FAA AVIATION NEWS

NOVEMBER 1967

COVER

Tall in the saddle, this young man's future was very cloudy until he came under the wing of the Flying Padre. . . See page 8.

FAA AVIATION NEWS

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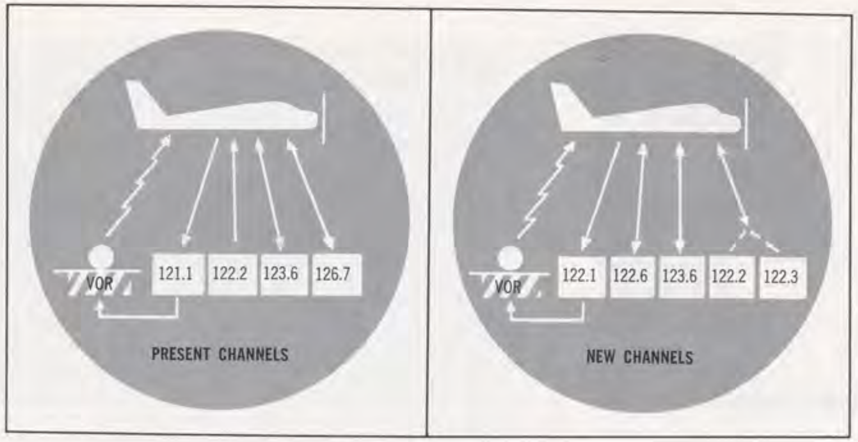


NEW FSS RADIO CHANNELS

FAA's 400 flight service stations and combined station towers will soon be offering general aviation pilots two new two-way radio communication channels in the 122-123 frequency band commonly used in VFR operations. Better flight information service and safer flying is expected to result from the new frequency line-up, which will go into effect on November 9, 1967.

As of that date, FAA flight service stations will begin to transmit and receive on both 122.6 and 123.6 *megahertz* (the current preferred expression for megacycles per second). In addition, wherever warranted by increased volume of air traffic, FSS channel 122.2 or channel 122.3 will also transmit and receive. The new frequencies will be listed in FAA's *Airman's Information Manual* and printed on low altitude en route and sectional charts.

Also, channel 122.0 will be assigned later to transmit and receive weather information from flight service stations.

In the past, only two channels in the 122-123 megahertz band were available to flight service stations for simplex operation (transmitting and receiving on the same frequency). Consequently, when the simplex channels were busy, aircraft with limited radio equipment (not equipped for IFR communications in the upper frequency band) were obliged to transmit on a "one-way" frequency and receive on another.

The Federal Aviation Administration has long been aware of the time and patience lost by pilots obliged to use "cross-channel" communications. In view of the current mushrooming of air traffic, the need for pilots to be able to communicate with ground stations swiftly and surely has necessitated opening up new channels in the 122-123 band which had previously been reserved for aircraft alone, or for unicom and multicom radio.

In working out the reassignment of channels with the Federal Communications Commission, FAA pointed out that the pilot who is transmitting on a one-way channel has no way of knowing immediately whether that channel is currently in use by other pilots. If so, he could be breaking up another pilot's transmission without getting his own message through.

> The term *mega* (million) *hertz* (cycles per second) is preferred because it is understood internationally. Heinrich Hertz was a 19th century physicist who measured the length of electromagnetic waves.

At the same time, the flight service specialist who is on the receiving end may find it impossible to unscramble messages arriving simultaneously. The use of simplex operations will prevent such confusion, saving time and trouble for both the pilot and the specialist who is trying to assist him.

Channel 122.6, now assigned as a simplex frequency for flight service stations, was formerly one of the four channels assigned as FAA control tower guard (receive only) frequencies. The remaining three tower guard channels (122.4, 122.5, and 122.7) are now considered adequate for the control towers in view of the fact that more and more general aviation aircraft are carrying sophisticated radio equipment with 360 channel capability, which gives them more than adequate access to all FAA facilities.

Channel 126.7, formerly assigned as a simplex frequency for flight service stations, will be used in the future as an air traffic control discrete communications channel.

The new frequency assignments were worked out by FAA and FCC in conjunction with representatives of the general aviation industry.

No other changes have been made in the frequencies assigned to air traffic control towers or en route centers. —*Lewis Gelfan*

What's Up Front

—a new series on aircraft engine components, how they work and how to prevent their failure . . .

Engine Exhaust Systems

Mention engine exhaust defects and the usual reaction among pilots is: "Carbon monoxide poisoning." As real and as insidious as it is (AVIATION NEWS, November 1966), CO poisoning is just one of three serious consequences of a defective exhaust system—the others are fire, on the ground during engine runup, or in the air; and engine failure or serious power loss.

Of all the major engine components "up front", the exhaust system probably receives the least attention from pilots and mechanics. It is generally thought of as simply a kind of gas pipe drain, for drawing off expended fuel. (In fact, it is also the main source of cabin and carburetor heat, and it includes a muffler which makes engine sounds bearable.)

Removing waste gases in an airplane is not as simple a task as it may sound. The high temperatures of these gases (in the range of 1,400° F.) demand careful shielding, and the piping is usually confined to a small, cramped area within the cowling which makes it highly susceptible to engine vibration. If metal failure occurs at any point, the stage is set for the escaping hot gases to set fire to lubricants, fuel, or inflammable solids.

The fire need not be a runaway conflagration to produce dire consequences—a fact amply demonstrated to a husband and wife pilot team shortly after their mid-morning takeoff last summer from a western airport. An exhaust fire (unseen by the plane's occupants) caused an abrupt fuel stoppage within minutes after takeoff. The crash landing that resulted destroyed their nearly new, rented airplane. The occupants escaped with minor injuries.

Above. Broken muffler baffle plate restricts engine power. Below. Crack, concealed by heater shroud need not be large to admit dangerous CO to cabin.

The age of that craft is interesting—*nearly new*. A detailed FAA study (still in progress) of exhaust systems shows the frequency of exhaust system failures reaching maximum at between 100 and 200 hours of operating time. The frequency of failure curve then falls off sharply at a generally constant rate to 1,200 operating hours. About 94 per cent of the failures happened within 1,200 hours. Significantly, more than 50 per cent took place within 400 hours.

Thus, the newness of an airplane is no guarantee that all systems and components can be taken for granted. In the accident cited above, the aircraft and engine had a total of 198 hours and had undergone a 100-hour inspection 43 days before.

In this accident the pilot responded with almost professional skill, when the engine quit abruptly at 5,000 feet about three miles from the field. He promptly switched tanks and moved the fuel booster pump into high in an unsuccessful attempt to restart the engine.

A subsequent investigation disclosed that the left exhaust stack was extensively deformed, cracked and burned out under the heat blanket. Escaping heat had set the nosewheel afire, and ignited the electrical wiring and hydraulic lines in the nosewheel well.

A vapor lock apparently followed, and when the pilot switched on the booster pump there was no response because the fire-seared wiring shorted out the system.

Ironically, a manufacturer's service letter recommending modifications in the exhaust system, published a month before the accident, had not been complied with. The letter recommended that the wrap-around heat blanket on the forward portion of the exhaust system be replaced with a different type of heat shield.

Even when an aircraft is substantially intact after a crash, exhaust failure as a probable cause is often difficult to trace. Such was the case when investigators sought to discover why a light plane with seven persons aboard failed to gain altitude after takeoff and pancaked into a stand of trees (fortunately, all aboard escaped injury).

The propeller, engine cowling, fuel system, windshield and instruments were undamaged. After investigators cleared away incidental debris—tree limbs, brush, etc. —the engine was cautiously run up. A power deficiency was noted.

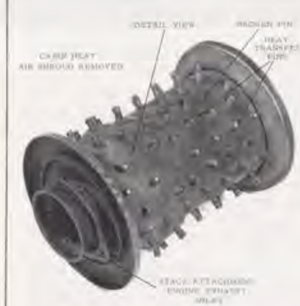
Maximum available rpm was 2,450 with 27" of manifold pressure. However, within a few seconds the rpm dropped to 2,000 rpm, where it stabilized. Additional power checks had the same result. Normal takeoff in this model aircraft is 2,625 with 28" of manifold pressure.

A faulty propeller governor was first suspected and the part sent to an overhaul depot for bench checking. It emerged with a clean bill of health. Clearly, something else was responsible for the rpm drop—and the culprit revealed itself when the cowling was removed preparatory to repairing the aircraft.

The No. 6 cylinder exhaust gasket was blown out completely, leaving a 1/16th inch gap between exhaust stack and the cylinder exhaust port. The cylinder rocker box showed evidence of extensive heat, and the shielding on the lower spark plug was completely burned away. The stainless steel fuel injection line to the cylinder was also heat scorched.

Total time on the engine since the last 100 hour inspection was 69 hours. (Design characteristics of the cowling made a preflight inspection of the exhaust system virtually impossible.)

Elimination of exhaust system associated aircraft accidents like these, as well as those associated with CO poisoning, is the aim of continuing tests being carried out at FAA's National Aviation Facilities Experimental Center (NAFEC), near Atlantic City.



Exhaust system failure often escapes detection because it is hard to see.

The tests have under scrutiny seven models of engines from well established makers. Mounted three abreast in specially designed stands that incorporate modified cooling scoops and oil coolers, the engines sometimes run as much as 80 hours a week. They are operated at take-off, high cruise and idling speeds according to a schedule that makes the hours of ground test comparable to actual flight experience.

What these tests will reveal remains to be seen but, as an adjunct, FAA canvassed its Regions for reports on exhaust system failures.

Analysis of these reports disclosed that slightly more than 50 per cent of reported failures were hazardous fatigue cracks and ruptures in the muffler outer wall that could admit carbon monoxide to the cabin through the heating system.

Thirty-eight reported cases of CO in the cabin came to light, along with 19 illnesses and 12 fatalities attributed to CO. These figures were regarded by investigators as being extremely conservative because these *documented* cases are believed to be only *one-tenth of the actual number* of failures.

Failure of baffles and diffusers inside mufflers accounted for 21 per cent of all reported exhaust system failures. Vibration and fatigue factors apparently were less pronounced in this area but extreme heat, with possible accompanying metal changes such as carburization (impregnation with carbon) or metal erosion, emerged as the major failure factor.

Contributing factors were engine backfires and high temperatures from combustion of raw fuel inside the muffler.

Exhaust manifolds, stacks, etc., which had deteriorated to a point where they no longer could contain exhaust flames, showed up in 20 per cent of the reported system failures. In addition to presenting a high fire potential, there was the accompanying danger of carbon monoxide poisoning because firewalls in many aircraft are not airtight. Fourteen fires were reported which were directly attributed to manifold and stack failure.

In the interests of weight-saving, aircraft engine exhaust parts generally avoid the heavy metal components found in automobile engines, such as cast iron manifolds. In the presence of high temperatures and constant vibration, the lighter metals are more vulnerable to imperfect design and overheating. In the interests of safety, the general aviation pilot should become familiar with the exhaust system of his aircraft, and know how and where to look for signs of trouble. ■

(Part II of this article, appearing next month, will discuss maintenance and preventive care of the exhaust system.)

Below. Issued in 11 monthly supplements and one annual summary, AIDS subscription is $1.50. Right. Mechanics are a prime source of AIDS maintenance input.

CLEARING HOUSE FOR AIRCRAFT TROUBLES

As accidents go, it wasn't spectacular—just expensive. The pilot was on a downwind approach for a routine landing when he tried to add power and the engine failed to respond. He crash-landed ¼ mile short of the runway, escaping injury but wrecking the airplane.

The cause was not difficult to trace: a maintenance failure common to the aircraft type. Investigators discovered the throttle shaft linkage to the accelerating pump disconnected and the accelerator pump shaft in the "full down" position—someone had neglected to safety-fasten the linkage. The report noted that recent service bulletins from both the carburetor manufacturer and the engine maker had outlined safe procedure methods, and that the aircraft had received a periodic inspection only about ten hours before the accident took place.

Suppose there was a convenient way for pilots, mechanics, inspectors and aircraft makers to keep informed on the common causes of recent flying accidents all over the country. How many would subscribe to such a service? Wouldn't it help cut down the accident rate?

This service has been available to general aviation airmen since 1950. It is called FAA's "General Aviation Inspection Aids" (AC-70), issued in 11 monthly supplements with an annual summary. Out of an airman population of over half a million there are exactly 3,841 subscribers—and FAA wishes there were many more.

FAA also sends Airworthiness Directives (ADs), to owners of record of specific types of aircraft, whenever mandatory corrective action becomes necessary. ADs are related to the airworthiness certificate of the aircraft, and must be observed before the validity of the certificate can be reestablished. Inspection Aids, on the other hand, supply purely informative, precautionary advice, with no specific action called for. They give the airman the benefits of nationwide practical experience with his model of aircraft, and they leave the choice of remedial action, if any, up to him.

The Inspection Aids service is the end product of a trouble-reporting program that depends on volunteer participation by aircraft owners, operators, mechanics, repair stations and inspectors, who are asked to funnel reports to FAA on all types of newly discovered mechanical weaknesses or troubles, preferably before they become a causal factor in an accident.

All that is needed to call attention to a potentially hazardous situation is completion of a pre-addressed, postage-paid card (FAA Form 1226—Malfunction and Defect Report) available at all FAA General Aviation District Offices, repair stations and from most mechanics with inspection authorization. A plain-words description of the malfunction or defective part, conditions under which it failed to perform correctly and a statement of probable cause and recommendations to prevent recurrence, is asked for on one side of the form. The reverse side provides for a sketch, to better describe the condition.

Except for approved repair stations, which must file the form under certain conditions prescribed by the FAA, all participation by the aviation community is voluntary.

In the nine months period ending on July 1, 1967, nearly 5,000 Malfunction and Defect reports (M and Ds) had been submitted by alert mechanics, pilots and other airmen. This resulted in the publication of 481 Inspection Aid items. In addition, 310 special service instructions were issued by aircraft and parts manufacturers, whose attention had been called to the problem by FAA through this service.

What happens to an M and D report after it is filled out and dropped into a mail box? First stop is the General Aviation District Office, where a check is made for adequacy of information. Next, the report moves on to the FAA regional office responsible for the original type or part certification.

Here specialists — aircraft maintenance technicians, experts in power plants, propellers, electrical equipment, airframe, etc. —evaluate the report, keeping an eye open for "repeaters" which would indicate a suspicious trend, or point a finger at a weakness in design.

Where redesign is indicated, the manufacturer is advised of the problem and asked for his solution. Frequently, the manufacturer, informed by dealers, owners and others, is already aware of the trouble and is far down the road toward solving the problem before the FAA becomes involved. Usually he is eager to take corrective action without FAA prodding in the form of an AD.

The Inspection Aids monthly supplement, prepunched for ready filing, lists aircraft items by manufacturer; also makers of engines, propellers, communication/aviation equipment and accessories. A typical entry might read:

Wing-Flap Up-Stop Beech, Model 95 and 95-55 Series	Investigation of reports indicating slight wing heaviness in flight disclosed the aircraft wing-flap stops were out of alignment. The rivnut securing the stop bolt had become dislodged and allowed a higher flap retract position.

This failed nosewheel stop will be reported in AIDS to warn mechanics.

Above. Before starting inspection, mechanic studies AIDS as safety precaution, time-saver. Left. Pilots are urged to contribute AIDS items.

A typical entry under "Engines" would read:

Ignition Harness Model 0-470 and 10-470 Series	Sparkplug leads have been shorting out because the shielding was chafing on primer lines and elsewhere. Faulty ignition has also occurred as a result of the lower leads' supporting clamps wearing into the shielding. Suggest harness leads be inspected at periodic intervals.

A section on "Maintenance Notes" calls attention to recent important manufacturers' service bulletins for various aircraft and parts. A "Special Notices" section calls attention to more isolated problems. Another section offers advice of a more general nature regarding such problems as the following:

PROCEDURES FOR REFUELING

Serious fuel leakage from bladder-type rubber-impregnated cells has, in a number of instances, been traced to careless fueling procedures with fueling equipment that utilizes a long fuel nozzle. These long metal nozzles can, in many installations, reach the bottom of the cells and cause tears or develop weak spots in the blatter material."

Case histories—accident investigation detections—are included to illustrate the relationship between good maintenance practice and safety. Pilot experiences which bring to light unsuspected problems or dangers are reported:

DEAD BATTERIES AND POWERLESS SOLENOIDS

During the investigation it was found that, if the engine in this aircraft is started by hand because of a dead battery, the electrical instrument (fuel quantity gauges, oil temperature gauges, etc.) on the instrument panel would not register. This condition exists because the non-self-excited alternator on the engine does not furnish electrical power unless the solenoid is closed by battery power. Thus, the operation of all electric appliances, i.e., aux. boost pumps, radios, lights, etc., is affected.

The annually published Inspection Aids Summary carries all the information provided in the 11 previous supplements, updated and revised as completely as possible. The Summary also lists recent publications of interest to airmen, both Government and commercial, and provides the subscriber with an opportunity to comment on the service. The latest edition, covering all of 1966, was published on August 22, 1967.

Subscription to the General Aviation Inspection Aids is available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at a cost of $1.50 annually ([illegible] abroad). ■

"A careful look at the engine, boys!"

"To fly a plane and ride a horse is every boy's secret dream"

"Flying Padre" explains radio use

At home on the range or aloft.

FLIGHT FROM DELINQUENCY

South Dakota's "Flying Padre" Prescribes a Mixture of Airplanes and Horses for Wayward Youth.

On a windblown 3,000 acre South Dakota ranch, beset by searing 90 plus degree heat in the summer and bone-chilling blizzards in the winter, the airplane has proven its worth in a most improbable role—rehabilitator of delinquent boys.

Since 1960, Father Don Murray, the Executive Director and founder of the non-sectarian Sky Ranch for Boys, has made the airplane the key to his unique and highly successful program for reclaiming the lives of troubled boys who otherwise might waste their youth in reformatories—or worse. On the prairies where Custer, Wild Bill Hickock and Calamity Jane became legends, the heartwarming efforts of Father Murray have won him the affectionate title of "The Flying Padre of South Dakota."

Of the more than 350 boys who have come to the Sky Ranch for the Flying Padre's special brand of therapy, an amazing 90 per cent have returned to become useful, productive members of the society which they had violently rejected.

The occasional visitor to Sky Ranch is jolted when he finds that the youngster who welcomed him in dusty boots and a weather-beaten ten gallon hat is no ordinary delinquent. Sky Ranch is for boys who have known "real trouble."

There are currently 45 youngsters at the ranch, ranging from 9 to 17 years. Their records show hostile acts—from stealing hub caps to mugging, burglary and, in a few cases, the taking of human life.

Most of the boys who come to Sky Ranch are under the jurisdiction of courts located throughout the United States. Many a belligerent newcomer to Sky Ranch has been branded "incurable" by a criminologist, psychiatrist, probation officer or social worker. These professionals have been astonished by Father Murray's phenomenal success with society's so-called incorrigibles.

Just as puzzling to the experts is Father Murray's use of "airplane therapy." As the Flying Padre sees it, there is nothing very strange about it. He points out, "To pilot a plane is the dream of almost every boy. At Sky Ranch, this dream can, and does, come true."

Airplane Therapy

Unscrambling the deep-rooted causes of a boy's delinquency is the first step in the rehabilitation plan. This riddle is often solved by use of the airplane.

Father Murray personally meets each new arrival and flies him to Sky Ranch. Though he may not know it this first plane ride usually is a very significant step down a boy's long road back to society.

Explains Father Murray: "Extensive flying at Sky Ranch is, first of all, a means of reaching the boy. I have personally experienced it enough to know it works." He feels that a young hoodlum will have much more respect for someone who, skillfully piloting a plane, "projects masculinity."

"Furthermore," says the soft-spoken Flying Padre, "identification with such a man is healthy for boys . . . I have found over the years that boys identify flying and cowboy living with rugged masculinity. In such an environment, the delinquent gradually sheds his 'beatle' type personality with its pretense, superficiality and emptiness, and slowly accepts a more realistic, manly and natural mode of living."

"In a plane, a boy must outmaneuver and conquer the natural elements and, in so doing, he soon learns more of the basics of life," says Father Murray. "Once a young man becomes a master of aerodynamics, navigation, metorology and radio communications, and flies the plane under many trying conditions, he finds a realism that cannot be matched by the time-wasting, unadventurous activities of the ordinary teenager."

The Sky Ranch philosophy is based on the premise that a man who introduces the boy to the new world of flying will have little trouble establishing a dialogue with the boy in other areas. Moreover, what the boy learns in becoming a pilot also helps him in the other studies which he pursues at the fully-accredited Sky Ranch school. These include mathematics, physics, and other natural sciences.

Every boy learns to fly at Sky Ranch; each becomes a CAP cadet. One hour each day is spent in ground school until the course is completed. Although all of the boys are on flying status, there is a merit system of good behavior: if a boy gets too many demerits, he is grounded. Thus, the desire to fly is also a constant incentive for obedience.

Eagles to Angels

Each boy's behavior and progress at the ranch affects his privileges and status as a pilot. On arriving at the ranch, the boy becomes an "Eagle." This entitles him to very few privileges. If he behaves himself and tries to get along, he advances to "Thunderbird," which entitles him to drive truck and tractor, ride horses and fly one of the ranch's two airplanes. When he progresses to the point where he becomes a stabilizing influence on the young toughs, he becomes a candidate for the ranch's elite, "Blue Angel" rank. As a Blue Angel he can get a hunting license, a driver's license and the much-coveted Private Pilot certificate.

The next step for the boy who has attained Blue Angel rank is transfer to a "half-way house" in the city of Belle Fourche, some 60 miles from Sky Ranch. At Belle Fourche he will attend regular high school classes with non-delinquents. Symbolic of the boy's return to society and in keeping with the program's aeronautical theme, Father Murray has named the half-way house "Wing Spread." At Wing Spread, the boy makes the final transition from the remoteness and discipline of Sky Ranch to normal community life. In effect, he begins to "spread his wings."

There is a special reason why Father Murray has been so successful in rehabilitating the lives of under-privileged boys. It all started in the post-depression era when young Don Murray was working his way through high school in South Dakota. Himself the product of a broken and impoverished home, he tutored other students, guided tourists through the nearby Black Hills, and played the drums at local dances to pay for his education.

It was while beating the skins on a shivery winter's night that he contracted a nearly fatal case of pneumonia. As he lay on a hospital bed wracked with pain and burning with fever, he prayed to God that his life might be spared. In return, he vowed that he would become a priest and devote the rest of his life to "helping boys who never had a decent chance."

His prayer was answered, and at Sky Ranch his promise is being fulfilled.

In 1947, Don Murray became Father Murray. On his first assignment in a southeastern South Dakota diocese, he met a flight instructor at Draper Airport. Father Murray caught his friend's enthusiasm for flying and became a licensed pilot in his spare time.

Later, in 1949, his pilot's license came in handy when he and another priest were assigned to a 14,000 square mile area in the northwestern part of the State. Serving this huge area, Father Murray logged more than 500 flying hours per year and wore out two airplanes. But there was little time left over for keeping his promise to boys who needed help.

Then, in 1953, having settled in the tiny farm town of Buffalo, 20 miles east of the present Sky Ranch, Father Murray took in his first juvenile delinquent. This was the challenge that he had been waiting for. He quickly demonstrated his talent for working with problem boys, and news of his accomplishments spread across the wheatfields and prairies. As he took in more and more boys, his success became so amazing that he was relieved of his regular duties and allowed to devote full time to his wards.

Sky Ranch Foundation

Interestingly enough, local tavern owners and liquor distributors were Father Murray's largest donors and most enthusiastic supporters. They spread word of the Flying Padre's humanitarian cause to their associates and, as a result, the big break for the future Sky Ranch came in 1960. Father Murray was asked to address a national convention of the Licensed Beverage Industries on the subject of his work with delinquent boys. The convention's reaction was electric. It set up the Sky Ranch Foundation and waged a national campaign to raise funds for building suitable rehabilitation facilities.

The Foundation purchased a 3,000 acre spread which became Sky Ranch for Boys. Located in the extreme northwestern corner of South Dakota, the ranch straddles the Little Missouri River and spills over into Southeastern Montana.

Today, the ranch consists of two airplanes, a dirt runway, hangar, barn, chicken coop, workshop, administration building, dormitories, chapel and school. Postal authorities have even granted the sprawling ranch its own post office address.

Seen from aloft, Sky Ranch for Boys would scarcely attract the attention of the unknowing pilot. It closely resembles the other few bleak, wind-driven homesteads scattered over the horizon. The sophisticated air traveler would be apt to describe Sky Ranch as just another "God-forsaken" expanse in the dreary landscape. But those who have visited Sky Ranch for Boys and seen its miraculous restorative power would never use that colloquialism. It is most inappropriate. ■

—Duane Freer

from the

LABORATORY

to the

FLIGHT LINE

N D T

Conclusion of a Two Part Series
on Non-Destructive Testing for Aircraft and Engine Failure

High on the list of wonder tools used in NDT is the ultrasonic probe—made up of sound frequencies beyond the range of the human ear. Using a coupling material such as oil or lubriplate grease, a beam of sound is directed at the material to be tested. A flaw or a break will interrupt the continuity and will reflect the beam back. Some of the vibrations return along the path of entry to the test crystal where it is converted to an electrical signal, to be amplified and visually displayed on a cathode ray tube, much like the bright display of the TV screen.

Ultrasonics came to the rescue recently when cracks began to appear in the main landing gear of heavy air carrier aircraft. In this particular case, the cracks occurred under the side brace collar, an extremely difficult place to get at. Under conventional practice, the aircraft would have been hangared, jacked up, the landing gear removed from the plane and the side brace collar removed from the strut with a special hydraulic press. All this would have to be done just to determine *if* a crack existed.

An ultrasonic wave, shot through the landing gear cylinder, proved to be a perfectly reliable guide, and converted a major maintenance problem into a routine check.

When evidence of upper wing skin fatigue was encountered in some very popular jet aircraft, investigation showed it was occurring *underneath* the beaver-tail reinforcement, a heavy piece of metal on the wing outboard about five feet from the fuselage. Visual inspection would call for draining the tanks, driving out scores of rivets, and removing the beaver-tail.

Faster Than X-Ray

X-ray was tried at first, a procedure that required draining the fuel, hangaring the aircraft, taping film to the wing and introducing an energy source on the bottom side of the wing. Very time consuming, very costly. The airlines teamed up and developed an ultrasonic technique that permitted the inspection to be performed on the flight line, with the aircraft in as-is condition—no hangaring, no fuel draining, no X-raying, and very little out of commission time.

Eddy current testing is another tool in the arsenal of NDT. Eddy current is a process which induces small circulating electric currents, or eddy currents, into a metallic material to be tested. Instead of getting a readout on a cathode tube, a small micro-amp meter displays a very sharp dip in the needle when a crack is encountered. (Any flaw in the material will act as a barrier to the eddy currents and produce an indication on the meter.)

Eddy current testing made its debut in the late 1950's when the airlines were seeking a way to spot minute cracks in wheel flanges

Above. Fluorescent dye penetrant kit can be easily carried to work site. Right. Cracks in clam shell thrust reversers show up clearly under X-ray examination.

Above. Radioisotope inserted in the center shaft of a JT4 engine to obtain X-ray photo from inside; film is placed outside engine. Below left. Mechanic uses ultrasonics to test landing gear. Right. Hand-held Magnaflux is fast, reliable way to check castings, forgings.

before they grew into full scale breaks. At a critical point, such as landing, the flange would break off, creating potential trouble. Again the airlines pooled their knowledge and developed eddy current techniques that spotted cracks smaller than one-sixteenth of an inch.

Nondestructive testing technology and methods of application are as subtle and versatile as physics itself. The range of their possible application throughout the field of aviation is as broad as it is exciting.

Wonder tools that any general aviation mechanic can stick in his back pocket may one day replace an entire machine shop. For the moment they are still on the cumbersome side, and the price tag is high.

The Price of NDT Tools

A Magnafluxing outfit for a 100-passenger airliner could run to about $800,000, for example. However, for an expenditure of as little as $145, a fixed-base operator can obtain Magnaflux equipment capable of handling small aircraft engine cylinder walls, propellers, and the like. For an outlay of from $1,200 to $2,500, a repair shop can acquire sufficient NDT equipment to handle most of the Magnafluxing associated with light aircraft.

Probably rock bottom on the price list is the cost of the simplest dye penetrant kit—$36 for a color dye package and $125 for a fluorescent dye outfit. Dye penetrant testing can be done in dishpan-sized batches or elaborate production lines. A systematic unit which can efficiently process small parts can be had for about $1,000. The more lavish the layout, the higher the cost.

Ultrasonic pulse test gear may be assembled for an outlay of from $2,000 to $5,000—plus. The "plus" is when ultrasonic devices are added to give the capability of measuring metal thickness from one side. This calls for the addition of a resonant ultrasonic instrument which would add about $1,200 to the basic cost.

The cost of eddy current equipment of the size and complexity used in most overhaul work begins at about $875, with $2,000 buying just about everything needed in the small shop.

Radioisotope nondestructive testing demands expertly trained personnel and rigid controls because of the potentially dangerous radioactive material used. For this reason its use is practically ruled out to all except the largest repair stations, aircraft manufacturers, airline maintenance shops and private testing firms not exclusively devoted to aviation.

Control of radioisotopes is held by the Atomic Energy Commission. AEC delegates distribution of the "sources" to private firms which are closely supervised. These distributors may sell the material to users who qualify by maintaining a specified level of training of employees and safety standards.

Each vendor of atomic materials is required to keep accurate records, by serial number, of each capsule sold. The user, in turn, must return decayed materials to a licensed vendor (not necessarily the original seller) who acknowledges receipt on his records. All records are subject to AEC review at any time.

The most commonly used radioactive source in aircraft work is iridium 192, a low energy isotope, particularly suited for the light density and thickness of aircraft metals. For heavier metals, cobalt 60 is frequently used.

Dispensing Radioactive Material

Radioactive material is dispensed by the "curie"—one curie being roughly equivalent to the radioactivity of one gram of radium (37 billion disintegrations per second).

A 50-curie source of iridium 192 sells for $400 to $450 and has an effective life of about six months, at which time its radioactivity has decayed to about one-fourth strength.

Even in its weakened state, the radioactive source is no harmless plaything to be discarded as casually as a dead battery. The source is returned to the supplier, who disposes of it by burial in radiation-proof containers in specially selected "atomic graveyards." Every precaution is taken to insure absolutely safe disposal for the entire period of radioactivity. In the case of a 50-curie capsule of iridium 192 this would be about two years; for a 50-curie slug of cobalt 60, about 55 years.

A correlated development to NDT is an inflight maintenance recording system known as "AIDS" (aircraft integrated data system), which "takes the pulse" of aircraft powerplants while they are in actual passenger-carrying operation. Several airlines are already using maintenance recorders regularly (not to be confused with flight data recorders, which all air carriers are required to carry).

The recorders register on computer tape such data as inlet pressure, turbine temperature, fuel flow, exhaust gas temperature, oil consumption, and other indicators of engine health. Inflight recorders are also being designed to monitor special operational conditions such as noise levels and vibration—other signals of structural wear.

The data is collected after the flight by simply removing the tape and feeding it into a computer. The readout has value not only to maintenance crews but also to logistics, engineering and flight crew training studies. This inflight monitoring of engine and airframe has given rise to a new term—"on condition maintenance"—which may eventually substitute for the practice of periodic replacement.

Still a long way off is telemetered engine performance information which would be relayed instantly to a ground station where, by means of an elaborate computing system, it would be evaluated on running basis and aircraft captains "flagged down" before trouble shows up on their instrument panel. This is the ultimate goal.

—*Frank J. Clifford*

Busy airspace below 10,000 feet prompted FAA to seek speed curb.

"SEE & AVOID"

FAA Asks 288 MPH Speed Limit

A maximum speed of 250 knots (288 mph) has been proposed by the Federal Aviation Administration for all aircraft operating below 10,000 feet mean sea level (MSL) in a move designed to give pilots more time to "see and avoid" other air traffic in the nation's most heavily traveled air space.

Existing regulations on airspeed apply only in the vicinity of airports. Approaching aircraft are currently limited to an indicated airspeed of 250 knots when below 10,000 feet MSL and within 30 miles of their destination. Within the immediate terminal area, the permissable speed drops to 200 knots for turbine-powered aircraft and 156 knots for piston-engine aircraft.

The new regulation would affect en route traffic, extending the 250 knot speed limit over the entire airspace below 10,000 feet MSL.

In proposing the new regulation, FAA cited the growing number of high speed aircraft now using the airspace below 10,000 feet, where the preponderance of VFR flying (by visual flight rules) is done, and where in good weather pilots must rely on seeing other aircraft in time to avoid them. Business and corporate aircraft are now estimated in excess of 25,000, including over 1,000 jets, with many of these planes having air speeds in the 500 to 600 mph range.

Recent studies of the mid-air collision problem have disclosed that the expanding volume of traffic has placed a heavy burden upon the pilot's physiological capacity with regard to vision, judgment and response.

1,000 MPH Closing Speeds

Without assistance in the form of radar or radio traffic advisory service, a pilot cannot be expected to sight another airplane on a potential collision course at distances greater than two miles. At the near-sonic speeds of some business jets, where the closing speed would be in excess of 1,000 mph, this would leave the pilot something like five seconds in which to determine whether a collision was imminent, decide upon proper evasive action, and take appropriate action.

The proposed 250 knot limitation under 10,000 feet would give pilots, in extreme emergency situations, about 12 seconds to react. As nearly as investigators have been able to determine, 10 seconds are considered a good safety margin.

The proposed rule would also promote a more efficient—as well as safe—utilization of the available airspace. It is believed that the higher speed aircraft, in order to achieve maximum performance and economy, would choose to operate in the unlimited speed airspace above 10,000 feet. This separation of aircraft by airspeed would enable FAA's air traffic control system to serve the public more effectively than at present, when air traffic controllers must handle aircraft with widely divergent performance characteristics at the same time and in the same general area.

Exceptions in the speed limitations would be made for certain military and special use aircraft which could not be operated safely under 250 knots. However, the vast majority of air carrier and general aviation aircraft in use today or planned for the near future would experience no difficulty in complying with the rule.

Comments on the notice of proposed rule making (Docket No. 8367; Notice 67-39) are being received up to October 30, 1967. Comments should be submitted in duplicate to FAA, Office of General Counsel, Attention: Rules Docket, GC-24, 800 Independence Avenue, S.W., Washington, D.C. 20590. ■

news

BRIEFS

• FEDERAL ASSISTANCE FOR FLIGHT TRAINING has been broadened by recent amendments to the G.I. Bill for Viet Nam veterans. Public Law 90-77 authorizes the Federal Aviation Administrator to approve 90 per cent of the cost of training for a commercial license for a veteran embarking on a career in aviation. The applicant must be a private pilot or have completed the required number of flying hours for the private pilot's certificate. He must also possess a Class II medical certificate, and enroll in flight school courses approved by both FAA and the appropriate State approving agency. Flight training assistance was previously authorized only when part of a regular college program culminating in a bachelor's degree.

• ACCLAIMED THE YOUNGEST JET PILOT in the U.S., and possibly the world, is 17-year-old Wayde Hampton Pitts, III, who first sprouted wings in a Cessna 150 at age 16. The Memphis, Tenn., youth, an "A" student in the junior class in high school, attended Lear ground school in Wichita in July before making his successful checkride in a Lear Jet. He also holds an instrument and multi-engine rating. His youth is also reflected in his lack of permanent certificates. "I've gotten so many ratings so fast that I am always flying with a temporary certificate in my pocket," he says.

• INFRA-RED SPECTROMETER INSTRUMENTATION aboard jet aircraft might be the tool that finally pulls the claws of CAT (clear air turbulence). This is the promise of FAA-sponsored tests carried out by the National Aeronautical Establishment of the National Research Council of Canada. The infra-red equipment was able to provide up to 8.5 nautical miles advance warning of thermal variations of five to six degrees C or more. Severe temperature variations have been linked with turbulence.

• FISCAL YEAR 1967, which ended June 30, was the flyingest year yet with 47.9 million operations being logged by FAA-operated air traffic control towers. This is a jump of 16 per cent over last year's 41.2 million operations. General aviation flyers chalked up 35.6 million operations, an increase of 20 per cent over last fiscal year. Air carrier operations were 8.6 million, and military 3.5 million, representing an increase of five per cent and seven per cent respectively.

• WITH SOME 150 POSITIONS CURRENTLY VACANT FAA has the "Help Wanted" sign out for qualified candidates to fill air traffic controller positions. Successful candidates will be given on-the-job training at full salary. Requirements: minimum age, 21; good physical health; a bachelor's degree or professional aviation experience or an appropriate FAA certificate. Starting salary range: $5331 to $10,927. For details: Visit or write to your local FAA area or regional office.

Taxiway "Blues" Will Vanish As Airports Switch to Green Lights

The familiar elevated rows of blue taxiway light that have guided pilots at major airports for the past 20 years will gradually be replaced by a new lighting system that will speed ground handling of aircraft.

The new lights are green and will be set semi-flush with the pavement in the centerline of the taxiway. Pilots, in effect, will be following a "track" of clearly visible light that will avoid the confusion now encountered with the blue light system where taxiways converge or intersect.

The blue lights, while adequate under most circumstances, were difficult to see in bad weather and tended to fade out ahead of the pilot, leading to confusion. Their elevated position tended to give the impression of a "sea of blue" when viewed at a distance from cockpit level in a taxiing aircraft.

The result was slow taxiing and a reduction in the flow of airport surface traffic.

The new centerline lights rise above the pavement level no more than one-half inch and will be spaced at optimum distances to get the most efficient light on curves and straight sections. The system will be hooked up to allow lighting specific routes to be followed by taxiing planes. Cost of the new centerline lighting system is believed to be comparable to the present edge light arrangement.

Public airport sponsors may apply for Federal grants under the Federal-aid Airport Program (FAAP) to help pay for the installation. (see article page 14).

New Airport Standards Shrink Width, Cut Cost of Runways and Taxiways

Construction costs of runways and taxiways can be trimmed substantially under new design standards prescribed for general aviation airports serving business jets.

Where the old standards called for 150-foot wide runways, the new recommendations allow the width to be pared to 100 feet; similarily, taxiway widths have been reduced from 75 feet to 40 feet. Clearances between runway centerlines and building lines are reduced from 750 feet to 350 feet.

The new standards were developed in recognition of the requirements of the growing number of business aircraft, including high performance jets. The old standard recommended runways 150-feet wide if their length exceeded 4,200 feet; this was felt to be excessive for most business aircraft.

Easily accommodated by the new standards are business aircraft ranging in weight from the 12,500-pound, eight-place, Lear Jet to the 54,000-pound, 24-passenger, Grumman Gulfstream II.

FY '68 FAAP FUND IS $70.2 MILLION; 386 AIRPORTS SHARE IN BENEFITS

The allocation of $70.2 million in Federal matching funds to construct and improve 386 public airports under the Federal-Aid Airport Program (FAAP), announced recently by the Federal Aviation Administration, indicated that Texas, California, and Florida lead the nation in general Aviation airport construction activity.

Texas has 23 approved projects, with an eventual cost of over $10 million, including Federal and non-Federal funds. California has 31 approved airport projects, costing over $9 million. Florida has 26 approved projects, which will cost over $5 million.

The FAAP program provides $64.1 million to improve 348 existing airports and $6.1 million to construct 38 new public airports. Allocations were based on $66.0 million appropriated by Congress, plus carryover funds from previous years. Local communities participating in the program must provide matching funds, usually on a 50-50 basis for those allocated by the Federal Government. Only public airports are eligible.

Thirty-eight new public airports will get $6.5 million in FAAP funds during FY '68.

The 38 new airports are located as follows:

ARKANSAS—Marked Tree; CONNECTICUT—Oxford; FLORIDA—Everglades; GEORGIA — Carrolton, Douglasville and Hinesville; INDIANA — Peru; LOUISIANA—Coushatta (Red River Airport), De Quincy, Homer and Oakdale; MAINE—Madawaska; MARYLAND — Leonardtown; MINNESOTA—Caledonia; MISSISSIPPI — Columbus (Golden Triangle), Drew and Olive Branch; MONTANA—Libby; NEW YORK—Potsdam (Damon Field).

Also, NORTH CAROLINA—Monroe; NORTH DAKOTA—Fort Yates (Standing Rock Airport); East Liverpool (Columbia County); OKLAHOMA — Sand Springs, Skiatook; OREGON — Glenedon Beach; PENNSYLVANIA — Chambersburg; SOUTH CAROLINA — Allendale; TENNESSEE — Lafayette; TEXAS — Canton (Canton-Van Zandt City Airport), Liberty, Shamrock, Livingston; VERMONT—Lyndonville (Caledonia County); VIRGINIA—Culpepper; WASHINGTON — Anacortes, Brewster (Anderson Field); and WEST VIRGINIA—Pineville.

Runway construction is FAAP-fundable.

With the exception of the Columbus, Miss., project, which will have a primary runway 6,000 feet by 200 feet, all of the new airports will have runways of 5,000 feet or less. The great majority of the new airports fall into the 3,000 to 5,000 foot runway class, suitable for all types of general aviation and limited carrier use.

FAAP projects to improve existing airports will concentrate on strengthening or extending runways in order to open the airfield to general aviation and small air carrier jets. FAA regional and local field offices work with community sponsors in preparing requests for allocations under the FAAP program. A record total of 778 requests were forwarded to Washington headquarters this year.

Airport Guide Points Out Pitfalls to Planners, Urges Look Into Future

Don't be beguiled by a low price tag or easy availability of a parcel of land when considering a site for an airport. There's a lot more to it than that, according to an airport selection guide issued recently by the FAA.

City fathers and others interested in building a new airport should take a long, deep look at present and future requirements. Important dollars and cents answers revolve around such questions as accessibility to users, construction costs, future expansion possibilities, obstructions, anticipated community response to aircraft noise, and nearness to other airports.

The guide points out that all sponsors of airports must notify the FAA of proposed construction, even though site selection is a local responsibility. The FAA must know what plans are being considered so that it can evaluate the project's effect on surrounding airspace. If no problems are found, the FAA bows out of the picture.

If public airport sponsors desire financial assistance under the matching grant Federal-aid Airport Program (FAAP), they must have a written endorsement of the proposed site from the nearest FAA area office. The endorsement, however, is only one of several steps in obtaining Federal assistance. The guide goes into detail.

Among other things it recommends at least a five-year forecast period for airports serving general aviation and a ten-year period for airports where both airline and general aviation service is expected.

Free copies of "Airport Site Selection," AC 150/5060-2, may be obtained from the Federal Aviation Administration, Distribution Section, HQ-438, Washington, D.C. 20590.

FORUM

FAA Aviation News welcomes comments from the aviation community. We will reserve this page for an exchange of views. No anonymous letters will be used, but names will be withheld on request.

• Shopping For Plane

I'm in the market for a used aircraft and I've been told *FAA Aviation News* carried an article on what to look for and what to avoid in such a transaction. How can I get a copy of it?

Tampa, Fla.

The article you refer to is "How to Buy a Used Aircraft" which appeared in the June 1966 FAA Aviation News. A copy has been sent to you.

• Nominations Sought

The story on Al Mooney in your August 1967 "Giants of the Industry" series brings back a lot of memories and points up another possibility. The Charles G. Yankey mentioned in the story is a prime reason for the existence of Boeing, Beech, Cessna and Mooney Aircraft. It was his vision, foresight and money that formed the later growth of these companies. Mr. Yankey is dead, but the industry should not forget him.

E. E. Carman
Mooney Aircraft Inc.

We are planning a later biographical series on aviation pioneers and it would seem that Mr. Yankey would fit into it very well. We will be glad to consider any material you care to submit.

• Fears May Be Groundless

I am a licensed pilot but haven't had a current medical certificate in a long time; it's a fear of being told I have diabetes, I guess. Occasional traces of sugar have showed up in some medical exams, but not all. If I admit this to the aviation medical examiner, I'm afraid he will impose so many limitations on my flying that it wouldn't be worthwhile.

Chicago

A history of sugar in the urine is not an automatic bar to certification. If sugar shows up on repeat examinations, the individual must be further tested to see if he is diabetic, prediabetic, or just has a low renal threshold with spilling of sugar into the urine without clinical evidence of diabetes.

In the case of low renal threshold, the airman is usually certified without any limitations. If he is found to have diabetes which can be well controlled by diet (no medication), he is considered for medical certification with the stipulation that he have his attending physician periodically submit followup reports on his diabetic status. These reports may be required as often as every three months.

• Ground School Manuals

Could you tell me of some FAA-sponsored publications that I could study in lieu of attending ground school? I am taking dual flight instruction but I realize I need more than this to pass a written exam.

Oak Ridge, Tenn.

Two publications, both available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, should be helpful. They are: "Private Pilot's Handbook of Aeronautical Knowledge" at $2.75 a copy and "Aviation Weather For Pilot's and Flight Operations Personnel" at $2.25.

• Bit by 'Copter Bug

After two hours of student time I find myself "bit" by the 'copter bug. Where can I get more information on rotorcraft and pilot requirements. Also, can you recommend flying magazines which would be helpful in my flying ambitions?

Canajoharie, N.Y.

Minimum pilot requirement for a rotorcraft private pilot license are: age 17, valid physical examination, passing mark in a written exam, 40 hours flight instruction of which 15 hours must be solo time in a rotorcraft, three hours solo rotorcraft cross country flight with a landing 25 miles distant from the starting point.

Excellent flying magazines of all kinds can be found at most news vendors. Most helicopter manufacturers publish magazines and newsletters concerning their products. These include: Bell Helicopter Co., P.O. Box 482, Ft. Worth, Texas 76101; Boeing Co., Vertol Division, Morton, Pa. 19070; United Aircraft Co., Sikorsky Division, Stratford, Conn. 06602; and Fairchild Hiller Corp., Hagerstown, Pa.

• How They Did It

The article "Air Speed Indicators" in the July 1967 *FAA Aviation News* included a photo of the "air log" mounted in the Wright brothers' *Kitty Hawk* when it made its maiden flight Dec. 17, 1903. Exactly how did it record air speed?

Sylacauga, Ala.

The "air log" (air-speed indicator) used on the Kitty Hawk *measured the distance traveled through the air by recording the number of revolutions made by the multi-bladed, wind-driven propeller of what actually was a form of wind gauge. These revolutions were displayed in much the same way as the miles traveled are recorded by the odometer portion of the car's speedometer. When the time of the flight was divided into the distance flown, the result was feet-per-second, or miles-per-hour.*

To make sure that only actual flight time was recorded, the air log and the stop watch were secured by a piece of string during engine run-up. When takeoff engine rpm was reached and the Kitty Hawk *moved down the launching rail, the string pulled the "lock" off the stop watch and air log and they commenced operating. At the end of the flight, the combination was shut off when the pilot cut the fuel to the engine.*

• A Point Well Taken

In the August 1967 *FAA Aviation News* there was a one-page article about the history of the autogiro, called "The Spanish Windmill".

This article appears to me to be largely a condensation of parts of a chapter of my recent book "Helicopters and Autogiros, A Chronicle of Rotating-Wing Aircraft" (J. B. Lippincott, 1967). It seems to me that in all fairness your article should have acknowledged the source.

Charles Gablehouse
New York City

Mr. Gablehouse's excellent and well illustrated book was one of the major sources of "The Spanish Windmill," although not the sole source.

• Where to Wait In a "Stack"

As a student pilot, I have not attempted to enter a busy airport because I would not know the right place to be when arriving planes are "stacked up". After being given 5th, or even 12th position to land, where do you fly while waiting—especially where there are parallel runways? There must be limits to the area for circling, elevation, direction, etc. Perhaps you can enlighten me on the standard approach to pattern at a busy airport.

Covina, Calif.

A two-way radio is a requirement when flying into a busy airport. It will help you to know the tower's transmitting and receiving frequencies and to have some experience communicating with or listening to air traffic controllers, as they use a form of verbal shorthand that saves time, eliminates garbled transmissions and presents information in an orderly manner. Listen to tower transmission just before you start your call, in order to avoid interrupting others, and take the time beforehand to familiarize yourself with the airport and surrounding terrain, so that if you are advised to "report over the reservoir" you know here to head.

VFR flights are required to hold when heavy traffic saturates busy airports. When this happens, VFR flights are told to hold at a specified visual fix. Directions for the holding procedure and turns, and information regarding other traffic holding at the same fix will be given. When your turn for an approach comes up, you will be instructed to report at a visual fix near the airport, with subsequent instructions to follow a specific aircraft landing ahead of you. If the airport has parallel runways you may be instructed to land on either "right" or "left", depending on operations at that time.

The following publications, available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, contain valuable information for student as well as proficient pilots: Airman's Information Manual ($13 per year); Flight Training Manual, AC 61-21 (70 cents); Private Pilot-Airplane Single Engine AC-61-3A (20 cents); and Federal Aviation Regulations, Part 91 (60 cents).

You might also want to visit a control tower where FAA personnel will be glad to answer your questions personally.

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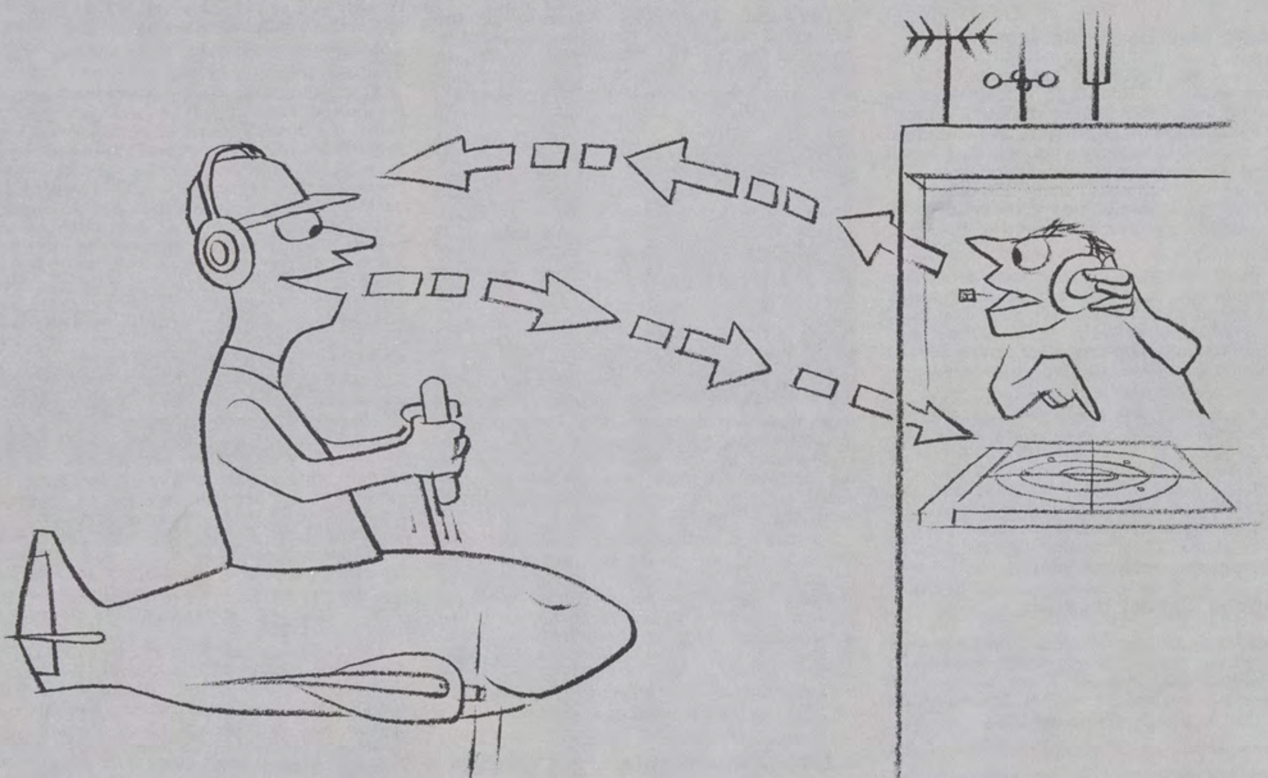

Are music to controller's ear