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"Army Aviation is indispensable to mobility in future wars. On it depends the Army's capability for moving men and equipment over short distances as fast as constantly changing battle situations may require." — *The Honorable Wilber M. Brucker, Secretary of the Army.*

Navigational Aids--

Key to Future Army Mobility

Colonel Horace M. Wood, *Sig C*

TO SURVIVE ON tomorrow's battlefield, the Army must have the tactical mobility to cope with conditions of atomic warfare. The need for mobility in the Army of today and of the future has been repeatedly expressed by those directing the destiny of the Army. The Army must have mobility unrestrained by road nets, the time of day, the vagaries of terrain, or the elements. The means of mobility must be completely responsive to the will of the commander and permit movement as rapid as the battlefield situation dictates.

UNRESTRICTED OPERATIONS

This presupposes that Army aircraft will not be confined to operations from prepared fields or strips but will be capable of operating from any field, road, or area of reasonable size, clearance, and surface condition.

To avoid limiting the commander's ability to conduct operations, we must be able to fly and navigate precisely and flexibly, even in the relatively low percentage of time in which instrument conditions prevail. Inaccurate and incomplete charts and maps, likely in a future war, dictate a supplementary means of guidance for the aviator.

Mobility and dispersion required for the Army of the future impose burdens on the facilities for command control and coordination, which are as applicable to Army Aviation as to the participating ground units. These facilities must provide greatly increased rapidity of transfer of intelligence, transmission of orders, target acquisition, logistic data, etc. Logically, electronics is the medium

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Colonel Wood is assigned to the Office of the Chief Signal Officer, where he is in charge of the avionics installation and retrofit program for Army Aviation.

which is expected to provide these added capabilities to the field commanders.

ELECTRONIC AIDS

The problem of providing electronic aids to mobility separates into two fields of effort: communications and navigation. Communications, in its commonly accepted meaning, is the more advanced of the two, with complete coverage of the spectrum and various proven techniques of providing voice, teletype, telegraph, facsimile, and data transmission.

Air traffic control is exercised as a function of command and as such has its own peculiar requirements for communications. Instantaneous point-to-point contact must be provided between points on the ground and to the aircraft and could conceivably require most or all of the techniques available. Requirements for exact position information may dictate the use of radar for en route traffic operations and separation, as an extension of the present requirement for approaches and landings through low ceilings.

With the expected complex of landing strips in most headquarters areas, primarily needed to avoid concentration of aircraft and organizations, the problem of expeditiously directing traffic in such an expanded terminal area will be more difficult. This, in itself, will generate added requirements for electronic devices overlapping the navigation field in order to get arriving aircraft sorted out and on the ground at the proper strip. This will be particularly true until the ultimate development when we may fly and navigate precisely by reference to lightweight equipment in the aircraft, without dependence upon ground-based aids or directions from ground personnel. Communications will remain as a necessary adjunct to command control and as a standby for traffic control in the event electronic components in the airborne system fail.

INSTRUMENT FLIGHT

Instrument flight and navigation systems, while showing progress and improved development, leave something to be desired for Army use in combat areas. Basic instrument flight is as simple to a well-trained aviator as navigation is from point to point using today's aids, which are readily available in quantity. In view of our large number of instrument rated pilots today and the amount of instrument flying being done daily, one may well ask what is so pressing about the problems of instrument flight. The reasoning to answer such a question goes something like this:

a. A relatively small percentage of Army Aviators are instrument rated; however, this situation is being corrected.

b. Instrument flight today requires extensive training and experience to develop required competence.

c. Available navigational aids, which provide practically all the instrument experience for Army Aviators, are carefully sited, painstakingly engineered as permanent installations, and operated and tested for long periods of time before commissioning. Consequently, they represent a high standard of precision and reliability.

d. Approach aids are also the result of painstaking engineering and test effort, and are operated and maintained by fully skilled and experienced technicians. Despite this, minimum ceilings are prescribed, below which approaches may not be made. Yet, tactical missions must be completed regardless of weather.

e. Helicopter instrument flight has been proven feasible and practical. Several hundred hours of actual weather flight have been made, both on and off airways, utilizing present-day standard facilities. Instrument flight in the helicopter is somewhat more tiring and demanding on the pilot; however, with the installation of automatic stabilization equipment, flying the helicopter by instruments is easier than in Army fixed wing aircraft without autopilot.

Present aids and methods of instrument flight follow procedures established for fixed wing aircraft. However, due to the capabilities of the helicopter, instrument approaches can consistently be made with lower minimums than fixed wing aircraft using present-day instruments. Numerous GCA approaches have been successfully completed to touchdown with indicated airspeeds of 30-35 knots. Automatic stabilization equipment takes full advantage of the helicopter's capabilities with special instruments such as the Ryan C. W. Doppler radar to measure ground speed and drift, a radar altimeter to measure height, and automatic engine rpm controls and "hover coupler." This coupler uses radar data to automatically bring the aircraft from an 80-knot cruise airspeed and 200-foot altitude to a zero ground speed hover at 50 feet at a preselected location. The pilot merely monitors the instruments. Surely with equipment such as this, the full instrument capabilities of the helicopter can be realized.

f. Present instrument flight procedures provide large safety factors for clearance of obstacles and other aircraft. This reduces the capacity of the system and imposes delays to air traffic during heavy traffic periods. Army Aviation tactical operations require low-level flight, literally in the "nap of the earth," around instead of above obstacles.

LIMITATIONS

Limitations cannot, in most instances, be placed on the number of aircraft which will be permitted to fly in a specified area, although adequate controls must be in effect. This means that the Army is confronted with a problem which requires a specialized solution. If aviation is to function efficiently as the means by which the Army in the field will attain that mobility and flexibility of movement which is a must in any future conflict, present aids must be adapted to match that mobility; and development of new items to meet requirements peculiar to aviation for the future Army must be expedited.

POSSIBLE SOLUTION

As a corollary, training of aviators in instrument flight is a present and continuing *must*. Means to guide the aviator in flight must be simplified and made more reliable, so that the training effort and time can be reduced with safety and with

assurance that proficiency can be achieved and maintained more readily.

A large amount of effort is seen in the development of navigational aids for aircraft by FAA, the USAF, the U. S. Navy, U. S. Marine Corps, foreign governments, and domestic and foreign industry. Available today, or on the horizon from development, are no less than 20 systems or aids to provide, alone or in combinations, a complete capability in varying degrees of instrument flight and navigation from takeoff to touchdown. Some of these are:

1. LF Non-Directional Beacon. A simple low frequency transmitter in widespread use today in conjunction with an ADF or loop receiver in the aircraft. Its accuracy is determined by the accuracy of the system carried in the aircraft. One of the least accurate systems. Not subject to line-of-sight considerations.

2. LF Range. The well-known system in use all over the world. Used in conjunction with an LF receiver or ADF in the aircraft. With the LF receiver, its use is confined to four fixed courses. With ADF, it is used as the LF non-directional beacon.

3. Visual Aural Range (VAR). A VHF system which was installed on a limited scale and is going out of use. It is a four-course range having two aural courses similar to the LF four-course range and two courses similar to the ILS localizer indicated on the cross-pointer instrument.

4. VHF Omnirange (VOR). This system is in common and extensive use in the United States and provides bearing to or from the station on a visual indicator. Over-all system accuracy (station plus receiver) is + — 4.0 degrees. Position over station is less sharply defined than LF range or beacon. It requires installation in a relatively large space clear of obstructions to avoid course errors caused by reflections.

5. TACAN (Tactical Air Navigation). This is a Rho-Theta system of the omnirange type, similar to VOR, but operating in the UHF region, providing both bearing and distance to the station on indicators. Its accuracy is greater than VOR (approximately + — 1 percent), and it may be rapidly installed with fewer siting problems than VOR. It requires more extensive and complex equipment in the aircraft and can be saturated by an excessive number of aircraft operating from one station. Coverage is limited by line-of-sight considerations.

6. Distance Measuring Equipment (DME). Operates in the UHF range, usually in conjunction with VOR, to provide distance from a known point, usually the VOR. In some cases it is used with ILS. Two or more DME stations can be used to determine position and to run a computer or pictorial display to give instantaneous location on a chart. This may also be accomplished using two VOR stations, VOR-DME, or one TACAN station.

7. Instrument Landing System (ILS). More properly identified as an Instrument Low Approach System (ILAS), is in common and extensive use today. It provides an accurate in-

dication on the cross-pointer instrument of a precise glide path to the runway. This is a carefully engineered, carefully installed fixed-plant system. Because it radiates multiple paths, it must be used in conjunction with other aids and in accordance with fixed procedures. It lacks mobility.

8. **Ground Controlled Approach (GCA).** This system uses precision radar and a well-trained operator. Siting and set-up time are not excessive and, by additional development to reduce weight and make the equipment more rugged, a reasonable degree of mobility can be realized.

9. **75 MC Marker Beacons (Z, FAN, Bone).** These are commonly used as an auxiliary to other aids to locate approximate position over a point. Useful as an auxiliary aid to the less complex and less sophisticated systems. Can be easily adapted for mobility.

10. **Decca.** A low frequency hyperbolic system of British origin. It is in use over most of Western Europe and can be applied to surface vehicles, particularly ocean vessels. It is probably the most accurate of the systems in widespread use today. It uses a master transmitter and two or three slave stations, carefully locked in phase relationship, to generate a grid of radio lanes over an area approximately 200 miles in radius. The receiver measures radio frequency phase relationship of the master and slaves to determine position, which may be displayed on "land" dials or shown directly on a pictorial display or roller-type map. Absolute accuracy depends upon the accuracy with which the station locations are surveyed, but repeatability is excellent, and Decca coordinates of a point will correspond very closely on successive trips to this point. Accuracy of position is within 50 yards near the center of the system, decreasing to the order of 1 mile on the outer fringes. As presently developed, the equipment is complex, bulky, and heavy for light aircraft.

11. **RAYDIST and LORAC.** MF (2000 kc) hyperbolic systems which have been and are being used around the Gulf coast in oil exploration and survey. While the method of operation varies somewhat from Decca, the end result is a similar hyperbolic grid over the area in which it is installed. An accuracy of 25 feet is claimed for the system close in, with 100-500 feet accuracy out to 50-75 miles. Its range is limited by sky-wave interference and ground-wave absorption at the frequencies used.

12. **LORAN.** The oldest of the hyperbolic systems in use. It is a pulsed system, and stations are operated as synchronized pairs. A line of position is determined by measuring the difference in arrival time of pulses from each station of a pair, and position is obtained by intersection of lines from two or more pairs. LORAN is useful out to 1,500 miles range but its primary use is by surface vessels and transport aircraft on long overwater flights.

13. **LORAN C.** This is a low-frequency type of LORAN, with the added refinement of phase comparison for greater accuracy. It has been estimated

that 14 units would suffice to cover the United States with a position-indicating accuracy of better than 1 mile anywhere within this coverage. The system is not mobile, and the airborne equipment at present is bulky and too heavy for Army aircraft.

14. Doppler Navigation Systems. Doppler navigational aids measure the rate of travel over the ground and the direction of travel by radar, and combine this information with data from an accurate heading reference and a known starting position. It computes present position, ground speed, drift angle, and other byproduct data as may be desired. The radar operates on a principle similar to radar speed-measuring devices used by the police, measuring the frequency shift of the received radar echo resulting from aircraft movement over the ground. While not yet precise enough for other than en route navigation, it will enable a pilot to navigate within range of ground terminal aids which can be used for letdown and landing.

There are at present a number of types of Doppler aids being manufactured both in the U.S.A. and abroad. The majority have been designed with larger aircraft in mind; consequently, most of them impose an excessive weight and power penalty for Army aircraft. The U. S. Army Signal Corps has models under investigation and development; with improvements in heading references, miniaturization, and reduction of power requirements, it is anticipated that an acceptable, reliable, and accurate system will become available to the Army.

15. Inertial Navigators. The basic principles of inertial navigational systems are in the precise measurement of very small accelerations, direction of movement and radial position with respect to the center of the earth. Accuracy, weight, and ruggedness are the main factors of concern to the developmental agencies at present. The principles of the device have been proven, but for practical application to Army Aviation requirements, inertial navigational systems are in the early developmental stages.

16. Consol, Dectrac, Navarho, Navaglobe, Cyclan, and Radux. These are very long range systems and as such have little application to Army Aviation in a tactical sense.

SOME NECESSARY CONSIDERATIONS

In meeting the requirements of the field Army for navigational aids and improved instrumentation, several considerations must be kept uppermost in mind. Weight must be held to a very low figure unless we are to see Army aircraft grow in size to maintain payloads, at the expense of unimproved-field and confined-area performance, and with a corresponding reduction in ability to follow and work with the field Army of the future. Power requirements are already beginning to exceed the capacity of aircraft electrical systems; they must be kept low to avoid added weight. To avoid a serious drain of fighting manpower into technical support channels, maintenance must be simplified and equipment made more reliable.

For tactical use an adapter is

being installed on Army aircraft to permit homing on a tactical FM set on the ground. Except in "no wind" conditions, it would be quite difficult to follow a specific track to or from a station, and so the device does not have general navigation utility. It does give the aviator a capability of locating an isolated unit, or can provide guidance to a specific spot on the ground otherwise unmarked. This unit is the AN/ARA-31, used in conjunction with the AN/ARC-44 FM radio transceiver.

It can be seen, therefore, that numerous electronic devices are available to provide navigational information to the aviator, particularly in the en route phase of a flight. Some can be or have been adapted to Army use in the field; others have limited or no application for tactical use, or have limitations or disadvantages which preclude their use in Army type operations.

MOST CRITICAL AREA

The most critical phase is in the terminal area of a flight, encompassing the approach pattern, final letdown, glide path, flare, touchdown, or hover, as the case may be. Unfortunately, from the standpoint of Army Aviation, this is an area demanding greater precision in equipment, and greater skill and faster reaction on the part of the aviator. In other words, this is the phase where the problem of three dimensions, with time and speed added, is forcibly demonstrated. ILS and GCA are attempts to solve this problem for the aviator, but greater accuracy, ruggedness, mobility, and flexibility are required.

INTERIM AIDS

We must be able to make approaches and landings in confined areas and on short strips or roads, without restrictions on choice of terrain, landscape, direction of approach, or weather ceilings. Other devices are becoming available to assist here. Absolute altimeters of terrain clearance indicators are now available. Most of these work on the radar principle, and at least one sonic altimeter for low altitudes has been developed. Accuracy on the order of 2 percent has been achieved.

As in the standard ADF, LF Range, Omni, and ILS (less glide slope) approaches today, the aviator must still form a mental picture of his flight path, using airspeed, altitude heading, wind drift, rate of descent, and time of position over the ground. These factors can be continuously fed to a computer, which will solve the complex trigonometric problem and present the results to the aviator on an instrument which is relatively simple and easy to follow. Devices of this sort have been developed and are called by such names as the "Zero Reader," "Integrated Flight System," "Flight Director," etc. These devices all reduce the load on the pilot but are not always sufficiently accurate for the final critical stages of a landing, and the ground devices with which they operate are in most cases not adapted to field combat use. Considerable work is being done by the Army, through the Signal Corps, working in conjunction with the Navy, Air Force, and industry, to develop systems of navigation and integrated instrumentation covering

all aspects of a flight.

During these development programs, emphasis is placed on ease of operation and interpretation for the aviator. Pictorial presentations to provide a visual impression of location and movement with respect to the ground will be provided. The ultimate aim is to make flight under little or no visibility closely approximate visual flying in its visual sensations and cues, ease and simplicity of performance, and safety.

Besides the high weight penalty and greater power requirements, each piece of added equipment decreases payload, as has already happened to some of our Army aircraft. Maintenance of such equipment generates additional requirements for manpower in an already critical category.

With the use of transistors, printed circuits, and miniaturized components, weight and power requirements will be significantly reduced. Modular construction techniques and simplified design for maintenance by replacement of easily removed expendable components will increasingly reduce the Army's dependence on large, cumbersome lines of communications and supply systems.

SUMMARY

To summarize, electronic communications equipment and navigation aids are in existence and available today to provide adequate point-to-point navigation, at terrain clearance altitudes, as required by Army Aviation in the future mobile Army. The choice may be made from several ground-based aids on varying degrees of complexity, accuracy, and mobility, as well as self-contained systems with various weight penalties. The critical terminal area of flight is less provided for, but development is being vigorously pushed. Improved instrumentation displays and associated computers will lighten the mental burden on aviators and reduce the training time to qualify an aviator for round-the-clock instrument flying with the field Army. However, all these developments cost something: weight, space, payload, power, maintenance manpower, money, and national resources. Development is proceeding, providing a fair compromise in all these areas, yet giving the accuracy, dependability, and flexibility of performance which will enable Army Aviation to provide the Army in the field the mobility essential in modern warfare.

Memo from Flight Surgeon

ALL NORMAL LIVING causes wear and tear on the body. Our bodies' cells are worn out through our daily activities and then replaced with new ones. Stress has been defined as the rate of all wear and tear caused by life. All emotions—love or hate, for example — involve stress; so does physical exertion, like a game of golf or just a brisk walk out to the ramp.

NO ESCAPE

Nobody can escape stress. But there are varying degrees and different forms of stress—mental, emotional, physical—all having some impact on health. Sometimes this is good, sometimes harmful, depending upon circumstances. Some stress is good for us. The important thing is not stress itself but its effects, for stress can be the spice of life.

Stress is a basic part of our experiences, involving our ability to adjust to changes in our lives. Whether or not the strain caused by these experiences can make our bodies break down and become susceptible to certain diseases depends to a great extent on our ability to handle them.

NATURE'S WAY

Strong emotions cause bodily changes because this is nature's way to make us act. Fear, for example, makes us tense. When we are afraid, hormones speed through the system causing the heart to beat rapidly. Muscles of the stomach and intestines contract, forcing blood into quick circulation. Breathing speeds up and other changes occur which help us reach a point where we can successfully meet an emergency or go through a difficult situation. Normal emotional stress is useful in many ways. You may get steamed up over an important or interesting job and, as a result, be able to handle the work more effectively. Pleasurable emotions involving stress can be exhilarating. You may get excited and stimulated doing acrobatics, or tactical flying. This type of reaction can pep you up. The letdown that follows is healthy relaxation. So it's important to know that the pleasant emotional reaction is usually good, not bad, for us. We can't and wouldn't want to live like vegetables — without feeling.

HARMFUL EFFECTS

The emotional stress that gets us down is the kind that makes it difficult or nearly impossible to relax. Intense and persistent anger, fear, frustration, or worry, which we may bottle up inside ourselves, can threaten health. This kind of emotional stress leads to trouble.

Studies show that almost half the people who seek medical attention are suffering from ailments brought about or made worse by prolonged emotional stress — too much worry, anx-

iety, or fear. When tension of this type is too often repeated or continues for a long time, when we overwork or worry to the point where we can't seem to take it easy and no longer get a good night's sleep, our bodies' chemistry may get out of kilter. That's why it's important to learn to tune down if we get too keyed up, be able to handle our emotional tensions, know and accept our physical and emotional limitations.

All this is easier said than done! But understanding is the first step—understanding ourselves and those around us, and using this understanding to make our lives and our relationships with people more satisfying.

HANDLING TENSIONS

Here are some of the ways people have learned to handle tensions successfully and to weather the rough spots of life more smoothly:

Balance work with play. That old saying about all work and no play making Jack a dull boy still makes sense. Besides, all work may also give Jack an ulcer or harm his health in other ways. If Jack has trouble taking it easy long enough to get some fun out of life, he probably ought to schedule time for recreation. For many people, an interesting hobby can be relaxing as well as constructive. On the other hand, work can occasionally be a kind of "cure" for emotional situations that are hard to bear—such as the death of a loved one, or losing a girl friend. Getting busy helps some people to stop worrying about their troubles.

Loaf a little. Very active people who feel guilty about sitting and doing plain nothing now and then ought to give themselves a chance to learn the art of loafing. While too much inactivity breeds boredom and may even cause stress, a few minutes a day doing nothing may help us to tackle our work with renewed enthusiasm.

Certain people need to learn to "let some things go." When a workload seems overwhelming, remember that you can do well only one task at a time. Concentrate on the particular job at hand and then go on to the next one without worrying about everything else that has to be done. Some things can almost always be set aside until later, or until tomorrow, and work usually goes faster and smoother when you have this attitude of doing one thing at a time.

Work off tensions. When we're upset or angry, we can try to blow off steam or work off our feelings with physical exercise. Pitching into some activity, like mowing the lawn, taking a long walk, or playing a game of tennis, not only helps to relieve anger but also makes it easier to face and handle irritating problems more calmly.

Talk out troubles. Sometimes it helps to "get it off your chest" by confiding worries to a sympathetic friend. When what appears to be a serious problem starts to get you down, it's wise to discuss it with your flight surgeon, or sometimes with an understanding member of your own family. Often another person can help you get your feelings into focus and see your

(Please turn to page 14)

Be Wise About Weight and Balance

"IGNORANCE IS BLISS," said one of the old poets, but he was not speaking of aircraft weight and balance. For years Army Aviators were not particularly concerned with either weight or balance. If you carried more than one other person in your light aircraft, you knew you were exceeding the limitations imposed by the manufacturer. But Army Aviation has grown and so have Army aircraft. With this growth has come the necessity for each pilot to know, understand, and be able to compute weight and balance.

AXIOMS

Weight and balance cannot be divorced from density altitude because aircraft will carry less weight as altitude above sea level increases. Therefore, temperature, humidity, and pressure must be considered to determine density altitude, which governs the weight-carrying ability of aircraft.

Why compute weight and balance? Is it because some ground pounder behind a large steel desk wants to give the pilot something more to do? The answer is no. Every commercial airline has weight and balance computed before all flights, and the figures are filed with FAA. The Air Force and Navy compute weight and balance before an aircraft's wheels are allowed to leave the ground. All Army Aviation personnel must take a good look at weight and balance and stress the importance and necessity of using it.

WHAT IS WEIGHT AND BALANCE?

As you would expect from the two words, weight and balance, the primary information gained is: Are you too heavy to fly and are you loaded within C. G. limits? Most aircraft will fly, or rather will leave the ground, with a tremendous overload. The weight limitation put on each specific aircraft is for safety. Each part of the aircraft is stressed to take a certain load without failing. Staying within that weight limitation adds to the life of the aircraft and the continued longevity of pilots, crew, and passengers.

Balance affects an aircraft's stability and handling characteristics. Balance can best be explained by thinking of the child's toy, the old "teeter-totter." With two children of equal weight, the teeter is in balance; if one child is heavier, his end will go down, the other end up. The same is true of an aircraft. If an aircraft is loaded too far aft, a nose-high attitude will result, which is particularly bad on takeoff. An aircraft loaded too far off balance will run out of trim and elevator controls.

The mission of the Army is such that operating in and out of small, unimproved fields is normal. Maximum performance takeoffs with a minimum clearance of obstacles is routine. Extra weight or out of balance conditions can cause that very narrow margin of safety to disappear completely. It is possible that some of the accidents

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This article was prepared by the United States Army Board for Aviation Accident Research.

labeled as "not enough power" should be changed to "too much weight."

Each pilot is responsible for the loading of his own aircraft. He is the person to whom the accident board will turn and ask: "Did you compute your weight and balance?" In normal routine flying, the pilot must exercise command and not allow his aircraft to be overloaded or loaded out of C. G. limits.

Helicopter pilots are particularly vulnerable to these two faults, an example of which can be found in the following:

An H-37 Mojave, participating in a demonstration, was loaded with a ¾-ton personnel carrier, 7 fully equipped troops, 4 crew members, and a full load of fuel. Weather at time of takeoff was 1,000 feet overcast; 2½-miles visibility in rain and fog; temperature, 72°; wind, east-southeast 5 knots, gusting to 16 knots. The pilot stated that during initial takeoff a large amount of power was needed. Later, in the demonstration area, the pilot was told to move his helicopter, since it could be seen from the stands. Because of other aircraft and a slight hill, a downwind takeoff was attempted. The helicopter settled in and crashed. The pilot's statement was: "At approximately 50 feet, the aircraft seemed to fail to climb and started to settle." The Mojave was 1,867 pounds overloaded, took off downwind, and the density altitude was 1,200 feet.

The best of equipment has a point past which it cannot perform. The pilot of this aircraft did not figure weight and balance before takeoff and did not know his density altitude. Result: 2 injuries, 1 fatality, and a direct cost of $700,000.

The completed weight and balance form for each aircraft is found in the "G" file. This form records the basic weight of the aircraft to include a full load of fuel, oil, and installed equipment. The pilot must have this information to determine how much additional weight the aircraft will carry. The pilot can find the necessary information pertaining to weight and balance in the Dash-1 of the appropriate aircraft tech manual. A complete explanation can be found in the Dash-5 (Weight and Balance section) of the tech manual.

Density altitude should be determined before weight and balance. Tables are found in Appendix I of the Dash-1 of the appropriate aircraft TM that supply data on the length of runway necessary for fixed wing aircraft and power requirements for rotary wing aircraft.

Density altitude can be computed with an E6B computer. However, since these computers are not always carried by rotary wing aviators, the following rule of thumb will provide an approximate density altitude that is accurate within 200-400 feet:

Density altitude = Pressure Altitude + 120 X (actual temperature —standard temperature)

Pressure altitude can be read directly from the altimeter by setting 29.92 in the window; 120 is a constant. Actual temperature can be read from the outside air temperature gauge. Standard temperature is 15° C. minus 2° C. for every 1,000 feet above sea level.

Sample problem:

Density Alt = Unknown
Field Elevation = 1,000 feet
Pressure Alt = 2,000 feet
Actual Temp = 25° C.
Std Temp = 13° C. (Std sea level 15° —2° for every 1,000 feet)
Density Alt = 2,000 + 120 X (25° —13°)
Density Alt = 2,000 + 120 X 12
Density Alt = 2,000 + 1,440
Density Alt = 3,440 feet

Weight, balance, and density altitude — the pilot is responsible for knowing all three. Weight and balance he must compute from tables provided for each type aircraft. The best place to obtain density altitude is the weather station, but it can be computed with the simple formula given.

It is folly to be ignorant about these things. Accidents caused by any one of the three have no place in the Army accident files. It is up to *you*, the individual pilot, to make that little extra effort to become a real professional.

Flight Surgeon

(Continued from page 11)

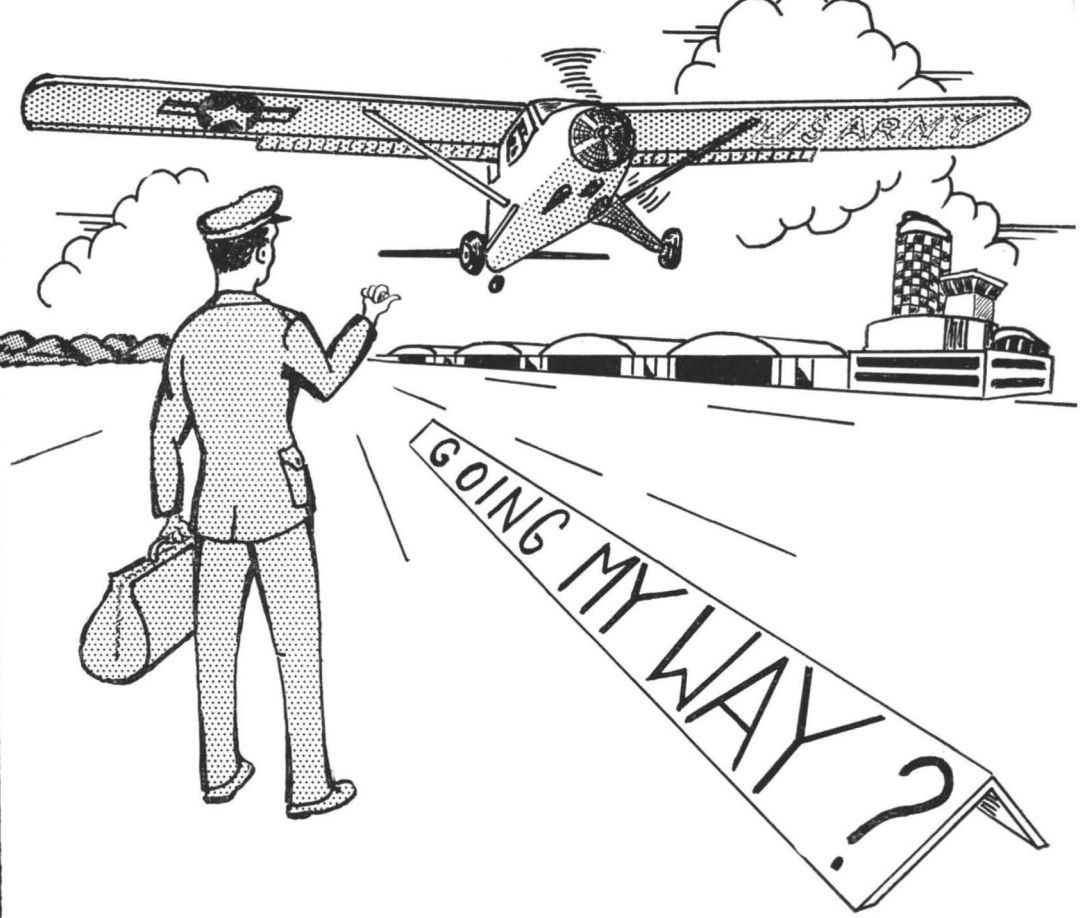
problems in a new light.

Learn to accept what you cannot change. Many of us get upset about circumstances which are beyond our control. Sometimes we even try to "make people over" to suit our own ideals and then feel frustrated or let down when we find that this cannot be done. We can look for the best in others while realizing that nobody is faultless.

Get away from it all. When you feel that you are going around in circles with a problem or worry, try to divert yourself. As simple a thing as going to the movies, reading a story, or visiting a friend can help to get you out of a rut. And there's no harm in shelving a painful situation long enough to catch your breath and regain the composure you need to come back and face the problem. When possible and practical, a brief trip, a change of scene, can give you new perspective. There are times when we all need to "escape," even if it's just a respite from routine.

Keep physically fit. If you keep yourself physically fit, you'll have more zest for living and be able to take stress and handle tensions more easily.

But there are no easy ways of avoiding, nor simple solutions to, the problems of life which cause undue stress and tension. Some of the ideas you read can be helpful. Experience, too, is a teacher. And other people can be helpful. By making the effort, we often find new and better ways to deal with the tensions in our lives.



William E. Vance

IN MORE THAN 22 years combined military and civil service I have flown, as a passenger, with the Army, Air Force, Navy, Coast Guard, Forest Service, Fish and Wildlife protectors, and various state agencies. I've ridden with all types of pilots and aircrews and I have a very good image of the men with whom I like to fly, as well as an equally vivid picture of those who made me wish the airplane hadn't been invented.

Suppose you are flying cross-country tomorrow. I call you the day before to find out if you have room for me.

You say, "Be at the field at 0730."

I show up at 0715 and find that you've already filed a flight plan. This I like (and I know you like my being early). I've come to respect the aviator who has set a takeoff time and expects to meet it. The entire ride will reflect the same precision. You ask me if I care to get the weather with you. I chalk up another bonus point because you're the type who appreciates the

interest every passenger has in the entire flight plan.

The paper work is finished and we walk out to the airplane. You introduce me to the rest of the crew, and that is important to me—that personal interest in the people with whom I'm sharing this experience.

The opposite, all too familiar scene goes something like this:

"Who's going on 1234? Got Jeps, Sam? Who has the clearance? Sergeant, are there enough chutes? Let's get this bucket of bolts in the air. Let's leap."

Lord, I think, this is another of those real gone flights. They want to get off before someone takes their airplane, or else the little wife can't be kept waiting.

THE PROFESSIONAL

This isn't meant to be the latest word on the niceties to be observed when traveling by military air. Rather, it is another impression to help define the frame of mind or attitude that adds up to the professional airmanship everyone respects.

Now, back to the airplane. I follow you around as you make a visual check. You pay particular attention to the controls, step up on a tire to look at something. Maybe I don't know what you're looking for, but that little act adds to my confidence in you. All this is a show for the ground pounders because I know you've checked the Form 781-2, and I'm sure you won't start up the engine only to discover that something on the form is redlined and that we have to change airplanes.

Before starting the engine, you get the attention of all the passengers and explain the flight plan. The crew passes out the parachutes, and you ask everyone to try his on.

The sergeant says, "Mister, your leg strap is a bit loose. May I tighten it for you?" As he helps me I think, *they're leaving nothing to chance. These guys are good.*

You ask how many have ever used a parachute; getting no reply, you go into it professionally: "I've never had to jump either, but thousands have done it successfully and so can you. Here's a few pointers to remember: Keep your head down when and if you jump. Pull the D-ring as soon as you're clear of the airplane. Keep your feet together and the shroud lines won't get between your legs." This sort of thing doesn't take much time but it makes a relaxed passenger.

ACE OF THE BASE

After becoming airborne, the pilot I like doesn't do any abrupt maneuvering without reason. If a turn can be made with a gentle bank, that's the way he does it, instead of racking it up with one wing pointed to the ground. It has happened to all of us at some time or another — when everything shudders in a steep turn, when the props get out of synchronization, when power and pitch settings suddenly change, and when turbulence makes one think everything is coming apart.

Once, flying from one base to another in a C-45, we encountered numerous thunderstorms. The pilot tried to climb over one, using maximum climb power. Unable to make it, he descended the same way, to go under it. On occasion we were in and out

of clouds. He grinningly informed me, "We're supposed to be VFR." At the time the aircraft was on solid instruments—on airways. I was apprehensive, of course, but more frightening than this was my vision of an airliner carrying children and women, all of them feeling safe and secure in the knowledge that the "airline people really know their business." They do, but this pilot sharing the same airspace didn't.

QUIET WORD HELPS

On a flight out west of the Rockies in a C-47, this happened: We were flying on the edge of a fast-moving cold front, and severe turbulence caused the old Gooney Bird to bounce like a Cub. The captain walked back and made a few reassuring remarks that settled everyone back in their seats. Those few cheerful words didn't cost anything but they banished uneasiness, and that counts for a lot.

Another time I was riding in a C-54 (the Navy calls them R5D) from the West Coast to the East. The aircraft was cleared IFR with en route weather mostly VFR. Severe turbulence was encountered over Arizona and New Mexico and the pilot used many power changes in attempts to maintain his assigned altitude and cruising airspeed.

We kept on, and by sundown the weather was generally clear but with scattered thunderstorms. Some hours after becoming airborne, the crew chief came back and told all the passengers to put on parachutes and stand by to bail out. When the door opened for the crew chief to return to the flight deck, I overheard the navigator and pilot arguing heatedly about their exact position!

We landed all right, after making a hairy go-around. The crew chief told me later that there was less than 15 gallons of fuel left. I felt a little reluctant about boarding another airplane operated by the same service a couple of hours later.

FREE RIDE, ROUGH RIDE

"So you're getting a free ride," you'll say. "Want plush seats and stewardesses maybe?"

No, but the way I see it, the effort an aviator makes to let his passengers know what may be expected dispels uneasiness and reflects well on himself and his branch of service. Should an emergency occur, a confident group of passengers will be less a problem than a group half-terrified by unexplained incidents.

An Army Aviation unit spoiled me, I suppose. Or all of them have, those I've come in contact with. I've seen them accord the same VIP treatment to an Assistant Secretary of the Army and a transient PFC. I remember one unit in particular where all of the things that make for a pleasant flight were done; in addition, the aviator gave me a briefing I've never heard repeated anywhere.

"Tighten the safety belt before tightening the shoulder harness," he told me. Then he explained that unless this is done the safety belt will be pulled to a higher position than desirable, placing pressure on the stomach rather than the bony structure in case of crash. A safety belt position which is too high may

also allow the wearer to slip under the belt. Such a briefing is a small thing, perhaps, but it shows competence—and consideration.

I appreciate the small courtesy of easy accelerations and decelerations. This can be especially important to someone who hasn't ridden in the Bird Dog before. Abrupt throttle closure makes the little bird's engine spit and pop, and to the uninitiated this can mean anything —all bad.

RAMP A FRONT DOOR

There's one more thing to say about this passenger business, and that's the treatment you get on the ground. You land at one field and you're met with a FOLLOW ME jeep and get the works — like a friendly face, transportation, and a briefing on facilities. But not always.

At some bases I've been told that the snack bar was closed for inventory or some other reason, and at others that civilians, even those on orders, could not be fed. Most of the time everything is fine, but occasionally you find lapses and one bad experience cancels out ten good ones.

It might be noted that from my experience, aviators think the grass across the hill is greener. Army and Navy aviators are always talking about the plush treatment they get from the Air Force, while the men in blue are always touting the Army and Navy facilities.

Army Aviators can make equally valid comments about passengers, too. I cringe with the pilot when passengers expect flight personnel to make with the baggage-carrying. Then there are the old heads who think safety belts are strictly for show, and those who clutter the airplane with candy bar wrappers, cigarette butts, and chewing gum wads.

When the question is asked, "Are you going my way?" the hitchhiker is betting that the saved travel time is worth taking on any and all comers as crew. Asking and nothing dismayed, I will continue to do so, because I've found competent airmanship much more in evidence than the other—the kind that makes me wish I'd remained on the ground.

Suddenly There Were No EDPs

Captain Theo C. Watkins, TC

ONE REASON FIELD maintenance officers turn prematurely grey is the lack of supply and maintenance support from the unit level. This is news to some who have heard the age-old cry to their unit commander, "The trouble's in field maintenance." These remarks are not made in a critical sense but rather to illustrate the need for close liaison between maintenance echelons.

The fixed field shop at Fort Benning operates on the principle of service to the customer. This attitude has been emphasized and re-emphasized to all members of the activity. An analogy may be drawn between our operation and a business operation. Unhappy customers are an extremely poor advertisement, and a business can't afford them. Neither can we at Benning's Field Maintenance.

It is my opinion, based on several years experience in the maintenance game, that a majority of the supply and maintenance flaps are self-generated. This statement may be rebutted by units who have waited months for supply action; however, please continue reading for clarification. It is an accepted fact in most units that the newest lieutenant with the latest date of rank will fall heir to the unit maintenance officer's job. Since this writer has long since accepted this prerogative of the commander, the following guide lines for unit maintenance officers are furnished with the hope that some fog may lift for at least one newly appointed maintenance officer.

1. Call on the supporting 3rd echelon maintenance activity. They will be around to see you on an assistance service visit, but go *first* to learn the trade language (SIAM, TMTC, SCAMP, etc.) and find out what a work order (DA form 811) is and its purpose.

2. Check your technical manual file against field maintenance files. The services spend a fortune on publications which ex-

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Captain Watkins is the Field Maintenance Officer at Fort Benning, Ga. Fixed and rotary wing qualified, he is a graduate of several maintenance schools and has accumulated over 3,000 flying hours.

plain in simple language how to perform specific maintenance and include pictures to illustrate the procedures. Find out how a Publications Requirement Table (PRT) is forwarded through channels.

3. Stay within your echelon of maintenance. More equipment is destroyed through "tinkeritis" than any other method. Consult the aircraft -18, maintenance allocation charts, and follow them. Promptly evacuate all 3rd echelon or higher maintenance to the supporting activity.

4. Keep a time change component chart. This area produces a majority of the self-generated flaps. Insist on a daily posting of accumulated time on hourly or calendar change components by your NCOs. Advise your supporting field maintenance activity of forthcoming time change component requirements at least 90 calendar days in advance. This will permit a lead time in the supply field and provide for workload programing in the maintenance. There isn't a supply system in the world that can provide parts without adequate lead time. Timely requisition action will ensure having the item in your hands when you need it, especially with present authority to extend certain components past normal time change date.

5. Maintain a technical manual time compliance chart. I am approached daily by very senior officers who ask, "What is this TMTC business?" A technical manual time compliance is neither mysterious nor difficult to execute. Any change or inspection of the aircraft or components after initial receipt designed to improve operation or extend time life is a tech manual time compliance. If kits are specified, they must be requisitioned.

6. Force your mechanics to use grease. Thirty percent of our maintenance difficulties could be alleviated if personnel would make use of the old grease gun.

To summarize, maintenance success at the unit (1st and 2nd echelon) level depends mostly upon common sense and the ability to read and interpret applicable publications. It reminds me of a story I heard on a recent cross-country to Palo Alto, Calif. A unit maintenance officer was hunting in a forest when a terrible storm came up. He looked for shelter, but there was none. It began to rain in torrents. He crawled into a hollow log, which fit snugly. The rain lasted for hours and, as the water soaked through the wood, the log began to contract. When the storm was over he could not get out. He strained to free himself, but to no avail. He knew if he could not free himself, he would die of starvation. His whole life flashed before him, especially his mistakes. Suddenly, he remembered that both his unit's Beavers were EDP in Field Maintenance because he had not anticipated a time change on propellers. This made him feel so small that he was able to crawl out of the log, vowing to initiate early supply action on future parts requirements.

EDP: **Equipment deadlined for parts. This newly authorized term replaces the old *AOCP*.**

The Saga of Johnny

Lieutenant Albert L. Smith, *Sig C*

THIS IS THE SAGA of Johnny Comequick, a handsome blending of *bon vivant*, chevalier, and Army Aviator. If you were in his flight class, you remember him well. If you weren't but have been around a while, you know the type. In his home country he was recognized as a lad whose devil-may-care attitude far surpassed that of any generation the Comequicks had previously admitted to. During his school years boyish wiles and foolish exploits gained him a measure of fame, and after graduation he emerged from his ivy-covered tower aspiring to further acclaim.

ANTICIPATED JOY

Johnny came to the Army anticipating personal accomplishment and the rewards of recognition. He viewed the khaki-world beyond his Second Lieutenant's bars as a limitless area to be exploited and explored. Of all avenues, flying was the most appealing and exciting to J. Comequick. Oh, how he coveted the wings and admired the status of the Army Aviator! THIS was for him!

While home on leave, Johnny proudly displayed his rank and Sharpshooter's Medal to the local populace. To everyone who listened, he announced his intention to become "A Watchdog of the Sky." The hometown cowboys gazed in awe at their hero.

So it was. Johnny Comequick blithely mapped his future 'midst the admiration of "his people," and there was much happiness in the land of the Comequicks.

A FIRST OFFENDER

Despite his skill and cunning, flight training was difficult for Johnny. He was prone to fly outside the prescribed area and almost got caught several times. Occasionally he'd make a dry run over the ammo dump, but that became dangerous after the

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Lieutenant Smith is a Training Officer in the Office of the Director of Instruction. He is fixed and rotary wing and instrument qualified, having 1,800 hours of flight time.

CG nearly got his number. He was constantly at odds with his instructors and couldn't understand "why the Army picked such boneheads for flight instructors." What chance did a bright young lieutenant have with such idiots instructing him? Take, for instance, the time Johnny cut the mags on a night flight. That stupid IP actually thought something *was* wrong! Then there was the time Johnny "sort of" undershot a low approach on the Omni. The IP was really square, never noticed Comequick's deft fingers setting the altimeter up 300 feet! Why, if Johnny hadn't been peeping out from under the hood right then, they probably never would have seen Southern Airways 447, let alone miss it by 40 feet!

Flight training provided many memories. The Southern Airways incident was one; another occurred shortly afterwards. That was the day he discovered how to hold a constant banking turn in the soup—set it up, cage the Artificial Horizon, uncage it, and you're in! He told nobody about it; after all, "Einsteins don't tell everything they know." When he broke out his Horizon wasn't exactly right. He credited it to low voltage and wrote up the battery when he landed. Even with the "mechanical error," Johnny thought it a pretty good stunt for a student to pull off.

FOLLOW ME

On his final cross-country Comequick slipped "the word" to a couple of his buddies. "Follow me . . . forget about position reports." They could always say their transmitters were "fritzed," and who'd know they had a bull session on 121.5? With long-suppressed derring-do, he led his buddies in close formation through decks of stratus. In true leadership fashion he buzzed a town to get its name from a water tower. "You've got no worry," he told them; "we're only 46 miles off—just the way I planned it." His buddies swore to secrecy. It wasn't until after graduation that the truth came out, and only then because Johnny wanted the "boys" in his organization to know that in him they were blessed with more than a fixed wing Army Aviator. He was undoubtedly a "Watch Dog Supreme."

A "GOOD" PILOT

He flew often and well during the first months of his initial assignment (which Johnny tried his utmost to redesignate "Comequick's Kamikazes"). His superiors tagged him "a good pilot," though in truth Johnny felt things should be done his way. He expected results from his subordinates, flattering to him. Too, he was inclined to get too "solidly sent" with the program; consequently, his confidence was rapidly approaching his "maximum-combat-overload-emergency-ability."

While assigned to "Fort Comequick" (as he called it), Johnny got to know the surrounding country "like a native." So, posting changes to his Jep was a waste of time. Although he made position reports now and then, he wondered why people gave HIM altimeter settings. Comequick of all people! Why, who else knew the terrain better, except maybe Cochise?

A routine mission was in the works one afternoon when Johnny was really "hot." He deftly finessed his *confreres* and was the first to volunteer for the flight. He knew a young *femme* a short hop from destination and figured to kill two birds with a single stone. J. Comequick filed his 175 with a happy grin and, as he waited for a signature, thought how easily two jugs of Scotch would fit into his new RON bag. Maybe he could squeeze in his Jep too. With his clearance signed, he trotted out to the strip wondering "how such jerks ever got to be weathermen—bunch of old ladies!"

On the line he shook the fuselage, kicked the tires, jumped in and taxied to position. The tower guns reminded him of Christmas, and he thought of home, of girls, and specifically of the date he'd line up on the homeward flight. He stuck himself into the headset unconsciously and called for takeoff.

For 4,000 feet he cursed the mechanics; when he broke ground he wished "the clutch of boobs" had taken more time loading his plane. Thanks to those meatheads he couldn't finish his chandelle!

DISASTER DELAYED

The flight was one of boundless monotony and perfect flying conditions. Johnny somehow managed to overshoot his 1800 hours ETA by twenty minutes and was impatient with the delay. He entered Base Ops eagerly and filed out for Fort Comequick with a fuel stop at Scratchville (and a nice visit with his "old buddy," Barbara). Johnny tripped into the "gents," washed up and checked to see if the altitude had spiked his Scotch. Happy that it hadn't, he made a quick call to Barbara, which confirmed his fuel stop.

As he sat boring his path, Johnny wondered again about the weathermaker. Just couldn't understand what he had tried to get across at destination. "Boy," he thought, "that dope is like all the rest—ought to be a witch doctor." Scratchville loomed on the horizon, and things seemed pleasanter after a few good slugs of the Scotch.

Barbara met him there and the visit was all that Johnny had expected. Afterwards, watching her bright red wagon zoom off, he hoped his "old buddy" wasn't angry with him for drinking most of the booze.

REVERIES . . .?

What a rare day it had been, Johnny thought. "Made an impression on the Old Man the way I beat my buddies to the draw. Got in a few more hours, too; that never hurt. But this little old fuel stop was the topper! A neat trick, all with government transportation and at government expense. Authorized? Smauthorized . . . " Who'd question a conscientious fellow like Johnny Comequick?

Flying back to Fort Comequick, Johnny cursed the crew chief for letting him forget his flashlight and the "witch doctor" for not giving the word about the rain and ragged ceiling he saw ahead.

WILD BLUE YONDER

Johnny Comequick's cockpit was an arena of recriminations against "them" and alibis for himself.

"Man can't be expected to do everythin' by himself. Darn things are hard enough to fly in good weather . . .

"Can't get any soothing music with all the static . . . maybe another shot of Scotch will help . . . man, I feel cold and sweaty! Gettin' real dark-gray out there . . . now real dark-black.

"Better look at instruments . . . Heh! That's it, Johnny! Look at the instruments when you can't see outside . . . 800 feet! Man, that ain't much . . . can't go upstairs in this stuff tho' . . . can always jump . . . yeh, jump . . . that's one thing NEVER FORGET. Check chute 'fore puttin' it 'n baggage compar'ment.

"Feel kinda disorientated . . . haven't had THAT much Scotch . . . must be the soup outside . . . Soupy Scotch.

"Come on head, hands . . . let's get outa this!"

Rain pelted the tiny ship and turbulence increased. His instruments showed a 40° error in course. He tried to get back; then he remembered the old Artificial Horizon trick from his training days. His mind reeled trying to recall what he had done then to get out of the soup.

TILT!

Through the storm's fury there came a roar as metal met mountain—a blinding flash, the falling, rolling, ricochetting pieces, then rain and wind and nothing more. Johnny Comequick's Artificial Horizon maneuver hadn't worked.

They never found Johnny, just several pieces of a Bird Dog; that's all. Some think it wasn't his wreckage, think that Johnny was too smart, too good a pilot to kiss a mountain in a storm. Flying Johnny Comequick . . . Times when I see individuals pull Johnny's old tricks, I think he MIGHT still be flying. Perhaps the late Johnny Comequick isn't "late" after all. Look around you. Is that Johnny over there, taxiing out to the strip with his pitot cover on?

MONTH IN AND MONTH OUT, the Gray Hair Department devotes its efforts to writing about the 12 percent of Army Aviators who become involved in aircraft accidents. The other 88 percent are seldom mentioned.

Unfortunately, many feats of outstanding airmanship and performance pass without notice because there is no formal requirement for reporting. Occasionally, some thoughtful person will write and report individual feats of superior performance by Army Aviators under adverse and emergency conditions. When this happens, Gray Hair typewriters slam into full speed.

WELL DONE

First Lieutenant Carl A. Wilson, pilot, and First Lieutenant J. W. Allman, copilot, departed Fort Bragg, N. C. last summer on an IFR flight plan to Chicago, flying an L-20 Beaver.

The aircraft entered the overcast shortly after takeoff, and Lieutenant Wilson continued climbing to his assigned altitude. Approximately 30 miles NE of Charlotte, the Omni red flag snapped up and the load meter jumped to maximum. Lieutenant Wilson immediately called Charlotte radio and requested a range approach to Charlotte airport.

Charlotte radio cleared the Beaver for the approach and descent to minimum altitude. At this point, the VHF receiver died. Lieutenant Wilson began the descent and turned toward the range station. Charlotte radio gave 500 feet overcast and 8 miles visibility during its regular weather broadcast.

The LF receiver became inoperative before station passage could be reached, and smoke began seeping from the baggage compartment. Lieutenant Allman changed to ADF while Lieutenant Wilson continued the approach. He passed the station and descended to the minimum for final approach. The aircraft was in a ragged ceiling, and here—you guessed it—goodbye ADF.

Easing cautiously below the ragged ceiling, Lieutenant Wilson lined up with the runway

The Gray Hair Department is prepared by the U. S. Army Board for Aviation Accident Research with information from its files.

ahead and completed his landing. Damage to the aircraft was confined to a burned out battery, caused by an improperly connected reverse current relay.

This action demonstrates a high degree of professional flying ability combined with cool and stable headwork under emergency conditions.

Well done, Lieutenants Wilson and Allman!

"He took slight notice of the skids as they settled into the spongy surface. . ."

COMPLACENCY

There is an old adage that a person can adapt himself to almost any situation or environment. That is, if one is subjected to a situation long enough, he will come to accept it as part of his natural surroundings and way of life, and is apt to treat it with indifference if not completely ignore it.

Adaptivity of mankind stems from the fact that Nature has made provisions for man and beast alike to adjust to their habitat in a constant fight for survival.

Some animals, however, have misinterpreted Nature's Law of Compensation, or if not that, have become victimized by it. This is the man animal. How many times have you seen a person, constantly exposed to hazardous duty for a period of time, become complacent and fail to maintain the necessary vigilance to survive, endangering not only his life, but the lives and property of others as well. You can probably recall many such persons. Take this case for instance:

The mission was a routine chow-run—old stuff for the aviator. He had flown 217 hours in a Sioux in the last 51 days, 72 of these hours in the past 12 days. He landed the whirlybird in the area prepared for him and watched the transfer of the food from the right seat to the ground. He took slight notice of the skids as they settled into the spongy surface, since it had happened before with no ill effects or consequences. He did not see that this time vibrations caused the skids to shift slightly aft and the heel of the right skid became entrapped under a hidden root.

Without bothering to get the Sioux light on the skids, the pilot prepared to bring it to a hover and do a turning takeoff to the right. He applied collective pitch, and the helicopter rolled to the right rear with the main rotor blades chopping away at a stump.

Many factors entered into the complete loss of this aircraft and near-loss of life:

The pilot had been required to fly an excessive amount of

hours over a short period of time; he could not be expected to perform at peak proficiency. Project personnel, being exposed to hazardous duty over a long period, were complacent. Local command failed to establish minimum requirements for helicopter landing sites; the site was improperly prepared for safe operation, and no effort made to improve it for a year. The aviator neglected to inspect for ground clearance of skids prior to takeoff. He could not compute density altitude because his helicopter was not equipped (as directed) with a free air temperature gauge. And so on.

Routine undeniably can be very taxing and monotonous. It can lull one into a disastrous sense of indifference and complacency to everyday dangers. This is an occupational hazard that an Army Aviator must recognize and combat. Otherwise, . . .

WINTER CAN BE FUN

What does winter mean to you? Is it Christmas, the bright New Year, snow and the great outdoors? It is all these things to some men. For others it means extra hazards and more care.

To the aviator winter has a special meaning. It means a time of treacherous ice and snow and often disastrous frontal activity which limits visibility and works hardships in general. It is a time that calls for alertness and demands extreme caution. Otherwise, a careless aviator is apt to find himself in the embarrassing position similar to the following:

The 2,000-foot runway lay like a jagged, yawning scar across the snow-covered landscape, its hard, black surface spotted here and there by patches of snow and ice. With the idea of practicing short field landings, the aviator changed his original training-flight course and directed his Bird Dog to the nearby field.

Touching down, the pilot applied brakes. The left wheel reacted normally, but the right wheel hit an icy surface, causing the Bird Dog to veer to the left. Attempting to recover directional control, the pilot applied full right rudder and brake. This, however, failed to correct the turn. The aircraft struck a small bank of snow on the left edge of the runway, ground-looped to the left and then struck a larger bank of snow, which caused it to nose up, and the right wing struck the ground. It finally came to

Winter can be fun

rest on the nose with the right wing and the right landing gear on the ground.

This pilot elected to practice short field landings on a runway not completely clear of ice. Investigation revealed, however, that the runway, though icy, was not an excessive hazard to this landing. The hazard was improper use of brakes on the icy surface and failure to use power for a go-around when directional control became difficult.

Winter aircraft mishaps are not unique with landings and takeoffs. As a matter of fact, an aircraft in the air and its pilot are just as vulnerable to the vagaries of low temperature with its accompanying hazards of snow and ice.

This aviator made a thorough preflight check, determined the Raven safe for flight and performed a normal takeoff in the face of light snow and fog. Fifteen minutes later, the pilot experienced a partial power failure and went into autorotation, heading into the wind toward a landing area directly to his front. A slightly higher than normal speed of 50 knots was maintained during descent because of high and gusty winds. Attempting to cushion the rapid descent, the pilot applied pitch. Making a touchdown, the aircraft skipped 52 feet and became airborne again. Applying full power to clear obstacles to the front, the aviator again noted a power failure, began autorotation and made a hard landing. The ground was firm and partially frozen. The aircraft skipped 95 feet again and came to rest 185 feet from the second contact with the ground.

Subsequent investigation determined that the aircraft was flown through snow and freezing mist with carburetor air filter bypass closed. This caused formation of ice on the carburetor air-intake screen, resulting in a richer fuel-air mixture.

Wintertime for many is the best of seasons. It could be for you, too—that is, if you read and observe rules for safe winter flying set forth in the Dash-1 for your aircraft.

OF MACHINES AND MEN

Some 50 years ago, man, by his inventiveness, placed himself in a totally unnatural environment. He pieced together some materials and launched the age of powered flight.

During this 50 years, aircraft have progressed in abilities for speed, altitude and endurance; they have grown larger, heavier, and more complex. Man, on the other hand, is cast in the same mold, produced by the same type of genes that made his predecessors.

Aircraft are products of standardized construction. Components and parts are designed and fitted for specific needs and each item may be replaced by an identical one. Not so, the human who controls aircraft.

Men are products of heredity, environment, and emotional experience. No two are ever alike in all respects. People are created unequal, and with learning and experience, they become more so. They differ in motivation and capacity for learning. They differ in aptitudes for particular activities, in interests, in beliefs, in emotional adjustments, in personalities, and in social skills. They differ in potentials for becoming successful doctors, engi-

An inept first autorotation

neers, teachers, or aviators. Those human qualities which combine to make a successful military officer are not always the same qualities necessary to adapt the officer to aviation.

Substitution of nonstandard parts for aircraft construction may result in malfunction of the machine and possible accidents. Substitution of human qualities necessary for aviation adaptability will result in weak performance and probable accidents.

An Army officer, age 30, was successful in performing the duties of his basic branch. He attained his RA commission in 1952. Five years later, this officer began helicopter training. As a student aviator, he experienced difficulties with flying from the beginning. He was the last of his class to solo, requiring 27 hours of dual instruction. He was given many hours of solo to practice primary maneuvers because of slow progress. The officer attained a total of 55 hours and was soon due for his second military progress check. He had never performed a solo autorotation.

This was the situation as he proceeded to the flight line on a clear, cool morning for a solo flight. Excessive mag drop was found after starting the Raven, and takeoff was delayed while a mechanic changed several spark plugs. The new spark plugs corrected the mag drop and the officer made his takeoff, climbed to 1,200 feet and began flying toward a stagefield.

The Raven engine sputtered several times en route and, looking around for possible emergency landing areas, the officer con-

tinued the flight. As he approached the stagefield, the engine sputtered more often. The Raven began to lose altitude and the officer started an autorotation.

In his own words, this officer believes he panicked "or blacked out" after downing collective pitch. His next awareness was of the ground coming rapidly up and he jerked collective pitch to the top.

The aircraft struck the ground in a skidding left turn and the right main skid dug into the soft ground. A main rotor blade flexed down and severed the tail boom. The officer next remembers sitting on the ground looking through the bubble of the heavily damaged Raven. He was not physically injured.

Following the accident, the officer stated that he was aware of his aptitude deficiencies for aviation training. He had contemplated resigning from the training program 6 weeks prior to the accident because of apprehension and fear created by his inability to build proficiency and confidence. He had decided not to resign because he feared a black mark on his record.

The most important social motive among humans is the desire for approval, recognition, and prestige. This motivation influences behavior, whether consciously or unconsciously. It can get us into uncomfortable and dangerous situations. The manner in which we perform under emergency conditions will be determined by our aptitude and proficiency for the activity in which we are engaged.

Who is to say whether or not this officer would have successfully completed his training had he not encountered an emergency situation? Experience indicates that humans who are not equipped with standardized aviation behavior patterns are no more fit to fly than an aircraft with a substitute nonstandard part.

MOMENT OF DECISION

There are occasions in everyone's life when he must make momentous decisions of varying degrees of importance and duration. Perhaps it will involve planking down the last sawbuck on a petrified nag in the fifth at Santa Anita. Another time you may say, "What-the-heck!" and take a chance on dating the luscious redhead and risk being found out by the suspicious brunette in the air section office.

Then again, the decision you have to make could be one that affects your very life and thousands of dollars worth of government equipment. To abort or not to . . . ? To try to clear that takeoff barrier or to draw back and attempt to get back on the ground? To go ahead or turn back? The decision could be a costly one if not made wisely—and in time. One aviator discovered the wisdom of this too late.

The pilot taxied to the end of the strip, made a runup check, turned his Bird Dog into the wind, and began his takeoff run. Hitting a dip in the surface, the aircraft bounced into the air. The tail was allowed to rise, assumed an almost level attitude and traveled 50-100 feet through the air, then bounced a second time. After traveling about one-half the length of the strip and believing the aircraft did not have sufficient speed to become air-

Indecision caused this accident

borne and clear the trees at the end of the strip, the pilot decided to reduce his throttle and get back on the ground. He managed to get the aircraft down, but not in time to stop before the Bird Dog ran into the trees.

The pilot escaped unharmed, but substantial damage was done to the aircraft.

There was no mechanical or material failure. Weather was not considered a factor. The pilot merely failed to keep the aircraft in a takeoff attitude and was slow in taking positive action to abort takeoff before reaching obstacles at the end of the strip. In short, he followed an unwise act with a too-late decision.

ARE WE EQUIPPED FOR ERROR?

"To err is human . . . "

Trite and a bit hackneyed, perhaps. Nonetheless, the soundness and validity of this sage observation, made many centuries ago by the Bard of Avon, remains till today unchallenged, irrefutable. Otherwise, the lot of accident investigators would be an easy one.

Unfortunately, though, human nature sometimes leans toward exhibitionism with no thought of personal safety, creating a constant need for research and evaluation of safety equipment and accident preventive measures. Take this typical case for example:

The morning broke with calm winds and clear skies. Visibility was 25 miles. A nippy 68° added briskness to an ideal day. The pilot, on a routine reconnaissance flight, landed his Sioux in a grassy field with the mission of contacting ground troops

"... he could have recovered if —"

and establishing pickup areas and landing sites for a troop lift and cargo mission. Assignment completed, he again took to the air.

The Sioux skimmed over the field with its skids about 4 feet from the ground. It maintained this altitude for approximately 200 yards before beginning to rise. Abruptly, the helicopter nosed upward for a brief moment, accelerated forward out of control, struck a treetop, spiralled and crashed into a clump of trees. Nearby ground troops, upon arrival at the scene of the crash, found that the pilot had suffered fatal injuries.

The aircraft had struck an unmarked communication wire strung between two trees, which shattered the plexiglass bubble of the Sioux.

Members of the investigating board classed the accident as pilot-induced. The pilot did not perform a complete ground reconnaissance prior to landing and takeoff. Furthermore, he held the aircraft at a low altitude during takeoff in excess of normal performance. In other words, the fatality was a victim of his own tendency to err.

Investigation, however, revealed that the aircraft was undamaged except for breaking the plexiglass and was flyable until it struck the tree. The flight surgeon reported that the pilot was not in control of the aircraft after colliding with the wire due to a severe blow sustained when the back of his head struck the top of the firewall. From these deductions, the flight surgeon concluded that had the pilot been wearing a crash helmet and had he been properly equipped with shoulder harness, he could have recovered from the initial mishap and safely executed a landing, without loss of life and probably without total loss of aircraft.

Thus again, human shortcomings joined hands with lack of adequate equipment and effected an irreplaceable loss.

Bogardus Snowden Cairns
Major General USA
14 February 1910 - 9 December 1958

A crowd of more than 2,000, including Deputy Assistant Secretary of the Army Courtney Johnson and 13 general officers of the U. S. Army, paid tribute to Major General Bogardus S. Cairns on January 10 when Ozark Army Airfield was renamed Cairns Army Airfield.

General Cairns was killed instantly on December 9, 1958 when his Sioux helicopter crashed in dense woods northwest of Fort Rucker Headquarters minutes after takeoff. Alone at the time, he was piloting his light helicopter to Matteson Range to view a helicopter firepower demonstration rehearsal. He was buried in Arlington National Cemetery on December 12 with full military honors.

Colonel James S. Luckett, commanding officer of the U. S. Army Aviation Center, reviewed General Cairn's military history, culminating with his assignment June 8, 1957 as Commanding General of the Aviation Center and Commandant of the Aviation School at Fort Rucker.

Lt General Clark L. Ruffner, Third U. S. Army Commander, told the assembled crowd that, "It is not my purpose to eulogize General Cairns, whose great leadership, courage, and vision are well known throughout the United States Army, but to thank God for letting us have him and letting us know him as long as we did."

The next speaker was General Bruce C. Clarke, Commanding General, U. S. Continental Army Command, who said, "General Cairns provided sound guidance and leadership to the Aviation School in development of the doctrine, tactics, and techniques for the coordinated employment of Army Aviation and the ground forces.

"He was forward-thinking and mobility-minded, both of which are so necessary to the successful Army of the future.

"I pay tribute, too, to his abilities as an administrator. I have seen the school advance in the quality of instruction and in producing training literature."

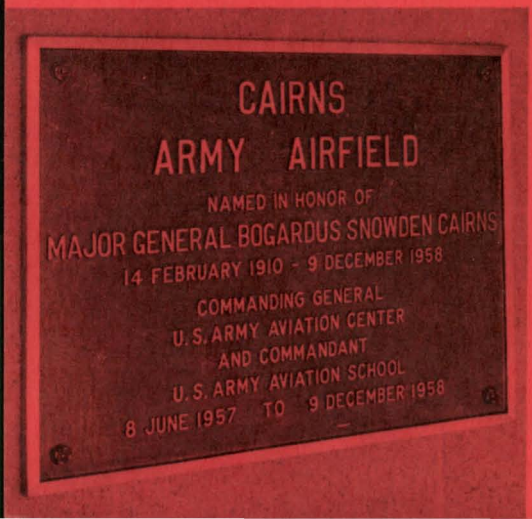
Also paying tribute to General Cairns was Mr. Johnson, representing the Honorable Wilber M. Brucker, Secretary of the Army, who was unable to attend.

Distinguished guests at the ceremony included (l to r) The Honorable Courtney Johnson, General Clarke, Major General Ruffner, and Colonel Luckett.

Following the speeches, Mrs. Doris B. Cairns unveiled a plaque and portrait of her late husband in the operations building of the newly-named airfield, and a flyover of Army aircraft passed in review.

A native of New York City, General Cairns was commissioned a second lieutenant in the Cavalry following graduation from the United States Military Academy in 1932. In 1935, he served at Fort Riley, Kansas, where he attended the Regular Troop Officers course and later the Special Advanced Equitation course at the Cavalry School. While at Riley, he instructed in horsemanship and was a member of the Olympic Pentathlon team.

In 1939, he was assigned to the 13th Armored Regiment of the 1st Armored Division, serving in Africa as executive officer; later in Italy he commanded the 3d Battalion until 1944. He saw action in the campaigns at Oran, Tunisia, Naples-Foggia, Rome-Arno, and Anzio.



His experiences at Oran were published in the MILITARY REVIEW under the title of "Armor at Oran."

Returning to the U. S. in 1944, General Cairns was assigned to the Operations Division, War Department General Staff, and later to the Staff and Faculty, U. S. Armored School, and Headquarters, First U. S. Army. In 1946-47, he attended the Combined Arms course at the Command and General Staff College, and in 1948 he attended the Armed Forces Staff College. He returned to Fort Leavenworth in 1949 as instructor at the Command and General Staff College. He attended the 1951-52 class at the National War College.

He returned to Europe in August 1953 and commanded Combat Command "R" of the 2d Armored Division until November of that year when he became Assistant Chief of Staff, G3, at V Corps Headquarters in Frankfurt, Germany.

Upon promotion to Brigadier General in October 1954, General Cairns became Commanding General, Base Section, USAREUR Communications Zone, with headquarters at La Rochelle, France. He returned to this country in 1955 and was deputy to the Assistant Chief of Staff, G3, Headquarters USCONARC, until he came to the Aviation School in February 1957 to begin flight training. He was awarded the rating of Army Aviator in May 1957, and shortly thereafter assumed command of the Aviation Center and became Commandant of the Aviation School. He was promoted to Major General on the first of September, 1958.