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Guest Day at Renton

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BYRON FISH, *Editor;* REYNOLDS PHILLIPS, *Managing Editor;* KEITH KINSMAN, *Art Director;* JIM DOUGLAS, *Assistant Editor, Wichita;* HELEN CALL, *Assistant Editor, Seattle and Renton.*

IN THIS ISSUE

THE BRIEFING

Tank Trapped

That man with a camera, Vern Manion, is back again this month, and as usual he's been in trouble. Last month in these columns we told you about his mad dash for safety, with hundreds of potentially explosive shells pointing at him, while he was snapping photos for the story "Firing Squad." Since then he's even been in the army, and all in the interest of pictures for *Boeing Magazine.*

Several Boeing men spent two days undergoing army combat training at Fort Lewis upon the army's invitation to see how the G. I. half lives, and Manion went along to record the event on film.

His assignment the second night was to cover the building of a pontoon bridge under fire. It was all very realistic, with the battlefield lit up by exploding shells and echoing to the chatter of rifle and machine-gun fire.

It was only natural—being Manion—that he should decide the pictures probably were better on the "enemy" side of the river. So he forded it and began making his way through the blackest darkness he had ever seen. Suddenly, out of this blackness behind him, came a rumble and a roar. Manion hit the ditch beside the road a split second before a huge tank crunched over the spot he had just vacated. Careening past, the monster opened up with its guns just over his head.

It was a good thing the tank missed him, Manion opined later, for those speed graphic cameras are hard to replace just now.

Vern Manion trades his camera, temporarily, for a 30 caliber machine gun.

ON OUR COVER—Photographer Vern Manion was just passing by at Renton Guest Day, August 27, and caught this unposed picture of Mrs. Sam Yount (left) and Virginia Chiene, a visitor from 432, Seattle. Our comment: "Hot dogs!"

CONTRIBUTOR CREDITS—Photos: USSTAF (pages 4, 19); U. S. Signal Corps (4); 8th Air Force (5); Vern Manion (6, 10, 11, 12); Richard Hubbell (7); Laura Gilpin (8); V. Dwight Krehbiel (9); Charles Bartlett (10); Robert Yarnall Richie (11); Massachusetts Institute of Technology, Ray Ruppel (13); OWI (14, 15); Mediterranean Air Force, British Newsreels Association (19).

Captive Acrobat

Lieut. John W. Raedeke, author of "Roller-Coaster over Germany" in the June *Boeing News,* has been taken prisoner since his famous adventure when he piloted a B-17 through a full inside loop, a spin, and pulled it out of a dive at 400 m.p.h.—all without a rudder and very little horizontal stabilizer—and ended by bringing it home for a perfect landing.

Mrs. Raedeke wrote *Boeing Magazine* of his capture this month:

"His friend wrote to me and said he had talked with my husband over the radio and this is what he told him: 'We have engine trouble. Two engines are gone. We are making a perfect landing. Everyone is O.K. We will be taken prisoners.' Then this friend added: 'You don't have to worry about Raedeke. He can land a B-17 without any engines—and there he had two to go on'."

If the Wehrmacht doesn't watch their new prisoner closely, he's likely to tie an ironing board onto a washing machine and fly it back to England.

★

Keep 'Em Flying

When the fleet of Boeing 247 transports were built in 1932, they not only set the style for modern air transports but have set some kind of an endurance record since. At the last count, ten still are serving as South American airliners, five are in Alaska.

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CAN THE B-29 SMASH NIPPON'S STEEL INDUSTRY?

The B-29 has declared war on the steel industry of Japan. If the B-29 wins, the Jap war machine will be choked to death.

By REYNOLDS PHILLIPS

AS has been pointed out on several previous occasions, it takes planes and ships and tanks to win a war. But before you can have these three items, as well as a considerable variety of others, you must have one all-important material: steel.

The same being true of your enemy, it follows, therefore, that if you can cut off your enemy's source of steel, his army and navy and air force will presently crumble about his head like a house whose foundation has been snatched out from under it.

B-29 DECLARES WAR

This, to judge from the opening rounds of the battle, is just what the Boeing Superfortress is setting out to do to Japan.

The Superforts' first blow, on June 15, struck the Imperial iron and steel works at Yawata, the largest steel mill in all Asia and source of one-fifth of Japan's steel production. Yawata has been hit twice since then. Another strike at Nippon's steel industry carried the B-29s far to the north, into Japan's Manchurian empire, where they bombed the Showa Seiko steel works at Anshan. Another mission took them to Nagasaki, situated, like Yawata, on the island of Kyushu, and home of not only huge shipyards but of the Mitsubishi steel works.

This, of course, is a mere beginning. The strikes will grow larger and larger, following the pattern of those on Germany, and they will become daily affairs. While they will not be concentrated exclusively upon the steel plants, the steel industry appears to have been selected as Target No. 1.

BACKGROUND FOR BOMBING

Just what kind of a job is it that U. S. air leaders have handed the Superfortress? What is the target like, and what are the B-29's chances of wiping it out?

When Japan chose to hurl herself into war with the United States, she did so knowing that even then she was short on steel production. She could stack her steel statistics alongside those of America, and she must have shuddered at the comparison. From her blast furnaces came a mere 8,000,000 tons of steel per year, compared with America's 88,000,000 tons. Even then, some ship repairs were being held up for lack of steel.

Either Japanese leaders were more stupid even than we have suspected, or they had reason for finding their steel prospects better than the figures would indicate. It is probable that they expected to be able to develop a tremendous industrial empire in their Greater East Asia sphere while holding back the U. S. and British forces with the military power their eight million tons could sustain. It is known, too, that Japan had set definite goals of steel production for herself, goals that were in considerable excess of her 1941 output.

The launching of war found Japanese blast furnaces ablaze day and night, concentrating entirely upon war production. Workers in the steel plants were paid from 1,400 to 8,000 yen per year, a fabulous wage in Japan and a clear indication of the importance the imperial government placed upon its steel production.

As a result of the emphasis placed upon steel, industrialists estimate that Jap steel output probably more than doubles its 1941 figure by this time.

CONCENTRATION CRAMPS

In the home islands of Japan, the steel industry is concentrated largely about Tokyo and the highly industrialized northern end of Kyushu Island, in the neighborhood of Yawata and Nagasaki. To meet the threat of bombs, Japan has been decentralizing much of its industry, moving it away from crowded cities. With the steel industry, though, this is hard to do. The steel mills, with their great blast furnaces, require many months to build.

Part of the answer to the decentralization problem was the development of Manchuria, officially known as the Jap puppet state of Manchukuo. With their deep military penetration of North China, the Japanese believed they had protected Manchukuo from bombing. The B-29s already have shown them their mistake.

Manchukuo is Japan's industrial ace-in-the-hole, and the Japs have gone about developing it with tremendous zeal. In 1937 they launched an industrialization program called, with a bald-faced infringement on Joe Stalin's copyright privileges, the Five-Year Plan.

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ILLUSTRATION BY HAROLD ELLIS

Running Interference FOR INVAS

These Fortress bombs, bursting just across the front lines, were part of the tremendous July 25 barrage that smashed German troops and installations, clearing the way for the giant U. S. offensive of July 26 in which the Yanks broke out of Normandy and went storming across France in the wake of the Fortresses.

To keep German planes on the ground, Fortresses continually pounded their airfields, kept them looking like this pock-marked one at Evreux-Fauville, fifty miles from Paris. The technique was to concentrate upon the intersection of two runways, putting both out of commission at once, as this photo graphically shows.

When the Yanks invaded France the B-17s were out in front of them all the way, like a blocker clearing a touchdown trail. The story is told by a Fortress pilot and former member of shop 104 at Boeing Plant 2, Seattle.

By CAPT. LEE H. DENNIS

THEY got us out of our bunks a little past midnight. That was a couple of hours early to be getting up for any ordinary sort of a mission, but we only grumbled and dressed and went out into the night. We still didn't suspect.

I walked down to the operations hut. A burly, helmeted MP was barring the door with a rifle.

"Name, rank and serial number," he demanded.

I began to get the idea then. They had never posted MPs at operations before, and your face was your pass wherever you went.

Inside there were more MPs, at every door. On the wall of the briefing room was a map that looked half as big as France itself.

"This is the Moment," the C. O. told us. "This is the day we really go to work." And he proceeded to explain our job for D-Day morning, a mission that was routine enough in itself but was the kick-off for the most hectic, most important bombing campaign in all history.

In that campaign our B-17s, the most famous strategic bombing planes in the world, were to become tactical bombers. The difference is a sharp one. A strategic target may be any distance from the battlefront—an aircraft plant, an oil refinery, a submarine yard—and if you knock it out the effect of the bombing won't be felt at the front for weeks or maybe months. A tactical target is in the battle area—a part of the battle itself. Hit it, and the effect will be felt right now.

BLASTING A PATH

So we, the men who flew the Fortresses, became as much a part of the invasion as the doughboys who stormed ashore on the Normandy beaches. We were running interference for the invasion.

It was shortly after four when we took off that first morning. The target assigned our group was Caen, in Normandy. It was a railhead, the junction of two main lines from Germany and from Northern France. Through it the Nazis were pouring reinforcements to throw at the Yanks' beachhead.

Going out over the Channel at dawn, we had fighter cover in a solid blanket. And bombers! I'd never dreamed there were so many planes in all of Europe.

Only once did our formation spot any Jerries. Heading north toward Caen we met a flight of ME-109s, but they were in a hurry to get elsewhere.

Over Caen the flak was only moderate. The Germans, we guessed, had moved some of their guns up to the coast. But German troops and German supplies were jammed into the rail yards down there like housewives at a bargain counter. We hit them with just eighteen Forts from 20,000 feet, and reconnaissance told us later that we had knocked out that rail junction for probably a three-week period. That prevented a lot of Krauts from reaching the coast in time to catch the Allies on the beaches.

From then on our 8th and 9th Air

TOP OF OPPOSITE PAGE—Before Allied troops stormed ashore on Normandy's beaches, the Nazis' coastal defenses — well mapped in advance by aerial reconnaisance — were pulverized by Flying Fortresses. This photo, taken just before the landings, shows a coastal gun position that B-17's have flattened.

ABOVE—Part of the pattern of smashing German transport and supply lines was the bombing of bridges over which German equipment and troops poured toward the front. This bridge was wrecked by Fortress bombs on June 11, when the Nazis were striving desperately to throw the Allies back into the sea.

Forces and the RAF ran a continuous shuttle service to France and back.

The Seventeens were in the air all day, every day. We hit the sack at night, dog-tired, and before the night was half gone they were likely to route us out to start the next day's operations.

The days of careful pre-mission briefing, of studying slides of the target, were gone. The raids became strictly spur-of-the-moment stuff, unlike any missions in the history of heavy bombing.

ORDERS IN A HURRY

Orders reached us in record time. When the ground forces in Normandy wanted a target knocked out, they sent their request to Eisenhower's headquarters. From there the field order went swiftly by teletype to Eighth Bomber Command, and on down to the bomber wings and out to the individual fields. It reached us in brief, straight-to-the-point form: "Such-and-such a point must be bombed by 10:35 o'clock."

The arrival of a field order was the signal for the hurried forming of groups, wings and divisions of bombers that would carry out the attack. Details were worked out in minutes' time by telephone. A group leader, picking up the phone, would hear something like this: "Can you get your group to ..... at 10:35? We don't know what the target looks like, but you hit it."

The answer had to be yes, and the bombers had to be there. A single minute's delay could be fatal.

For the most part, pilots and crews were ordered to stand by their ships with no advance knowledge of what the mission was or where they were going. Just before take-off time a jeep made the rounds, giving them the target.

Sometimes the target was a concentration of German troops that was giving the Allied armies trouble. Sometimes it was a gun position, or a bridge over which Boche reinforcements and supplies were pouring to the front.

We paid regular calls on the Nazi airfields that were sprinkled through Western France. Whenever the planes from a particular field would grow troublesome, we dropped in for a brief visit. We didn't hit them too hard, because some day we would want to use those fields ourselves. But we hit them often, pock-marking the runways with light explosives that would prevent the Jerries from using them for a while. As soon as the Germans got them repaired and had their planes in the air again, we returned.

MORE THAN RABBITS

Most of our targets weren't as easy to spot as the airfields. The Germans are masters at the art of camouflage. Usually, in the case of a gun battery or a rocket bomb launching platform, for instance, all we could see from the air was a patch of trees. We dropped our bombs, and when we looked back and saw things exploding down there, we knew those woods were full of more than rabbits.

As I mentioned earlier, the raids were spur-of-the-moment affairs with us. By the same token, they were for the most part split-second affairs too. If our timing was off it could mean death to American doughboys down there. In a lot of cases we were called on to knock out an enemy strong point by a certain hour and minute, and five minutes later the Yanks on the ground were advancing on

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The "Strat" in Strategy

When the Stratoliners came home to Plant 2 their tongues were hanging out. They'd been helping create history in a large way, ever since the war began.

By DICK WILLIAMS

BACK in Iceland the weather men at the field had said the Boeing C-75 could expect mixed rain and snow squalls. Now the drab-painted transport, roaring westward a thousand miles out of Newfoundland, had found them.

It was November, 1942, and the men in the plane, hugging the base of a low and ragged overcast, saw the gray North Atlantic waters only in patches, through the obscuring scud and mist. They were on instruments one minute, off the next.

Capt. S. T. Stanton, the skipper, squinted outside, then left the controls to Capt. R. E. Churchill, his first officer, and stepped back into the cabin.

WHO'S THAT?

As he stood talking with a passenger —the C-75, as on most trips, had "brass" aboard—there was a sudden rattling outside, like machine gun fire. He remembered later that it sounded as if the lead weight on the trailing antenna was flailing the back of the ship.

The freighter's gunners snap-judged the 307 for a German Focke-Wulf *Kurier.*

ILLUSTRATION BY JAMES WANDESFORDE

A moment later the plane lurched, made a violent turn to the right and, like a frightened bird, pulled up into the safety of the overcast.

Stanton ran forward, to find Churchill looking grim and pointing downward. It was ack-ack, the first officer said, and he had seen tracer bullets streaking up between an engine and the cockpit.

Nobody had been hit, but through an inspection plate aft, Stanton could see ugly, jagged holes in the tail.

As the C-75 fled westward, Newfoundland seemed to lie at the end of a long, long road. But they got there, and when they piled out to look at the transport's wounds, they found a 20-mm. cannon shell had torn through the skin and exploded.

ITCHY FINGER

They had been sighted, as the plane had dropped through the overcast, by an eastbound Allied freighter whose gunners snap-judged the transport, evidently, for a Focke-Wulf *Kurier.* But the flyers had to agree that a freighter's gun crew, if it wants to live at all, must live by the rule of "when in doubt, fire."

The airplane that flew through that brush with disaster was a four-engine land plane. Once it had been a luxury ship, the *Comanche;* now it was strictly G. I. Two rows of bucket seats lined its forward passenger compartment, five 212-gallon fuel tanks were trussed back of

ABOVE—The sleek, big 307, blazing the trail to higher altitudes, was the pre-war phenomenon of U. S. airlines.

OPPOSITE PAGE—Back from the wars with an honorable discharge, the Stratoliners checked in at Seattle recently for rework. Employees clustered curiously about the first one to arrive.

the navigator's "office," and eight plain canvas bunks filled one side of its mid-section. Opposite them were three deep lounge chairs, upholstered in blue, sitting as incongruous reminders of what the plane had been.

What it had been—and, under the khaki war paint, what it remained—was a Boeing Stratoliner, gone to war like some air-borne Queen Mary.

It was Boeing's Model 307B, world's first high-level, pressurized transport, and it had joined the Army Transport Command, with four sister ships, as a C (for Cargo)-75, after two years in coast-to-coast service with Transcontinental & Western Air, Inc.

OVER-THE-SEAS VETERANS

"What became of the Stratoliners?" is a question that can be answered today, because the Transport Command has mustered them out with honorable discharges. Boeing-Seattle is reconverting them, and by January 1 they will be back with TWA—once again as the only four-engine transports in domestic airline service.

TWA used to advertise that its Stratoliners—the *Comanche, Zuni, Cherokee, Apache* and *Navajo*—had gone to war. They might have said, with reason, that the Boeings had joined the General Staff. For the "Indian quintet" hobnobbed with generals, admirals, ambassadors and even a king; went on many a world-wide tour of inspection, visited the capitals of Allied nations in every continent but Australia.

Their globe-trotting added up to a stupendous seven and a half million miles, flown in 44,911 hours.

Noteworthy in the Stratoliners' war records are that North Atlantic incident involving the *Comanche's* tailfeathers, and a close call one day at Natal, Brazil. There an incoming 307B knocked its landing gear off in skimming a dike.

Worth noting, yes—because they are the *only* "wound stripes" in the whole durable quintet. The statistics are terrific: number of airplanes, 5; total hours with ATC, 45,000 (nearly all of them over the North and South Atlantic); total ocean crossings, 3,000; planes lost, 0; personnel lost or injured, 0.

RECRUITED FOR KHAKI

A good man for translating those statistics into the Stratoliners' real story of accomplishment is TWA's Bob Loomis, engineering supervisor of the line's intercontinental division.

"The Transport Command was just getting going when it began negotiating for the Stratoliners in the fall of 1941," Loomis recalls.

"Pearl Harbor speeded the deal along. Jack Frye, TWA president, contracted to turn the planes over to the army, and in January of 1942, at Kansas City, we began converting the planes for army use.

"We ripped out the fancy interiors, removed the cabin pressurizing system, put in the extra fuel tanks, installed a lot of special equipment. The first of the five went into ATC service in February, 1942, and we had to work fast to make it by then. You see, the Boeing Stratoliners were selected as the planes most capable of carrying high-ranking army and navy men on the 'global commuting' they had to do."

LAND AND SEA PLANE

The historic first ATC flight of the Stratoliner went from Washington, D. C., to Trinidad, Brazil, the African Gold Coast and Cairo and back.

Thus the Stratoliners actually initiated ATC's transocean service, and they proved that land planes could fly the Atlantic dependably. They broke trail for the thousands of planes which have been flight-delivered over the ocean to bases in England, Europe and Africa.

TWA and the army laid out two routes, both from Washington, D. C. The first ran South to Natal, across to

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Get a load on that wing

By HELEN CALL

The heart of a plane's performance lies in its wing. That's why the B-29's wing had to be the greatest airfoil ever designed.

INVENTING used to be thought of as sort of a Ouiji board game, with the prospective inventor waiting hopefully for an inspiration from the blue. If he ever turned up with an idea the public tended to put it in the same category as an act of God.

Unpredictability is no longer an inventor's prerequisite. Most inventors these days are called engineers and they are expected to invent automatically.

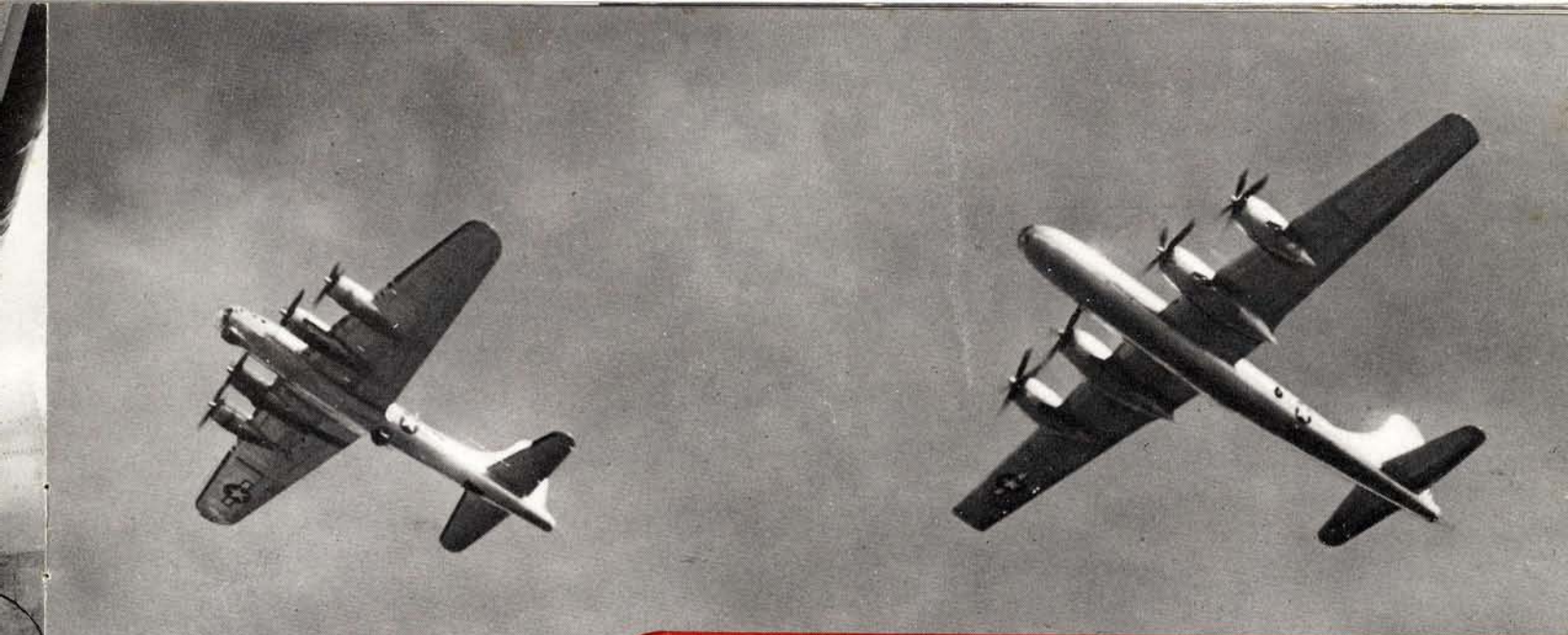
In the category of inventions on request was one of the greatest engineering achievements evolved for the B-29—the Boeing "117" wing. Turning out a new wing involves the purest of aerodynamic theory and the most ivy-towered variety of research. And to complicate cool research, in the case of the Superfortress' wing, the job had an "urgent" tag attached in big red letters. The wing was one of the "hottest" parts of this husky new bomber that the Army was anxious to get its hands on. They wanted all the secret weapons available, for even at that time, 1940, war seemed inevitable.

THE WING'S THE THING

What any plane can do depends chiefly upon its wing. The wing determines how fast the plane can go, how far it can travel and what load it will carry. What Boeing came up with is proving itself to be the best performance wing in the air.

While the B-29 is impressive in size, there have been quite a few planes as big built before. But none of them has ever gone so fast. The problem of attaining the B-29's amazing speed and combining it with what has always been its antithesis—range and load—were what the wing designers were first confronted with.

What was wanted was something that seemed almost impossible with the wing limitations of four years ago. But the late Eddie Allen, then head of Boeing flight and aerodynamics, and Chief Aerodynamicist George Schairer deter-



ABOVE—Comparison of the B-17 (left) and B-29 wing—each designed for a particular job. The long, narrow Superfortress wing allows unexcelled speed and range.
OPPOSITE PAGE—The B-29 high-performance wing. The huge flap is responsible for excellent landing and take-off characteristics. Nacelle tip prevents air turbulence.

mined to produce a wing to fulfill the unheard-of performance the army wanted.

Their wing design was not a dramatic new idea that would upset the aerodynamic world. Wing design, along with most aircraft design, doesn't work that way. Getting a better wing is a job of translating theories into practice until you've got the best possible workable combination.

To design a wing the aerodynamicists start off with various mathematical formulae. They know what sort of performance they'll get from a wing with the lines suggested by the formulae. So they draw up numberless possible combinations, hoping that each will turn out to be just the one they are looking for.

In the case of a wing for the Superfortress, the Boeing engineers had no time to lose. They got six or eight possibilities and froze on them. The final product had to be one of those. The wings were made up in junior size for wind tunnel testing, for in the tunnel they could determine how the wing would act in the air.

HIGH REFINEMENT

The B-29 wing, when they finally found the right design, was tagged the Boeing "117" airfoil. According to George Schairer it "merely represents a refinement of all that is known in the science and a lot of darned hard work."

What is a good wing? An aerodynamicist would tell you that primarily a good wing is a wing with low drag. It has low drag at high speeds and low drag at cruising speeds. It has high lift and good stall characteristics.

The engineers knew they had to design a sure-fire wing while they were about it. The Army had signed up for the plane, although what they had bought was not the finished product but a piece of research.

The B-29 contract was the biggest single project in dollars that the Air Forces had ever contracted for. And they had ordered just on their confidence in Boeing engineering. This left the company with a heavy responsibility. There was no room for "turkeys" on this ship.

SPEED-UP PROBLEM

The one new fundamental problem the wing designers faced was the aerodynamic puzzle of how to drive a mass weighing more than twice as much as the B-17 through the air at a speed much faster than the B-17.

That might not appear to be such a tough proposition considering the new engines that were available for the B-29. The Wright 2200 horsepower engine would give the ship a total of 8800 horsepower, almost twice the B-17 power of 4800. But the engineer's problem is not one in simple arithmetic.

If you want twice the speed, you must have much more than just doubled horsepower. Roughly speaking, the horsepower required goes up as the cube of the velocity—or eight instead of two times. When you double the speed you have four times the drag or wind resistance, which in turn requires more horsepower to overcome it.

HORSEPOWER ON HORSEPOWER

This merry-go-round of piling horsepower on horsepower is limited at the beginning by the amount of power the engines can turn out.

Explains Wellwood Beall, vice president in charge of engineering, "We simply undertook to produce an airplane that would have no more drag than the B-17 even though it was twice as big. In other words, an aerodynamically cleaner airplane."

First they shaped a long, thin, tapering low-drag wing with an exceptionally high aspect ratio—which is simply the relation of length to width. (A "high" aspect wing is long and narrow). Twenty miles per hour was added to its speed by the use of butt joints and flush rivets. The wing skin is a new heavier aluminum alloy, 3/16″ thick. This made a smooth, strong wing, neither too limber nor too stiff. With these and other neat tricks the engineers shaped up a plane that was thirty-nine per cent cleaner than the B-17.

IT PACKS A LOAD

To lift the ship's sixty tons, and to give it the unparalled flight performance that was to be required of it, it was necessary to increase the pounds of total gross weight carried by each square foot of wing surface. The B-17 has a wing loading of 34 pounds per square foot and the B-29 is rated at 69—more than double the B-17. A high wing loading ordinarily carries with it the undesirable factor of high landing speed.

The combination of outstanding flight performance and outstanding landing performance had never been achieved before with the minimum of compromise that would be necessary to make the B-29 just what the Army and Boeing wanted it to be. In the end Boeing aero-

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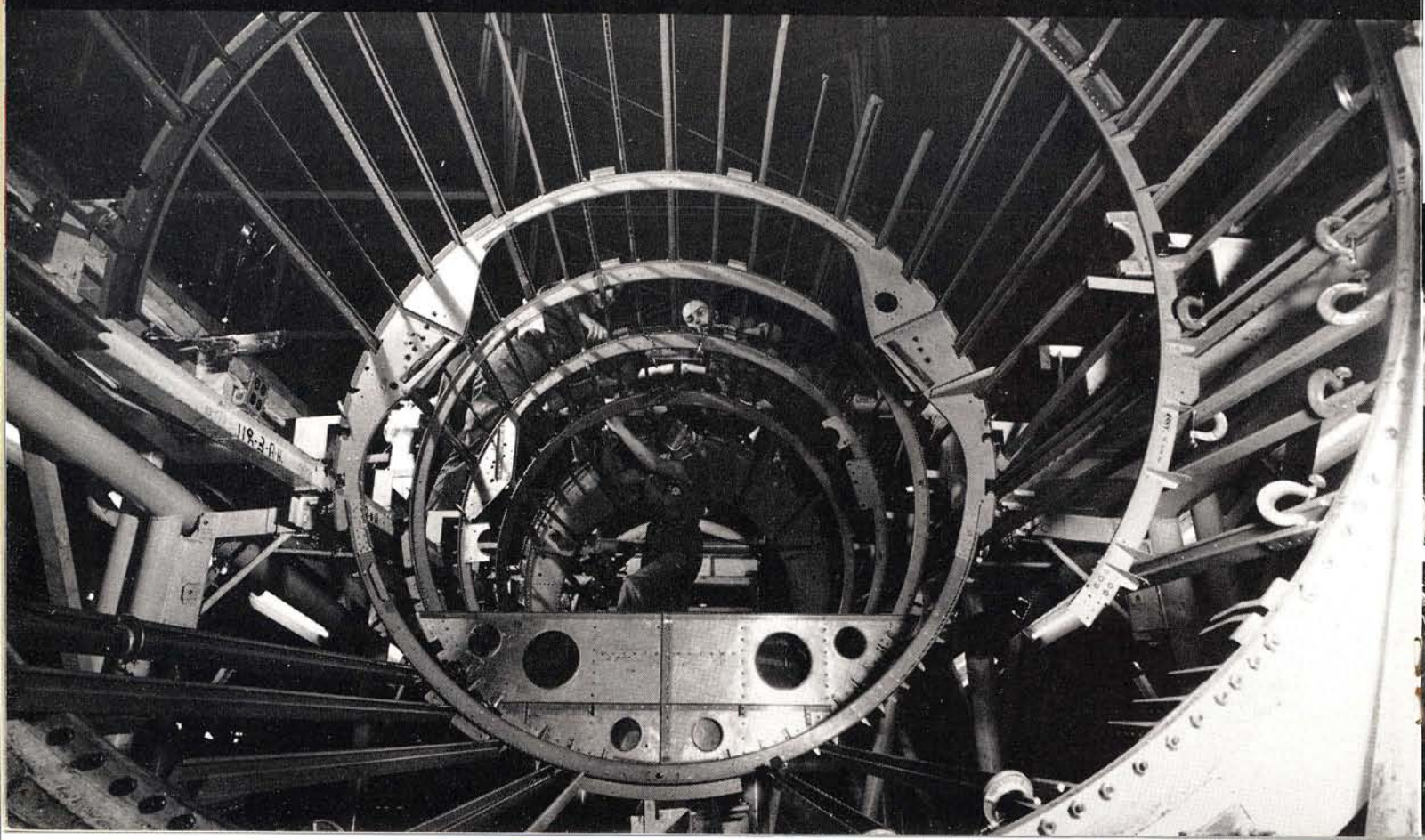
Tokyo—straight ahead. A long line of B-29s heads for the door of the Renton plant. Soon four such lines will be operating.

These Wichita folks are putting together the skeleton of the Boeing B-29—the circumferential and longitudinal stiffeners.



B-29 bomb bay sections are lined up in military precision as Renton workers prepare them for a load of Tokyo-bound bombs.

Dorothy Ring, Eloise Goebel and Dorothy Ludwig of Renton work on the spherical bulkheads of the pressure compartment.

Our Destination - TOKYO

THE photos on these pages are among the first pictures of B-29 production to be released. They show production that is aimed in one direction only: toward Tokyo. Thus, with all Boeing plants swinging rapidly to B-29 manufacture, the jobs and the efforts of Boeing workers will not be affected should Germany surrender tomorrow or the day after. There is, in the approaching surrender of Germany, however, one danger:

At this point in our war with Japan the man in the street can tell, as readily as any general or admiral, what the enemy wants.

What he wants—and it is not what he asked for in the beginning, at Pearl Harbor—is a respite, a chance to get his breath.

To a tiring fighter, the interval between rounds is all too short; the seconds when he fights only so he can be saved by the bell, all too long.

Today Japan hopes to be saved by the bell . . . by the same bells that ring out for Europe's liberation.

She knows it is too much to hope that we will take a real time-out. But if we only coast, just for a while . . .

Admiral Nimitz, setting foot on repossessed Guam, had his own answer: "We have not reach the stage when we can hold anything back . . . we cannot sit and wait . . the way to beat the Jap is to keep on his tail."

The men and women whose share in this war is to work each day in Boeing plants, began long ago the transition from war in the West—with B-17s—to war in the Pacific—with B-29s. Increasingly, their present concern is the Superfortress whose might is adding a new meaning to airpower.

Peace in Europe? A satisfaction, yes, but no cause to sit down and rest.

Bomb bay sections, standing upended in their jigs, take shape rapidly beneath the skilled hands of Wichita bomber builders.

Acres of stored parts are ready for assembly. Norma Janson inventories Renton's surrealistic-looking stock of dorsal fins.

"Trained Seal" Rivet

To get the B-29's pressure cabin sealed in like a vacuum bottle, a new kind of rivet was needed —an airtight rivet. What's that? Let Jerry Eckberg tell about it.

THIS is about a man who reduced eleven pounds by putting his feet up on his desk.

And while the poundage came off an airplane and not off the man, it's still a neat trick, calculated to save bomber-building time as well as bomber weight.

The man is Gerald Eckberg, coordinator of manufacturing at Boeing-Seattle. The weight- and time-saver, which Eckberg says had two other men in on the play, is a self-sealing rivet. The airplane is the Boeing B-29 Superfortress.

The skin of the pressurized Superfort is sealed, to keep the air from leaking out into the thin atmosphere at high altitudes. The success of the pressure system depends a good deal on the cabin staying airtight.

CANNING TECHNIQUE

The customary way of sealing it has been to use impregnated tape or brushing compounds where sections of skin are joined, because rivets alone wouldn't be airtight.

Getting a perfect seal, as every home canner knows, is no cinch. The B-29 being more complex than a fruit jar, the job of sealing it is complicated, too. While the sealing tape or compound successfully seals the B-29 fuselage, it's a troublesome and messy business.

It means cleaning surfaces before the sealant goes on, applying the tape or compound, punching or reaming rivet holes through the tape, and cleaning up after riveting. It's also likely to entail getting goo on tools, which makes them slippery, and getting it on one's hands, which makes them sticky.

All of which was under discussion one day between C. P. Keeble, engineering process unit chief; Lou Goldman, rivet supervisor, and Eckberg.

The conversation wasn't recorded, but Eckberg remembers saying that a self-sealing rivet certainly would save the B-29 a heck of a lot of time and material.

"After that," he says, "I got to figuring (that's when his feet were on the desk) and along came an idea—for a little seal ring, notched right under the head of the rivet."

IT WORKS

The ring would push into, and fill up, any irregularities in the rivet hole. So they figured, and so it turned out when Keeble, Eckberg and Goldman had some custom-made seal-ring rivets driven into test sections of B-29 skin.

They called their new rivet, informally, "the keg" for Keeble, and Eckberg, and Goldman. They sent a few to Wichita, a few to Canada, for test and comment, and the comment was both quick and interesting.

Engineering, the Army and everyone else who passes on such things thought "the keg" a great idea, and everyone wondered why nobody ever thought of a self-sealing rivet before. But the inventors advise riveters not to go looking for it in the bins tomorrow or next day. While the engineering department is sure the new rivet is just the thing, they still have to put it through a series of exhaustive tests. After that, it has to go through army acceptance.

EACH ONE BETTER

But as soon as the rivet makers get a stock of the self-sealer built up, it will go into the B-29 as another in the steady stream of changes that make each Superfort a little better than the one it follows on the line.

Fifteen hundred and eighty-one feet of tape, say Eckberg and L. J. Searle, Plant 2 factory general superintendent, will be saved on each airplane. Plus scores of precious hours.

Also important is the fact that 1581 feet of tape weigh eleven and one-tenth pounds. And when you must burn three and a half tons of high-octane fuel to fly four tons "over the hump" to China bases, an ounce of airplane is worth a pound of thought.

But taking to thought to save steps, time, material and money in the construction of Boeing planes, is nothing new to Gerry Eckberg.

MAN WITH IDEAS

Now in his nineteenth year with Boeing, Eckberg keeps in his desk a March, 1937, issue of the *Boeing News*. His picture is in it, and an article about an Eckberg idea for forming plastic under steam pressure, which won a suggestion-contest prize.

The same issue pictures a fleet of miniature Flying Fortresses, cast by Eckberg and later presented, one by one, to the Army flyers who took delivery on the first thirteen B-17s.

Now it's the "trained seal" rivet, which will save literally thousands of hours of production time and shorten the "hatching time" of those mighty warbirds, the Superfortresses. There will be more ideas, too, because when a man plunks his feet on the desk and starts figuring—well, that's how Aristotle got his start!

Jerry Eckberg takes a look at his handy little production time-saver, the "keg."

FLUTTER BUGS

One thing an airplane can't stand is a case of flutter – the trade name for the shakes that can tear an airplane to pieces.

By MARGARET YOUNG

ON a day back in 1940 one of the finest bridges in America, the Tacoma Narrows span that crossed Puget Sound, began to twist and turn like a great animal writhing in pain. In a short while it had crashed into the Sound.

To this day, most citizens of the Pacific Northwest wonder what caused the span's collapse. But aircraft engineers don't wonder—they recognize the handiwork of an old acquaintance of theirs, called *flutter*.

Briefly, flutter is vibration that can shatter and destroy the framework of a bridge or a building or an airplane. In the earlier days of aviation it sometimes sneaked up on a plane, singling out any one of a number of parts—the wing, body, stabilizers, fin or control surfaces. When it set in, a wing, rudder or aileron might be shaken off and the plane come hurtling from the sky.

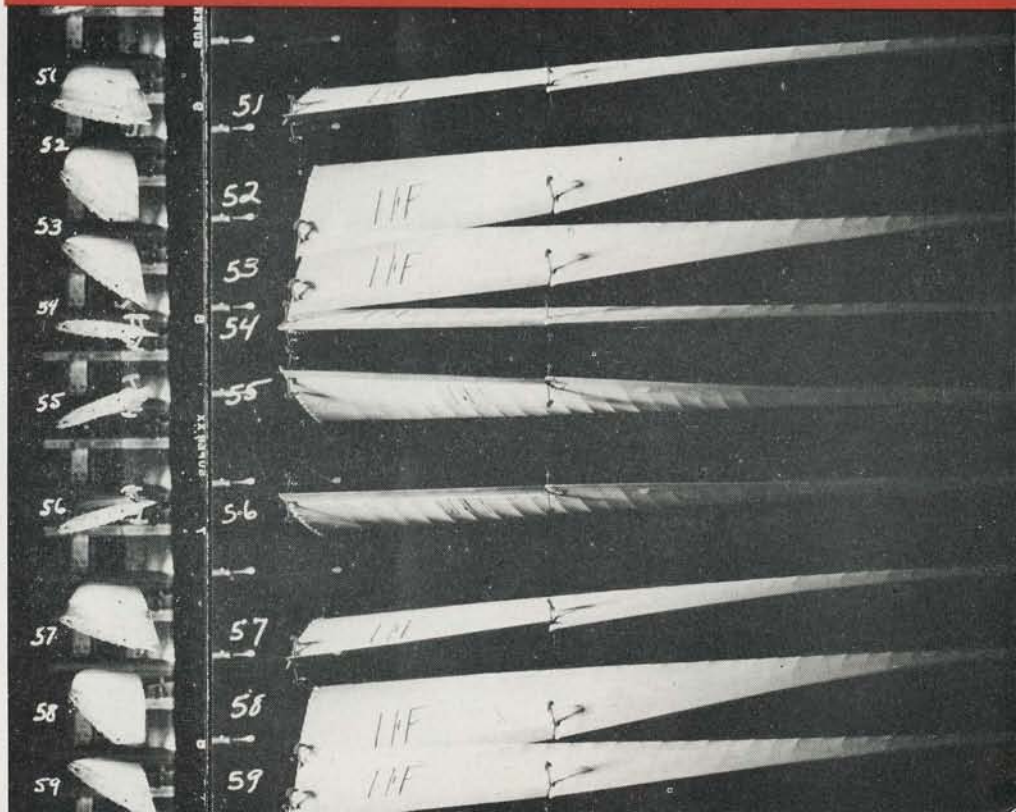
Today, however, with the instruments of modern science, aircraft engineers have learned to eliminate it from a plane before the ship has reached the production stage.

FLUTTER DOCTORS

To make sure that flutter stays away from its planes, Boeing has among its engineers a group of flutter experts, men who are trained to diagnose the first faint symptoms of the malady and to recommend preventative measures. Even before a new plane design is completed they make their calculations. When the first test ship comes off the assembly line, they seek verification of what the figures have already told them. With instruments called vibrators, vibration pickups, amplifiers and recording oscillographs, they measure and record the pulsations of the plane.

For flutter, in the beginning, is a kind of minute pulse, a sort of throbbing hid-

(Continued on Page 18)



TOP OF PAGE—This is how a wing looks to a flutter man. The vibration of every section is recorded in lines on a graph by means of a series of electric strain gages.
ABOVE—On a special B-17, Ellis Levin and John Shepard take flutter readings.
BELOW—This section of movie film, made at Massachusetts Institute of Technology, reveals wing flutter in an airplane model that is undergoing a wind tunnel workout.

Paper Route over

The scene below looks like any ordinary printing house, but what it's printing is bombs—paper bombs. Here the propaganda leaflets are counted and stacked after coming off the press, somewhere in Britain.

U. S. airmen load leaflets into bomb cases that look like the actual McCoy. They are destined either for German readers or for citizens of occupied areas to whom they will give information or instructions.

AAF technicians insert time fuses into noses of leaflet bombs. Fuses will explode containers and release contents by pulling rip cords in container's outer wall that will tear the bombs into strips lengthwise.

IN the post-invasion drive on Cherbourg, Flying Fortresses and other Allied planes dropped a great deal of stuff designed to hasten the departure of the Germans from that city. Some of it accomplished this goal by explosive means. Some accomplished it in a manner less violent but equally effective.

The latter type of bomb, carried by Boeing B-17s, was packed with sheets of paper that resembled Sears Roebuck handbills. On some of the printed leaflets the cornered Germans could read the hopeless facts of their position. On others they could read a report on the death of the Nazi 716th Infantry Division, abandoned by the German Command and wiped out by the Allies—a report written by a captured Boche infantryman.

On all the leaflets was a cordial invitation to surrender and live. Thousands of Germans accepted it, thus saving not only their own but countless American lives as well. This, psychologists hastened to point out, is only the latest in a long line of instances in which propaganda leaflets have proven effective.

BUSINESS IS GOOD

This leaflet-dropping is the air-borne branch of psychological warfare, a branch whose business has been tremendously increased since the invasion, both in volume and effectiveness. The Fortress-flown literature is delivered not only to Nazi troops but is mixed with the diet of bombs fed the citizens of Germany's homeland, too. And perhaps even more important with the invasion in full swing, other leaflets are serving as textbooks in sabotage for the continental Underground. Millions of them have guided French citizens in the bottlenecking of German transport.

The photos on these pages are the first to be released showing preparation and distribution of printed bombloads.

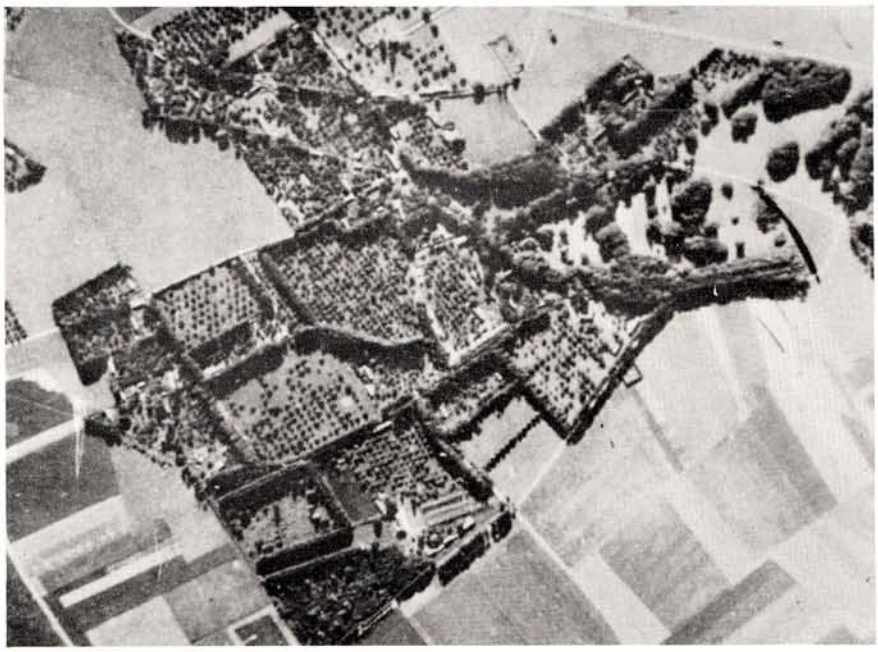
Europe

Leaflet at left was dropped on French town, bearing an "urgent message from supreme commander of AEF."

The paper bombs are stowed aboard Fortresses in the same fashion as any other type of bomb. They're towed on low bomb trucks, like the one in the photo, to the plane's belly, where the bombs are hoisted up into the waiting racks.

Tumbling earthward, the propaganda bombs look as deadly as any. These are falling on Merseberg, Germany.

Like a great snowstorm, leaflets float down on Oranienburg, a German aircraft manufacturing city. They can be aimed with great precision, and psychological bombing often comes as an immediate follow-up to a real bombing raid. Notice the bomb strikes on the target area below, still smoking, on both sides of the floating shower of leaflets. Nazis don't like either type bomb.



You've wondered what a robot bomb launching platform looks like? Here's one beneath this phony patch of woods at Bertreville near Pas de Calais. Heavy line of trees near upper right throws a shadow that probably means it's the actual launching ramp.

Running Interference for Invasion

(Continued from Page 5)

the position. A five-minute delay would have sent our bombs hurtling down on our own troops.

One of the best examples of timing and probably, I think, the most effective piece of bombing in the entire war, came on July 26. That date will be remembered a long while, for it is the day General Bradley's forces broke out of Normandy and went swarming across France, shattering the German armies.

Bradley had been waiting weeks for a clear day, a day that would enable us to put all the airpower we had over the battlefront. It arrived on July 25, and we went to work to spring the Yanks from the Norman peninsula. Actually, the weather was far from perfect for air work. It was sloppy and overcast, but it was the best we had seen for a while and there was no point to waiting longer.

SMOKE ON THE ROAD

The front line at that time ran parallel to a certain highway. Our artillery laid down a long row of smoke bombs along the road to mark it for us, and our field order said to blast anything we could see on the other side of the highway.

Everything we had in the way of airpower went over that day. From the Eighth Bomber Command alone there were three divisions of heavy bombers—chiefly Fortresses—each division with a full dozen wings. The Ninth Air Force and the RAF were out in full force, too, with every size and type of plane.

We went over in a long line of groups, wave after wave of us. We were supposed to bomb from 16,000 feet but the cloud layer forced us down to 11,000. The first line of groups dropped fragmentation bombs on the Jerry anti-aircraft installations, completely covering a two- or three-square mile area with bursting frag.

PITY THE KRAUTS

There were so many planes in the air I could hardly find room to wheel my big Boeing into a turn. The bombers sat over the German lines like a parking lot full of cars at a ball game. Riding up there and looking down, I couldn't help feeling a twinge of pity for the poor Krauts below us. So many bombers were hitting one spot at one time it was hard to imagine any men living through it.

We kept that up all through the 25th, and through the morning of the 26th. Our orders said to cease bombing at 11:55, and at that moment the bombs stopped falling as abruptly as though someone had snapped off a light. At 12:00 the American tanks moved across the highway.

That is how the Yanks launched their mad dash across France. They found an enemy already bleeding and numb and on the ropes.

Can the B-29 Smash Nippon's Steel Industry?

(Continued from Page 3)

The Five-Year Plan was a herculean effort, and before its completion the Nipponese had twice revised their objectives upward. Despite this, the end of the five years found them far behind their goal in the production of pig iron, steel, coal and iron ore. In virtually every enterprise they have attempted in Manchukuo, they have been beset by a shortage of equipment and raw materials, of manpower and of transportation.

JAP SHOWA PLACE

The great pride and joy of the Manchukuon empire is the Showa Seiko steel works at Anshan. There may or may not be significance in the fact that Japan prepared its Pearl Harbor attack shortly after Showa had begun to produce.

Jap industrialists planned a 3.1 million tons annual capacity for the Showa works but it did not materialize, largely due to the failure to get furnaces built.

A large metallurgic works built at Miyanahara in 1940 was scheduled for two million tons capacity. So far as is known, it never got there.

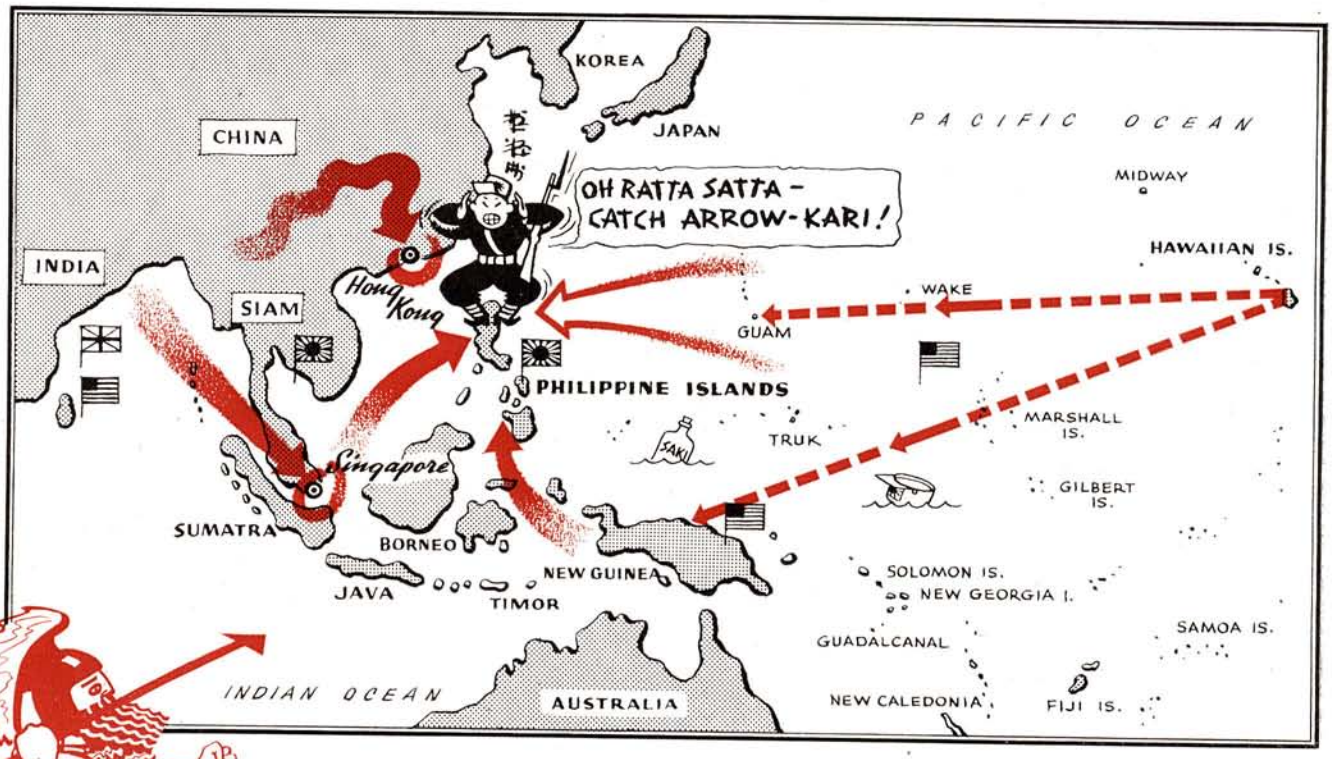
DOUBLE TROUBLE

Scurrying about like an industrious scuttlebug, the Jap has bumped into production trouble wherever he turned in Manchukuo. Handicapped initially by a shortage of coking coal to get his Showa and Miyanahara furnaces going, he finally began getting shipments through North China in 1941. Plagued by a lack of iron ore, he marked time in the steel mills while opening a large new ore deposit in Antung, near the Korean frontier. When the ore began coming from the ground, poor transportation facilities delayed it in reaching the mills.

The Manchukuon mills undoubtedly are doing better by now, but their production must be maintained by so delicate a balance of materials, labor and transport that continued bombing should disrupt it tremendously.

Singling out the Jap steel mills one at a time and pounding them, U. S. air leaders are planning to apply increasing pressure to the windpipe of Nippon's entire war production until it has been choked to death.

In the process, you will hear again and again such names as Yawata, Nagasaki, Kobe, Osaka, Kamaisho, Kawasaki, Kanagawa, Muroran, Anshan and Miyanahara. In these cities lie the steel mills that are feeding the Japanese war machine. You will find them beneath those B-29 bombsights.



WIN THE WAR WITH ARROWS

Almost every publication today has a military analyst of its own. Consequently, *Boeing Magazine* presents, herewith, its analyst, who turns out to be one Motley Bunch. Mr. Bunch should be a genius at interpreting the situation, for he has been in plenty of them.

Heretofore Motley's fame has been chiefly connected with such matters as revealing the inside story of a day nursery, but then a lot of other top-notch military analysts were soap opera announcers not so long ago. So here, from behind his eight-ball, Motley speaks, bringing you the real dope on winning the war.

By MOTLEY BUNCH
Boeing Magazine's Military Analyst

THERE are a couple of ways in which we can win the war, but the easiest way is by means of arrows. This weapon was developed by us military analysts. I'll let you in on our secret.

The arrows pierce right through armies, tanks, battle fleets and distance. All you need to make them effective is a map, an artist and a publication to print them. The artist draws the enemy's flag on the enemy's parts of the map, our flags on the rest. Then the arrows.

Suppose you are a military analyst and you want to recapture the Philippines. It's a cinch. First your artist draws dotted lines from the Hawaiian Islands to Guam, and to northern New Guinea. These are our supply routes and insure all the war materials we need. Of course there is a little matter of mileage involved, but all you need to overcome that is workers at home, ships and time.

Now that we have our supplies, we aim our first arrow from Guam to Luzon. This is an open-shaft arrow, sharp at the point and getting fatter all the way to the end. This type of arrow is peculiarly effective, to judge by all the magazine and newspaper maps. It shows we've a beachhead at Luzon.

Now we draw an arrow off the western tip of New Guinea and curve it right up the channel west of the Celebes to Mindanao—zip! This is the "pincer movement" arrow, and it nips off all the Nips south of the Philippines.

With a flip of the pen, we find ourselves in Burma—but not for long. We're off on another arrow, this time across the Himalayas. In no longer than it takes to draw it, we've reached Hong Kong.

Now we military analysts come up with one of our most effective weapons, the circle. One squiggle of the pen and we have encircled Hong Kong. This captures it. From Hong Kong it is as easy as drawing an "invasion route" arrow to establish a beachhead on Formosa.

Well, as you can see by this time, the Japs are in one hell of a spot. There's no place to retreat to but Malaya or Borneo, and one arrow from India to Singapore recaptures that port, while another arrow drives north from Singapore to the Philippines, blocking the last way out. The Philippines are ours!

Of course there are some sourpusses who claim that the only way you can win a war is to go on fighting and to stay on the job building planes and ships. That's one way, all right . . .

But, boy, page MacArthur and Nimitz. We've another map to show them.

The "Strat" in Strategy

(Continued from Page 7)

Liberia or Accra, then up to Kano and Cairo and way points. By early summer of 1942 the 307Bs, now C-75s, were operating on the northern route too—via Newfoundland, Labrador, Greenland and Iceland to Scotland and England.

Usually the northern crossings were nonstop between Newfoundland and Scotland, and until the Ascension Island base was carved out the planes went nonstop across the South Atlantic too.

"STRAT" CARRIES WAR STAFF

The planes carried a hundred kinds of "hot cargo." A flight the Nazis would have liked to know about, was made by the *Apache* in the spring of 1942, while the battle of the Atlantic waxed fierce and America struggled to build an air force in Britain.

The *Apache* quietly loaded at Bolling Field, Washington, D. C., and took off for England, with a star-studded passenger list that included Gen. George S. Marshall, chief of staff; Gen. H. H. Arnold, commanding general of the Army Air Forces; Gen. Dwight D. Eisenhower, now supreme commander of the Allied expeditionary forces; and Admirals Ernest J. King and John Henry Towers. Their business, of course, was the planning of the African invasion.

DECORATED

The following November the *Apache* was rewarded with another job: to fly to Chungking and pick up Mme. Chiang Kai-shek and bring her to the United States. Capt. C. N. (Connie) Shelton flew her both ways on her trip to acquaint Americans with China's fight with Japan, and he and his crew were decorated with the "order of the flying cloud" when they returned her safely home.

The cargoes weren't always famous names. Once it was two cows, another time twenty-four pigs, that went by Stratoliner to a base that had to keep its meat fresh on the hoof.

CONFERENCE SHIP

King Peter of Yugoslavia, Brazil's President Vargas, and Gen. Ira Eaker were among other headline personalities to find the Stratoliners safe, speedy and comfortable in ocean flights. When President Roosevelt flew to Casablanca—aboard a Boeing Clipper—for his historic conference with Winston Churchill in January, 1943, the *Zuni* and *Apache* were in the Presidential party.

Then there was the critical period in the African fighting at El Alamein, when the Allies ran out of a certain type of shells. The big airplanes with the Indian nicknames flew into the breach. They formed a flying ammunition train, shuttled whole planeloads of shells to Africa—enough and on time.

THEY PAVED THE WAY

By then other types of planes also were flying the oceans for the Air Transport Command. They outnumbered the Stratoliners many times. But for nearly a year the five 307Bs, first domestic planes to roam the world, carried the bulk of the passengers and freight that

Stratoliner

the United States flew in both directions over the Atlantic.

Sometimes they had to go long periods without the luxury of any maintenance at all. They just kept on being rugged, and the TWA pilots developed for the five "Injuns" as much respect and affection as if the planes had been human.

Since the ocean routes were a contract operation, the first to be established by ATC, the planes were flown throughout their army careers by TWA flight crews, serviced by TWA maintenance men at most of their bases.

THEY ALWAYS GOT THERE

The flight crews wore ATC uniforms, each seven-man group including the captain, first and second officers, navigator, radio operator, flight engineer and purser.

On long trips they carried, usually, twenty passengers—although on occasion it was more than twice that many. The Stratoliners called at airports in China and India many times. One of them distinguished itself in 1943 with a record of seventeen ocean crossings in twenty-two days!

And always, whether eastbound with brass hats, plane parts and knocked-down guns, or westbound with mica and other critical war materials, the Stratoliners got there. It was their knack of always getting there, as much as any factor, that made their war record first good, then remarkable, finally amazing.

Get a Load On That Wing

(Continued from Page 9)

dynamicists achieved it — an unusual combination of flight and landing characteristics that compromised neither.

To do it, they pulled their most famous wing trick out of the bag. They originated a set of enormous wing flaps, bigger in themselves than a good many fighter wings, and the biggest ever put on an airplane.

The flaps increase the ship's lift by two-thirds at the crucial moments of landing and takeoff. By giving the plane more lift it permits a slower speed than it would without flaps. The wing, alone, would stall at the slow speeds required for safe maneuvering near the ground.

The "117" has been used on three Boeing planes now — the Wichita-built AT-15 trainer, the Sea Ranger and the B-29. On all of them it has proven—well, "revolutionary" is a word that engineers dislike. But their wing is certainly the happiest combination of aerodynamic characteristics ever packed into one wing.

Flutter Bugs

(Continued from Page 13)

den deep in each structural part. This pulse, a natural wave-like vibration, is in every building, bridge, or rigid structure. In all-metal aircraft it becomes dangerous when uncontrolled and increased beyond its normal proportions.

A warping, or increase in the amplitude of the vibration, is the element known as flutter.

BRIDGE COLLAPSES

In the case of the Narrows bridge, for instance, the bridge structure was built with insufficient stiffness and the air currents passing over it increased the natural vibration and caused the bridge to sway. On this particular day the wind velocity was such that the vibration was increased to the extent of warping the structure. Such disaster could overtake an airplane wing, if care is not taken in designing it.

The simplest way to eliminate the possibility of flutter would be to pack a lot of extra weight into a plane's structure. However, this would defeat the purpose of the aircraft, since it would drastically reduce the payload.

Hence it is the flutter men's job to calculate the critical flutter speed—the speed at which flutter will set in—and to see that it is safely above the maximum speed at which the airplane will be flown. When this is done, flutter is gone for good.

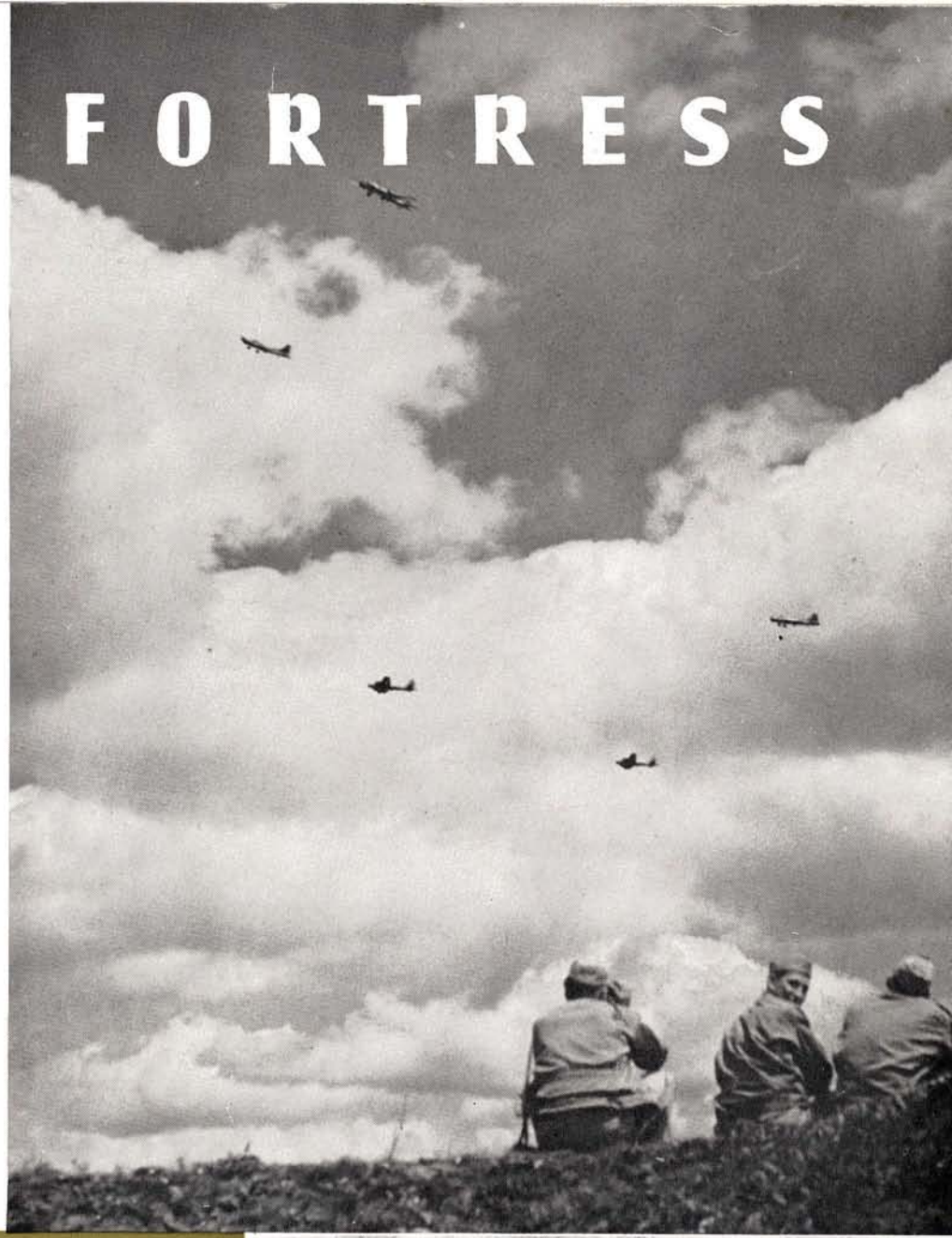
Tovarich FORTRESS

THERE'S now no spot in Germany or in German-occupied Europe that Flying Fortresses can't hit. They have proved it, this summer, with a series of unprecedented shuttle raids that not only have exposed all of Europe to U. S. bombs but have helped bring closer working ties to the Anglo-American-Russian alliance.

The B-17s made their first triangular shuttle criss-crossing of Europe early in June. The first leg of the bombing mission was from England to Russia, with their target the synthetic-oil plant at Ruhland, fifty miles southeast of Berlin. At new U. S. bases in Russia—as unprecedented as the raid itself—they refueled and took on a load of bombs for a Polish oil refinery. Their stopping place this time was Foggia, Italy. From Italy back to England they took a lick at railroad yards in France.

The Russians received them with ceremony, and with many a side-glance at what they called "magnificent equipment." It was their first good look at a Flying Fortress.

American soldiers who reached the base in advance of the flight to prepare for the incoming bombers watched as the first Fortress to reach Russia came in for a landing (upper photo). Leader of one of the first shuttle raids was Lt. Gen. Ira C. Eaker, commander of the Mediterranean Air Force, who was welcomed to Russia by Red Army officers and U. S. Ambassador Averill Harriman (below). A Russian officer (lower right) casts a professionally critical eye at one of the strange-named Fortresses.



Buy War Bonds — to Have and to Hold

The story behind the Boeing Superfortress

Remember back to January, 1940? The war in Europe was not yet five months old and war with Japan still two years away, but the U. S. Army Air Forces even then determined they must have an airplane *that would carry a heavier bomb load farther, faster and higher* than any the world had ever known.

Leading aircraft companies were invited to submit designs.

In February, thirty days before Hitler invaded the Low Countries, the Army radically increased its specifications. Those new requirements made the design problems still more difficult. But Boeing—with its unequaled background of 4-engine experience in building such planes as the Flying Fortress, the Stratoliner and transocean Clippers—was in the best position to solve them.

Wind-tunnel tests of the Boeing model so impressed the Army that Boeing was authorized to build three experimental airplanes. And then—even before the first of these had been completed and flight tested—the Air Forces decided that *this* was the world's number one bomber! Quantity production was ordered—*one of the greatest manufacturing programs ever put behind any weapon of war.* This program eventually included the Bell and Martin plants as well as three Boeing plants and literally hundreds of sub-contractors.

This placed upon Boeing a tremendous responsibility, not only in successfully engineering the design but also getting it into production.

A master plan had to be created . . . factories built . . . new tools designed . . . co-ordination of production arranged in all participating plants.

So sound was the basic design that not one major change had to be made when actual flight tests got under way. And approximately a year and a half later the first production models were bombing Japan.

Superfortresses are taking their place along with the famous Flying Fortresses in Boeing's effort to provide the Army's great bombing crews with the best possible airplanes to accomplish their hazardous and important missions.

DESIGNERS OF THE FLYING FORTRESS • THE NEW B-29 SUPERFORTRESS • THE STRATOLINER • TRANSOCEAN CLIPPERS **BOEING**