME SPAN

(Continued from Page 1)

Design construction — Meanwhile, about 15 months after the fighter branch requests its fighter proposal, the military service re-evaluates the project and awards an experimental contract (three months). Engineering for the experimental models begins, lasting for about 12½ months (well into the third year). Work is scheduled by production planning (nine months), and work orders are prepared and released according to schedule (14 months). At about the same time, procurement of subcontracted parts begins, lasting about 13½ months. Tooling for the experimental aircraft also gets underway, a 12-month job.

Construction of the first experimental airplane begins about 16 months after the design proposal is requested, and the second experimental airplane is put into production about six weeks later. Shortly afterwards, the company starts building a third plane for static testing.

Test phase—Testing of the static airplane begins about two years after the military asks for its fighter proposal. This testing lasts about six months; and by the time it is completed, tests of the first experimental plane are underway and tests of the second experimental plane are beginning. It takes about six months to put each of the aircraft through a complete test phase.

Problems in the Plant

Production phase—In the meantime, the manufacturer has started preparing his plant layout (11 months) and has begun work on methods studies, production engineering and preparation of operation sheets (22½ months). During the last half of the third year, the military re-evaluates the aircraft and awards a production contract (three months). Engineering for the production airplanes is now underway (12 months), as is a study of requirements for production equipment and machine tools (six months).

During this period, machine tools and production equipment are procured (eight months), and work is scheduled by production planning (nine months). Work orders also are prepared and released according to schedule during an 11-month period. And the 16-month job of planning a subcontracting program and placing orders for purchased parts begins.

Thirty-five months after the fighter proposal was requested, the manufacturer is able to start procuring raw materials and equipment for the plane (13 months). Some six weeks earlier, the contractor has begun accumulating purchased tooling, tool materials and supplies.

Tool Orders—Fourth Year

Time studies of operations are started about the 34th month, and continue throughout the remainder of the production process. And the 7½-month job of preparing and releasing tool orders begins at about the start of the fourth year.

At the same time, manufacturing of tooling—detail, jigs, fixtures—gets underway; personnel—clerical, shop inspection—are hired and inexperienced workers trained; and production of detail parts is begun.

No Short Cuts Possible

Building of sub-assemblies takes about 6½ months, and production of final assemblies about four months.

As the fourth year draws to a close, the high-speed fighter gets its final touches, rolls out to the hangar and is cleaned up for delivery.

And a few days after that, the plane flies—and the military service accepts a new fighter.

The entire 48-month process, subject to slight variations, is filled with essential activity. Not one step can be by-passed or one short cut taken—except at the expense of quality.

This is the reason that the life-and-death decisions of 1956 and the later 1950's have to be made today by America's military planners.

Government Plans Intensified Support Of Transport Helicopter Development

By Richard K. Waldo
Chief Economist, CAA, and Chairman, Helicopter Working Group, Air Coordinating Committee

The Federal Government has adopted a policy of intensified support of commercial transport helicopter development, as the result of a recent study and report made by the President's Air Coordinating Committee.

Waldo

The report found that military development and use of transport helicopters is advancing the art to the point where effective utilization of large multi-engined rotary wing aircraft on short-haul airline routes can be foreseen. Primary advantage of the helicopter is that it is capable of operating from small downtown or close-in heliports rather than outlying airports, thus providing appreciable time saving in downtown-to-downtown schedules, particularly on routes with relatively short distances between stops. This should permit considerable penetration of the short-haul travel market, which up to now has been dominated by rialroad, bus and private auto.

The transport helicopter's first application will be on metropolitan area radial-type routes where it can carry the mails at much lower cost than the small equipment now in service, as well as functioning as an aerial shuttle to and from airports. As larger and multi-engined ships become available, its range of effectiveness will be broadened to include short-haul linear-type intercity routes of the local service and trunk airlines.

Cutting Operating Costs

Although direct operating costs of the most advanced transport helicopters under development will apparently be at least 50% higher than those of fixed-wing aircraft of comparable size, advances in the art are expected ultimately to bring costs down to a more competitive level.

Present and prospective military requirements preclude the early commercial availability in quantity of transport helicopter types now in production, while the first of the larger multi-engined types now in the development stage will not be available for commercial operations for 3 to 5 years. However, in view of the present and potential value of the helicopter to the commerce of the U.S., the postal service and the national and civil defense, the report recommends that a limited number of transport helicopters be made available to commercial airline operators for service testing and regular operations.

Major Recommendations

Major recommendations of the report call upon the Post Office Department to continue the use it has made of helicopters in expediting terminal handling of mail in the Los Angeles and Chicago areas, and to make maximum use of such additional metropolitan area services as the CAB certificates; the CAB to authorize helicopter mail services in additional metropolitan areas as required; and the CAA, in collaboration with the CAB, to continue its generally sympathetic and promotional approach toward helicopter Civil Air Regulations, as well as to study helicopter airways and landing area requirements. NACA is asked to increase its emphasis on basic helicopter research.

PLANES QUIZ

Seventy per cent score on this quiz is excellent. Sixty per cent is good. Answers on Page four.

1. Crop dusting and spraying rquires nearly as many pilots in the U.S. as the nation's airlines use. True? False?

2. Scheduled airlines of the world now use 3,830 transport aircraft. Of these, U.S. manufacturers built: (a) 50%; (b) 70%; (c) 80%?
3. Where is the world's highest airport?
4. What is the operational life of a spark plug in modern airliners?
5. Cost per pound of building a fighter plane prototype has increased since World War II by (a) five times; (b) seven times; (c) nine times?
6. Jet powered transport planes will require longer runways. True? False?
7. Jet engines can be started in as little as (a) four seconds; (b) 30 seconds; (c) two minutes?

8. Airlines of the world now employ (a) 100,000 people; (b) 150,000; (c) 200,000?
9. How many Air Force bases does the U.S. have now?
10. At the peak of World War II the "average" Navy plane cost $160,000. What would be your estimate of the average cost today?

BOYER

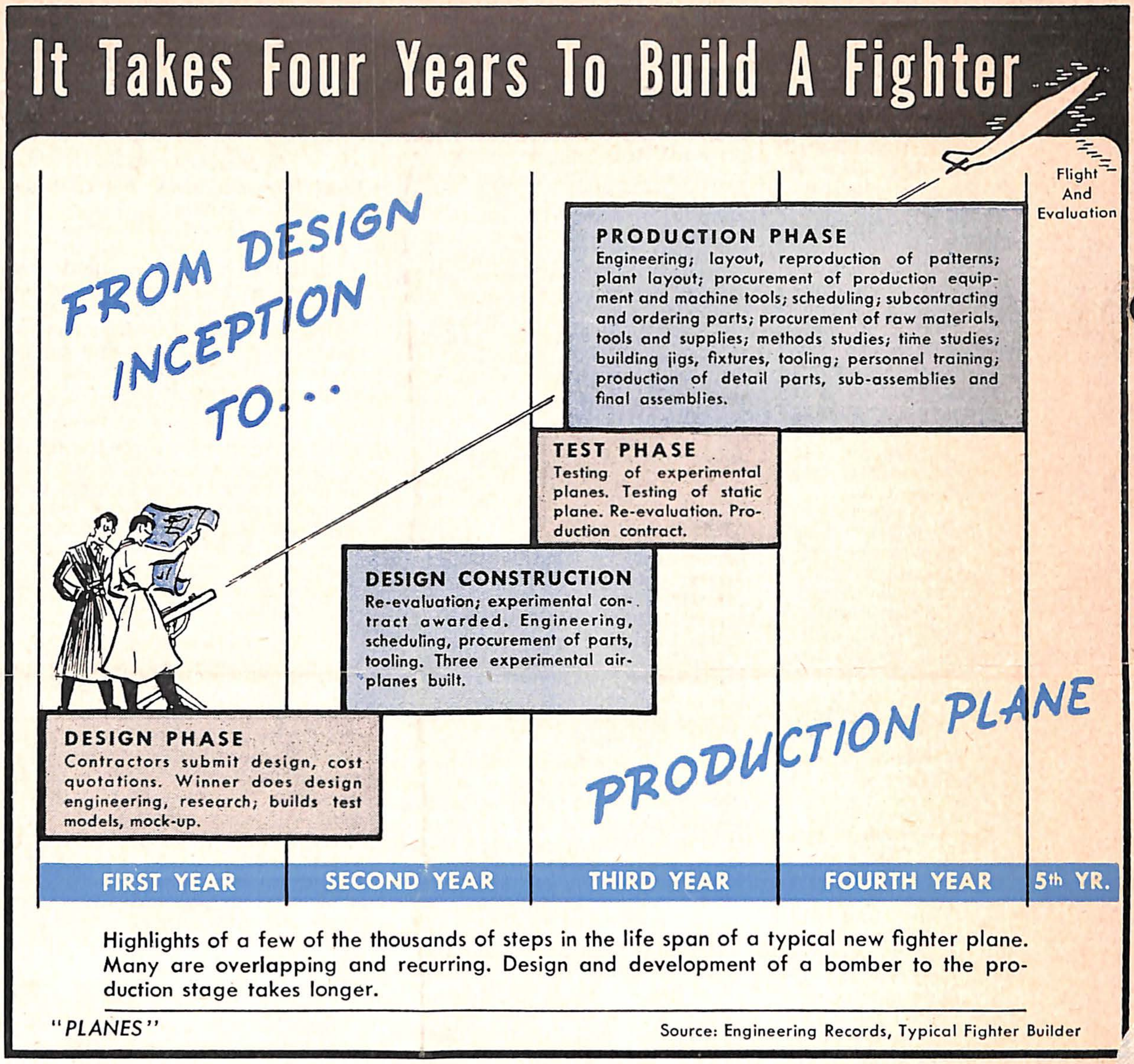
(Continued from Page 1)

month. Moreover, in size, complexity and performance these airplanes must far outstrip their counterparts of World War II days.

Despite the proven ingenuity of the aircraft industry, there is no shortcut to such a buildup. Serious problems confront us now, and the next nine months are apt to be a continuing critical period.

The revised schedule is the result of the chief bottleneck encountered to date—the production of new jet engines, held down by the lack of machine tools and certain critical materials. Airframe production, accelerated swiftly during the months following Korea, will, in the months to come, outpace the increase in jet engine output, and rescheduling is aimed at more nearly matching airframe and engine production.

In a defense mobilization program such as ours, scheduling of planned airframe production must be done realistically. Because modern airplanes are infinitely complex, the factories require vast "pipelines" stretching all across the country, fed by thousands of components and parts manufacturers and suppliers. When the momentum of the vast manufacturing process is cut down at the airplane factory, it must also slow down clear back along the nationwide supply lines. Thus the whole finely correlated industrial machine is geared down. And it can't be speeded up again by the turning of a valve or the pulling of a lever. Every individual part and component plant, large and small, must go through the readjustment process — a time-consuming and extremely costly proposition at best. The current schedule adjustment will prevent such an unfortunate occurrence in the months to come.



Highlights of a few of the thousands of steps in the life span of a typical new fighter plane. Many are overlapping and recurring. Design and development of a bomber to the production stage takes longer.

"PLANES"   Source: Engineering Records, Typical Fighter Builder

Cutbacks are Costly

If we are to prevent higher price tags on the airplanes we must have, and if we are to hold together the trained manpower teams which must produce them, we must avoid any foreseeable situation which might result in drastic rescheduling. It is impossible to estimate the effect of schedule cutbacks on costs and employment once production momentum has been achieved.

What is penalizing aircraft production now is the result of what we didn't do 16 months ago. The lack of sufficient engine capacity is traceable directly to the shortage of machine tools now that acceleration of engine production becomes vital. It was not until recent weeks that priority assistance, pricing relief, government pool orders, and a sympathetic understanding of the problem cleared the way for the machine tool industry to get its production into high gear. This long lag is now being felt severely and will manifest itself for many months to come.

Can't Let Lowest Factor Govern

Even though we are forced to adopt the expedient of rescheduling, it must be remembered that if we gear airframe production to the scale of current inadequate engine output, we are making the lowest common denominator the limiting factor. This is contrary to the philosophy of production which has enabled us to rearm in other crises.

We cannot forever adjust schedules to pace the lowest factor of supply. This type of approach cannot be accepted as a guide for the future. Rather, we must buttress production all along the line and do a detailed job of allocating resources in short supply to the most urgent programs.

The airframe builders themselves are now face to face with another bottleneck — a serious shortage of materials, particularly certain types and shapes of aluminum, copper and steel. Unless more adequate supplies are found, deliveries of aircraft will be adversely affected within the next few months and undoubtedly throughout the coming year.

We must bring up our production all along the line as rapidly as possible. As long as our nation is in danger we cannot be satisfied with inadequate aircraft production schedules. This means that we have got to *anticipate* the problems in materials, supply and production. Never again can we afford to be placed in a position such as that caused by lack of foresight on machine tool requirements.

Military Vs. Civilian Demands

Already we have had an example of failure to heed some of the lessons we learned in World War II. In a mobilization and production program such as aircraft manufacture, the mistakes, the oversights and the spring training errors come home to roost with finality six to nine months after they happen.

The aircraft industry and all government agencies involved have got to give full attention to dealing with potential bottlenecks before they occur, bring all the elements of production into balance, and effect synchronization of the flow of materials into completed battle-ready aircraft.

Our problem is infinitely complicated by the fact that what we are trying to do has no parallel in history. During World War II we had all-out production; we also had complete control and channeling of materials until the war was won. Now we are coping with accelerated military production and huge civilian demands at the same time, both voracious consumers of materials, and users of labor and facilities.

Thus far we haven't done too badly in this dual role—it is still possible for the average citizen to shop along Main Street and purchase practically any article which suits his fancy and his pocketbook with, perhaps, a little emphasis on the latter!

"Time May Be Running Out"

At the same time, military end products are beginning to roll off the assembly lines, made possible to a large extent by the diversion of a portion of our basic materials, and in the area of certain critical metals and alloys, a major part of the supply.

But this is no time for complacency — time may be running out on us in this the greatest peace insurance program of all time. Thus far, our energies in a large part, have been devoted to the creation of facilities for production of both material and end product, and in the months ahead we will start to chew up metals and utilize manpower at ever increasing rates. We will then face the supreme test of this giant undertaking, the so-called "butter and guns" program.

Then and only then will we learn how successfully our planning of today will stand up under the scrutiny of tomorrow.

Answers to Planes Quiz

1. True. Latest CAA analysis shows more than 6,400 pilots do dusting and spraying. The airlines last year employed 7,250.
2. (c) 80% are U.S.-made.
3. The La Paz, Bolivia, airport is 13,400 feet high. It soon will have a 16,000-foot runway.
4. One airline reports spark plugs last 750 hours in its two-engine planes, 1,300 hours in four-engine planes.
5. (c) Nine times. Cost of an outstanding World War II fighter prototype was $25 per pound. Prototype of a current jet fighter cost $230 per pound.
6. True. Engineers say runways for jet transports should be 12,000 to 15,000 feet long.
7. (a) A self-starter has been developed which needs only 3½ seconds to get a jet engine up to 2,000 rpm. It weighs 75 lbs., can be carried in the plane.
8. World airlines employ some 200,000 people of whom 10% are aircrew.
9. There are now 232 U.S. air bases in use in this country and abroad. These will be increased to 309 under recent Congressional authority.
10. Bureau of Aeronautics says "average" Navy plane now costs $800 000 to $900,000, compared to t[illegible] World War "average" at peak pr[illegible]duction of $160,000. They are muc[illegible] larger airplanes with more complex equipment and give greater performance. They take longer to build and wage and material costs are higher.