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SPECIAL SECTION
Begins After
Page 50

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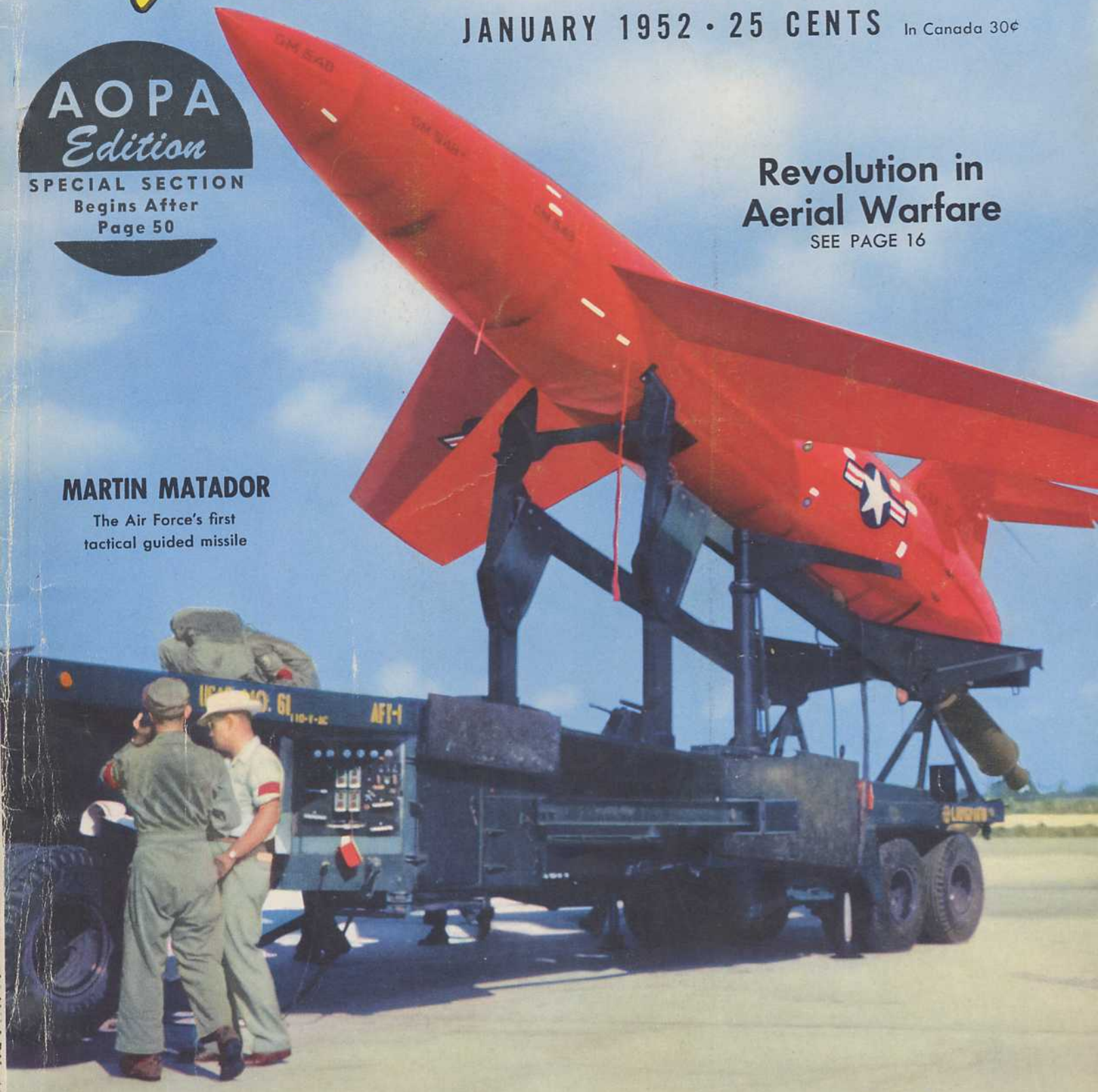
SEE PAGE 16



MARTIN MATADOR

The Air Force's first tactical guided missile

MEDIUM BOMBERS CARRY THE BIG PUNCH

SEE PAGE 9

THE COVER: Martin Matador (B-61).

FLYING

Reg. U. S. Pat. Off.

CONTENTS • JANUARY, 1952

SHORT FEATURES

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Have you a STEPCHILD in the COCKPIT?

By R. F. SANDERSON

Your magnetic compass still has a job to do for you despite all the new navigation devices.

THIS FORGOTTEN and neglected fellow is tucked away somewhere in the center of your instrument panel. His modest little two-inch dial is dwarfed by crackerbox-sized radio equipment and assorted instrument dials as large as alarm clocks.

His name is "magnetic compass," (FLYING, June, 1951). He is fast becoming the stepchild of navigation. There is a widespread conspiracy afoot to disinherit him in favor of radio.

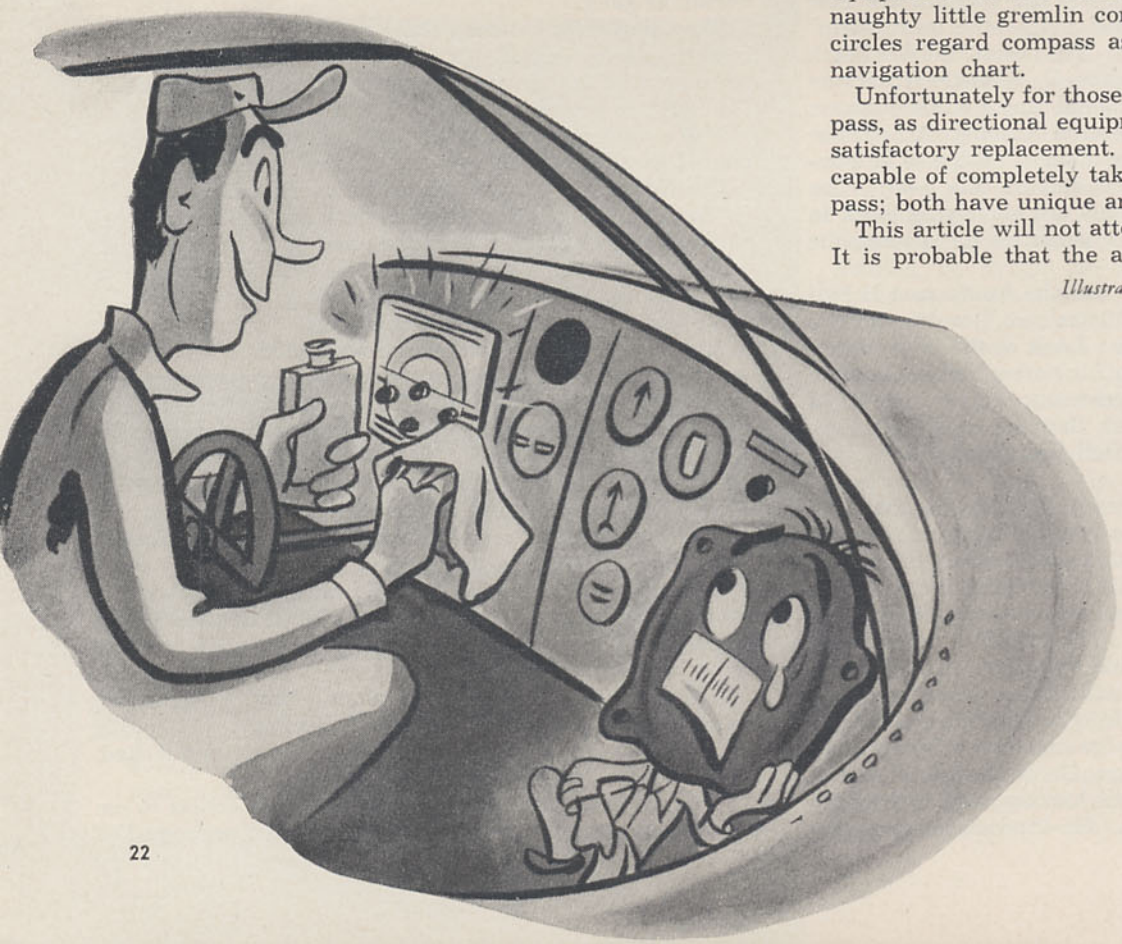
With so much emphasis now being placed on omni, VHF, ADF, VAR, and ILS, we must not be surprised if latter day birdmen automatically catch the idea that the magnetic compass is an antique, an ineffectual pensioner from biplane days, included on the instrument panel only out of deference to past services and not to be relied upon in the progressive present.

Some extremists will even assert that the compass is thoroughly fickle, a sporadic liar to be doubted at all times. Airplanes today, they imply, carry around radio equipment worth a thousand dollars solely to keep that naughty little gremlin compass in line. Certain aviation circles regard compass as suspiciously as an inaccurate navigation chart.

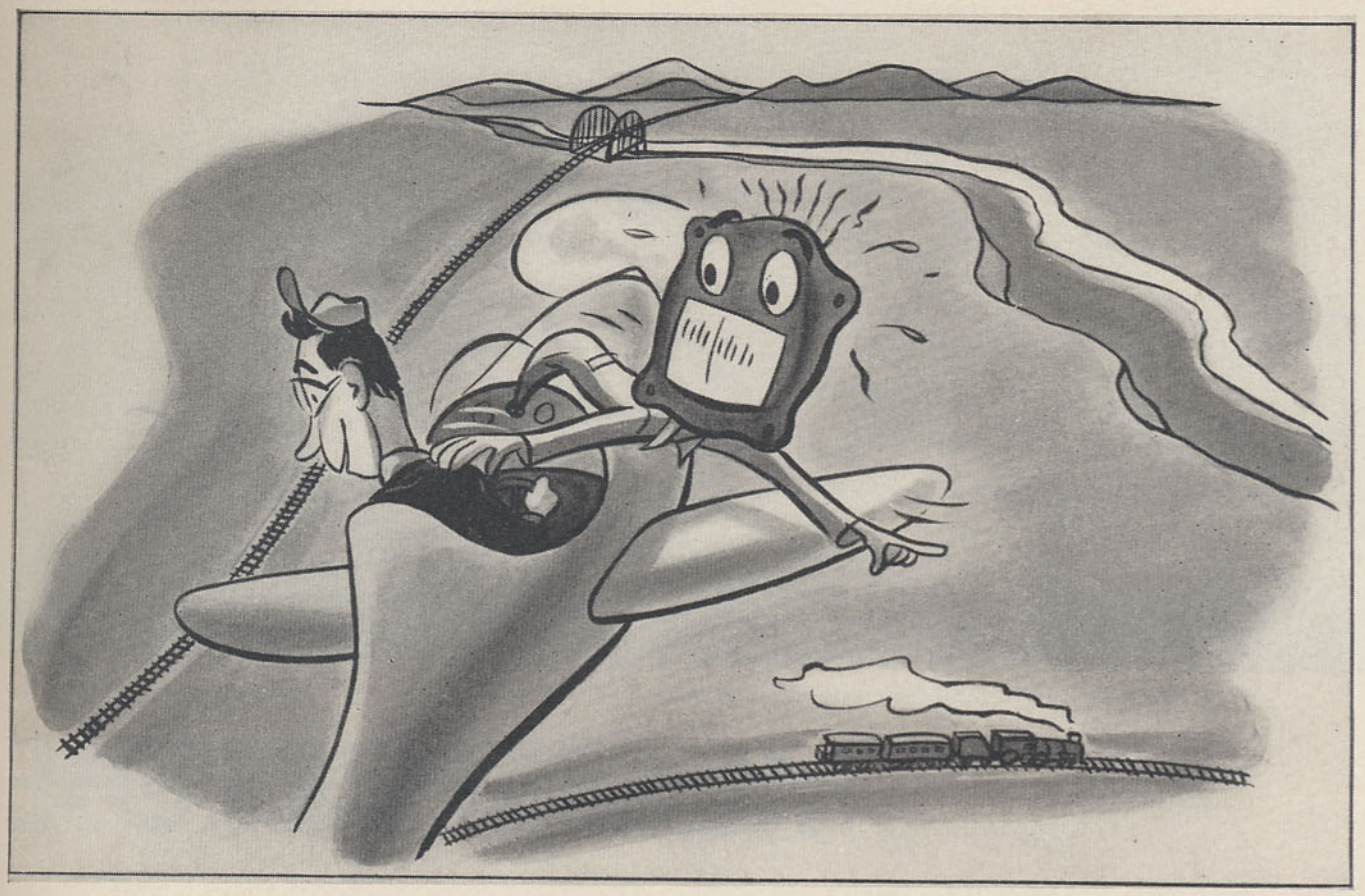
Unfortunately for those who slander the magnetic compass, as directional equipment for navigation we have no satisfactory replacement. Radio at present is utterly incapable of completely taking over the duties of the compass; both have unique and clearly defined duties.

This article will not attempt to whitewash the compass. It is probable that the average compass in the average

Illustrated by Don Moss



The magnetic compass is even more sensitive than the altimeter. It's very upsetting to him when pilots have no confidence in him. Often neglected for newer instruments, he is rebuffed and ignored even when offering sound advice. It's not that he wants to run the plane alone. He just wants to work with the rest as a full-fledged panel member.



plane today is not a completely reliable pathfinder. However, this is not the inherent fault of the compass. If the engine suffered from similar neglect, the airplane could not even take off. Pilots and owners ignore compass troubles with an almost criminal indifference. It is small wonder that an instrument untouched and unchecked for three or four years or more may be off a few degrees on more than one heading.

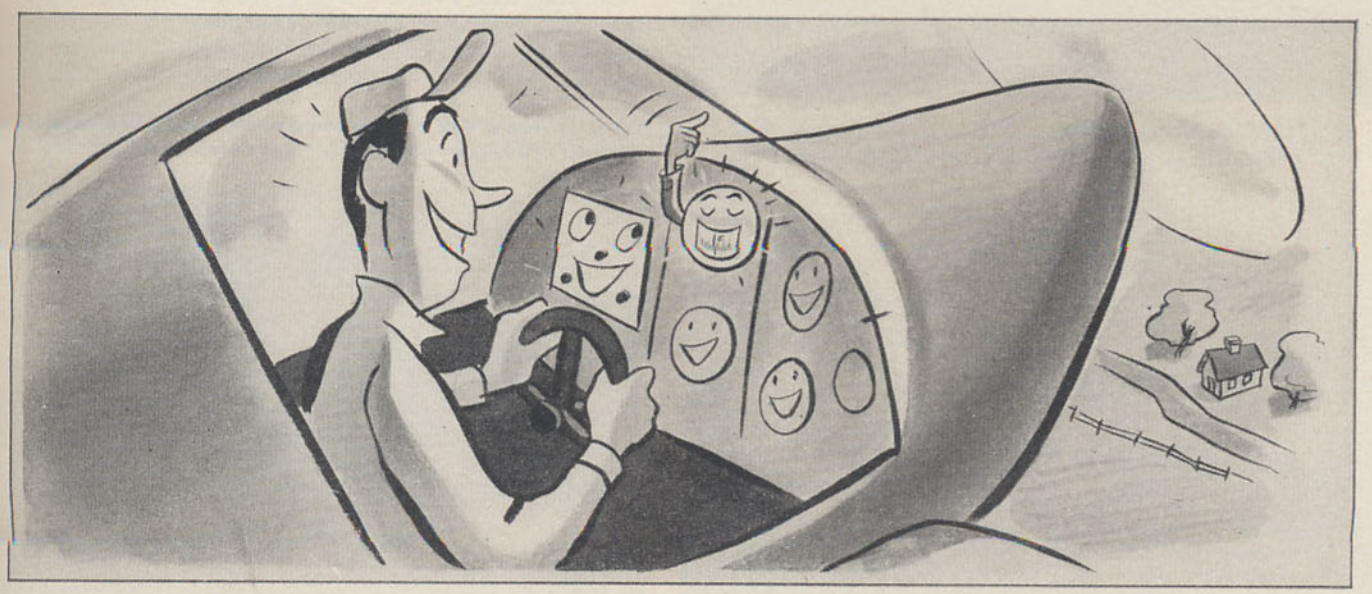
The truth is that the average compass receives less maintenance than a goldfish bowl. When the liquid gets low, it is refilled (sometimes). When the glass becomes too dirty to see through, it is cleaned. This is the same care a goldfish bowl gets, only the goldfish get it more often.

Compare this to the attention accorded other aviation equipment. Mags get checked at every take-off. Spark plugs are jerked as soon as points burn. The radio goes into the repair shop whenever it shorts or statics. Ship and engine both are carefully inspected and brought up to snuff every hundred hours.

And the compass? While the airplane itself goes through three major overhauls, the compass gets no more attention than the aircraft manufacturer's decal. If there is one on the ship somewhere it is O.K. It is simply assumed that the compass is not exactly accurate, and the matter let go at that.

Unfortunately, this sort of compass neglect is at its worst in training ships. It is no wonder that fledgling pilots develop deep suspicions about compasses in general. If the training ships themselves suffered from equivalent neglect, the surviving students would quit flying altogether.

Our impressionable student on his first cross-country flights, with the encouraging approval of his instructor, winks at the compass and flies from A to B with the help of railroad tracks, rivers, terrain, (*Continued on page* 62)



Multi-Purpose Jet

(*Continued from page* 26)

distinction easier and "hot" action follows as F-84s drop jelly bombs to spread searing flame. Jelly bombs also are effective against the thick hide of tanks.

No story of the F-84 in Korea would be complete without a paragraph on maintenance. It is a comparatively easy plane to maintain, but it is not a simple problem in a theater as rugged as Korea. Mechs must work around the clock and in incredibly bad conditions, but despite those handicaps the maintenance record has been remarkable. So far, the plane has had a 70 percent utilization factor in Korea. That is, seven out of every 10 *Thunderjets* have been ready for operations at all times, despite battle damage.

The *Thunderjet's* ability to "take it" and still get back to base also is noteworthy. Republic has always stressed pilot protection and built-in ruggedness. The World War II *Thunderbolt* was a remarkably sturdy airplane and the record book is full of stories of its ability to go through heavy fire and return home with damage areas that few other fighters could have survived. The *Thunderjet* is carrying on that tradition. In fact, Republic in the field of jet fighters is duplicating its accomplishment in the field of piston-engine fighters—versatility. The *Thunderbolt* was a multi-purpose fighter; so is the *Thunderjet.*

Pilots returning to base safely with battle-damaged jet engines are completely "sold" on the turbo-jet for combat aircraft. One Republic F-84 pilot with the 27th Fighter Wing received a direct hit in one of the combustion chambers of his Allison J35 axial type engine. It seemed to explode and a lot of damage was done to the diaphragm and the turbine wheel buckets. However, the pilot was able to return from the combat area all the way back to Japan.

Another F-84 pilot took a burst which put a hole in the oil tank of his J35 and completely shot out the oil-return line. Although he was more than 200 miles away from base at that time, he returned safely with no oil pressure.

Still another F-84 was hit by a MiG's 37 mm. cannon, causing numerous holes ranging from six inches in diameter to pin-point size. In addition, the turbine wheel was hit, several buckets were damaged, and there was a sizable hole in the combustion chamber. Back at the base, the pilot had the evidence on his side when an observer said it was impossible for a plane to fly with an engine in that condition. One pilot had nearly half a horizontal stabilizer shot away and reported on landing that he "felt a little jar but she handled well."

The F-84E now in Korea is the result of operational experience in the field translated into improved features by Republic engineers under the supervision of the plane's ace designer, Alexander Kartveli. Radius of action is now better than 850 miles and range is about 1,200 miles. Service ceiling of the "E" is above 45,000 feet.

Firepower for ground support and other purposes includes six .51 caliber machine guns, eight 5-inch HVAR (high velocity aircraft rockets), two 1,000-pound bombs, two 100 or 500-pound fragmentation clusters, aircraft depth charges, incendiary bombs, and napalm tanks. Combinations of these weapons are used, depending upon the mission. Rocket and bomb holders are retractable.

The "E" also incorporates improved maintenance and accessibility. There are 180 access doors, enabling ground crews to service the plane rapidly between missions. The battery lift is retractable, gun deck is hinged and there are snap-on electrical leads and throttle disconnects for rapid engine interchangeability.

In addition to increased structural strength, the fuselage of the "E" is 15 inches longer in the nose section to allow more room and comfort for the pilot. Additional structure in the wing and empennage sections enable the airplane to withstand greater "G" loads than are actually called for in Air Force requirements. Aerodynamic fins on the tip tanks enable the airplane to go through maneuvers even under full load conditions with tip tanks on—the first time this has been possible with jet fighters.

The exact number of *Thunderjets* assigned to Korea has not been announced. The 27th Fighter-Escort Wing, sent out from Bergstrom AF Base, Austin, Tex., aboard an aircraft carrier, has been relieved. That operation began in May as the 27th's replacement, the 136th Fighter-Bomber Wing, began its phase-in job. Then in June, 1951, the 49th Fighter Wing, until that time equipped with F-80s, converted to F-84s. The 116th Fighter-Escort Wing moved into Korea in August, 1951. The 136th, a federalized Air National Guard outfit, went to Korea from Langley AF Base in Virginia, and the 116th moved in from George AF Base in California.

Republic's "E" has the longest range of any jet fighter now in production for the Air Force, but it soon will yield that distinction to the sweptwing F-84F, latest modification of the *Thunderjet* series. The 84F already has flown with two jettisonable 450-gallon external fuel tanks under the wing and they extend the range beyond the point reached by the 84E. As a fighter, the 84F will be capable of very high speeds and exceptionally long range operations. As a ground support plane, it will be able to carry more armament than the record-breaking loads of its sister model. END

Stepchild

(*Continued from page* 23)

and other visual aids. Occasionally, about half as frequently as he checks his tachometer, the student glances at the compass and notes with satisfaction that all is functioning normally. That is, the dial is oscillating about as rapidly as the wheels on a slot machine.

On advanced cross-country flights, the instructor introduces the radio. This somewhat expensive item of equipment, the instructor could explain, is actually maintained. Expensive radio ground facilities are also maintained, by the government. Therefore the radio can be counted on to pull a pilot in to the airport in situations where a compass, which costs little in the first place, and receives no attention later, might not do so well. Radio work usually fascinates the developing pilot, and radio is unquestionably a great aid in restricted visibility. Soon we have produced another pilot who has practically substituted the radio for the magnetic compass.

To regress several centuries into the history of navigation, long before the airplane needed a directional guide, early ships at sea depended on their magnetic compasses to bring them from port to distant port. Compasses cruder than those in today's training planes guided the ships of Columbus and Magellan across trackless unexplored seas and home again. Today, transoceanic and overseas pilots and navigators trust the compass as their primary navigational instrument, and as such they give it the respect and care it deserves.

Thirteen years of flying in 50 different countries on five continents have convinced me that compass navigation is just as practical for a lightplane as for a transport. Two winters ago my brother and I embarked on a flight to Southern Mexico in an 85 h.p., two-place ship without any radio equipment whatsoever. Before leaving we carefully swung the compass with the tail in level flight position and the engine running. Using a graph of this recorded deviation (which proved as high as 18 degrees) to correct every heading, we began a 5,700-mile flight.

In Southern Mexico maps are sketchy and inexact. Recognizable checkpoints are far apart. On the trip from Tabasco across the unbroken green jungles to the Tehuantepec coast we planned to use mountain peaks for landmarks. After a long flight over anonymous terrain we arrived in the vicinity of the mountains to find our checkpoints swathed in heavy clouds. There was no way to determine our position visually—or for that matter with radio, had we carried one. For over two hours we flew a steady course corrected for 14 degrees deviation. Within 10 minutes of our ETA we arrived at the desire pass and turned left through it to the coast settlement and airport.

With a compass which was admittedly inaccurate (we did not have time to compensate it before we left) but on which we knew the error, we cruised across poorly mapped country with confidence. Our peace of mind and saving in flight time more than compensated us for the two hours spent in carefully swinging the compass before our departure from the states. Since there were few radio facilities enroute and most of these were on freak frequencies, standard radio equipment would have been of little help.

Having an equally bad effect as error in the compass is error in steering. In turbulent air small compasses with a short card radius oscillate disconcertingly. This can be partly remedied by a compass with a larger card radius. For my own ship I traded a 10-dollar bill for an army surplus compass which, though it has a 4-inch card, nonetheless fits a standard instrument hole. At the price good compasses are selling for there is no excuse for not having a good one in your ship. However, even the best compasses oscillate in unstable air.

It is a common illusion of lightplane pilots that airline compasses somehow do not oscillate. Actually, transport compasses get the DTs just like other compasses and are required, as well, to lead their pilots through heavier turbulence. Airline pilots do not steer by magnetic compass but by directional gyro. At regular intervals, during the momentary periods when the ship is level and the compass card stabilized, the pilots reset gyros to the correct compass heading. This practice eliminates steering error.

There is no reason why lightplanes cannot use the same system. Gyro installations these days are not expensive and the average instrument panel has instruments of far less utility than the directional gyro. Recently my brother installed a gyro in his personal plane and freely acknowledges the improvement in his navigation.

With an accurate compass deviation graph to correct headings and a directional gyro to steer by, compass errors and steering errors can be eliminated. Under such controlled conditions the difference between where the ship is and where it is supposed to be, is strictly the result of wind.

You can now actually put into practice the wind drift corrections methods that the C.A.A. has been trying to get across in the commercial pilot exam for lo these many years. Instead of a theoretical exercise to be forgotten when mastered, use of a standard computer for wind drift problems is now a real and practical navigational help.

Doubting Dilberts to the contrary, most lightplane compasses can be kept accurately up-to-date on their deviation curves. A compass should be re-swung twice a year; compass swinging makes good fun on non-flying days. There is nothing complicated about it. Simply line the ship up on the four cardinal compass points of a compass rose, and then the intermediate points—eight in all. Use a plumb line from the prop hub and from the tail wheel to insure accurate alignment. The tail should be raised to approximately level flight position (a tall sawhorse will do) or the reading will be inaccurate. The engine should be running at partial throttle, and it is a good idea to turn the radios on and off at every heading—if this makes a difference, note the number of degrees difference.

It has been the purpose of this article to outline what can be done with the magnetic compass—not to disparage the use of radio in navigation. The importance of radio navigation is real and should not be underestimated, but radio is in no way a substitute for the compass, as some people are trying to make it.

And for accuracy and dependability, radios are far more fallible than compasses. A compass may take a spin or two over a magnetic area, or may be off a couple of degrees, but it seldom goes out altogether. I have had radio sets go out from normal causes, and from being hit by lightning while in the air, and when a radio is out, pal, it's really out! Too, radio aids do not exist everywhere. A great deal of personal flying is done off airways, and in the north and in the west and in foreign parts many areas do not have radio coverage. In such places a pilot without an accurate compass and the confidence to use it can easily fly into a tight spot.

To gain confidence in compass navigation the student pilot must see accurate results. Unless compass and gyro equipment give him accurate course guidance and accurate steering, the student will be unable to wean himself away from the constant crutch of radio which at some time during his career is apt to be jerked out from under him when he most needs it. Dead reckoning compass navigation becomes an interesting game with accurate equipment. The major drawback to its use in marginal weather (not too marginal, mind you) is lack of practice.

With CAVU conditions many pilots weave down the course line content to hold a plus or minus 15 degree heading error. From time to time they correct course by strictly visual means. When the conditions for flying get marginal and the visibility shrinks, there are far fewer check points and they are needed much worse. Naturally, the time to practice up for bad weather flying and poor visibility is when the weather is good. It takes more than a mathematical mind to make a weather pilot out of a sunshine pilot. Conscientious practice is the answer. And the time to practice is when it isn't necessary to do so.

But above all, if you intend to do any serious compass flying, give your compass more care than a goldfish bowl. Give it half as much maintenance and calibration care as you give the rest of your flying equipment.

With care and attention, a compass will develop from a neglected stepchild into a very smart little feller indeed. Just give your compass a chance and see for yourself, even if it means a few bucks for an overhaul every few years. END