SUPERCHARGED PILOT

By

MARC HANLON

Milo Burcham, looking like a "man from Mars," is shown climbing from the cockpit of the Lockheed P-38 after a stratosphere test flight.

AERIAL warfare, with perfection of new high flying bombers, has definitely moved into the stratosphere, which means that interceptors must be prepared to go up to 33,000, 34,000, 35,000 feet and higher. And they must get up there fast.

Man, on the other hand, is put together for habitation of the lower atmospheric levels. Unless artificially supplied with oxygen, he cannot long survive above 20,000 feet. He has an even more serious weakness. When the barometric pressure is lowered the gases in his system expand. The less the pressure, the greater the expansion. The greater speed with which this pressure is reduced, the greater is the danger to him, unless . . . he is "supercharged."

And that is one of the reasons Milo Burcham's stratosphere test flights of the Lockheed-built, twin-engine P-38 interceptor pursuit is of interest to present and future pilots. He was supercharged when he made those flights.

Supercharging or decompressing for high altitude flying is not new. It has been tried out experimentally at the Mayo Clinic in Rochester, Minnesota, for the past two years in a low pressure cabin, and to a limited extent by the Army Air Corps; but as far as is known, Burcham is the first to test its value for actual stratosphere flying in the speedy interceptor-pursuit type ships.

Supercharging, also termed denitrogenating, consists of breathing pure oxygen for 30 minutes or more while exercising. The oxygen drives nitrogen from the system. Nitrogen, being a gas, expands in the tissues and blood stream in the higher altitudes. Unless the amount of nitrogen in the body is reduced about one-half, the expansion of nitrogen causes bubbles to form. In severe cases this can result in temporary paralysis or unconsciousness. The formation of nitrogen bubbles in the tissues and blood stream is known as aeroembolism. The same thing happens when a deep sea diver comes to the surface too rapidly. Nautically, it is called "the bends." The results are similar.

The aeronautical bends, with the pilot at the controls of one of these new interceptors capable of diving at 600 miles or more an hour, could be fatal.

When the nitrogen content of the body is properly reduced, however, aeroembolism is not likely to occur. This has been proved in more than 100 tests made at the Mayo Clinic. The symptoms of aeroembolism are lightheadedness, smarting of the eyelids, formication or crawling sensation over the skin, and pains in the extremities, around the joints or along the tendon sheaths or nerve trunks.

Burcham reported none of these reactions during the repeated trips he made into the stratosphere, and he duplicated the flying that would be done with one of these aerial hornets called upon to repel a high flying bomber attack. Taking off from Union Air Terminal, he skyrocketed the one-place P-38 into the stratosphere in about the time it would take the average person to walk around the block. And then he opened up the throttles of the two 1100 h.p. Allison engines and streaked through the empty spaces of the upper air faster than man has ever traveled before.

The blistering speed of the plane was radioed to a group of research engineers at the airport, headed by Chief Research Engineer C. L. "Kelly" Johnson, and recorded by a motion picture camera focused on an auxiliary instrument panel.

No pilot answering a bombing alarm will, for some time, reach a stratosphere objective faster, or give "supercharging" a better test.

The speed and rate of climb of the P-38 and the other fighters being built in the United States is opening up a new series of problems for the men who will fly them. The heights which they will reach has increased the dangers of anoxia (oxygen insufficiency), and the speeds with which they climb to critical altitudes has made aeroembolism (aerial bends) a real concern.

Burcham, with the assistance of Marshall Headle, Lockheed's veteran chief test pilot, has made important contributions to the airmens' knowledge of these problems as well as to their solution. This has been due to a great degree to the thoroughness with which preparations for the test flights were made. Headle, who in all the years he has been flying has never lost a plane, took the P-38 up only for its first check flights and then turned it over to Burcham to run the engineering, altitude and speed tests.

Milo, a few years back, was one of the country's ace aerial acrobatic performers and still holds the world's upside-down flying record. His preparations for these more hazardous forms of flying taught him the importance of proper advance planning. It is recalled that when he started out to break the upside-down flying records he prepared for his flights

by rigging a chair to the ceiling of his garage and sitting in it upside-down for brief periods, not so much as to accustom himself to the position as to test his special safety belt installation.

Before he took over the testing of the P-38 he went back to the Mayo Clinic at Rochester to get a head-to-toe physical check-up, and then spent a week conducting experiments in the Clinic's low pressure chamber in which various altitudes can be maintained, to get better acquainted with the vagaries of the upper air. Among the things he tried out were simulating a free fall from 35,000 feet with oxygen, bailing out at 35,000 feet without oxygen, and a routine trip up to 40,000 equipped with a B.L.B. oronasal mask.

The latter trip was made with a captain and sergeant from Wright Field. Milo recalls that even seated in the low pressure chamber it became an effort to talk as the altitude was increased above 30,000 feet. A fly that had entered the chamber on its own, however, appeared not to be affected by the altitude.

"The three of us kept him on the move all the time," recounted Burcham, "but he flew as briskly at 40,000 feet, as he had at sea level. He apparently hadn't heard of anoxia or aeroembolism."

In his free falling experiment, Milo went into the chamber alone, and became so intent on going up and down at various levels that when he started his free fall from 35,000 feet he ran out of oxygen. Fortunately for him he has a ceiling of about 20,000 feet, but it was a close call. (Pilots have "ceilings" just as do airplanes—different men react at different altitudes.)

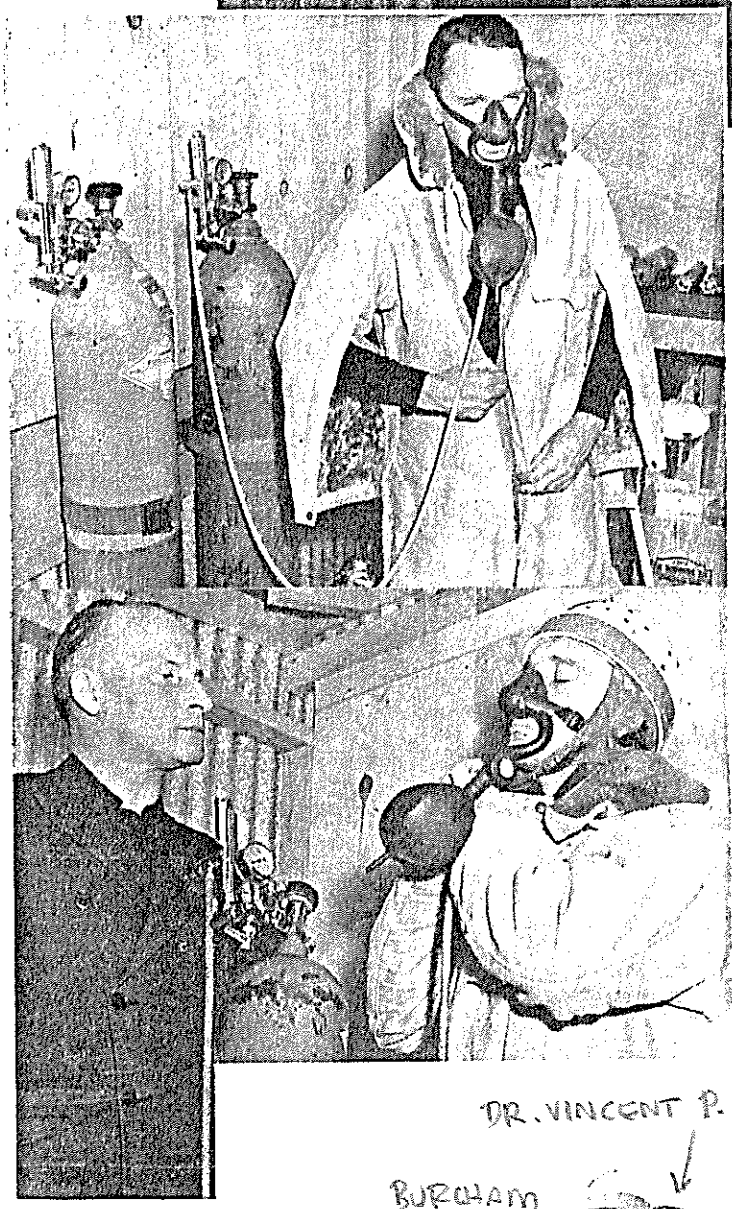
His "bailing out" experiment, made the next day, was the first of its kind in the several hundred altitude tests conducted at the Mayo Clinic. It has resulted in a revision of instruction to flyers going into the extreme altitudes and has also caused Milo to revise his own ideas about what he would do in case of trouble in the stratosphere.

Let's start this experiment at the beginning with Milo and Dr. W. Randolph Lovelace, II, assistant surgeon at Mayos, walking the treadmill at a clip of approximately three miles an hour for 30 minutes, breathing pure oxygen through B.L.B. oronasal masks to "supercharge" themselves for the trip into the simulated stratosphere.

We might even have gone back further to their diet, from which gas forming foods had been eliminated. The reason being that as the external pressure on the body grows less, gases expand. The higher the altitude, the less the pressure and greater the expansion until it reaches a point of extreme distress and possible critical results.

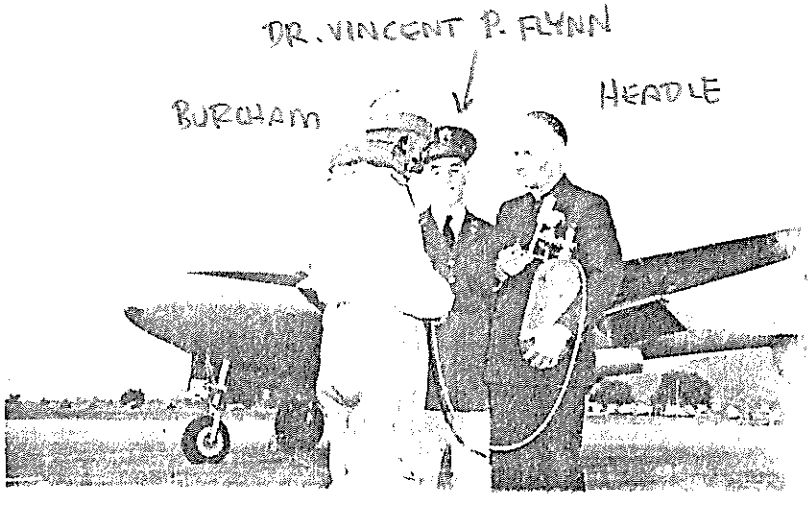
In the experiments conducted at Mayos, however, it was found that a normal healthy person who had gone through the process of decompression does not suffer from the bends. Hence the Mayo recommendation to all pilots going to 30,000 feet or above is to denitrogenate in advance. In extreme cases

Marshall Headle, left, and Major Flynn check Burcham's time under pure oxygen before letting him take off for the stratosphere

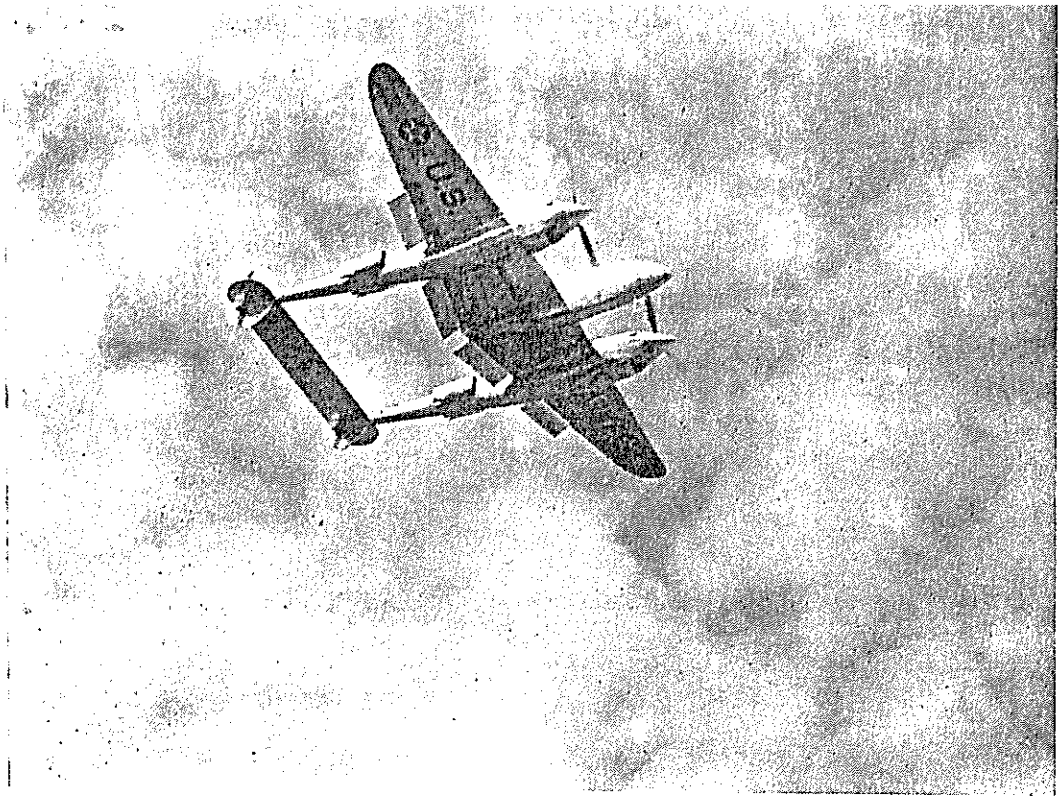


Still breathing pure oxygen, Burcham starts dressing for the sub-zero temperatures of high altitudes.

Headle, chief Lockheed pilot, holds the oxygen supply for Burcham as he buckles his crash helmet. Each star on the helmet is an hour in the air aboard the P-38.



Burcham switches from the portable tank to a pocket flask for the climb into the waiting ship. Then he will connect his mask to the plane's oxygen supply.



A flight photograph of the Lockheed P-38 interceptor pursuit. This unusual picture was made by Lockheed photographers from another plane while Burcham was making routine flap stall tests at an altitude just above the ceiling of the camera plane.

aeroembolism is followed by temporary paralysis or unconsciousness, and is helped by return to lower altitudes. While the symptoms occasionally occur in a mild form around 18,000 feet, the critical altitude is 30,000 feet. Any time a flyer goes up to that level he is running the risk of "the bends" if he has not been properly decompressed or "supercharged" in advance.

But back to Milo and Dr. Lovelace. After being decompressed they took their places in the low pressure chamber and started an "ascent" into stratospheric atmosphere at the rate of about 5,000 feet a minute to approximate the speeds expected from some of the newer fighting planes. In advance it had been planned that when they reached an altitude of 35,000 feet, Milo would duplicate the actions he would go through in bailing out of a disabled plane, without using oxygen from the time he disconnected from the plane's supply until he was ready to go over the side. He would then start using oxygen from the emergency flask (good for 10 minutes) he carried with him.

When the gauge in the cabin registered 35,000 feet, Milo knocked off his mask connection with the chamber's oxygen cylinders, and went through the motions of unhooking his safety belt, adjusting his parachute and then jumping to his feet and pressing against the top of the chamber as though freeing a hatch that had become jammed. He next braced his feet against the opposite side of the chamber and exerted a force equal to that required for kicking himself free of the plane. It was only then that he put the tube from the emergency oxygen flask in his mouth.

Dr. Lovelace noticed that the valve was not on and called Milo's attention to it. At the same time the tube fell from the pilot's mouth. As he reached for the tube and fumbled with the valve—he collapsed unconscious on the floor of the chamber! In the close quarters Dr. Lovelace had difficulty in getting an oxygen mask over Burcham's face. Within a few seconds after the oxygen supply was restored the doctor was able to lift Milo back to his seat. His first conscious effort was to place the tube from the emergency kit in his mouth and then try to finish the act of bailing out!

He was not immediately aware that he had been unconscious. He had had no warning that he was on the verge of collapse!

"It took several seconds for me to comprehend what Dr. Lovelace meant when he said, 'You sure gave me a thrill'," Milo recalled in recounting his experience.

"If I had been bailing out of a plane, instead of just going through the motions in a low pressure cabin," said Milo, "I'd never have gotten out alive."

As a result of this experiment, the advice of the Mayo Clinic to those who are compelled to leave a plane above 25,000 feet is to switch on the emergency supply of oxygen immediately they disconnect from the plane's oxygen cylinders. To delay is to run the risk of losing consciousness from lack of oxygen. Burcham, whose oxygen-less ceiling is higher than most persons, passed out in approximately 30 seconds from the time he disconnected his mask at 35,000 feet.

Faced with the problem of leaving a ship in the stratosphere, many flyers have said that they would make a free fall until they had reached a livable altitude before pulling the rip cord of their chute. For two reasons: first, the fact that it would take five to ten minutes to descend in an open parachute to an altitude in which they could maintain consciousness, and, second, to escape from the extreme cold of the upper altitudes. If not properly clothed, a flyer might freeze his extremities on the way down in a parachute. Also, excitement and cold causes an individual to use more than a normal supply of oxygen, and in most instances it is feared that in a slow parachute descent the oxygen in the emergency flask would be exhausted before an altitude was reached that would sustain life.

Burcham, as a result of his experience, however, has made up his mind to try to ride his ship down to lower altitudes, if it should become disabled in the stratosphere.

On this theory he wore only a light flying suit over his street clothes for his stratosphere test work. There was a second reason for it. The ground temperatures during most of his flying ranged from 60 to 70 degrees F., and the temperature at the plane's ceiling 30 degrees below zero. This, and the fact that the size of the one-man cabin would have made a heavy flying suit decidedly uncomfortable in the lower altitudes.

"I preferred being a little cold at the end of my climb than being overheated at the start," observed Milo.

Being considerable of a realist about this flying business, he doesn't minimize the dangers of stratospheric flying.

"Until we have progressed further in our knowledge and flying equipment," said Milo, "the pilot who takes a plane up in the stratosphere is flying in lethal territory. Failure of the oxygen supply can get him a quick introduction to his ancestors. Jumping out into temperatures of 30 and 40 degrees below zero can shorten his time here or give him one awful frost bite. And if he wants to keep healthy, he had better keep supercharged."

Appreciating that being home for dinner with his wife and two youngsters depended on the care with which he prepared for his trips "upstairs," Milo overlooked no detail. For his work and the subsequent stratosphere flying that will be done by other Lockheed test pilots, a special decompression room was built next to the Lockheed test hangar at Union Air Terminal.

The equipment installed for this purpose includes one cylinder (commercial size) of oxygen, one stationary gymnasium bicycle, B.L.B. nasal face masks (several for different pilots), emergency oxygen kits to be used by the pilot between the decompression room and the plane, and one commercial-sized cylinder of helium (80%) and oxygen (20%) to open up the inner ear passages closed by the change from the high to lower levels. Once a pilot has started the process of denitrogenation he cannot again breathe "fresh" air, which contains nitrogen, without nullifying all his effort. As a result, the pilot must breathe only pure oxygen from the time he starts exercising in the decompression room

(Continued on Page 30)

SUPERCHARGED PILOT

(Continued from Page 20)

until he return to the lower altitudes from the stratosphere.

The decompression operation is quite simple. The pilot slips on the oxygen mask, opens the valve in the oxygen cylinder and starts pedaling the bicycle. Inasmuch as he must keep it up for 30 minutes he sets a very slow pace in order not to become overheated. To insure the oxygen getting to all parts of the body and aid in driving nitrogen from joints and the extremities, he occasionally stretches his arms to the side and overhead.

For his stratosphere flights Burcham always exercised in light street clothes to guard against overheating. He put on his flying clothes after completing his supercharging, but while still "hitched" to the oxygen cylinder. This complicated his dressing and didn't improve him photogenically, but eliminated all possibilities that he might get a whiff of nitrogen-polluted fresh air.

As a result of his supercharging precautions, Burcham reports that at no time did he suffer any traces of aeroembolism on his stratosphere flights.

He was always examined before and immediately after his high altitude flights by Dr. Vincent P. Flynn of Pasadena, flight surgeon for the Army Air Corps detachment at Long Beach. The doctor found him to have a subnormal blood pressure, 105, before he started supercharging in the decompression room. After 30 minutes on the bicycle, breathing oxygen, his blood pressure had dropped to 100 and was down to 98 when he returned from his journey into the stratosphere. In view of the fact that Burcham had been making repeated trips into the higher altitudes for several weeks prior to his preparations for the service ceiling tests, the doctor was inclined to believe that his extensive use of oxygen might have caused the low blood pressure. To be sure on this point, however, he said would require considerable experimentation with other pilots under similar conditions. Other than the subnormal blood pressure, Dr. Flynn found no symptom that Burcham had been affected in any way by his excursions into the upper air.

There is one detail in his preparations for extreme altitude flying that every pilot will fully appreciate. The person who is breathing pure oxygen cannot tell whether he is getting it. There is no sensation in the nose or lungs to tell him. The gauge may show oxygen in the cylinder, but the supply to the pilot may be interrupted for some reason that might not immediately be known. And since there is no warning of oxygen exhaustion, Milo wanted some visual evidence on which he could depend to tell him when he was getting an adequate oxygen supply. For this purpose he made, in his own workshop, a glass gauge, with brass fittings, to be inserted at a point in the oxygen flow line where it could be seen at all times. In the glass container he inserted three tiny balls made from the pith of a Yucca plant. They bounce merrily in the oxygen stream when an adequate supply is being received, and lie inert when it has been cut off. If it is to be given a name, it might well be called the "Burcham visual oxygen gauge."

There was one part in Burcham's test flight preparations in which he had no hand. That pertained to his crash helmet. The mechanics at the experimental hangar took over this part of his equipment. During the first few weeks his helmet bore a new ornate design each time it was brought out to him. Before he started his stratosphere flying, however, a red, white and blue design was standardized on, augmented by red, blue and gold stars, one star for each hour spent in the air in the "Yippie," the mechanic's name for the P-38. When Burcham turned the "Yippie" over to the Army Air Corps for final testing at Wright Field, 58 stars shown from his crash helmet. The ground crew also made it the occasion for a celebration by giving him a ride from the plane in a small red wagon used in carting starting batteries to and from the ship.

There is one thing that keeps the crew of experimental mechanics and pilots knocking wood at Lockheed (Everybody who writes or talks about it knocks wood, too, and it wouldn't be amiss if the reader joined them). No ship taken from the Lockheed test line has failed to come back. It is a record that speaks well for the skill of the mechanics, as well as the pilots, and has developed an esprit that is reflected in stars pasted on a crash helmet.

Some commercial and military fliers are inclined to raise their eyebrows at the idea of decompressing before going into the higher altitudes. Marshall Headle, who has test flown every type of plane built by Lockheed but two, and who began flying in the last war, believes this is due to past experiences of pilots flying slower planes.

"The speed of the new ships and their high rate of climb has put new problems in stratosphere flying that were not apparent a year or so ago," said Headle in discussing Burcham's P-38 tests and future combat flying with ships of that type.

"With more and more bombers having ceilings above 30,000 feet," he continued, "our interceptor pursuit pilots will have to go into the stratosphere above them to get into position to attack. In most instances they will have climbed to their positions within ten minutes, and less than fifteen. The research tests on the effect of altitude on the human body have shown that it takes 30 minutes to eliminate sufficient nitrogen from the system to avoid the risk of the bends above 30,000 feet.

"A few years back it took two or three times as long to climb above 30,000 feet than it does in the new planes. Where the pilot began taking oxygen soon enough he actually decompressed himself while flying his plane and in most instances noticed no ill effects from his high altitude work.

"There are cases among test pilots in the past two years, however, of serious after effects from extreme altitude flying, where proper precautions were not taken in advance. I recall one pilot who on returning to the ground complained of double vision resulting from nitrogen bubbles getting into the blood stream. He was unable to get relief until the nitrogen bubbles had been absorbed. Many a pilot has come down after a high altitude test and felt generally miserable for days without knowing specifically the cause. It is quite possible that some of our unexplained accidents could be traced to aerial bends.

"Very little good is accomplished in developing faster planes, with improved performance, if the pilot is not in condition to utilize that speed and performance when he reaches his objective. Reactions are always slower at high altitudes, even with an adequate supply of oxygen, and speeds are greater. Any further handicap could easily render the pilot virtually useless and jeopardize his safety."

There are scores of instances in the past of pilots passing out temporarily at high altitudes and regaining consciouness in time to pull their planes out of dives. With one of these new planes living at more than 600 miles per hour a pilot might not have time to pull out of the dive before striking the earth if he were unconscious for only a short time. Headle believes that if the military forces follow up on the research done at the Mayo Clinic, they will develop a high pressure room, supplied with pure oxygen, to house pilots on call. No time would have to to be taken for "supercharging" when a battle alarm sounded. The pilots would he ready to go into action without being in danger of being laid low by the bends when they reached their attack positions.

The speed of 400 to 500 miles an hour (and more in the stratosphere) of these new planes is another reason the pilot must be in full possession of his faculties at all times, according to Headle. A change in direction going at these speeds will cause a pilot to "blackout" the same as though he pulled out of a 400- or 500-mile-an-hour dive. A "blackout" on a bank might find the pilot coming to in a dive from which he could find it difficult to pull out.

"As a result of Burcham's experiences at the Mayo Clinic and in actual stratosphere flying, we are going to insist at Lockheed that our pilots and technicians going up to 30,000 feet or higher be decompressed in advance. It eliminates risks that have been needlessly taken in the past," said Headle.

"It is ironical that we learned to supercharge motors for high altitude flying before we discovered the necessity of supercharging the pilot."