OCTOBER 1962

UNITED STATES ARMY AVIATION DIGEST

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OCTOBER 1962 VOLUME 8 NUMBER 10

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

The DIGEST is an official Department of the Army periodical published monthly under the supervision of the Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. Photos are U. S. Army unless otherwise specified. Material may be reprinted giving credit to the DIGEST and to the author, unless otherwise indicated.

Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U. S. Army Aviation Digest, Fort Rucker, Alabama.*

Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, 27 November 1961.

To be distributed in accordance with requirements stated in DA Form 12.

LETTERS

Sir:

The following TWX Excerpt brought to my mind a similar incident of several years ago:

L-19A PILOT'S SHOE became wedged between right rudder pedal and side of cockpit during landing. Pilot's foot came out of low-quarter shoe while attempting to get shoe free. Incident damage to aircraft. No injuries. (TWX Excerpt, DIGEST, June 61.)

The accident I recall involved a student pilot's foot becoming wedged between the rudder pedal and the fuselage upon landing. The L-19 crashed and burned. The IP managed to pull the student's foot out of a low-quarter shoe, saving the student's life.

At that time aviators were wearing either low-quarters or combat boots for flying. After the accident there was a scurry to get everyone into low-quarters. This move has no doubt saved lives and prevented injuries. Other solutions could have been made to this problem: redesign the pedals, change the clearance between pedal and bulkhead, keep the pedal and shoe soles coated with a nonslip material (or possibly condition aviators so they won't subconsciously try to push the rudders through the firewall). All of these solutions, including the one adopted, have some serious disadvantages.

Many fliers wear combat boots or jump boots, primarily for ankle support and leg protection in case of bailout or ejection.

I seriously question the value of ordinary combat boots as ankle support for the inexperienced jumper. The infrequency of bailouts from Army aircraft makes the wearing of combat boots even less desirable.

Low-quarters have the advantage of quick removal in emergencies but are sorry cross-country footgear after a forced landing or on a walking reconnaissance of a tactical strip. Sand, rocks, briars, and brush inside and outside low-quarters make for sore feet and flat wallets, to say nothing of their disastrous effect on spit shines.

An interim solution to the problems of cross-country suitability and ready removability may be the return to the loose top boot similar to the half Wellington, although I know many commanders abhor and absolutely forbid the wearing of same. I think this is because so many wearers permit their trousers to ride up on top of the boot, giving a very sloppy unmilitary appearance.

Full Wellingtons have high tops which prevent the trouser leg from riding up, yet are still easily removed in emergencies. They also afford leg protection when wading through the boondocks.

The main disadvantage of the full Wellington is financial. Most of us are already overburdened with expensive uniform items. An engineers' field boot, however, will serve the same purposes at considerably less expense. They don't shine very well, but which ones do?

I think the ultimate solution lies in research and design of special footgear to serve the needs of Army Aviators—not only footgear but special clothing and equipment, from head to toe.

In some units the well dressed aviator goes into battle looking like a cross between Sir Lancelot and Yogi Bear. Well meaning commanders and supply officers insist on issuing and requiring all the clothing and equipment authorized by TA 21. Little consideration is given to the requirements for the aviator to maneuver himself and his gear into his weary beast of burden and then coax the beastie off the ground.

Still other commanders frown on and even prohibit the wearing of special items of clothing such as flight suits and jackets.

Let us design practical clothing and equipment for the aviator. Let's make the best use of existing items until the ultimate is available; and let us leave the

surplus, bothersome, impractical items in the supply room—or better still in the taxpayers' wallet.

C. L. HEISS, Capt
Avn Plt, 2d Inf Bde
Ft Devens, Mass.

• *Unfortunately Wellingtons and half Wellingtons fall into the "neither" realm—neither low quarters nor combat boots—and aren't official footgear. From the safety standpoint, considering all aspects of the problem, the U. S. Army Board for Aviation Accident Research recommends combat boots as the most suitable footgear, as does the Navy and Air Force.*

The Quartermaster Corps Research and Engineering Command are working on flight clothing for aviators and disposable type clothing for aviation mechanics. What is required to be worn at individual installations and what is carried to the field is the unit commander's prerogative. Possibly an "education" program is in order to make commanders familiar with the problem.

Safety Boots for all Navy Fliers

High-top flight safety boots, formerly available only to selected units owing to limited supply, were released for issue to all flight personnel July 1, 1962. They may be drawn on logbook issue as part of personal flight gear. The new boots will cost squadrons and other activities approximately $10.50 per pair.

Most flyers who have worn the new boot consider it superior to the N-1 field shoe it replaces. The boot is extremely soft on the inside, being leather-lined in soft calf, but it provides good protection with its rugged waterproof exterior and steel-cap protected safety toe.

During preliminary tests, Service Test Division pilots at NATC PATUXENT RIVER reported the boots comfortable, both flying and walking. They also found it compatible with stirrups and rudder pedals of the 20 models of aircraft flown during the evaluation.

An earlier version of the boot had a zipper up the side. In this model, the zipper has been eliminated.

From NAVAL AVIATION NEWS, July 1962.

In a recent helicopter accident the pilot was badly burned around both ankles. The severity of the burns was the result of his wearing nylon socks and low quarter shoes.

Nylon is a thermoplastic material. A thin thermoplastic material will disintegrate and disappear in the presence of heat, leaving the underlying skin exposed; a thicker thermoplastic layer will melt and fuse into the skin and underlying tissues causing severe damage.

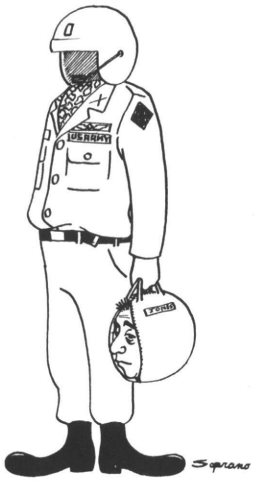
Nylon should not be worn next to the skin in any position where it may be exposed to flames or flash. Nylon watch straps must be singled out as offering the greatest risk because of the exposed position and the presence of important nerves to the hand running fairly close to the skin in the region of the wrist. Nylon socks when worn with walking shoes are also obvious bad risks.

Nylon worn over another layer of clothing or under a clothing layer may be considered as offering no risk in the case of flash burns and little in the presence of open flames.

—Flight Safety Focus

Sir:

Although I have not seen many cartoons as such in the ARMY AVIATION DIGEST I am sending the enclosed sketch for possible publication. The cartoon has a safety theme and might be used with one of your features.



PAY ATTENTION TO DETAILS

This cartoon was drawn by Sgt Kenneth C. Soprano, RA-21290030, an Air Traffic Controller in the 4th Aviation Company, Fort Lewis, Wash. His cartoons have added a little life to the bulletin boards of the 4th Aviation Company for several years and I think a lot of Army Aviators would appreciate this one.

WAYNE A. HANSON
1st Lt, CE
4th Avn Co, 4th Inf Div

Sir:

I appreciate very much your letter forwarding me a copy of the U. S ARMY AVIATION DIGEST containing Part I of "The Army Aviation Story." I read the article last night and considered it to be the best I have seen on our early history. If the other parts are as good, you will have done much to acquaint our people with the story of how Army Aviation has developed.

O. GLENN GOODHAND
Brig Gen, Artillery

Use of Army Aviation in Counterinsurgency Operations

Major Marquis D. Hilbert and Major Everett Murray

THE SERGEANT turned off the beacons at exactly 2200 hours. He had left them on for 3 minutes and the planes had passed over the drop zone right on schedule. They had come in from the right direction, and it sounded to the sergeant as if they had been at about the right altitude.

With the lights out, the dark overcast night appeared blacker than it was as the sergeant peered up. Three packages had been paradropped and were silently drifting toward earth. The sergeant wondered if they would hit the DZ, a small confined area surrounded by dense woods and thick undergrowth.

"Okay Mac, let's have some light," a voice boomed out in the darkness. "Let's see what we got."

Lights flooded the DZ and revealed two parachutes draped over packages. The third chute was found snarled in the limb of a tree at the edge of the clearing. Its cargo swayed from side to side about 6 feet above the ground.

"Close enough," said the man who had asked for the light. "Tell them they scored with all three. That's twice in a row, isn't it?"

It was twice in a row that this team had hit the DZ while being trained by the 22d Special Warfare Aviation Detachment (SWAD) at Fort Bragg, N. C.

SWAD was assigned to the Special Warfare Center on 21 March 1962 with the mission of developing tactical doctrine for the employment of Army Aviation primarily in three types of operations: counterinsurgency operations, unconventional warfare, and psychological operations.

This article will deal only with counterinsurgency operations which consist of both military and civil action to destroy or prevent enemy guerrilla activities. Unconventional warfare and psychological operations will be dealt with at length in future articles.

How does Army Aviation fit into the picture? Before answering, it is necessary to take a quick look at the guerrilla force in its environment. The very nature of guerrilla operations presents the initiative to the guerrilla. Guerrillas secretly assemble and attack weaker government forces or installations which are essential to the country's economy. They then disband and melt back into the population until an opportune target again presents itself. Guerrilla bases are usually established in remote areas such as mountainous terrain, swamplands, forests or jungles. The guerrilla moves swiftly and stealthily on foot, carrying only sufficient ammunition and rations necessary to sustain himself during the planned operation. Pursuit by vehicle is often impossible because of the terrain, so the government's counterguerrilla force is reduced to foot pursuit, thus placing him on the same mobility level as the guerrilla.

History of counterguerrilla activities throughout the world has established four basic problem areas experienced by governments confronting guerrilla elements. These are lack of sufficient mobility, adequate flexibility, favorable firepower ratio, and reliable communications.

Here's the cue for the entrance of Army Aviation. In the military operation, light planes and helicopters provide the counterguerrilla commander with mobility, flexibility, a favorable firepower ratio, reliable communications, reconnaissance and photo capability, medical evacuation of wounded personnel, resupply, and innumerable other means of support. In civil action Army Aviation provides transportation for educators, doctors, officials, and the sick. It also lends a helping hand in emergencies and offers other means of support and assistance to the friendly government.

MILITARY ACTION

Aerial movement of the counterguerrilla force over virtually

Maj Hilbert is Aviation Officer, Special Warfare Center, Ft Bragg, N. C. Maj Murray is with MAAG, Colombia SA.

The Caribou, able to carry 24 combat equipped troops into relatively confined areas, provides support in counterinsurgency operations

impassable terrain immediately transfers the mobility advantage to the counterguerrilla. Use of transport airplanes over longer distances, paradrop of airborne troops to cut off retreat of the guerrillas, and landing counterguerrillas in confined areas permits rapid massing of troops to cut off retreat or attack guerrilla encampments. Small teams of fixed wing transport aircraft and rotary wing cargo aircraft have been organized by the 22d Special Warfare Aviation Detachment for just this purpose.

The guerrilla has the advantage of choosing his time and place for attack. He attacks only where he can mass a superior force or exploit the element of surprise. He can hastily retreat to the guerrilla assembly area or recede by small groups or individuals into the countryside.

To achieve the flexibility necessary to overcome these advantages, the counterguerrilla has found a valuable assist in the transport aircraft. Use of aircraft permits the government forces to mass troops to reduce the guerrilla's advantages. Troops can be hastened from various bases and massed at an appropriate place. Pursuit patrols can be flown into desired areas to gain a mobility advantage. Patrols can be sustained by aerial resupply in pursuit missions until the guerrilla force is destroyed. Wounded can be aeroevacuated. This factor permits pursuers to be quickly unburdened of casualties. Fresh patrols can be flown in to maintain the chase. The guerrilla band gradually exhausts its hand-carried supplies during retreat and, as constant movement and lack of nourishment wears him down, the guerrilla foot mobility advantage fades away.

Hunter-killer patrols can also be placed into guerrilla-controlled territory to search out and harass the guerrilla elements. Patrols can lay ambushes for extensive periods of time if supported by aerial resupply. In the past, patrols have been able to sustain themselves for approximately 7 days. In many cases, they spent 3 days traveling into an area, 1 day searching, and 3 days returning. With airmobile support, patrols can be placed into an area in a matter of hours or minutes; aerial resupply sustains them for 30 to 40 days; aircraft return the patrol to its base. Aviation can indeed improve the flexibility of the counterguerrilla force.

When the counterguerrilla is reduced to foot mobility, he must also reduce his armament to the level of the guerrilla's. He can carry small arms and a limited amount of ammunition. The firepower ratio is then reduced to the numerical difference between the opposing forces. The guerrilla has retained the capability for ambush which can quickly overcome a superiority in numbers of personnel and weapons. When the government forces are thus reduced to an equal firepower capability of the guerrilla band, then all of the advantage lies with the guerrilla.

Army Aviation elements operating in the environment of the foot soldier can provide a decidedly favorable firepower advantage for the government

H-21 Shawnees provide counterinsurgent combat patrols with the mobility and flexibility required for combatting the guerrilla

forces. Army aircraft operate out of small landing fields and confined areas in direct support of the counterguerrilla commander. Immediate responsiveness of the Army Aviation element to the counterguerrilla's needs can enable decisive firepower to be placed on the guerrilla once he is engaged. Relentless pursuit by the armed Army aircraft places the guerrilla within firing range at any time his position is exposed.

Guerrilla raids can prove disastrous to the guerrilla once he has exposed himself to aerial firepower. Once the guerrilla force disbands, aircraft can range over the area and attack the smaller groups of guerrillas as they attempt to disperse into the countryside. The relatively low and slow armed Army aircraft is uniquely suited to this task.

For an attack against an assembled guerrilla force or a guerrilla base, rocket and/or cannon armed Army aircraft can be successfully employed for saturation area fire to both soften the enemy and to provide aerial fire support during the engagement. Use of aerial flares to maintain light over a contested area can greatly facilitate night attack of targets by armed aircraft.

If the guerrillas attempt a holding action, the troop carrying capability of the aircraft is again brought into play. A larger force can be greatly delayed by shielded rear guard action if the larger force lacks an advantage of mobility. Conventional tactics against rear guard actions call for deployment followed by an outflanking maneuver. Time required to deploy and outflank is sufficient that a well trained rear guard can withdraw in time, keeping force intact. Advantages of the armed helicopter in support of operations against a rear guard force are immediately apparent. Armed aircraft can post troops on the route of retreat, on the flanks or behind a holding force. They can observe the holding force and call for and direct the fire of indirect fire weapons.

When the holding force is laying down fire against oncoming ground troops, armed helicopters can attack that holding force from flanks or rear. Armed helicopters can disrupt any attempts by the holding force to withdraw as an organized unit, especially when such a force lacks complete concealment from overhead vegetation. It is very difficult to believe that holding actions could be effective when opposed by a larger ground force supported by armed and troop carrying aircraft.

Aircraft with fixed and flexible mounted machineguns can provide suppressive fire for the assault forces and are ideally suited as escort aircraft with troop-laden Army transports. As escort aircraft, they accompany the troop carrying aircraft and attack personnel in guerrilla-controlled territory who fire small arms as the aircraft convoy is passing overhead. The 22d SWAD has developed teams of aerial weapons and armed reconnaissance aircraft solely to provide a firepower advantage for the counterguerrillas.

Ability of the guerrilla to strike vulnerable targets of his choosing and at his chosen time has always required government forces to scatter large numbers of troops as security guards throughout the nation. Threat of guerrilla attack has in itself immobilized great numbers of troops to protect strategic installations and the civilian populace. Such immobilization necessarily enhances the guerrillas' capacity to roam the countryside and prey upon the populace for food and supplies.

Large conventional-type forces can be quickly deployed by helicopter to overcome concentrated, guerrilla rear guard action

Reconnaissance and surveillance aircraft can serve to immobilize the guerrilla force. Con-

Helicopter armament currently used in counterguerrilla warfare includes a .30 caliber machinegun fitted in the door of H-21s

tinuous surveillance of hostile or suspect areas reduces guerrilla activity. Repeated aerial photo coverage of suspect areas can reveal sufficient information regarding guerrilla movements. Night time visual and photo reconnaissance using flares can further hamper the guerrilla. Presence of surveillance aircraft prohibits the guerrilla from building fires, growing crops in the jungle clearings, and moving in the open countryside. Continual harassment by surveillance aircraft can help wear down the will of the guerrilla.

Reconnaissance over avenues of communications and over specified operational areas can serve to discover ambushes and other guerrilla activities. Reconnaissance flights along the nation's borders will discourage and/or discover movements across the border by unfriendly forces supporting the guerrillas. The 22d SWAD has organized reconnaissance and surveillance teams to accomplish these essential daily routines.

Dispersion of government troops introduces another problem for the counterguerilla force. Great dispersion, especially among the poorly equipped armies of the emerging nations, introduces communications difficulties of sometimes insurmountable proportions. Constantly reliable communications are absolutely essential to the counterguerrilla commander, since he is primarily in the reaction business. He cannot react when communication breakdowns prevent word of guerrilla activity from reaching his headquarters. During an antiguerrilla operation, communications are essential to receive patrol reports and/or battle information.

The reconnaissance aircraft plays a vital role during these operations. The aircraft's position in the air provides line-of-sight radio communications through heavy jungle canopy and over intervening mountains. Aircraft speed can be used to hurry messages from place to place, using air pickup and drop techniques. This aircraft can be used as intermediary to call for and direct air strikes, to request reinforcements, to report intelligence information, and perform many other valuable communications services.

Use of aircraft by the counterguerrilla force commander as his aerial command post enables him to direct the operation from a vantage point. The commander is in direct line-of-sight communication with all forces within his command. In addition, he can move rapidly from one subordinate unit to another. He can land at an appropriate place to assume command of individual units when necessary. His observation of the battle area from the aerial vantage point, immediate responsiveness of the Army Aviation elements, and direct communications with all subordinate units presents the counterguerrilla commander with a decided advantage over his adversary. Truly Army Aviation has been developed to support the counterinsurgency force.

Teams enumerated in previous paragraphs are organized into Light Aviation Special Support Operations (LASSO) units for deployment into underdeveloped areas of the world at the invitation of friendly governments. The LASSO unit is tailored to fit the requirements of its mission. Command control, operations, communications, POL and ammunition supply, motor maintenance, and aircraft field maintenance teams are tailored as support elements in the LASSO units.

A LASSO unit is thus designed to perform the five functions of Army Aviation:

- Reconnaissance, Surveillance and Target Acquisition
- Command/Control
- Maneuver
- Firepower
- Logistics

Basic aircraft teams have capabilities to perform one or more of these functions. The LASSO unit has these principal elements:

Reconnaissance
Strike
Airmobility

Reconnaissance teams provide reconnaissance, surveillance target acquisition, command/control capability, aeromedical evacuation, and firepower. Strike teams provide firepower and limited troop maneuver, reconnaissance, and logistical resupply. Airmobile teams provide troop maneuver, reconnaissance, and logistical resupply.

The four basic tenets of the infantry commander are thus enhanced by the LASSO unit. They are:

Find Them
Fix Them
Fight Them
Finish Them

The reconnaissance teams will assist to "find them." The strike teams will assist to "fix them and fight them." The airmobile teams will deliver the troops and ammunition to "fight them and finish them."

Tremendous possibilities exist for LASSO units to assist friendly governments to turn the tide of the counterguerrilla war and establish peace in their homelands. Special Warfare Center has introduced an additional concept of counterguerrilla operations. Properly employed and integrated into the counterinsurgency force, Army Aviation may tip the scale in favor of the counterinsurgent.

CIVIL ACTION

Military operations discussed in previous paragraphs are by no means the only counterinsurgency activities in which a LASSO unit will engage. Just as important are counterinsurgency activities of a LASSO unit in the realm of civic actions.

Counterinsurgency encompasses a far greater spectrum of activity than military counterguerrilla warfare. A counterinsurgency program covers the broad spectrum of social, economic, military, political, and cultural aspects of a nation. A sound counterinsurgency program must not only defeat the guerrilla in mortal combat, but must strike at the root of dissidence. Dissatisfaction and unrest in a country, be it economic, social, political, religious or ethnical, provides the fertile ground for highly motivated partisan elements to lead persons into overt and covert actions designed to undermine the influence and authority of the central government. In many cases this social unrest is stirred by social and economic inequality. Dissatisfied religious and ethnic groups can also become the pawns of the revolutionary elements.

Glossary of Counterinsurgency Terms

INSURGENCY — A condition resulting from a revolt or insurrection against a constituted government which falls short of civil war. In the current contest, subversive ininsurgency is primarily communist inspired, supported, or exploited.

COUNTERINSURGENCY — Those military, paramilitary, political, economic, psychological, and civic actions taken by a government to defeat subversive insurgency.

GUERRILLA WARFARE (GW) — Military and paramilitary operations conducted in enemy-held or hostile territory by irregular, predominantly indigenous forces.

COUNTERGUERRILLA WARFARE — Operations and activities conducted by armed forces, paramilitary forces, or nonmilitary agencies of a government against guerrillas.

A central government must establish a positive program of reforms and actions which will serve to convince the populace that the government is trying to serve their best interests. Failing this, defeated and destroyed guerrillas will merely be replaced by new dissidents who will take up the fallen arms.

LASSO units are specifically designed to provide the aviation support to a positive government program of assistance and reform within the nation. Until emerging nations can afford construction of adequate transportation and communications means, LASSO units can be employed to help develop a feeling of unity among the various sections of the nation. Rapid transportation among the nation's communities can be provided by LASSO units. LASSO teams can be assembled in support of disaster relief operations. They can transport government workers and supervisors among the communities, helping the local populace to help themselves.

Assistance can be quickly taken into all remote regions in the government programs to improve farming methods, increase production, establish sanitation measures, provide medical facilities, initiate educational programs for young and old, assist development of local governments by the people and for the people such as village councils. LASSO units can play an important part in all of these programs designed to develop the national conscience and loyalties of the people.

LASSO units conquer century-old natural divisions of a nation such as rivers, impassable swamps, impenetrable jungles, and insurmountable mountains. Remote areas are brought within hours and even minutes of their central government as contrasted to days and weeks in the past. Food, fuel, construction equipment, pumps, motors, generators, building material and books can be transported to the farthest regions of the nation. Teachers and leaders can be transported about the nation. The maimed and the sick can be evacuated to modern medical facilities.

Communications can be established among communities by air, transporting radios, radio equipment, parts, technicians, and instructors. Mail can be delivered. Telephone lines can be laid by air. Vast reservoirs of good will can thus be stored among the populace toward their central government and the United States.

The greatest value can thus be gained from LASSO units through their civic actions in support of a positive, dynamic governmental program designed to enlist the patriotic loyalties of the populace. The extensive importance of this phase of LASSO units operations establishes the reason why the LASSO units must be unique among all aviation units. Officers and enlisted men must be highly-skilled technicians. Aviation is a technician's game. The aviator, the aircraft mechanic, the radio repairman and sundry other technicians must be professionals. They will be operating under primitive circumstances. Their native-born American ingenuity will be taxed to the limit under the best of circumstances.

Aviators will be requested to perform missions in difficult terrain and during inclement weather, both day and night. Their professional knowledge and proficiency must be of the highest order. Enlisted personnel must be trained to accomplish their tasks under the most trying and most difficult circumstances. Aviators must accomplish intensified training in advanced aviation techniques. They must know and understand their own capabilities and limitations as well as those of the aircraft they fly. Limited availability of sufficient aircraft makes every loss a costly one. Every loss through lack of training, lack of judgment, or lack of knowledge is a disaster.

Intensified technical training and truly professional capability only partially prepares an officer or enlisted man for service with a LASSO unit. Every member of a LASSO unit must be thoroughly educated concerning the people and the country to which he is assigned. Weeks, months, and even years of helpful deeds and accomplishments can be erased through ignorance or improper conduct of members of a LASSO unit. Before deployment to a country at the invitation of a friendly government, all members of the LASSO unit must be thoroughly educated concerning the land and its people.

The history of the nation can be learned as a beginning. The history must include not only their military heritage, but also social mores and customs, ethnic development, economic development, religious history, political history and cultural heritage. They must not only know how the indigenous personnel act, but also why they act as they do. They must learn a tolerance of the indigenous customs; they must achieve an understanding as to why they lack so much of what is taken for granted in the United States. They must undergo language training to attain at least a sub-fluency level of 850 words. Various dialects in the nation offer additional barriers. If teams will be located within a specified area, that dialect must be learned.

If any member of the LASSO unit is found deficient in this training, he must be reassigned from the unit, regardless of his professional ability. Proper area-orientation of all personnel is essential to assure true effectiveness of the unit.

U. S. Army Special Warfare Center is uniquely qualified to ensure that this area-orientation is soundly accomplished during the intensified training period required to mold individuals into a unit. Therein lies the fundamental objective in training LASSO units at the Special Warfare Center. Intensified advanced aviation training blended with area-orientation and indoctrination results in an effective and efficient product: a Light Aviation Special Support Operations (LASSO) unit molded as a strong right arm for the counterinsurgency program.

Listed on next page in the first column are the major capabilities required of both sides in counterguerrilla operations. The capabilities and problems encountered by the guerrilla and the counterguerrilla force are discussed in the next two columns. The capabilities Army Aviation might add to the counterguerrilla force are discussed in the fourth column.

CAPABILITY	GUERRILLA	COUNTERGUERRILLA	INCREASE IN COUNTERGUERRILLA CAPABILITY PROVIDED BY ARMY AVIATION
Surveillance Observation	Advantage of counterguerilla through knowledge of country, well-concealed hideouts and assistance from civilian population.	In underdeveloped countries, limited by terrain that permits only foot mobility and frequently in dense vegetation. Hider has great advantage over seeker in dense terrain. Frequently limited by inadequate knowledge of country.	Greatly increased capability by affording an air platform for observation. In the case of the helicopter, however, capability permits minute inspection.
Intelligence	Greatly facilitated if they have sympathy of civilian population. Prerequisite is knowledge of people in restricted area of operations, their customs and area topography. Aided by better intelligence since they are close to and a segment of the local population. They do not have problems of coordination of information.	Greatly facilitated if they have sympathy of civilian population. Greatly handicapped if unfamiliar with country, language, local customs, inadequate observation.	Better observation provides more intelligence. More accurate intelligence can greatly increase area of observation. Observers can be flown over difficult terrain to suspected guerrilla bases. Evidence of superiority by use of flying machine may induce allowance of portions of civilian populace. Assistance which may be rendered by evacuation of sick and supply of food, fuel, clothing and medical supplies may encourage a favorable attitude by citizens.
Weapons and Firepower	Weapon - firepower capabilities are inferior. Cannot fight fixed battles. Cannot carry heavy equipment on forays; hence, cannot readily engage aircraft except with small arms. Inferiority in firepower is compensated by initiative, rapid movement.	Far superior, especially in heavier weapons. Problem is to bring these into effective use.	Mobility can be employed to deliver troops to advantageous locations. Airborne weapons may be brought into action.
Transport and Mobility	Usually limited to movement on foot. Hardened, can move comparatively rapidly in rough terrain. Counter enemy mobility by ambush and limited use of mines.	Foot, tracked or wheeled vehicles. If vehicles are roadbound, mobility so provided has limited value against guerrilla tactics.	Point to point through air highway. Not dependent upon trafficability of roads. Can well increase foot mobility by factor of 50 and vehicular mobility factor of 5. Can greatly increase response capabilities. Guerrillas, once detected, cannot run away from aircraft. Not hampered by road blocks, ambush, mines, etc.
Use of concealment. Passive defense against observation fire	Very capable, often hide among civilians. Takes advantage of terrain and vegetation. Rapid movement by foot.	Position generally known. Ground movement reveals position and gives indications of interest.	Not especially easy to localize or hit by small arms fire. Nylon webbing for vital areas should provide considerable protection against small arms fire. Air movement provides less information as to intent of operation. Guerrillas have much less time to respond against air attack and air movement.
Communications	Difficult. A prime objective is to cut counterinsurgent communication lines.	Difficult in underdeveloped countries because of vulnerability of communications lines. Facilitated by reliable radios.	Can facilitate radio line-of-sight communications through use of airborne relay station. Messages can be quickly flown from point to point when electrical communications means are unavailable.
Logistic	Must depend upon civilian population for much food. Must depend upon outside sources for weapons and ammunition. Difficult.	Frequently available at base. Problem is transport through poor roads and hostile areas to points at which support is critically needed.	Can greatly facilitate by airborne supply and resupply of active operations.

Malayan Operations

The operations now being conducted in South Vietnam are similar in many respects to those conducted a few years ago in Malaya. The air operations will be of particular interest as you take a view of

Lieutenant Colonel M. W. Sutcliffe

THE BATTLE to save Malaya from being taken over by militant communism, which has now almost faded into the background in international affairs, lasted from 1948 to 1960. This "emergency," as it was called (the cold war had not at that time been quite so clearly recognized for what it is), has been the only occasion in which Communist aggression in Asia has been defeated. So the conduct of operations, especially air operations, is of considerable interest.

THE COUNTRY AND THE CLIMATE

To understand the operational problems, one must know a little of what the country is like and understand the background of the terrorist activities. Malaya is a peninsula some 500 miles long and up to 200 miles wide. From the map, one can see that in the north it joins Siam. The southern tip has the important sea and airport of Singapore, which is only one degree north of the equator. The peninsula has a backbone of jungle-covered mountains rising to a height of 7,000 feet.

Col Sutcliffe is the British Liaison Officer with the U. S. Army Aviation Board and the Aviation Center at Ft Rucker.

Four-fifths of the entire country is primary jungle with thick undergrowth. One hundred feet above the ground the foliage makes a solid green roof, shutting out the sky. The remaining one-fifth of the country is in rubber plantations, rice fields, tin mines, native farms and villages.

Communications, especially on the eastern side of the peninsula, are limited. There is one north-south railway through the country, but by mid-1953 a line had been opened up running to Kota Bharu in the northeast. There are two main north-south roads on the western side of the country from Singapore to Kuala Lumpur, thence only one road north. There is only one lateral road from Kuala Lumpur to the east coast and one other in the south end of the peninsula. Only a dirt road connects the townships along the east coast.

The average noonday temperature is around 90° F and the humidity is always well up in the 80s. There is little wind, but rainfall is heavy throughout the year. Most days one can expect thunderstorms, which make flying in the mountain areas hazardous. The nights are usually fairly clear, but by morning mist may form in the valleys; and the mountains are covered with stratus clouds, though this normally burns off by 9 o'clock in the morning.

Under British control, which was successively imposed at various dates from 1819 onward, on the various native states which make up Malaya, the country has been transformed from a complete jungle to a rich and prosperous country which produces almost one-half the world's natural rubber and about one-third of the world's tin.

Of the total population of just over six million (6,278,763 in June 57 census, excluding a further 1,445,929 in Singapore) rather more than half are Malaysians, over a third are Chinese, and the remaining few hundred thousand are other Asian peoples, mostly from the Indian subcontinent. The standard of living is the highest on the mainland of Southeast Asia, and Malaya would indeed have been a rich prize for the Communists.

THE TERRORIST ORGANISATION, AIMS AND TACTICS

The Communist Terrorists (CT) were organised and led by the Malayan Communist Party (MCP) and formed an army known as the Malaya Races Liberation Army (MRLA). The Min Yuen, or peoples organisation, was the civilian counterpart of the MRLA, with the task of providing contacts and supplies, obtained mainly through terrorism and extortion in the towns and villages.

Chin Peng was the leader of the CT organisation and the overall commander of the five to six thousand armed terrorists, the vast majority Chinese, deployed in and from the various jungle bases. However, even this small number of terrorists operating in a country like Malaya constituted an effective force.

The terrorists were organised into platoons varying in strength dependent on availability of food and supplies, but generally were 30-50 strong. There were other units responsible for producing propaganda material, some technicians for working on weapons and explosives, and others who were responsible for the care of cultivations in the jungle, which are described later.

Although the MCP had originally hoped to establish a "liberated" area somewhere in Malaya, probably as a basis for claiming early recognition as a breakaway Communist state, their efforts soon became devoted almost exclusively to inflicting maximum disruption on the governmental machine and maximum damage to the economy of the country by hampering production of the literally vital rubber and tin.

CT operations ranged from simple intimidation of labour to carrying out ambushes on the winding jungle roads and attacks on isolated village armouries, rubber plantations and tin workings. Operations varied from those mounted by a section of 4 or 5 guerrillas to the larger operations mounted by a platoon of 40 to 50 strong. As always the guerrilla's job was to hit and run, and not to stand and fight a better armed, though usually less mobile enemy.

THE PROBLEM IN MALAYA

The basic task of the government in Malaya was to destroy the Communist Terrorists organisation and restore internal stability to the country. The CT organisation was able to take advantage of the dispersion of native villages and plantations and did not hesitate to terrorise the villagers.

In 1950 General Briggs, who was at that time in charge of anti-bandit operations, formulated the Briggs Plan. This plan aimed at bringing proper administrative control to a population, some of which had never been controlled before. The main features of the plan were:

- Resettlement of squatters from scattered and isolated areas into areas which could be controlled.
- Organisation of a home guard and expansion of police forces.
- Organisation and development of an effective intelligence force.
- Provision by the army of

the framework of troops throughout the country to support local police, and at the same time have sufficient force to mount any large scale operation.

- Regrouping and control of local labour in the mines and on the large rubber estates.
- Welding together the civil and military forces at all levels.
- A propaganda programme aimed at winning the hearts and minds of a people who had been terrorised into subjection.

The aims of this plan were to cut off the Terrorists' supplies, and weld the Malayan people into a unified country ready to stand alone as a member of the Commonwealth.

THE BROAD PATTERN OF EVENTS

In 1951 the Terrorists had succeeded to a great degree in slowing down the economic life of the country. Road and rail traffic was dangerous; rubber plantations were closed; and tin production was seriously affected. The Terrorists' most spectacular success was the ambush and killing of the British High Commissioner, Sir Henry Gurney.

Sir Henry Gurney was replaced by a military commander, General Sir Gerald Templar, who was given wide powers over both civil and military operations in the country. The Briggs Plan was continued, though stepped up in intensity. Communist supporters or sympathisers were more firmly dealt with; and even more important, the Malayan people were made to realise that it was their own country they were fighting for.

War Executive Committees were formed in each state and consisted of the prime minister of the state, the British advisor, the chief of police, and the senior army commander (usually the brigade commander), and the secretary of Chinese affairs. These State War Executive Committees formulated the policy for the conduct of operations within the state. At a lower level a similar committee, known as the District War Executive Committee, was formed, consisting of the district officer, the senior police officer, and the senior local army officer (usually a battalion commander).

Over a period of time, through contacts and information, the locations of the Terrorists units were plotted. As the Briggs Plan started to become effective through police and military action, the villages became increasingly safe from the Terrorists' extortions. The more this happened, the less the villagers cooperated with the Terrorists and the more information became available.

Typical "Chinese-garden" style terrorist cultivation in a clearing, deep in the jungle. This one hadn't yet received the oil-spray treatment aimed at depriving the terrorists of needed food

In particular, the Terrorists in the jungle began to find themselves forced to cultivate their own food. This they did by making cultivations deep in the jungle. The climate of Malaya is favourable for quick growing crops and this enabled the Terrorists to survive. Their weapon replacements and ammunition were obtained from raids and ambushes. There was no evidence of outside material supply. The Royal Navy, together with patrol vessels of the Royal Malayan Navy, kept a close watch on the long coast line. Possibly a few supplies came in from sympathisers over the Siamese border, but this was controlled to a great extent by police and military action.

The relentless attack against the Terrorists, the success of the food denial operations, and the surrender of the weaker members of the organisation led to the eventual downfall of the CT organisation, though many of the hard core were never captured.

GROUND OPERATIONS

The readers of the DIGEST are mainly concerned with air operations; so, I will limit my remarks about ground operations only to what is essential to enable readers to understand the problems. Operations in jungles and mountains are essentially the preserve of the infantry; so, the majority of the British Forces in Malaya were infantry battalions. Other than convoy duty on the roads, armour could take no part, and suitable artillery targets were few and far between.

From a ground soldier's point of view it was a war of ambushes, of jungle patrols, and of following up whatever contacts occurred. Good information, intelligent and cunning section and platoon commanders, and lightweight, quick-firing weapons were the basic needs. Ground troops, many operating with Iban trackers brought in from N. Borneo, learned how to follow tracks and to operate in small detachments in the jungle, either self-contained or, for long periods at a time, supplied by air. Success in bandit kills were

Jungle fighting—a bone-wearying task for the infantryman

often slow, and many hundreds of hours of patrolling in deep jungle were necessary for every kill.

As the war progressed and the Terrorists found themselves cut off more and more from local supplies and isolated from their outside contacts, they moved into the deeper jungle. So our ground patrols also had to move into deep jungle. By 1953 and 1954 it would often take a patrol 5-6 days of hacking through deep jungle to get into an area from which to start their operations. A casualty from sickness, snake bite, or enemy action could easily mean the end of a patrol, since it would take many days to carry the casualty out.

One expedient adopted to overcome this was to establish patrol bases, known as "forts," deep in the jungle. These bases served two purposes. First, by building small airstrips, patrols could be airlifted directly to their patrol base, thus saving days and weeks of relentless jungle marches. Second, they served as a post from which the Aborigines, many of whom had been coerced to work on Terrorists' cultivations, could be controlled. Trading for their small needs of life was started and medical help offered, and by degrees they were weened away from the CTs and, indeed, increasingly provided useful intelligence on them.

"Fort" Dixon with adjacent airstrip in 1953. It was a difficult 3-5 day march through jungle from the nearest military post

AIR OPERATIONS

The air war in Malaya can be divided into four distinct areas:

- reconnaissance by light aircraft,
- offensive air operations,
- supply dropping,
- helicopter and STOL operations.

I will deal with each of these operations separately, but first I would like to outline the basic organisation for the conduct of air operations. Air headquarters in Malaya was established at Kuala Lumpur, which was also the Army headquarters. A joint operations centre (JOC) was set up which controlled an air support signal unit with tentacles to each brigade area throughout the country, as well as to each of the airfields. All requests for air support were filtered through the JOC except for light reconnaissance aircraft, which operated directly with the brigades where they were permanently based.

Malaya is well provided with airfields, ranging from the large bases in Singapore, and Butterworth in the northern part of the country, to a variety of light aircraft strips located throughout the country. Strike aircraft operated only from the major airfields located at the northern and southern ends of the penin-

Landing on a jungle strip, which typically had difficult approaches

Photo by Scottish Aviation Limited

sula, whilst all the air supply aircraft and helicopter forces were based at Kuala Lumpur in the middle of the country. Had there been more helicopters available, they would have been decentralised more around the country and thus would have saved much lost positioning flying time. However, they were always in short supply, so had to be held centrally.

RECONNAISSANCE BY LIGHT AIRCRAFT

Army Auster aircraft were placed under command of each brigade. These aircraft provided the basic air reconnaissance for the whole of the air operations. Even had higher performance aircraft been available, it is doubtful they could have done the job better, since only the slow flying aircraft were able to spot the hidden cultivations and jungle camps.

Their tasks varied from visual reconnaissance flights over the jungle to leading in and marking targets for strike aircraft. They carried out small-scale supply drops, dropped leaflets in Terrorist areas, flew communication sorties, flew out casualties, located lost patrols, and the hundred and one tasks that have become the lot of the light army aircraft. However, the most important task was the reconnaissance role.

In a country which has little road and rail communication, virtually no navigation facilities, and unpleasant weather much of the day, the Army light aircraft pilots had an unpleasant job. If an aircraft went down in the jungle, chances of survival or rescue were remote, though in one case an NCO pilot walked out after almost 30 days in the jungle.

OFFENSIVE AIR SUPPORT

The type of operation and the jungle terrain did not favour offensive air operations, since targets were fleeting and lacking in opportunity and could not easily be found through the thick canopy of trees. Offensive operations were of two kinds: bombing on a marker put down by a light army aircraft on a known CT camp, and bombing in a harassing role into an area known to contain Terrorists. The first of these attacks proved successful only on occasions. The second, harassing bombing, assisted in the long term in making some of the wavering Terrorists surrender.

The primary role of light Army aircraft is jungle reconnaissance

Patrols relied on air supply. Note smoke signal for wind

SUPPLY DROPPING

As the operations moved away from the jungle fringes, the need for supply dropping increased. A patrol operating in the jungle would need a resupply drop every four to five days. The patrol radioed to their base giving their position (often understandably inaccurate) and their requirements for food, clothing, and medical aid. This would be relayed over the air support net to the JOC and a copy of this signal would go to the Royal Army Service Corps Air Supply Company, based on the airfield at Kuala Lumpur. The supply missions would then be flown the following day as one of the daily 30 to 40 small, isolated sorties.

The task of supply-dropping aircraft should not be underestimated when one considers weather, the problem of finding the patrols, and, lastly, trying to drop supplies into a small clearing or DZ in the mountains, often only the size of the aircraft itself.

As always, the air supply aircraft kept up their World War II tradition of flying in any weather and seldom returning

without dropping their supplies. This inevitably led to a number of crashes into mountainsides.

Some units preferred not to have air supply except in emergencies, since they considered it gave their position away to the Terrorists. These patrols relied on porters to carry in supplies to forward dumps. Many of the Gurkha troops followed this method, and their success in the jungle was outstanding. However, in the main, the army lived on supply drop in the jungle and at the jungle forts described above.

Casualty loaded aboard S-51 helicopter in jungle LZ

HELICOPTER AND STOL OPERATIONS

In 1949 the first of the Royal Air Force light helicopters went out to Malaya to be used in a casualty evacuation role. Their value was soon realised, though it was not until January 1953 that the first H-19 type cargo helicopters, flown by the Royal Navy, were to arrive in Malaya. They soon proved their value and were employed in troop-lifting operations throughout the country.

Helicopters were always in short supply and strict priorities were kept for their use. They were used for troop lifting, spraying jungle clearings (defoliating), resupply missions, communication sorties, and casualty evacuation. The mobility and flexibility of the helicopter in this type of terrain cannot be overemphasized. Often 4 to 5 days march through the jungle could be saved by an hour's flight in a helicopter.

For some unaccountable reason our helicopters were never fired on, though on occasions they would surprise Terrorists in a jungle clearing. Possibly the Terrorists were too concerned in making their escape. However, frequently an LZ would be strafed by fighter aircraft before the helicopters touched down.

By mid-1953, the first of the Prestwick Pioneers also arrived in Malaya. These aircraft, with their extremely short takeoff, were almost able to compete with the helicopter. Much of the troop-lifting into the jungle forts was undertaken by them. However, they needed a prepared surface and though in this type of terrain they are complimentary to the helicopter, they are not as versatile.

The helicopter saved many days of endless jungle marching

CO-OPERATION WINS

The "emergency" in Malaya lasted over ten years and was a tremendous undertaking, both from a civilian and military point of view. The peoples of Malaya had first to believe in their rights to be free people; and, second, they had to be convinced of the ability of the security forces, both police and military, to safeguard them. Until this was achieved, information so vitally needed in guerrilla type operations was seldom forthcoming. As the resettlement plan and food denial operations became effective, the war moved in deeper jungles where air operations were so vital. Co-operation and understanding between the services and on the district war executive committees, and state war executive committees were an essential part to successful operations. And in all of this, army aviation, as it is known in U.S. Forces, played a major part.

NILSWEAT and N. S. F. R.

(no sweat flight rules)

Gerald T. Thorpe

WHAT'S ALL this talk about filing VFR or IFR? Posters all over the place, articles in flight magazines, all about when to go VFR or IFR.

There is no problem when a flight is made under N.S.F.R. The rules are simple and are designed to eliminate a lot of unnecessary items.

NO SWEAT FLIGHT RULES

Copywrited by St. Peters Gazette

Do not check weather. Weather observers and forecasters use a crystal ball, and your guess is as good as any.

Do not file a flight plan. You are in trouble if you fail to close out. Besides it's no one's business where you are going.

Do not check the fuel, etc. This is the ground crew's responsibility.

Do not take a map. Columbus proved they are not necessary. Dead guesstimation is the best.

Study VFR and IFR rules only enough to avoid violations. Some people never get the picture.

Now that you know the rules, let me relate to you one of my own flights under N.S.F.R. to prove it's no sweat.

This flight started like any other normal flight, with a query to the line boy as to the status of fuel and oil in the Luscombe. After exchanging our ritual of brakes, contact, etc., I was on my way. Making a careful mag check and receiving a green light from the tower I lined up and took off. As I climbed out I noticed the weather didn't look good, but the beacon light was not on so it must be at least 1,000 feet and 3.

After breaking traffic I turned to the guesstimated heading to my destination, some 80 miles south. The operator who rented me the Luscombe had tried to sell me a map. Those fellows will do anything to make two bits plus tax. Besides having a map would be admitting that 90 percent of pilots are right.

After about 30 minutes out (I say "about" 30 minutes, because who uses a clock?) the weather had really deteriorated. It had forced me down to about 100 feet and visibility was a good half mile. No sweat; things looked pretty good. One cigarette later I recalled that the radio towers of WLW were right on course and if I did continue to my destination in this weather some unimaginative FAA representative would file a violation on me. Most of those fellows really believe in their rules. I made the decision to turn back. My quick thinking saved the day, for as I banked, the steel girders of the radio towers took shape out of the haze. That was real navigating —hit my checkpoint right on the money. All I need to do is use my head and going from place to place is simple.

Mr. Thorpe is with the Standardization Division, Dept of Adv F/W Tng, USAAVNS. He is fixed wing qualified with 8,500 flight hours.

At this point, I coolly made the decision to climb on top and not take any more chances of flying into something because of this poor visibility. Since the only flight instruments in this ship were an altimeter, airspeed, and mag compass, I turned to a heading of east so the compass would be stable and started my climb. With 2200 revs on the prop, 70 miles on the speed, all I had to do was keep the compass level and on E. No sweat; I pulled out my pack and lit up.

The climb was uneventful. Four cigarettes and 8,000 feet later I broke out into the warm sunshine. Turning to my guesstimated heading for home I settled back with a smoke. My planning was really working out. The farther north I flew, the lower the tops became; once in a while I could see the ground through a hole. I decided at this point that going into my home field would not be such a good idea. If their weather was down I would get a violation for sure. There was a small airport south of the city that had no tower or control zone. That would be my best bet. When my mental calculation told me I should be there, I looked down through a hole and saw the field. It was a simple matter to spiral down and land.

At the airport restaurant I had a cup of coffee, bought a pack, and called home field on the phone. They were VFR but not expected to remain so. I made a quick decision to go, got a crank from the line boy, checked mags, traffic, and was on my way.

The ceiling was about 800 feet. To avoid flying low over the city (violations and all), I decided to circle to the west.

Two cigarettes out, the ceiling was still about 800 feet so I made a wise decision to go back to the airport I had just left. As I turned on the guesstimated course I checked fuel. The gauge was bouncing on 0; the engine must have burned more fuel than I figured. Still no sweat; I would be back on the ground in a few minutes.

As the minutes went by and no airport, I had to admit I did not know my exact location. I leaned back, took out my fresh pack and, as I was lighting up with the matches from the airport restaurant, right before my eyes I saw a map. Printed on the inside of the folder was a map showing how to drive to the airport. Good planning pays off. I found the field and landed before running out of fuel. The gauge must have been wrong; I had figured my time right after all.

When the weather cleared I returned to my home field and told the operator about my flight. He said something that sounded like "of all the dumb luck." He must have meant getting the matches was luck. The rest was skill and good decisions.

Now that you see N.S.F.R. really works, go out and make your no sweat flight.

Record Holder Undergoes User Tests

The record-holding YHU-1D currently is undergoing Army Phase E user tests with the Airborne Service Test Division of the Airborne Electronic and Special Warfare Board, Fort Bragg, N.C.

Piloted by U. S. Army Aviation Board personnel from Fort Rucker, Ala., the YHU-1D demonstrated its sling load capability by carrying a wide variety of equipment. Also, 19 missions were flown with eight paratroopers for 1,500-foot jumps, six of them performed at night.

Other evaluation exercises to which the YHU-1D Iroquois was put include medical ambulance operations, field maneuvers with fully-equipped troops, loading and unloading demonstrations with C-124s, C-130s and C-133s.

The YHU-1D's extensive user tests included hot weather performance at the Army desert test center at Yuma, Ariz. and altitude performance testing at Fort Carson, Colo. Cold weather testing at the Army's arctic test center at Fort Greeley, Alaska, is still in progress.

The D model Iroquois claimed three world records in April—two for time to climb and one for speed on a closed circuit course. The speed record was set at 134.9 mph for 1,000 kilometers and broke the existing Russian-held record by more than 50 percent.

NO MARGIN?

Gerard M. Bruggink

GOOD PILOTS and surgeons have more in common than the public's admiration and high income taxes. You have to trust your life to the hands of both of them and once they have you strapped down, they try to inspire confidence in their capability by casually remarking: "In our profession there is no margin for error."

When you first hear this statement it sounds indeed as a declaration of professional standards and integrity, to be interpreted as: "Have no fear. You're in competent hands." You believe this for a while, because you want to believe it. However, when the surge of takeoff power or the stealthy hand of the anesthetist, feeling for your veins, announces the finality of your decision to trust these people, you begin to see a different meaning in this no-margin-for-error line: "I can't afford to make an error. If I do, it will be my last one, at least as far as you're concerned!" Before you can protest, the aircraft is rolling or your consciousness is dissolving in sodium pentothal.

This somewhat flippant opening scene illustrates two extremes in the interpretation of the popular axiom that in flying there is no margin for error. As usual, the problem is one of semantics and it might be well to put this proud motto into its proper perspective, once and for all.

Mr. Bruggink is Chief, Human Factors Branch, Aviation Crash Injury Research Division, Flight Safety Foundation.

Taken at its face value and assuming that any departure from safe standards or practices constitutes an error, the statement is obviously untrue. Every pilot with a rudimentary sense of honesty will admit that a blunder does not necessarily result in an accident. If this were the case, aircraft would still be built in bicycle shops and John Glenn would probably be an obscure Marine practicing jungle warfare.

To make the statement literally true it must be assumed that the term "error" has a very exclusive meaning, namely: errors which cause accidents. In that case the statement has hindsight value only and as such becomes a dud, because it would be an overstatement of the over-obvious. The suggestion not to make an error when you know it will result in an accident is about as useful as the advice not to commit adultery when you know you'll be found out.

What is the proper interpretation of this fine maxim and how does it apply to the everyday duties of a pilot? This question cannot be answered without first deciding whether there is a margin between "deviation from safe standards or practices" not resulting in an accident and an "error" in the form of a causative agent in an accident. Some examples will facilitate orientation in this muddled area.

Three identical aircraft, with crews of the same experience level, proceed independently from A to B under VFR conditions on IFR flight plans. Aircraft number 1 follows the flight plan to the letter and lands at B from a simulated ILS approach —for the benefit of one of the younger crew members—after 60 minutes flying time. (During the climbout from A, the aircraft was on a collision course with a descending aircraft, as a result of a mixup in Approach Control. An accident was avoided by alertness and quick action on the part of the crew.)

Aircraft number 2 cancels its IFR flight plan shortly after takeoff and short-cuts to B, landing there after 50 minutes flying time. (The crew is not aware that a light twin had to take violent evasive action, because they were not cruising at the proper quadrantal height.)

Aircraft number 3 follows the same procedure as number 1, but lands after 55 minutes from a specially requested straight-in approach. (The reason for this straight-in was a very rough engine. Actually this aircraft should not have flown, as it had been written up several times for a rough engine and excessive oil consumption. The crew and the maintenance people agreed, however, that it would be more practical to ground the aircraft at B, the home base.)

From the point of view of the supervisor who sent these aircraft from A to B, the missions were successfully completed; all aircraft landed in one piece at the point of destination. As a matter of fact the supervisor might have some complimentary things to say to the crew who made the flight in only 50 minutes. The "initiative" of crew number 3 may be even more pleasing to him because it simplifies the overhaul problem. The performance of the first crew, who used every minute of the flight for proficiency training, fell within the normal line of duty and was, therefore, too prosaic to attract attention.

From the point of view of the safety officer it was a hairy day for the organization. It does not make a difference to him if you call the unprofessional behavior of the involved parties deviations or errors. To him each discrepancy means only one thing: a potential accident source. He understands the fallacy of judging performance and safety solely by the absence of accidents, and he has to live with the disturbing knowledge that the same errors tomorrow may have disastrous results.

Only one conclusion can be drawn from the foregoing: THERE IS NO MARGIN BETWEEN APPARENTLY HARMLESS DEVIATIONS FROM OPTIMUM TASK PERFORMANCE AND GLARING ERRORS. Deviations and errors deserve the same preventive efforts, because the magnitude of the accident potential which they create is seldom governed only by the degree of deviation or error. In many cases the actual occurrence of an accident, or its severity, depends on circumstances beyond control of the person whose neglect started the chain of events.

Where does this leave the slogan: "In flying there is no margin for error"? Exactly where it should be: uppermost in the mind of the pilot who considers himself a true professional. His interpretation is the only correct one: YOU CANNOT CONDONE SECOND-RATE PERFORMANCE, BECAUSE ANY DEVIATION FROM OPTIMUM MEANS A LOWERING OF STANDARDS AND AN INVITATION TO DISASTER.

It is unfortunate that the safety of these professionals and the people in their charge is often jeopardized by the incompetence and complacency of those who do believe in a margin for error, because they have gotten away with sloppy performance and blunders too often.

What Your Best Friend Won't Tell You . . .

a survey will

TAKE IT FROM me, the Aircraft Accident Prevention Survey is the aviation safety officer's best friend.

I'm Capt Anon Y. Mous, ASO at Fort Wherever, and I was assigned here following a rash of accidents. My first step was to complete Section II of the survey. The statistics I gathered guided me in my initial attempts to lower the local accident rate.

The survey took 10 days of hard work but I am convinced that the effort expended will repay itself a thousand times over in the months ahead. The survey brought into focus many different facets of airfield operation that I had never consciously connected with accident prevention.

If you are planning to conduct a survey of this type at your airfield, here are a few suggestions that should help:

- Don't attempt to start without first completing Section II entitled "Analysis." You will find out from this where to concentrate your prevention efforts.
- Gather all your reference material listed at the rear of each section before starting to work. You can't get by without it.
- Remove the staples from the survey and have it punched for insertion in a loose-leaf binder. It's much handier this way.
- Be specific when writing in the answers. Remember, you'll want to make a follow-up survey to determine results and look for other discrepancies.

These were the main discrepancies I found:

Airfield Data

Runway and taxiway shoulders need policing and mowing. Pierced steel planking found imbedded in solid soil and protruding above surface. Communications wire found strewn about runways.

Prepared by U. S. Army Board for Aviation Accident Research.

Concrete lip for taxi light was exposed above ground level.

Closed runway was unmarked.

Parking apron for helicopters was unmarked.

Clearance from edge of apron to fixed obstacles was inadequate.

No lighted wind indicator was on or adjacent to the airfield.

Vehicles used on and around airfield were not marked in accordance with regulations.

No record of filter changes was available at POL dump.

Operations Office

Operations officer assigned was on part-time duty.

Airfield diagrams on wall did not show field boundary, tetrahedron, parking areas, tower, buildings, etc.

No SOP for airdrome officer was in use.

Map of local flying area showing caution and restricted areas was inadequate in size and proper markings.

Form F for weight and balance on file for L-20 was undated.

Local Hazard

Sign between garrison and airfield pointing out dangers of low flying aircraft was poorly located and needed repainting.

Sign warning motorists not to stop near end of runway needed repainting.

Several communications poles near operations buildings should either be removed or have clearance lights installed.

Airfield area was in overall state of poor police.

SOP for snow removal, grass cutting, and general support by post engineers was nonexistent.

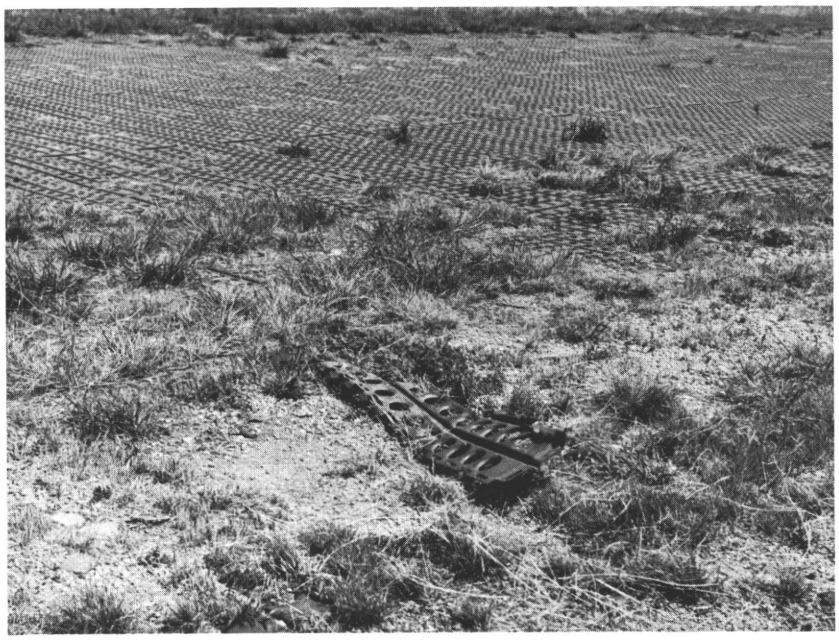
Local regulations were not frequently reviewed to ensure compliance and coverage of all flight line operations.

Conditions of satellite and auxiliary fields were not prominently displayed in operations.

SOP for crash-rescue plan was nonexistent.

Crash phone net was checked weekly instead of daily. The net was inadequate. Should include tower, fire station, and division.

Waiting for an accident to happen



An important sign unreadable. Field needs mowing, policing.

Pre-accident plan was not up-to-date.

Weather

Present teletype machine was inadequate. It was designed to receive approximately 70 words per minute and was operating on a circuit sending approximately 100 words per minute. As many as five breakdowns have occurred daily.

Space in flight planning and weather area was inadequate.

NOTAMS file was not up-to-date due to breakdowns of teletype machine.

Control Tower

Only a small portion of main runway was visible from the tower.

The tower was not included in crash alarm system from Operations.

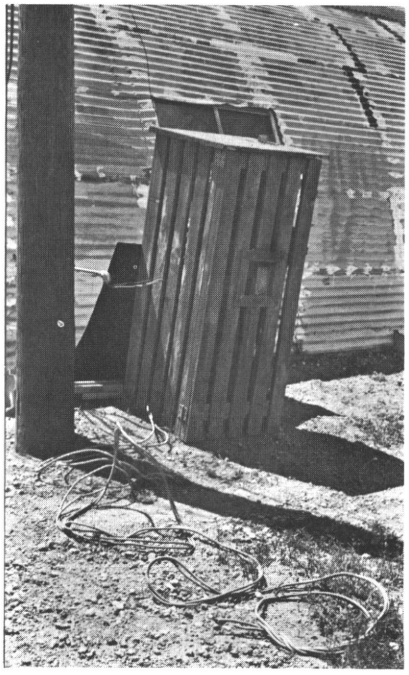
Vehicular traffic could not be controlled or monitored completely from tower because all portions of runways and field were not visible from the tower.

System for acquiring auxiliary power for emergency tower use was time-consuming. Tower

personnel were required to get portable unit from nearby hangar when power failure occurred.

Sun glare was prevalent during day from reflections on windows, walls, and ceilings. Glare from flying aircraft at night was especially confusing.

Tower operator was required to vacate tower and descend to ground level to adjust runway light intensity.



Where tower operator descends to adjust runway light intensity. Note heavy-gauge wire

SOP in tower was not current.

Aircraft Rescue and Firefighting

Responsibility for supervision of rescue and firefighting activities was not clearly defined.

Periodic maintenance, testing, and replacement of equipment was not considered adequate.

Only two of four units of equipment were equipped with two-way radios.

Crash-rescue units needed tactical maps properly gridded and standardized with tower.

Drivers were not familiar with local road system. No plan set up for familiarization and testing.

There was no established and continuous training program for all personnel.

Training equipment was inadequate. Need aircraft emergency hatch and entrance charts, mockups, foam, and other supplies.

No set plan was established for manning of reserve apparatus and calling of off-duty personnel for handling of unusual emergencies.

SOP did not include plans to secure cooperation of civil authorities in emergencies occurring off the post.

Only one fire plug, poorly located, was in airfield area.

Aircraft Operation

Traffic patterns were not satisfactorily adhered to.

Tower-air discipline was poor.

Aircraft taxied too fast.

Pilot Training

Checkout requirements for each aircraft were not specified in writing to include hours.

Only two fixed wing aircraft were available for instrument training for 70 pilots. Only one instrument examiner was available and he had other duties.

Post regulations were not well defined and some items were nonexistent. An airfield SOP was needed.

An instrument refresher course was practically nonexistent.

Link trainers were available but not fully utilized.

Approximately 25 instrument cards had expired. Lack of suitable aircraft, instructors, examiners, and an instrument training program were reasons given.

Sufficient copies of pilots' handbooks were not available for all types of aircraft.

A functioning pilot standardization board was nonexistent.

Medical Safety

The flight dispensary was not in immediate vicinity of the flight line.

Messing facilities were not convenient to the flight line.

There was a shortage of medical corpsmen assigned to the crash-rescue unit. Most of the personnel were ambulance drivers with insufficient medical training.

A helicopter ambulance, crew, and medical technician were not assigned to airfield.

Ambulances were not equipped with many items of crash-rescue equipment. During survey, inspectors had removed first-aid kit from ambulance on duty.

Safety program was dormant, apparently from lack of leadership and interest.

Some pilots, and flight surgeon, lack protective helmets.

Personal and Emergency Equipment

Parachutes and flight clothing were not properly stored.

Posters and educational material on care and use of parachutes were not displayed.

Equipment pool for pilots was nonexistent.

Flight personnel did not demonstrate an awareness of the advantages of proper flight clothing at all times in regard to flight suits, gloves, and boots.

Maintenance

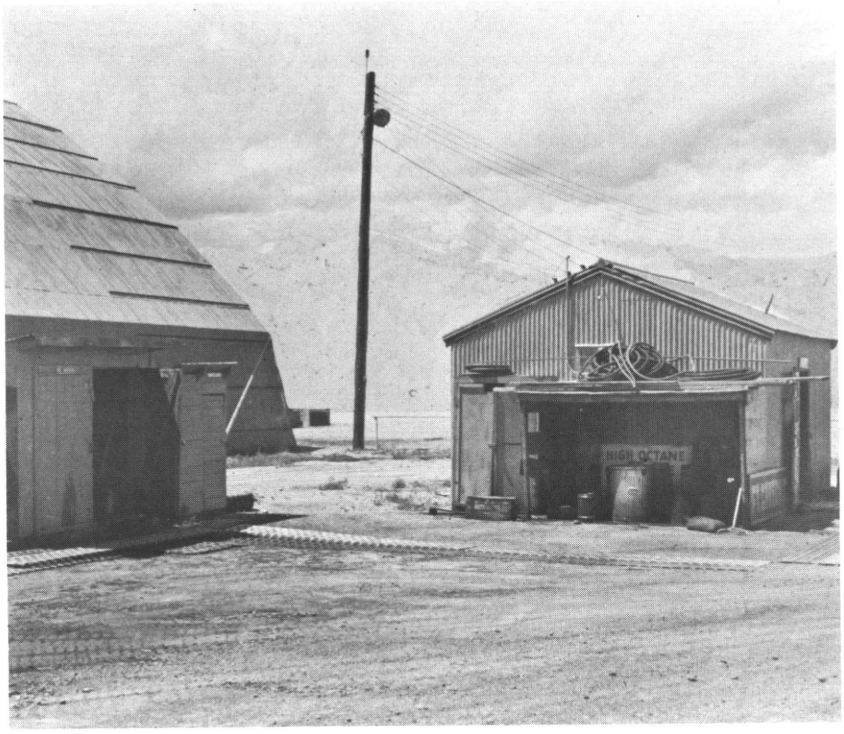
Adequate personnel were not available.

Parking areas for aircraft near hangar were not marked.

There was no established method for checking fire extinguishers in aircraft.

More educational material was needed to indoctrinate personnel.

POL area was located too close to hangar.



POL area located too close to the hangar. Note hidden sign

Personnel were smoking in hangar and POL areas.

Poor drainage in building area.

Hangar heating and lighting facilities were inadequate.

Instrument Approaches

Instrument approach conflicted with ILS from nearby air base. GCA operator was available only part time because of other duties.

Accident Prevention Program

A well-organized, aggressive accident prevention program did not exist.

No aviation safety officer prior to my arrival.

Close liaison was not maintained with aviation safety personnel of lower and higher headquarters.

Coordination was not maintained with the PIO to educate the local populace on accident investigation and prevention procedures.

There was no up-to-date preaccident plan in effect.

Accident investigations were not always complete.

It was apparent that I faced a man-sized job. Analysis of the situation pointed to a need for quick action. I dug in to get the following things accomplished first:

- A complete revision of SOPs for all phases of the airfield operation.
- I went to my commander and laid the cards on the table. I requested that a meeting be called of all key personnel. At this meeting I pointed out the problems, offered solutions, and asked for full cooperation. The commander backed me 100 percent.
- Next, a physical cleanup and improvement of the airfield area was begun. For example, new signs are now positioned at the proper places, and the field and area is policed and mowed on a regular schedule. Runways, taxi strips, and airfield vehicles have been properly marked.
- I undertook an ambitious monitoring program and have kept in close touch with all personnel in an effort to instill the idea that "safety is everybody's business."
- A full-time operations officer was assigned and he wiped out many of the discrepancies that existed. A sound training program is in effect and morale has soared.
- A follow-up survey was conducted to determine the effects of corrective action from the first survey.

The second survey showed that a number of discrepancies still existed. This, of course, was expected due to the long-range planning involved to correct some of the problems. For example, a new hangar, an improved tower, relocation of the POL area, new buildings, grading, etc. — but they are on the way — thanks to the Accident Prevention Survey.

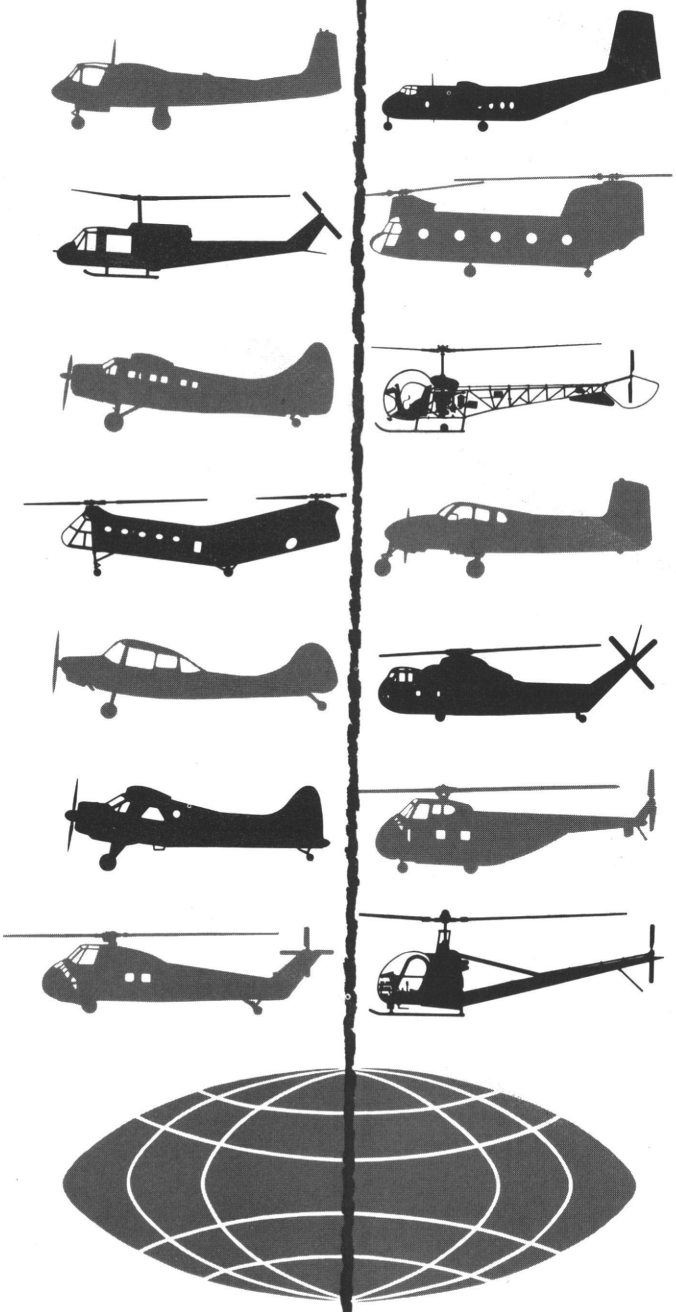
(See "It Could Happen to You," inside back cover.)

What causes accidents? Mechanical defects cause a few, conditions cause a few more, but the biggest single factor in accidents is human failure.

prepared by
THE U. S. ARMY
BOARD FOR
AVIATION
ACCIDENT RESEARCH

TWX EXCERPTS

From August and September



H-21C WARNING LIGHT for aft transmission came on during flight. Forced landing with no damage accomplished. Caused by dirty aft warning light relay.

H-19C ENGINE FAILED during hover. Forced landing accomplished with no damage. Suspect fuel starvation.

H-34C EMITTED excessive exhaust smoke with simultaneous decrease in oil pressure and increase in oil temperature. Forced landing accomplished with no damage. Caused by failure of master rod bearing.

H-13E STRUCK TREE during attempt to back down into open area after aborting takeoff from confined area. Aircraft landed nose low, breaking off right skid. Incident damage to main rotor blades.

L-19A STRUCK TREE during pullup from message drop in river bed. Major damage to right wing. No injuries.

H-13G STRUCK WIRE during simulated strafing run. Major damage to bubble, main rotor blade, and dynamic stop cables. No injuries.

H-13G SETTLED and landed hard during hovering downwind turn. Incident damage to front and rear cross tubes.

L-19E ENGINE FAILED during low reconnaissance. Aircraft force landed on sandy terrain. Major damage to propeller, landing gear, and both wings. Suspect fuel starvation. No injuries.

H-23D TOUCHED DOWN TAIL LOW during low level autorotation demonstration. Incident damage to tail rotor blade and 1 inch-drive. Suspect premature pitch application and late cyclic correction.

L-19A STRUCK TREE during night takeoff from minimum lighted field strip. Incident damage to left wing. Caused by 30° drift off course during takeoff climb.

HU-1B TAIL ROTOR STRUCK GROUND during practice autorotation. Major damage to tail rotor blades, 90° box, tail boom, and landing gear. No injuries.

H-13E ENGINE LOST POWER and ran rough in flight. Forced landing accomplished with no damage. Cause undetermined pending analysis.

AC-1A SETTLED SHORT of intended landing area and right gear struck top of grass-covered, 4-foot embankment. Right wing sheared at root. Gusty surface wind considered a factor. No injuries.

HU-1A BOUNCED during touchdown from practice 180° autorotation. Main rotor flexed into and severed tail rotor drive shaft. Major damage to tail rotor drive shaft and tail boom. Weather not a factor.

L-20A STRUCK DIRT MOUND while moving off taxi strip to let another aircraft pass during night operation. Incident damage to propeller.

H-19D ENGINE BACKFIRED and failed momentarily during power reduction on base leg for landing. Forced landing accomplished with no damage. Suspect water in fuel.

H-23D LANDED HARD during attempted power recovery from simulated forced landing. Main rotor blades flexed into tail boom and caused antitorque failure. Aircraft spun clockwise for two complete turns and came to rest upright. Instructor pilot sustained minor back injury.

H-19D ENGINE FAILED in flight. Forced landing accomplished with no damage. Caused by materiel failure of bell crank on induction system mixing unit assembly, resulting in starvation of carburetor air.

L-20A SETTLED during final approach and tail wheel struck seawall. Incident damage to tail cone and tail wheel. Gusty surface wind probable factor.

L-20A VEERED and became airborne after landing touchdown, apparently stalled, and touched down tail low. Major damage to tail wheel assembly, horizontal stabilizer, and fuselage. Light rain and low visibility possible contributing factor. No injuries.

H-23D LANDED HARD from practice 180° autorotation, bounced, and came to rest upright. Incident damage to lateral snubber assembly, tail skid, aft tail rotor drive, and main rotor blade tip assembly. Suspect insufficient pitch application.

H-19 LOST GROUND REFERENCE due to dust from rotor wash during takeoff. Aircraft drifted to right in hover and right main gear and forward gear struck ground. Dust cleared and aircraft landed with minor damage to strut fitting, fuselage, and bulkhead.

L-20A FORCE LANDED immediately after takeoff when smoke was detected in cockpit along with high voltage and loadmeter readings. Suspect electric short and overloaded circuit.

L-28 ENGINE FAILED during takeoff. Turn was made to avoid house. Aircraft struck tree and powerline, spun around, and contacted ground going backwards. Passenger sustained broken nose. Crash facts message did not describe damages. Aircraft was flown with known excessive drop on right mag. (L-28 is Helio Courier)

H-21C CHIP DETECTOR LIGHT came on in flight. Engine ran rough and developed unusual noise. Forced landing accomplished with no damage. Cause undetermined pending analysis.

L-19E TAXIED into fence. Incident damage to right wing.

H-13E LOST POWER in flight. Forced landing accomplished with no damage. Caused by failure of cylinder and piston assembly.

H-23D STRUCK BRUSH during low reconnaissance. Major damage to main rotor blade. Gusty surface wind considered possible factor.

L-19A TAXIED into culvert. Incident damage to propeller.

H-13H ENGINE FAILED in flight. Aircraft destroyed during attempted autorotation. Pilot and passenger sustained minor cuts and bruises. Caused by exhaust valve failure in No. 5 cylinder.

H-23D ENGINE OVERSPEED to 4,000 rpm during power recovery from simulated forced landing. Forced landing with no damage accomplished. Engine overspeed caused by failure of sprag clutch.

H-19D EMITTED GRINDING NOISE from transmission housing area during flight. Forced landing accomplished with no damage. Caused by materiel failure of fan in generator.

H-19D STRUCK GROUND with tail skid and tail rotor blades during flare at zero airspeed in practice autorotation. Incident damage to tail rotor blades.

H-23D TRANSMISSION WARNING LIGHT came on in flight. Forced landing accomplished with no damage. Aircraft rocked back and tail rotors struck ground after crew exited. Extent of damage unknown. Cause of warning light coming on undetermined pending analysis.

H-19C MADE SNAPPING NOISE followed by loss of rotor rpm in flight. Forced landing accomplished with no damage. Caused by failure of upper drive shaft bolts.

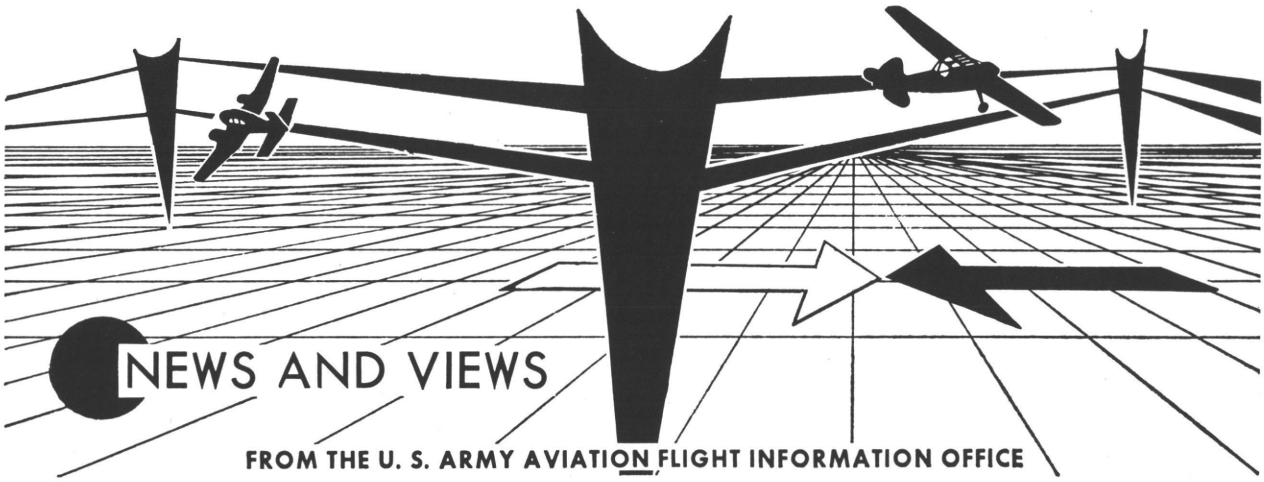
TL-19D LOST OIL PRESSURE in flight. Forced landing accomplished with no damage. Caused by loss of oil due to unsecured oil cap.

HU-1A ROCKED FORWARD during touchdown, caused incident damage to Plexiglas in lower nose section.

L-19A ENGINE LOADED UP during simulated forced landing and failed to respond during recovery. Aircraft landed in peanut field with no damage.

H-19D TAXIED INTO GOAL POST on football field while maneuvering into position for takeoff. Major damage to main rotor blades and goal post. No injuries.

L-20A EMITTED SMOKE from under cowl during takeoff at approximately 75 feet. Takeoff was aborted and aircraft landed on runway with no damage. Caused by loose clamps on coupling hose of oil overflow lead line.



Transponder Set AN/APX-44

THE OPERATION and use of the transponder in Army Aviation for identification purposes is a new experience and problem. The advances being made today in the communications and electronics field, plus the development of more complex equipment, have made it more difficult for the Army pilot to become proficient in the operation and use of the many new present-day communications and electronics devices. There is a period of time when the new "black box" is not fully accepted by the operator, mainly because he knows less about it than other equipment he has been using. It is, therefore, the purpose of this article to aid in reducing this period of non-acceptance by explaining away some of the apparent mysteries associated with the What, Why, Where, and How of the transponder in its relations to air traffic identification.

Before a piece of equipment can be used to its best advantage, knowledge is necessary relative to what it is and its capabilities. A better understanding of the capabilities and limitations of the transponder necessitates a description of the equipment and its inherent technical characteristics.

In general, a radar set operates by sending out powerful, short, intense pulses of electromagnetic energy transmitted as ultra-high-frequency radio waves, and then receiving the portions of the energy that are reflected back to it. The elapsed time between the emission of a pulse and return of an echo is a measure of the distance to the reflecting target. A transponder is a device that, when it receives the original radar pulses, triggers its own transmitter to give a strong reply of one or more pulses independent of possible radar echoes from the vicinity. The transmitter need not be very powerful to be able to give a reply much stronger than the echo from usual targets.

What is the principle of operation? A good question. A transponder is normally a passive device. Without stimulation it is quiescent, awaiting the reception of a specially keyed pulse. When a suitably pulsed signal is received, it comes to life, the transponder is actuated or triggered and then emits a series of pulses characteristic of that particular transponder. The process of triggering is known as "interrogation." Any device used to interrogate a transponder may be designated as an interrogator. Although the response is like an echo, it differs from one in several ways.

The use of airborne transponders and ground interrogators is intended to increase the usefulness of radar for control of air traffic and identification under nontactical conditions. Positive replies to ground radar interrogations and positive identifications of aircraft in all weather without the need for aeronautical maneuvers, plus identification in restricted military defense areas, are benefits of this system.

In the Report of the Task Force on Air Traffic Control, known as Project Beacon, published by the Federal Aviation

Agency, it is proposed that all aircraft weighing more than 12,500 pounds be required to have a standard long range beacon transponder that would be used for identity, signal enhancement, and to telemeter altitude from a sealed aneroid altimeter.

Physically, the Transponder Set AN/APX-44 is a lightweight radar unit, consisting of a radar receiver-transmitter, a mounting, a control unit, and a suitable antenna. This set is designed to receive, decode, and respond to the characteristic interrogations of the basic Mark X Identification Friend or Foe (IFF) System, to the interrogations of the Mark X IFF System supplemented with the Selective Identification Feature (SIF), and to the interrogation of civil secondary ground radar systems (ATCRBS). The receiver section of the set can be operated on a single preset frequency of 1,030 megacycles (mc) and the transmitter section can operate on a single preset frequency of 1,090 mc.

The transponder set can also be used to transmit specially coded emergency signals or position identifying signals, even though the set is not being interrogated by a ground-based IFF system. The AN/APX-44 is limited to line-of-sight range subject to the slight bending effect peculiar to ultra-high-frequency (UHF) transmission, and depends on the height of the aircraft above ground. It is especially constructed to permit installation in smaller type aircraft, such as observation craft, training craft, and helicopters.

Interrogatory signals, consisting of pairs of pulses spaced to form a code, are transmitted to the AN/APX-44, which decodes the interrogation and transmits a coded reply to the questioning source. The form of the coded reply, which can be preset by the transponder set controls, presents positive identification of the nationality and position of the aircraft. Receipt of an unsatisfactory reply by the ground-based IFF system may result in such tactical action as deemed necessary by authorized military personnel.

The operation of the transponder set should not present a problem, it is operated from the pilots' flight position with the control unit. All necessary controls and indicators are conveniently grouped on the control panel. The three independent coding modes, or combinations of the three, available to the pilot are:

- Mode 1 provides the pilot with 32 possible code combinations, any one of which may be selected while in flight.
- Mode 2 provides the pilot with *one* code combination which is *preset prior to flight* and which may consist of any one of 4,096 possible code combinations.
- Mode 3 provides 64 additional code combinations, any one of which may be selected by the pilot while in flight. The transponder set also provides the facilities for the following five types of operations, each of which may be selected by the aircraft pilot:

Normal—Modes 1, 2 and 3 or combinations of the three.

Modified (SIF)—Modes 1, 2 and 3 or combinations of the three.

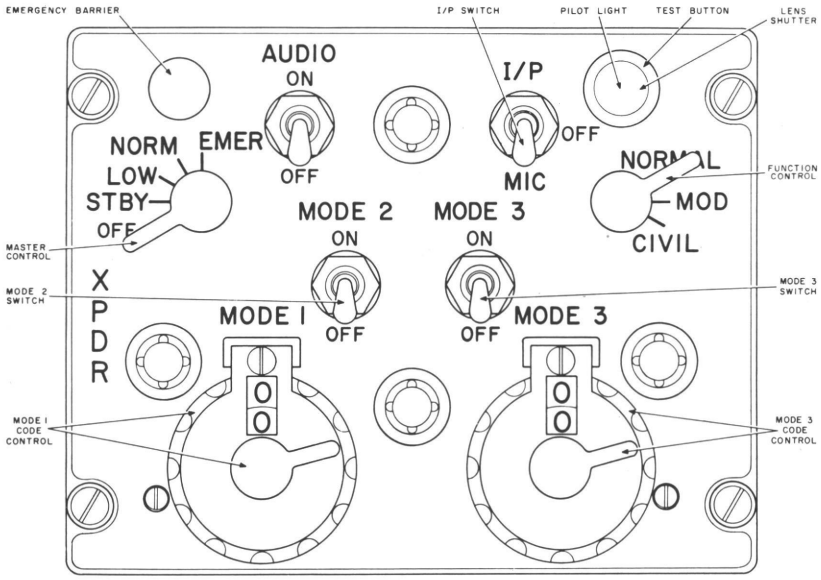
Civil—Mode 3/A.

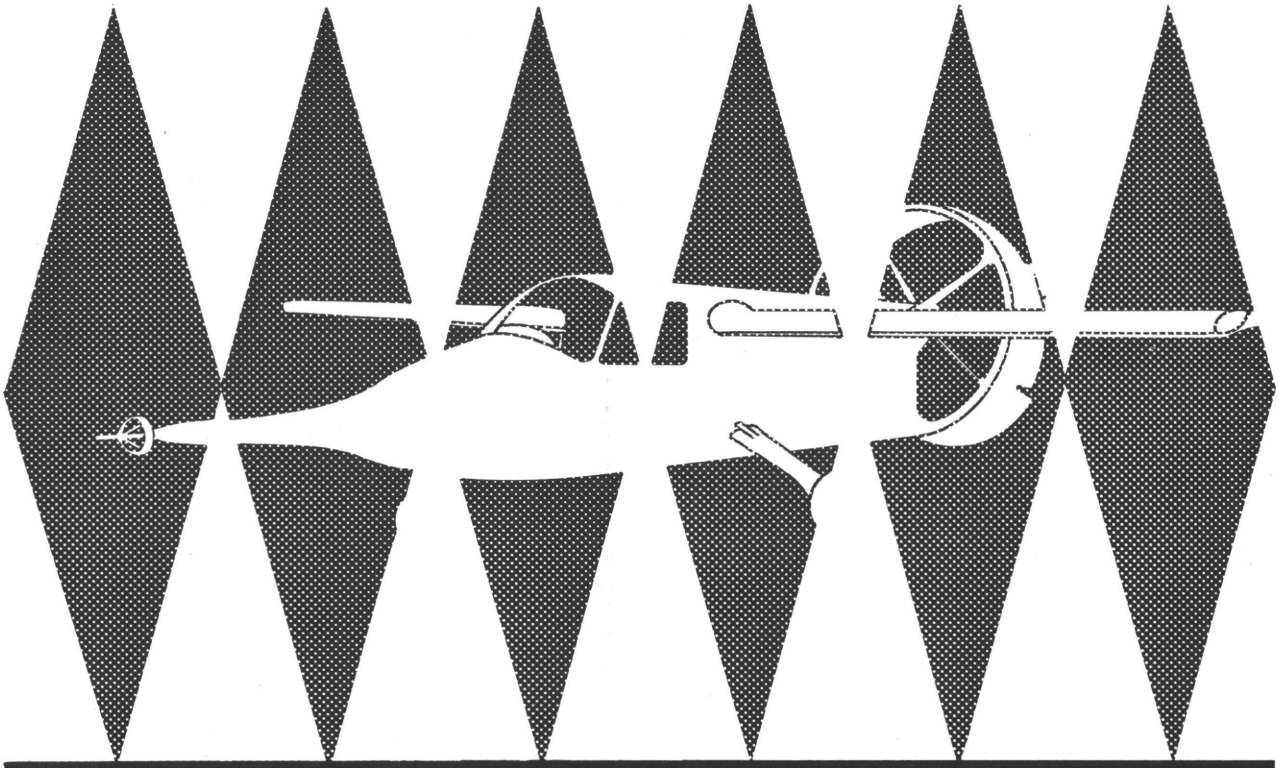
I/P Position Identification.

Emergency.

Upon entering an aircraft equipped with an AN/APX-44 Transponder Set for the first time, you will see a control panel that looks something like the drawing at left. The data presented in this article has been limited to the use of this control.

For more detailed information, and other procedures, relative to the use of the Transponder Set AN/APX-44, or for any other desired type of operation as discussed in this article, it is suggested that reference be made to the Technical Manual 11-5895-217-12 which is available through the normal AG supply channels.





THE ARMY AVIATION STORY

PART V - V/STOL AIRCRAFT

BY MSGT THOMAS M. LANG

WHAT WILL BE the nature of future Army aircraft? When work began on the Tower of Babel, and ever since, engineers have been known as grandiose thinkers. The ancient aeronautical engineer who invented the flying carpet demonstrated a high degree of imagination. His spiritual descendants are carrying on in the same tradition. Today, newly discovered principles of aerodynamics are constantly being explored and many will be adapted in future Army aircraft.

In size alone, Army aircraft of the future may reach fantastic extremes, both large and small. Scientists continue to devise miniature machines having the same capabilities as their large predecessors. On the other hand, there is a demand for aircraft capable of carrying increasingly large loads.

In October 1959 the Army Aircraft Development Plan was initiated. This plan provided guidance for the future of Army Aviation and included Army Study Requirements (ASRs). These ASRs described broad objectives to be incorporated in the development of aircraft for light observation, tactical transportation, and manned surveillance.

These ASRs were released to industry at Fort Monroe, Va., on 1 December 1959. In February 1960 the aviation industry submitted 119 design concepts as possible answers to the Army's future aviation requirements.

After thoroughly analyzing the Army study requirements and industry's design concepts, the aircraft developments program was started.

As a first step it was decided to obtain a new light observation helicopter (LOH) which should be phased into the system during the 1965-1970 time frame. Specifications called for this aircraft to be a turbine powered, easily maintained, lightweight, single-rotor helicopter. It was intended that this aircraft should be used primarily for visual observation and target acquisition, command control, and reconnaissance.

Twelve companies submitted LOH bids, and three — Bell Helicopter Company, Hiller Aircraft Corporation, and Hughes Tool Company, Aircraft Division — won the preliminary competition. Each has contracted to produce five prototype models, from which a final winner will be selected. It is anticipated that the LOH will eventually phase out the L-19, H-13, and H-23 aircraft currently carried on the Army Aviation inventory.

Another aircraft being developed for Army consideration is Bell's XV-3, which combines the characteristics of the helicopter and the airplane. This fixed wing aircraft has prop-rotors capable of being tilted up for helicopter-type vertical take-offs and landings, and tilted forward while airborne for airplane-type flight.

The original XV-3 project was started in 1951 under a joint Army-Air Force contract which called for Bell Helicopter Company, Doak Aircraft Company, Inc., and Ryan Aeronautical Company to develop a convertiplane for Army use. Bell began extensive testing and later the other two companies dropped out of the program. Bell built two XV-3s (4147 and 4148). The first made its initial flight on 23 August 1955. On 25 October 1956 the first XV-3 (No. 4147) was destroyed in an accident caused by instability of the three-bladed prop-rotor as then developed. The prop-rotors were replaced on the second XV-3 (No. 4148) with the two-bladed semi-rigid model, which proved satisfactory.

The second XV-3 was the first aircraft of its kind to achieve 100 percent inflight conversion of its tilting prop-rotors. Bell test pilot Bill Quinlan made the historic flight on 18 December 1958 at Bell's Fort Worth, Texas, plant. The XV-3 conversion takes about 10 seconds if done continuously or it may be accomplished on a gradual step-by-step basis. This process entails transferring the lift from the rotors to the wings without abrupt loss of altitude.

Maj E. E. Kluever, the first Army pilot to fly the Bell XV-3 convertiplane, stands beside it after completing the flight on 8 August 1961 at the National Aeronautics and Space Administration's Ames Research Center, Moffett Field Calif. The flight included hovering, low speed maneuvers, and conversions

Photo by NASA

The convertiplane combines the VTOL characteristics of the helicopter with the high speed and greater range of the fixed wing aircraft. In the event of an inflight power failure while in an airplane configuration the prop-rotors can be tilted to a helicopter - type configuration and the aircraft autorotated to the ground.

A research aircraft in which the Army and Navy have interests is the Mississippi State MARVEL (Mississippi Aerophysics Research Vehicle with Extended Latitude).

This project is unusual in that it is not immediately concerned with the development of a finished product aircraft. Actually the MARVEL is to be the last in a series of research or test bed aircraft used to explore and marry the following aerodynamic and structural innovations.

- *Boundary layer control (BLC).* Thousands of tiny pinholes are drilled along the surface of the wings of an aircraft. The aircraft's engine drives a pump to provide a suction through these holes which makes the passing airflow adhere to the airfoil. The MARVEL project is investigating both laminar boundary layer control and high lift boundary layer control—both of which will be discussed below.
- *Use of glass fiber.* While glass fiber is heavier than some materials used on aircraft, it can be produced with a very smooth finish — a prerequisite to laminar boundary layer control.
- *Camber - changing wing.* The shape of the entire airfoil can be changed from within the

cockpit to provide maximum lift/minimum airspeed or maximum airspeed/minimum lift.

- *Ducted propeller.* Experimental work at Mississippi State has shown that the shrouded prop can double the thrust of the open pusher propeller.
- *Control System.* Rudders and elevators attached to the shroud are expected to provide satisfactory directional control.

In 1950 Mississippi State researchers were using the Schweizer TG-3A sailplane to explore the characteristics and potential of laminar flow boundary layer control. The intent was to reduce drag and thereby improve cruising characteristics and extend the range of an aircraft.

At the same time the researchers were interested in further exploring and developing the potential of high lift boundary layer control. Research continued on laminar and high lift BLC with the TG-3A. However, by 1955 high lift BLC research was being done with the L-21 and L-19, while laminar BLC work with the TG-3A continued as a separate but related program.

While experimenting with high lift boundary layer control, it soon became apparent that high thrust greatly improved the aircraft's performance during steep climbs and while operating from short fields. Consequently, Mississippi State's researchers turned to the Anderson-Greenwood AG-14, which was modified to make use of a shrouded pusher propeller aft of the fuselage. Thus, Mississippi State researchers were exploring the BLC potential on three fronts—laminar flow, high lift, and high thrust.

It was at this point in 1955 that the MARVEL concept was born. Mississippi State researchers decided to consolidate their three-pronged attack on BLC problems by incorporating the structural and aerodynamic innovations mentioned above into one research aircraft—the MARVEL.

Photo by Mississippi State University

Mississippi State's Marvelette

To date the MARVEL has not been completed. However, its prototype the XAZ-1 Marvelette was first flown in March 1962. The Marvelette has an all-metal fuselage, but has glass fiber, camber-changing wings which are being tested for incorporation into the MARVEL.

The MARVEL will be constructed almost entirely of glass fiber. Like the Marvelette, it will incorporate a ducted pusher propeller and boundary layer control — both for high lift and laminar flow. However, the MARVEL is expected to have a slightly different appearance from its prototype and may have minor modifications, depending on the results of Marvelette research. The MARVEL is expected to be ready for flight in late 1963 or early 1964.

If the Mississippi State MARVEL presents an unusual appearance, then surely the giant XC-142 tilt-wing is "out of this world." Now in the advanced planning stage, this tri-service project started on 1 February 61 with the initiation of a design competition.

Design proposals were received from ten companies on 3 April 1961. Most of the designs incorporated either ducted propellers or tilt-wings. One included two short tandem wings with ducted propellers at each wingtip.

In September 1961 the design winner—a tilt-wing model—was announced. Three companies are participating in the project and it is expected that engineering flight as well as operational evaluation testing of the completed aircraft will take place in FY 1965.

Chance Vought, subsidiary of Ling-Temco-Vought is the prime contractor. Ryan Aeronautical Company is building the aft section of the plane, including the tail, engine mounts, and nacelles. Hiller Aircraft Corporation is designing and building the gearing shafts, propellers, flaps, and ailerons.

As now envisioned the XC-142 will be capable of transporting four tons of supplies and equipment. Cruising speed is forecast at 250-300 knots. With a full payload, or 32 fully equipped troops, the XC-142 is expected to have a combat radius of 200 to 300 nautical miles. Without cargo and equipped with extra fuel tanks this aircraft is expected to have a ferry range of approximately 2,600 nautical miles.

That odd-looking kite you may see someday above the battlefield will not be flown by a little boy with a ball of twine, nor need the time of the year necessarily be March.

What you see probably will

be the Flex Wing aircraft as conceived by Mr. Francis M. Rogallo of National Aeronautics and Space Administration. Now being developed by the U. S. Army and Ryan Aeronautical Company, the Flex Wing embodies principles developed by such aviation pioneers as Otto Lillienthal and uses a pusher-type propeller, as did the Wright Brothers' aircraft.

Basically this aircraft is a flexible wing fastened to a rigid frame which supports a platform carrying the pilot, engine and payload.

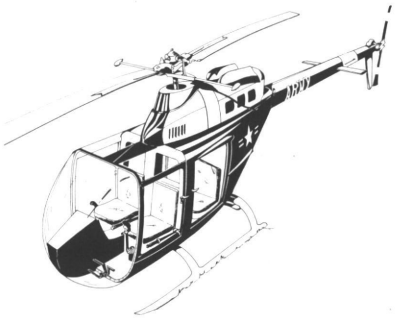
When used as a towed glider behind a helicopter it has been estimated that the Flex Wing could carry six times the payload of the helicopter.

A small version of the Flex Wing may be used as a remotely controlled drone. An enormous version, without engine, might be folded and attached to a rocket booster. After the rocket is fired and the booster dropped, the Flex Wing would unfold and glide to the ground.

In counterinsurgency operations, it may be feasible to glide the Flex Wing silently to a prearranged spot, unload supplies and pick up wounded for medical evacuation. This silent feature would be a big advantage in that it would enable all activity in the area to be completed before starting the sound of the engine for departure.

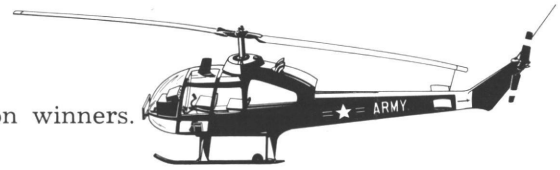
Also, the Flex Wing may be substituted for the parachute when dropping Special Forces personnel. The advantage over the parachute would be a softer landing and pinpoint accuracy. It is predicted that a soldier jumping at an altitude of 5,000 feet could select any landing site up to approximately 4 miles away. In this model, collapsible rubber tubes would replace the rigid frame of the wing to allow for compact folding and storage aboard an aircraft. The tubes would be inflated by means of a cartridge.

Neither current nor projected future Army Aviation aircraft resemble in appearance or capability that first Wright biplane delivered to Fort Myer, Va., on 20 August 1908 for user testing. As would be expected, many changes have evolved over the years. But as matters now stand Army Aviation, though very much in the air, still rests on solid ground in assurance of future growth.



HO-4—Bell D-250, four-place light observation helicopter.

One of the three winners of the Army's design competition for a light observation helicopter. The HO-4, like its competitors in the finals of the LOH program, is being designed as a lightweight, single rotor, four-place helicopter capable of carrying a 400-pound payload (in addition to the pilot and fuel). Each aircraft will use an Allison T-63 gas turbine engine. Plans call for each winner to deliver the Army one LOH a month for five months beginning in October 1963.

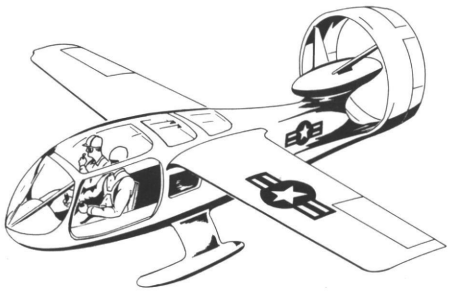


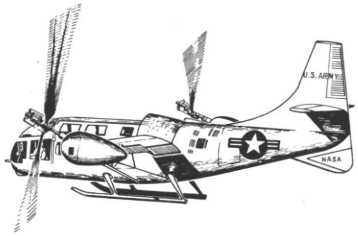
HO-5—Hiller 1100. One of the LOH design competition winners. See HO-4 for characteristics.

HO-6—Hughes 369. One of the LOH design competition winners. See HO-4 for characteristics.

MARVEL—Mississippi State, two-place, research aircraft.

The Army is assisting Mississippi State University in development of the MARVEL as a test bed aircraft to explore various aerodynamic and structural concepts (see accompanying story). It is hoped that the MARVEL will have a level-flight speed of 240 mph and a landing speed of 40 mph. It will be powered by a 263 hp Allison turboprop T-63 engine, also being developed by the manufacturer for Army consideration. First flight is set for 1963-4.

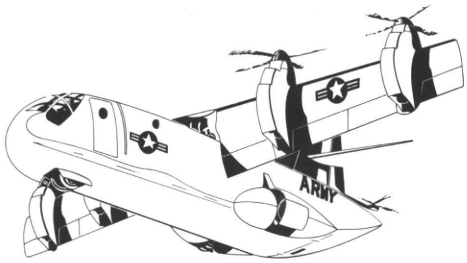




XV-3 (H-33)—Bell, four-place convertiplane.

Two XV-3 aircraft were built in FY 1955 as a part of an Army research program of V/STOL aircraft. The XV-3 uses a 450 hp Pratt & Whitney engine (R-985-AN-3). The XV-3 project is still being developed.

XC-142—Ling-Temco-Vought, Ryan, Hiller; pilot, copilot and 32 troops; VTOL transport. This is an Army-Navy-Air Force project. Plans call for five aircraft to be built. Each will use four General Electric T-64-GE-6 turboshaft engines.

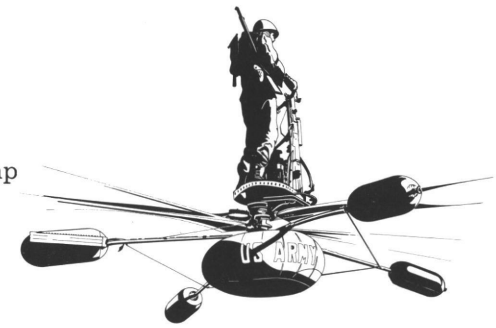


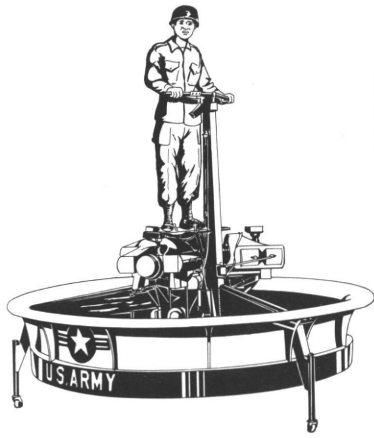
Flex Wing—Ryan, towed glider or drone.

The first prototype model of this aircraft was powered by a 100 hp Continental engine but later a 180 hp Lycoming engine was substituted. Future experiments may show that turbine or rocket engines could be used, with horsepower appropriate to the size and mission. Small, powered models may become drones and large models without engines used as towed gliders. Personnel and cargo capacity will vary according to model.

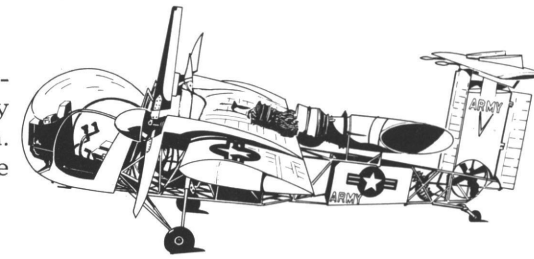
HZ-1—De Lackner, one-place, flying platform.

The Army obtained the HZ-1 for evaluation. It used a 40 hp Kiekhaefer Mercury Mark 55 engine.





VZ-1 *Pawnee* — Hiller, one-place, flying platform. The Army obtained the VZ-1 for evaluation. It used three 40 hp Barmotive engines.

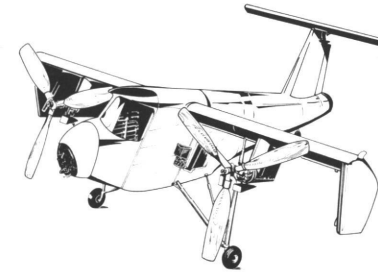


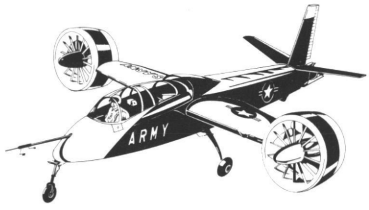
VZ-2 (upper right)—Vertol, two-place, tilt wing.

The VZ-2 is being developed for Army consideration. It is commercially designated Model 76 and uses a 600 hp Lycoming engine (T-53-L-1A).

VZ-3 *Vertiplane*—Ryan, one-place, deflected slipstream.

The VZ-3 is being developed for Army consideration. It is commercially designated Model 92. It uses an 825 hp Lycoming engine (T-53-L-1). The VZ-3 has been flown as slow as 15 knots in level flight and descended at 1600 fpm at idle power settings.



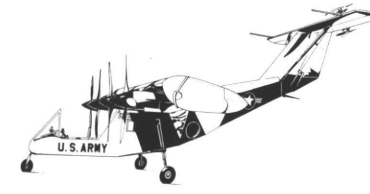


VZ-4—Doak, two-place, convertiplane.

This is an Army project to develop a V/STOL aircraft. The VZ-4 is commercially designated Model 16. Two wing-tip ducted fans are powered by an 825 hp Lycoming engine (T-53-L-1).

VZ-5—Fairchild, one-place, deflected slipstream.

This is another Army project to develop a V/STOL aircraft. The VZ-5 is commercially designated M-224-1, and uses an 1100 hp General Electric engine (T-58-2A). The aircraft was built to evaluate the deflected slipstream principle and control problems involved in transition from hovering to forward flight. It is not intended for future production.



VZ-6—Chrysler, one-place aerial jeep.

The VZ-6 was developed for Army consideration. It was a ground effects machine powered by two 380 hp reciprocating engines. The project was terminated following a crash of the VZ-6 in 1959.

No drawings available on VZ-6 through VZ-9.

VZ-7 — Curtiss-Wright, two-place, aerial jeep.

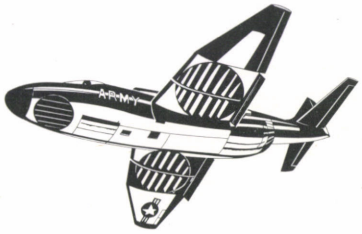
The VZ-7, another Army project, was a ground effects machine using a 425 hp Aertouste II turbine engine. The project has been terminated.

VZ-8 — Piasecki, four-place, aerial jeep.

The VZ-8 is being developed for Army consideration. It is commercially designated Model 59-K. It is a ground effects machine which originally used two 180 hp Lycoming engines (0-360-A2A). It was later redesigned with a 425 hp Turbomeca Aertouste II B engine.

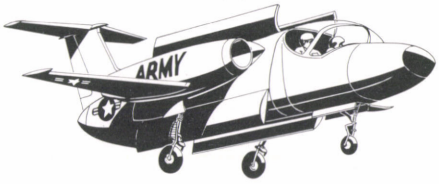
VZ-9—Avro Aircraft Limited, "flying saucer."

This was an Army-Air Force project to develop a "flying saucer" shaped ground effects machine. It was powered by three Continental J-69 turbojet engines.



VZ-10 *Hummingbird* (redesignated XV-4A)—Lockheed-Georgia, two-place, jet thrust diverter.

Two of these experimental aircraft are being built for Army evaluation. An augmented jet thrust diverter system is incorporated in the design. It is believed that this feature will enable the aircraft to dart from ground hover to a speed of approximately 500 mph (Mach .68) at 35,000 feet altitude in approximately 3 minutes. The VZ-10 uses two Pratt & Whitney JT 12A-3 turbojets. It made its first conventional flight in the summer 1962.



VZ-11—Ryan two-place, lift-fan propulsion.

This aircraft will be powered by two General Electric J-85 jet engines and will utilize the lift-fan propulsion system. It is expected to make its first flight in mid-summer 1963. Available data indicates that it will be capable of taking off vertically and then assuming forward speed in excess of 500 mph.

Off-the-shelf aircraft considered, but not in general use by the Army

Pioneer—Scottish Aviation Limited, five-place fixed wing aircraft. It uses a nine-cylinder, single bank 500 hp radial engine.

Twin Pioneer—Scottish Aviation Limited, pilot, radio operator and 16 passengers; twin-engine aircraft. Uses Alvis Leonides 520/540 hp radial engines.

OE-2—Cessna, two-place, fixed-wing aircraft. It uses a 265 hp Continental, six-cylinder, horizontally opposed, supercharged, air-cooled engine.

HOK-1—Kaman, pilot, copilot and three passenger helicopter. This aircraft uses twin, two-bladed, intermeshing, counter-rotating rotors, and has a 600 hp Pratt & Whitney engine (R-1340-28).

G-91—Fiat, one-place, NATO jet airplane. It uses a Bristol-Siddeley Orpheus MK 803 axial flow turbojet engine which has a rated sea level static thrust of 5,000 pounds.

G-91T—trainer version of G-91; two-place, tandem.

N-156—Northrop, one-place supersonic airplane. It uses two YJ-85-GE-5 axial flow turbojet engines which develop 2,500 pounds of static thrust each at military power and 3,850 pounds with afterburner.

T-38—trainer version of N-156; two-place, tandem.

A4D—Douglas, one-place, jet airplane. It uses a Wright J65-W-16A turbojet engine with a multistage, axial flow compressor driven by a two-stage turbine which develops 7,700 pounds of static thrust at military power.

Helicopter Rescue Operations

Captain Jimmy L. Hatfield

A MAN DIES IN so many minutes, not over a distance of so many miles. Critically injured patients must receive proper treatment as early as possible. This is the essence of aeromedical evacuation.

The crash rescue helicopter at Fort Rucker has proved invaluable in reducing the tremendous loss of lives and equipment resulting from aircraft crashes and fires. Helicopter rescue is a combined operation to remove trapped and injured crewmembers from the aircraft, to suppress fires, to render emergency medical assistance, and to evacuate the injured to a medical treatment facility.

To appreciate some of the factors involved in the operation of the Crash Rescue Section at Fort Rucker, a brief survey of the area of operations of the U. S. Army Aviation School is needed. The local flying area covers a radius of 50 square miles. A total of 6,000 students are trained each year in the various aviation courses by a staff and faculty of 1,200. Fort Rucker ranks first among all military installations in the total amount of traffic (over 300,000 flying hours last year which involved over 1,000,000 controlled operations—see page 39).

In such saturation of air traffic, the mission of the Crash Rescue Section takes on increased importance. In fulfilling its primary objective of rescuing the occupants of a distressed aircraft, the fact that an aircraft can be replaced and a pilot's life cannot becomes the focal point for all organization and procedures.

RESCUE AIRCRAFT

Several characteristics are desirable in a rescue aircraft: excellent forward and downward visibility, minimum range of 3-4 hours flying time, ability to land on unprepared areas, large cargo capacity, high maneuverability, instrument flight capability, and ability to operate at comparatively slow speeds. It is apparent that the helicopter is the only operational vehicle meeting all these requirements. In addition, should engine failure occur, a safe autorotation can be made. The H-34 Choctaw is used at Fort Rucker for the rescue vehicle.

CREWMEMBERS

A pilot, copilot, two firefighters, a first-aid specialist, and a crash guard form a crash rescue crew.

Every *pilot* assigned for rescue duty is a Medical Service Corps officer who is highly qualified in emergency medical treatment and has extensive experience in combat or field aeromedical evacuation, These aviators maintain a high degree of

Capt Hatfield is Aviation Psychologist, U. S. Army Aeromedical Research Unit, Ft Rucker. He is an Army Aviator with over 2,500 helicopter hours.

flying proficiency and are constantly aware of flying conditions in the area. The pilot must be alert and actively supervise all activities pertaining to the safe operation of the aircraft. The crew and patients are his responsibility.

Two crash rescue *firefighters* perform daily inspections of fire suppression and rescue equipment to assure its adequacy and availability for emergencies. In event of fire at the scene of the crash, the firefighters, wearing protective clothing and carrying two fire bottles each, cut a path through the fire to crash victims. They assist the aidman in forcing entry into a wreckage and loading the patients on the helicopter, and take all necessary steps to secure the wreckage.

The *medical aidman* takes whatever steps are necessary to reach crash victims. He will assist the firefighters during forced entry, moving wreckage, etc., but his primary duty is to administer first aid, move injured personnel, and load litters aboard the helicopter.

The *guard* remains at the scene of the crash to protect government property. He admits only authorized persons to the immediate vicinity of the crash, prohibits smoking, and conceals personnel or equipment that should not be exposed to general view.

RESCUE EQUIPMENT

The rescue team is constantly evaluating new equipment and techniques; however, past experience indicates the following equipment is essential.

- In addition to the standard aeronautical and crash maps available to all Army Aviators at Fort Rucker, the rescue pilots have a diagram taped to the instrument console which displays the magnetic heading and omni radials to all of the strips and airfields being used.
- Three flashlights are carried for emergencies and night operations.
- Smoke grenades are carried for marking an area for positive identification and for determining wind direction before landing.
- The aircraft must have an external hoist with attachable rescue bag. The external hoist is mandatory equipment in helicopter rescue operations, but the hoist attachment is usually determined by the nature of the rescue operations involved. A canvas rescue bag designed by Maj Gen Ernest F. Easterbrook, former Commandant of the U.S. Army Aviation School, is the best hoist attachment developed by the Army to handle a variety of missions. (See DIGEST April and December 1960 issues.)
- Two litters are in position at all times and a third litter can be immediately installed.

Equipment used by crash rescue crew. Fire-fighting equipment is at left; crash rescue, right

- Firefighting clothing consists of asbestos hood, bunker coat and trousers, gloves, and boots. This clothing permits the firemen to withstand the heat encountered while removing the patient from a burning aircraft.
- A canvas crash entry kit, easily carried by one man, contains screwdrivers, pliers, wire cutters, axe, knife, hacksaw, metal saw, shovel, plugs for gas leaks, and a grappling hook.
- Eight chemical fire extinguishers are available. This amount of firefighting equipment is not adequate to completely extinguish a large fire but is sufficient to provide protection for removal of injured personnel.

The aidman's equipment consists of a doctor's bag, first-aid kit, splint set, resuscitator, and 4-6 blankets.

The guard is provided with engineer tape to mark the crash scene, no-smoking signs, rations for one meal, and an FM radio to relay messages to firefighters and aidman from pilots in the helicopter.

TRAINING

The Army does not conduct school training in crash rescue and firefighting operations normally associated with helicopters. Therefore, the Crash Rescue Section supplements standard firefighting training with extensive on-the-job training. Each pilot and crewmember receives 50 hours of flight training aboard the crash helicopter before they are released for duty as permanent crewmembers.

Aircraft crash accidents and emergencies normally occur suddenly and with a minimum of advance warning to permit extensive on-the-scene preparation. Therefore, all crash firefighting and rescue personnel must go through a continuous on-the-job training program to include

- fire and crash rescue organizations;
- crash mobilization procedures;
- fundamentals of combustion, fire control, and extinguishment;
- firefighting and crash rescue vehicles, equipment, and operations;
- aircraft identification, arrangement, and characteristics familiarization;
- basic rescue and first-aid procedures;
- actual burning grounds practice in simulated crash accidents;
- review and discussion of actual past accident operations.

Teamwork is the keynote of modern crash rescue operations. Failure of one member may jeopardize the lives of his fellow crewmembers, to say nothing of those of the aircrew. Prompt, independent, and intelligent action on the part of crewmembers is an absolute necessity. Each crewmember must not only operate as an individual but as a component part of a general firefighting scheme, each with full knowledge of the intentions and objectives of all other participants and fully trained to perform his own duties.

PRIOR PLANNING

Because crash rescue is highly specialized and of an extremely emergency nature, it is essential that a comprehensive plan of action be placed into effect for instantaneous mobilization. At least one crash rescue helicopter remains on alert during daylight periods of scheduled student flight training activity. Personnel on alert assignment remain near the crash equipment. A standby pilot will be on call after duty hours and on Saturday, Sunday and holidays.

Crash maps are located in the crash control center, all airfield towers, fire stations, rescue aircraft, military police headquarters, hospital, and every aircraft assigned to Fort Rucker. The maps display a numerical grid system and are used as a standard map reference in determining and reporting crash location. Surrounding areas in which crashes are most likely to occur are studied in advance by the crash crew in a combined air and ground survey.

COMMON PROCEDURES

Cairns operations serves as the crash control center at Fort Rucker. Several crash bells are located in this area. In the event of an aircraft crash or impending accident, tower personnel immediately sound the crash alarm bell. Notification of a crash may be received by telephone or by radio from any aviator spotting a crash while flying in the local area.

Upon hearing the sound of the crash alarm bell, the pilots and crash crew immediately board the helicopter, start the aircraft, contact Cairns tower for information on the crash and request an immediate takeoff in the appropriate direction. This part of the operation requires only 1 minute and 30 seconds.

As soon as the helicopter is airborne, the pilot concentrates on flying, the copilot on navigation and radio procedure. By this time, the crash control center is able to relay additional information to the crash helicopter. The firefighters and medical aidman can monitor this information and talk with the pilots via intercom during the flight. This knowledge is vital to the crash

crew, enabling them to plan their rescue intelligently before they arrive at the scene of the crash.

During any emergency flight, the crash helicopter is given priority over all traffic in the area. It is painted white with red crosses as an aid to its rapid identification.

The pilot tries to make an approach and landing as close as possible to the crash victims. The copilot continues to relay information to the crash control centers and to crewmembers as they make final preparations for landing.

After completion of the landing, the two firefighters, aidman, and crash guard leave the helicopter to perform all necessary steps to assist the crash victims and secure the wreckage to prevent further damage. During this stage, the crewchief often assumes complete responsibility for the action of his crew. If additional manpower is needed, the copilot will assist the crew. The pilot will always remain in the helicopter to relay messages and in case of fire to hover the helicopter in position to blow flames and heat away from the firemen as they attempt the rescue.

In a densely wooded area, the helicopter may not be able to land near the crash scene. In such instances, the helicopter will approach the accident at low altitudes and use the external hoist and rescue bag to lower a medic and/or firefighters into the crash area and to remove casualties.

Crash victims, both ambulatory and litter, are loaded in the crash rescue helicopter and flown immediately to the hospital. En route, the copilot requests crash control center to verify that a standby ambulance, or flight surgeon if necessary, is at the hospital helipad. He also gives a complete report of the crash and its results; however, fatalities and serious injuries are not mentioned in the clear on any radio net. A simple code system is used by the pilot in communi-

cating this information to the crash control center. The medical aidman will render first-aid during flight and inform the pilot of any necessary information to be radioed to the hospital.

AEROMEDICAL EVACUATION

The advantages of helicopter evacuation can be considered under three major headings: speed in evacuation, patient comfort, and selective evacuation.

- The ambulance helicopter gives more rapid evacuation due to the minimum landing site requirements and its ability to travel over unfavorable terrain.
- Comfort of the patient is not merely a luxury. With helicopter evacuation the patient not only reaches the proper treatment facility faster, but also in much better condition.
- The speed, range, and flexibility of helicopter evacuation permit the removal of the patient directly to the treatment facility best equipped and staffed for his particular type of injury.

PROBLEMS AND LIMITATIONS

- *Firefighting in a densely wooded area* presents the most serious problem for helicopter rescue in Army Aviation. First, the crash helicopter does not have the capability to fight a fire from an airborne position. Second, it does not carry sufficient firefighting agents to completely extinguish a large fire.

A fire suppression kit carried in by cargo sling and dropped at the crash site, is an excellent firefighting technique, but it does not solve our problem. The majority of Army Aviation accidents involving fire occur in wooded areas where it is not possible to lower such a kit close to the fire scene.

A practical proposal for extinguishing the aircraft fire in a densely wooded area would be a "flying fire truck." This would require installation of a special kit containing a firefighting agent, tanks, pumps, and hoses in the cargo compartment or in an external position similar to auxiliary fuel tank installations.

Although this is a solution, if the crash helicopter carried sufficient chemical and/or foam to extinguish a fire, would there still be space available for the crew and additional rescue equipment? There is always the possibility that it would be necessary to use two helicopters in the same rescue operation.

- *Interruption of crash telephone circuits and crash radio net* by individuals asking for information regarding the crash is always a serious problem. Personnel who are not actual participants in the immediate operations should stay clear of the scene. Base commanders should be instructed to render all assistance possible to rescue forces but to refrain from taking control away from trained search and rescue personnel.
- *Weight and balance is especially critical in the helicopter.* We are concerned with lateral as well as fore and aft center of gravity. During the summer months, it is necessary to operate the H-34 with the aft fuel tank empty. The helicopter is very sensitive to wind direction and velocity, density altitude, temperature and load factors.
- *Helicopter rescue operations are sensitive to weather and darkness.* Even though instrument equipment and instrument qualified pilots in Army Aviation have increased tremendously, rescue operations are seriously hampered, delayed, and in some cases aborted, when the ceiling and visibility are below minimum standards.

* * *

Aeromedical evacuation has been a tremendous morale builder at Fort Rucker; student pilots know that someone is standing by at all times to give them assistance in any emergency. Lives without price and costly equipment have been saved by the Crash Rescue Section. In the future the crash rescue helicopter will prove even more valuable in all types of rescue as its advantages are further exploited and its limitations overcome.

Total Landings and Takeoffs at Fort Rucker in 1961

	CAIRNS	*LOWE*	*HANCHEY*	*STAGE-FIELDS*
VFR	225,088	356,060	64,704	437,205
IFR	30,184			
TOTAL	250,272	356,060	654,704	437,205
GCA (included in above)	(26,212)		(4,074)	

GRAND TOTAL—1,108,241, an increase of 8,615 over 1960.

Total Flight Plans Handled in 1960

	CAIRNS	*HANCHEY*
VFR	25,284	8,073
IFR	7,215	2,164
TOTAL	32,499	10,237
GRAND TOTAL—	42,736	

Crash and Rescue Firefighting

Lieutenant Lester H. Hollans

THE L-19 CLIPPED a tree on climbout from a road strip and the Army Aviator alerted the tower that he would be making an emergency landing. "Roger," replied the tower operator, "we'll have a fire truck standing by."

A fire truck! The aviator had never thought about a fire breaking out. Then he remembered a safety conference covering fire accidents. What were those figures again? Oh, yes, the instructor had said that an aviator's chances of surviving a nonfire accident are 22 times greater in helicopters and 13 times greater in fixed wing than they are in accidents involving fire. And the most astounding figures of all pointed out that fires account for 35 percent of the fatalities in fixed wing aircraft and 63 percent of the fatalities in rotary wing aircraft.

As these thoughts flitted across his mind, the aviator's momentary panic disappeared in his realization that a crew of expert firefighters would be waiting to help him—whatever might happen.

Inflight fires are rare but fires breaking out on the ground are fairly common. Fire can be caused by exhaust flames igniting the grass beneath the aircraft, fuel tanks rupturing upon impact during a forced landing, or in numerous other ways. Regardless of the cause, the hazards from fire are always real and ever present.

What does it take to fight an aircraft fire? What kind of equipment? How many men? Let's look for a moment at some of the problems involved in fighting aircraft fires.

If any outfit in the Army needs perfect physical specimens, it is a firefighting unit. A man with a limiting profile or one just recovering from a slipped disc operation will be of little use in an emergency where time is a major factor. A crew with a physically unfit man is like a football team with a peg-legged quarterback — they can start the game, but they can't run with the ball.

Crew training is of the utmost importance. Firefighting should be instinctive. An aviator can suffocate in the cockpit in a matter of minutes. There just isn't time to fumble around the flaming aircraft playing musical chairs with the fire hoses. Last minute orders should come only from the crewchief and then just to direct the operation, not to be assigning duties.

One obvious item in crew training is often overlooked. With ejection seats a reality in Army aircraft, the crew must know how to get the occupants out without putting them into orbit. The location in each type aircraft of possible fire-producing points, such as the batteries, fuel tanks, and electrical wiring, should be common knowledge among the crew. This information, along with other items such as passenger and crew exits, is found in TB AVN 23-63, U. S. Army Fire Fighting and Rescue Manual.

Your crews may enroll for training in the Air Force Extension Course number 5711, Fire Fighting and Aircraft Crash and Rescue. The course is administered by the Air University, Extension Course Institute, Gunter Air Force Base, Montgomery, Ala. See your local Education Center or write directly to the Air University. The manuals for the course are excellent. No crash and rescue section should be without them.

Lt Hollans was stagefield officer, Airfield Command, Cairns AAF, when this article was written. He is now working on his masters degree at VPI.

No correspondence course can ever take the place of actually walking into a flaming pool of gas that has just spilled from an aircraft. The men are naturally a bit reluctant to do this; yet, to wait for experience until an emergency occurs is too late. To build the crew's confidence, fuel should be spilled on the ground in a firefighting pit and each man sent into the flames wearing full equipment. The ideal fuel spill would contain about 250 gallons of gas and oil.

What kind of equipment do the men need to walk into a pool of fire? Heat reflecting coats and gloves, asbestos hoods and thermal boots are a must. To fight his way to the cockpit and then be unable to grab a hot door handle and open it is sheer folly. The need for heat reflecting pants and covers for the coats is apparent. If you've never stood in the middle of a flaming pool of oil and gas, you can't imagine how hot it can get. Barbecued crews are totally ineffective. Oftentimes the fire will be beaten back and a layer of foam will cover the fuel spill. All looks well when, without warning, the foam parts on the fuel and the crew find themselves surrounded by flames. Combat boots and fatigues are not the answer here.

Regardless of crew training, little can be done to save a pilot without an adequate fire truck. Some trucks have more foam capacity than others. A truck that may be fully capable of handling an H-13 fire might be of little value around a burning Caribou. But even an inadequate truck, manned by a well-trained and equipped crew, can often do a job that normally wouldn't seem possible.

What can you do to improve your truck and its utilization? The truck must be in perfect working order. If the turret will not operate, then a stream of foam and/or water cannot be directed on the fire as desired. A clogged hose nozzle can lose the whole lifesaving battle for you. Another item of major importance is the positioning of the truck. The truck must have easy access to all runways. Its path to the scene of a crash must be free of obstructions, such as

"No correspondence course can ever take the place of actually walking into a flaming pool of gas that has just spilled from an aircraft"

"Crash fire trucks do not hook up to a fire hydrant. They are self-contained units . . ."

ditches. If the physical layout of the field cannot be improved, then the driver must be thoroughly familiar with all routes to the runways. And it goes without saying that no other vehicle should be parked to block the front of the firehouse.

Most fields have two fire trucks on duty. Crash fire trucks do not hook up to a fire hydrant. They are self-contained units and when a call is answered and the foam and water supply depleted, the truck must be recharged. The standby vehicle can then take over in its absence. Another thought, too. Once the truck is emptied, that's it. The standby truck may be needed to complete the rescue operations. What kind of condition is your standby vehicle in?

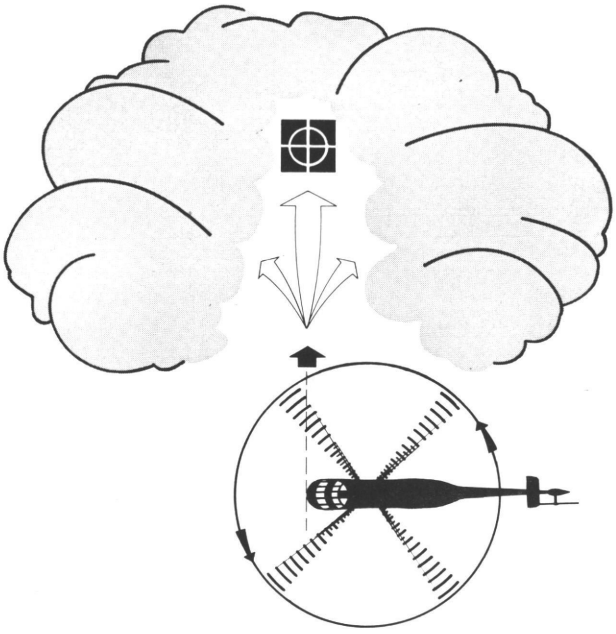
Crew composition can be as complicated as a squad in the attack. The ideal crew would consist of six men: a crewchief, driver, assistant driver, first hand-line man, second hand-line man, and a rescue man. The crewchief should be the best trained, most experienced member. He directs the whole operation and is the only one to be giving orders during the emergency.

A driver must be thoroughly familiar with his truck and its operating apparatus. Some trucks have more gadgets than a Mohawk cockpit, and it takes time to learn the use of them all. The driver must also know the best route to the crash. Upon reaching the scene he stops the truck and puts the pumps into operation. In some trucks he must remain in the driver's seat to operate the pump. On others he can get outside and work the valves. He must keep the crewchief in view and receive any signals to change the pressure or mixture of the spray or to reposition the truck. Perhaps his most important job is to determine the wind direction while answering the call. If he parks downwind, the flames will be blowing into the crews' path all the time. The truck should be positioned upwind. The assistant driver helps the driver and is available to take over for anyone who might be overcome by smoke and heat.

The hand-line men are responsible for care

"Heat reflecting coats and gloves, asbestos hoods and thermal boots are a must in fire fighting"

and cleaning of the equipment. But when they reach the crash scene, they are the ones who grab the hoses and cut a path through the flames to the cockpit. Standing behind them is the rescue man. As the hand-line men suppress the flames and cut a "V" path to the wreckage, the rescue man goes in and pulls out the pilot. The aviator's life depends on the teamwork of these three men.



Skill is necessary for the following procedures. How close can the truck be brought to the fire? Get too close and the spray pattern from the turret nozzle may overshoot the whole fire. The spray pattern necessary depends entirely on the size of the fire. Getting too close may blister the paint on the truck. If the fuel is still pouring out of the wreckage, it may possibly flow under the truck and catch it on fire too. If your crew was too small to start with, the remainder will have to make up for the loss. The same would be true if one were to be overcome by smoke and drop out.

The Air Force is using an airborne suppression kit carried by sling load method to the crash scene. The helicopter sets the kit down about one hundred feet upwind from the fire. Moving back another 20 feet the firefighting crew is discharged. As the crew grab the hoses and start into the fire the helicopter moves still another 100 feet upwind and comes to a hover, directing its rotor wash on the fire. Thus fresh air is blown toward the fire, cooling the firefighters, blowing the flames ahead of them, and directing the fresh air on the cockpit for the pilot to breathe.

Recent tests by the U. S. Army Aviation Board have proved this technique with an H-34. The main rotor is positioned just to one side of a wind line leading to the cockpit. The tail rotor is positioned on the same side and in a perpendicular manner to the wind line. This resulting narrow band of cool air has often made the difference between life and death for trapped aviators.

No two fire emergencies are alike and your crew will learn something new each time. Months or years can go by without the crew being called upon. Such is often the case. For this reason keeping your crew training level and morale high may be difficult. But no amount of extra effort is too great when you consider the primary mission—to save a life.

From the

USAAVNS

Dept. of Maint.

The HC-1 (Chinook) mechanics course is now in advanced stages of planning. Training for the pilots transition course and the mechanics course is scheduled to start in the near future. Student loads have not yet been determined.

A total of five major trainers, which are scheduled for delivery in January 1963, have been placed on contract to support the program of instruction. These consist of the following:

- Composite Powertrain, Flight Control, and Hydraulic System Trainer.
- Fuel System Trainer.
- Electrical System Trainer.
- Hydraulics System Trainer.
- Stability Augmentation System and Automatic Stabilization (ASW-12) Equipment Trainer.

These trainers are being engineered and constructed by the Vertol Division of The Boeing Company in accordance with the specifications required by the Department of Maintenance.

In addition to the above trainers, Vertol is under contract to supply one complete set of their service school lesson plans and a set of their overhead transparencies. Plans are presently under way to produce numerous 35mm slides at the factory. These slides will be photographed at the assembly line with the components in various stages of construction. These slides will be used in conjunction with the factory set of overhead transparencies.

As in all mechanics courses in the USAAVNS, an actual aircraft will be necessary for the student to perform the numerous practical exercises necessary before he is capable of maintaining the aircraft. At present the plans call for one Chinook to be assigned to the department to fulfill this requirement.

Prerequisites for the mechanic entering Chinook training have not been completely firmed up as of this date; however, it is certain that he must have at least one year of experience as an aircraft mechanic in the field.

Supervisor and instructor personnel have completed the factory training school. Their immediate efforts are directed toward completion of lesson plans and the final preparations for the first class.

Falcon's Nest

How many good aircraft mechanics do you know? If you come in contact with one of the better mechanics in your unit, show him a bolt with two dashes located opposite each other on the head and ask him if he can identify it by type. Another good question. If you have a lighting circuit in an aircraft containing two 48-watt bulbs wired in parallel and fused for 5 amps and add another 40-watt bulb in parallel, will the circuit still function properly?

These questions and many others like them are elementary, yet 90 percent of aircraft mechanics, including your better ones, cannot give you the answer right away.

If you are a maintenance officer, conduct a survey among your maintenance personnel to determine how many of them have a good sound knowledge of the fundamentals of aircraft maintenance. You will, no doubt, find the number to be few. The blame cannot be put fully on the mechanic; perhaps it has been a number of years since he has been to a maintenance course. You can say that he should have been keeping up with the fundamentals or reviewing them. Have you been helping him? Do you as maintenance officer conduct any refresher training for your people? If not, now is the time to start.

After training is started, you will find the number of EDPs, as well as problems in general, will be greatly reduced, thus increasing the efficiency of your unit and the ability to accomplish your assigned missions.

At the present time numerous parts are being returned for depot maintenance which require only a single minor adjustment to return them to supply channels for installation in our aircraft. One of our most common troubles is generator failure. In many cases mechanics have replaced generators, reversed current relays and voltage regulators only to discover, after three EDPs, and many hours of labor, the cause was actually a faulty switch. Only one case of this nature can be quite expensive and time consuming to a unit; yet, it may happen several times.

As maintenance officers and supervisors, we can alleviate some of the cost and time involved by ensuring that our maintenance personnel receive refresher training in maintenance fundamentals.

Dept. of Tactics

This department recently studied techniques for dropping flares from helicopters. Successful tests have been conducted in dropping Mark VI flares from the HU-1.

Accompanying photograph shows Sp/5 Gerald M. Morgan, Instructional Support Branch, demonstrating the manner in which the flares were dropped.

Upon approval of the techniques being studied, Tactics plans to integrate into the curriculum both classroom and field exercise type of instruction on employment of flares from helicopters. The techniques and procedures will also be included as changes to appropriate training literature.

The department is investigating the feasibility of teaching the use of camouflage detection film using the AO-1 Mohawk. This is in addition to the normal black and white photography being used in AO-1 tactical training exercises.

The purpose of this film is to facilitate the detection of camouflaged installations in surroundings of natural vegetation. This is accomplished through the strong color contrast which is achieved between vegetation and infrared-absorbing types of camouflage. This is true even though there may be little or no contrast between these objects when seen by the unaided eye, or when recorded on common color film.

Although this film may be used alone for camouflage detection, interpretation is greatly facilitated if it is used simultaneously with high contrast Ektachrome aerial film. This is accomplished by using two cameras, mounted and operated so as to record identical areas simultaneously.

The use of this film will afford the commander another means of detecting information on location and disposition of the enemy. This will be the first known use of color photography by Army Aviation.

Small Detachment Provides Vital Function

A SUDDEN SLEET storm nearly wrecked George Washington's careful plans for the famed Christmas Eve crossing of the Delaware. . . .

An unusually severe winter did more to decimate Napoleon's armies retreating from Moscow than enemy troops. . . .

Such incidents and accidents attendant on weather can be multiplied thousands of times from military history.

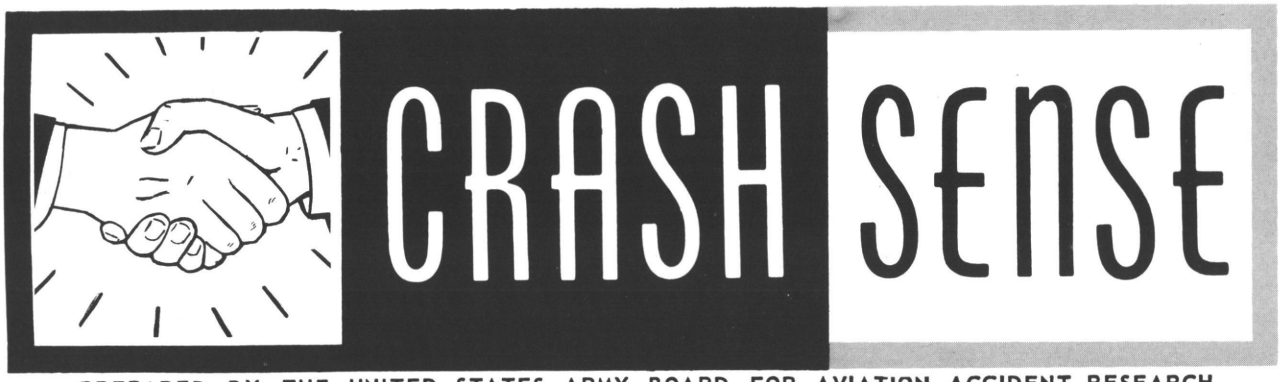
Today the increased mobility of military forces and the expanding area over which they will be called on to operate, render even more important the availability of continuous and accurate weather information.

In Italy, particularly in the rugged Alps and on the slopes of the Apennines, it is extremely important that every pilot have complete weather data. To provide this information for units of the Southern European Task Force (SETAF), a small but highly dedicated group of U. S. Air Force weather specialists maintain weather service operations at Boscomantico Army Airfield near Verona, Italy.

In addition to providing day-to-day weather information to all SETAF units, the meteorological specialists of Detachment 1, Seventh Weather Squadron (USAF), accompany SETAF's 110th Aviation Company to the field during training exercises to provide continuous weather data. To aid their observing and forecasting, the detachment has a mobile weather station. The portable station is transportable in less than a half-dozen boxes and can be set up in less than one hour.

The mobile equipment includes a ceiling light and clinometer (devices used to determine cloud height) a wind directional and speed indicator tower, and a weather plotting board.

How do the men in blue feel about being the only Air Force unit attached directly to SETAF? "We feel we are a vital part of the Army Aviation team operating in northern Italy," comments their commanding officer.



PREPARED BY THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

"Congratulations to . . ."

WRITING IN THE LETTERS section of the August 1962 DIGEST, Captain Paul W. France suggested a "heads out and unlocked" category titled "Congratulations To . . .".

This month CRASH SENSE has several examples of the type Captain France suggested, and we're happy to lead off with congratulations to . . .

CWO ELLIS E. BRABEC

Fort Hood, Texas. On 5 April 1962 an orientation flight in two H-19s from the 501st Aviation Battalion was arranged for a visiting general and his party. One H-19 was piloted by Lieutenant Halff, copiloted by 2nd Lieutenant Chin, crewchief, SP-5 Stanley. The second was piloted by CWO Brabec, copiloted by 2nd Lieutenant Righthouse, crewchief, SP-5 Sorrells. The general and his party were flown to the field for a briefing at III Corps Headquarters and then to a briefing at North Fort Hood.

After lunching in the field they were flown to Gray Air Force Base for a briefing on air force operations in Trackdown. From there they were to fly to the northwest reservation and observe a cargo drop from a C-131 Hercules aircraft. En route to the area the H-19 piloted by CWO Ellis E. Brabec had a sudden loss of power, followed by rapid engine surges and then complete engine failure. CWO Brabec did an excellent job of landing on muddy, rolling terrain with no damage. After a short delay, an H-13 aircraft from the 501st Aviation Battalion transported the general back to the airfield, while the rest of the party returned in another H-19.

CWO Ellis E. Brabec (left) receives congratulations and certificate of appreciation from Brig Gen J. H. Chiles, assistant division commander, 1st Armored Division. Looking on is Col C. H. Hollis, CO, 1st Brigade

Inspection of the downed aircraft showed failure of the carburetor system. A spare carburetor was installed the next morning and the aircraft was flown in and returned to flyable status.

CWO WILLIAM E. FLOWERS
CWO WILLIAM ROBERTS

Fort Hood, Texas. In the evening hours on 2 April 1962, CWO William E. Flowers of the 501st Aviation Battalion was piloting an H-34 aircraft along the south range of the Fort Hood reservation on Trackdown operations.

CWO William Roberts was following Mr. Flowers in another H-34 when he observed that Mr. Flowers' aircraft had a sudden engine failure.

Mr. Roberts immediately landed at a nearby airstrip and directed his landing lights across the strip. This gave Mr. Flowers ample light for a safe landing.

Both aviators attended the same flight school at Fort Ruck-

CWO William Roberts and CWO William E. Flowers are commended by General Chiles.

er in 1955-56 and had talked about such a situation occurring. Due to CWO William Roberts' ingenuity and quick thinking a near tragedy was averted.

CAPTAIN LOUIS J. STADLER CWO JAMES I. McGEHEE

Fort Rucker, Ala. Captain Stadler and CWO McGehee, flying an H-37B, were taking part in a demonstration at Longstreet Stagefield, 16 April 1962. Their mission was to fly in on a contour approach and unload a ¾-ton truck, an 81mm mortar, and five men.

A number of movie cameras followed the huge helicopter's approach and recorded what appeared to be a normal touchdown. But inside the Mojave, a totally different picture began to unfold.

Approaching the touchdown spot, Stadler instructed McGehee to open the clamshell doors when the main gear touched. Down below, the two crewchiefs, S/Sgt James A. Cosden and SP-5 Fred Dyals were preparing to release tie-down straps to the truck and stand by to direct the driver out as soon as the helicopter stopped. But as the Mojave touched, its left main gear collapsed. This caused the aircraft to tilt to the left, and the left clamshell door dipped into

Captain Stadler and CWO McGehee examine drag link similar to theirs which failed.

the sod and was ripped away from its hinges.

In a matter of seconds Cosden reported a hydraulic leak to the pilot by intercom. MeGehee, in the copilot's left seat, reported oil streaming from ruptured lines in the left engine nacelle. Captain Stadler, sensing something wrong, had already applied power and pitch for a hover. About this time Longstreet Control called and reported fuel trailing. Captain Stadler, after instructing the crewchiefs and passengers to abandon the aircraft, moved the aircraft away and to the rear of the spectators. After an unsuccessful radio appeal to secure a truck to rest the crippled side of the aircraft on, he decided to move to the south and look for a suitable terrace.

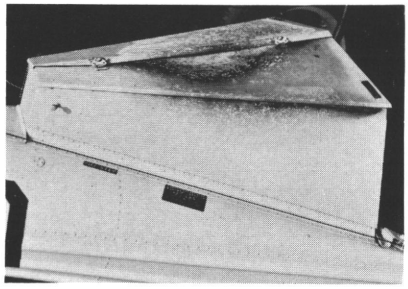
Knowing that the H-37B would not hover with one engine, and expecting the left engine to quit any second, Stadler knew a resting place had to be found — and soon.

With hydraulic pressure to the throttle servos out, McGehee was struggling to keep rpm up and was prepared to exceed the red line, if necessary, to keep the left engine running.

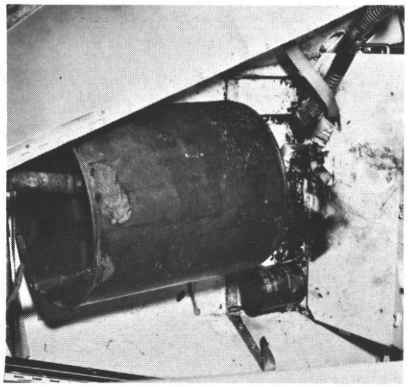
While searching for a suitable terrace, most of the 30 gallons of oil had marked a dark path across the stagefield. A sizeable terrace was spotted, and then— as if ordered for the occasion— another one appeared with a washout below it. Captain Stadler carefully moved into position over it, and slowly decreased power and collective until solid contact was made. It worked. Level heads produced a level landing.

SPONTANEOUS COMBUSTION

An H-23F was on an extended cross-country flight over a remote area, refueling from 55-gallon drums previously positioned along the flight route by a fixed wing aircraft. A funnel and chamois were used to filter the fuel. After refueling, the pilot placed the funnel and chamois in the baggage compartment located on the tail boom. The pilot continued to his destination, landed, and saw fire and smoke coming from the baggage compartment. The fire was extinguished and a two-inch hole was found burned through the top of the baggage compartment.



Fire damaged compartment



Fire damage inside compartment

In addition, the paint on the inside of the compartment and articles stored there were found burned.

The cause was determined to be spontaneous combustion, with the fire originating in the wet chamois which was attached to the funnel. Flames passed through the funnel and out the small opening at the base, creating a blowtorch effect. This burned the hole through the metal top of the baggage compartment. It was considered possible that static electricity created by the passage of fuel through the chamois may have aided combustion.

Corrective action for this one appears obvious: never carry combustible materials, including gas cans, chamois used for refueling, oily rags, etc., in aircraft baggage compartments. Always insist on using static grounding cables when refueling.

H-37 CARGO HOOK

A Mojave hovered into position over an S-141 shelter for an external sling load operation. The shelter contained radar equipment and weighed approximately 4,000 pounds. The hookup was made and the liftoff started. At this point, the H-37 lost power and the pilot lowered the shelter back to the ground. He attempted to release the load, but the electrical release system would not function. Finally, after some trouble, the crewchief was able to release the load from the hook with the manual release. But during this time, the shelter had been inadvertently lifted again and it dropped from approximately 4-14 feet.

The radar equipment was damaged to the extent that it had to be returned to the factory for repair. The skids and the rear section outer skin of the shelter were damaged.

The Mojave was flown to a nearby base, and a check of the hook system revealed that the electrical wiring was broken next to the cannon plug at the hook. The wire was repaired and the hook checked out satisfactorily. A visual check of the wiring to the hook was made and the plastic covering of the wiring was found cracked in numerous sections. This indicated excessive wear through bending during retraction and extension of the hook.

Other cargo hook failures have been attributed to dirty hooks, corroded microswitches, and excessive wear.

All of these causes are normal and to be expected. They are also self-evident. No elaborate testing equipment or microscopic inspection is required to detect them.

A recent spot check of H-37 aircraft entering the remanufacture program revealed that cables for cargo hooks had not been replaced since the aircraft was procured, in spite of the fact these cables were frayed and cracked beyond acceptable limits.

The minimum inspection requirements for the H-37 cargo hook are that the hook be inspected daily for cleanliness, security, fraying, cracks, distortion, damage, and operation. This inspection, if made and corrective action taken, will prevent cargo hook failures and damage to valuable loads and aircraft.

FIELD SELECTION

X unit was taking part in a large-scale field maneuver. At approximately 1700 hours, the unit got the order to move to a new location. They flew into the new location just before dark, landed, and parked the aircraft.

The field was fairly rough, with tall weeds and grass, a dip, and a slight uphill slope. Trees on the downhill side were approximately 40 feet high and those on the uphill side were 10-15 feet.

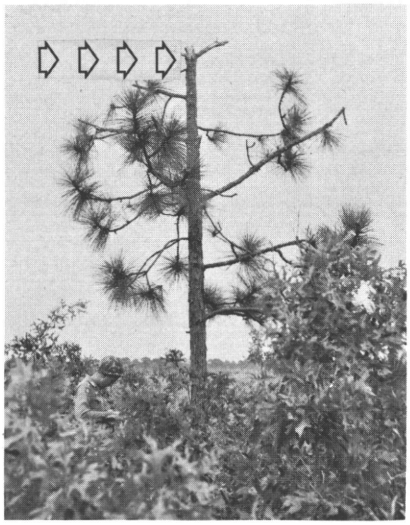
A radio-relay mission, to last from 2100 hours to 2400 hours, was assigned the unit. There was a great deal of discussion and apprehension by the pilots about operating out of the strip at night. The company commander went to battalion headquarters to see if an HU-1 could be used for the flight. He was unable to obtain a rotary wing aircraft, so an L-20 was assigned for the mission.

Let's let the pilot tell what happened in his own words:

"I had elected to take off over the low trees since the wind was negligible. So I had a crewchief guide me in as close to the trees as possible on the opposite end of the strip and line me up.

"I ran the aircraft up and everything was functioning normally. I checked the flaps through and set them in the takeoff position. I trimmed the aircraft in a nose-low position and ran it up to 37 inches manifold pressure and maximum rpm. I held the brakes for maximum power buildup and then started my takeoff roll. At [a point] a little over half-way down the strip the aircraft got light and seemed to fly off. However, almost immediately, I had a sinking sensation. By this time, I felt I was too far gone to stop, so I added what little throttle was left. By this time I was hitting small bushes, so I pulled up as sharply as possible without stalling. I felt a sharp thud on the aircraft and it slowed for an instant and sank a little, but kept flying. The aircraft picked up airspeed immediately and did not seem to lose power or vibrate."

The aircraft was flown to a



"I felt a sharp thud. . ."

nearby airfield and landed without further incident. Postflight inspection revealed major damage.

The L-20 instructor pilot for the unit was the first to land on the strip late that afternoon and this is what he had to say:

"On landing I noticed that the propeller of my aircraft was approximately 1 foot in thick weeds and I felt that a good 30 percent of the propeller efficiency would be lost because of the thick weeds approximately 4 feet high. One L-20 struck some trees during its landing approach, and another took three passes at the field to make a landing. The field was very tight to operate in. I informed my superiors that I felt the field was not safe for night operations. Visibility on the night of the accident was poor. It was dark with a light scud moving in and a light haze on the ground."

And here's what the company commander had to say:

"I did not consider the field safe for night operations and informed my superiors of this, and recommended the use of helicopters for a radio-relay mission that had been assigned to my company to support. I was informed that helicopters could not be used for the mission, that the mission had to go, and that my unit had this mission to begin at 2100. At this time, I felt that an experienced aviator could get an L-20 out of the field, provided he landed somewhere else. I felt this was the only aircraft capable of fulfilling the requirements of this mission."

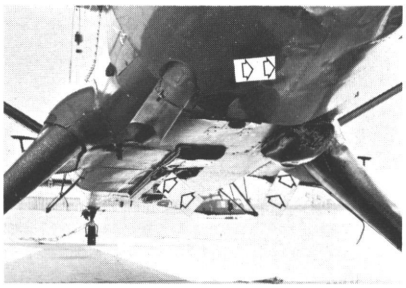
And there you have it — a hurry-up move to an inadequate field and complete disregard for the opinions of the unit's most experienced and qualified aviators. Thanks to dame fortune, the pine tree was only 4½ inches in diameter where it was hit. It could just as well have been a 3-foot thick oak!

HOW MUCH WARNING?

An Iroquois pilot, carrying three passengers and a crewchief, took off for a routine local flight. About 3 miles from the airfield, the master caution warning light came on, the low oil pressure red warning light came on, and the oil pressure gauge indicated zero.

The pilot made a forced landing and shut down the engine. He and the crewchief checked the engine area and could find no evidence of leaking. The engine was restarted and again no oil pressure was indicated in the cockpit. At this point, IT WAS ASSUMED THAT THE OIL PRESSURE GAUGE HAD MALFUNCTIONED!

The engine was shut down again and the pilot told the passengers to remain where he had landed and he would return to the airfield and pick up another helicopter to continue their trip. The engine was restarted and the pilot lifted the aircraft to about 20 feet where he heard a sharp noise. He immediately bottomed collective pitch and



Results of "sharp thud"

flared. During the flare, the tail stinger and tail rotor blades struck the ground, breaking the tail rotor and gear box free. The main rotor blades flexed down and chopped through the upper portion of the tail boom, severing the tail rotor control cables and No. 4 tail rotor drive shaft. The aircraft then leveled and settled to the ground, continuing forward until the left skid struck a depression and rolled the aircraft to the left. The main rotor blades struck the ground and tore the transmission free. It fell directly to the left of the fuselage with the rotor head and blades still attached. The aircraft then settled back to the right and came to rest upright.

The oil pump was removed from the engine and was found to have a sheared drive shaft. The drive shaft was sheared by pieces of bearing housing and small bearings jamming the rotating portion of the pump. Further inspection of the engine revealed excessive metal particles in the oil system and throughout the accessory drive section of the engine.

The question remains: How much warning? Do we need a Rube Goldberg invention to slap the pilot in a strait jacket once he gets the aircraft on the ground? Or do we need pilots who will accept the fact that something must be wrong when TWO warning lights go on and the oil pressure drops to zero?

It Could Happen to YOU

Captain Charles F. Koegel

THE OLD SAYING that we can learn a lot through "Hangar Flying" within aviation circles is certainly true. I have learned quite a few gems of wisdom by just listening to the old timers.

We also learn a lot about flying through our own experiences; some are quite routine, others, "hairy."

I would like to pass along one of my "hairy" ones, in the hopes that it may save someone from ending up with a wrecked chopper [or H-13, HU-1] and possible serious injury.

It happened during my initial checkout in the H-13. At the time our fueling facilities at this airfield consisted of two pumps set in concrete in front of operations, and surrounded on three sides by pierced steel planking. To be fueled, aircraft had to either taxi or hover up beside the pumps.

One day, after approximately 2 hours and 15 minutes of dual instruction, my instructor pilot stated that I was ready to solo, but that we would have to refuel the helicopter first. He took the controls, hovered into the fueling area, and set the helicopter down. During the refueling, we discussed the maneuvers which I had just completed. He said that since he weighed over 200 pounds, the helicopter would appear to be much heavier on my side when I flew it again solo.

The refueling over, I started the engine, and performed my runup in the same spot in which the IP had set it down. By this time the fueling area had become quite cluttered with aircraft, and rotor clearance was at a minimum. I pulled pitch to come to a hover and just as my IP had said, the right side came up first. Remembering what he had said, I didn't give it another thought. Three seconds later I realized that his absence was not the reason the right skid came up first, but that my left skid shoe was caught in the PSP, and that the helicopter was turning over.

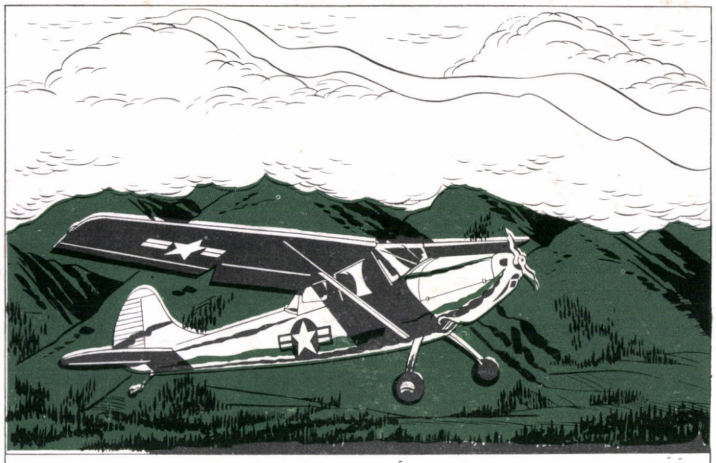
By this time I had full right cyclic control and went down with the pitch to try to set the helicopter down again, but the angle was so great that it continued to tip to the left. I pulled pitch to try to break away from the PSP (still with full right cyclic). At the same time, the skid shoe came loose. The helicopter left the ground almost on its side, and for awhile I had "A Tiger by the Tail." Only sheer luck kept me from hitting the fuel pump or another aircraft. After about 15 or 20 seconds, I got the machine under control again, and set it down with no damage or injury.

I have learned a few things from this experience:

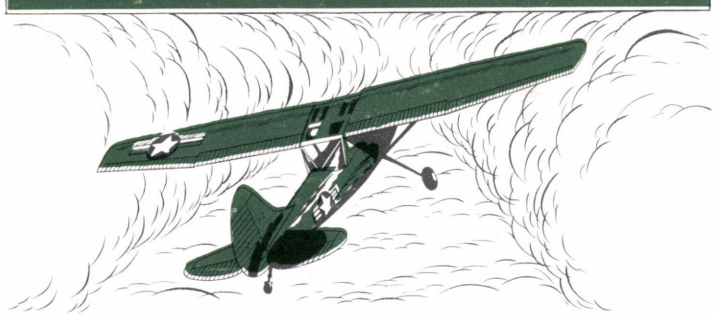
- Never "pull" a helicopter off the ground; slow and easy will do it.
- PSP is very dangerous if not anchored properly, and if loose should be avoided if at all possible with recon type helicopters.
- When in a confined area, leave room for the unexpected; when in doubt, put it on the wheels, and push it out first.

SUCKER HOLE

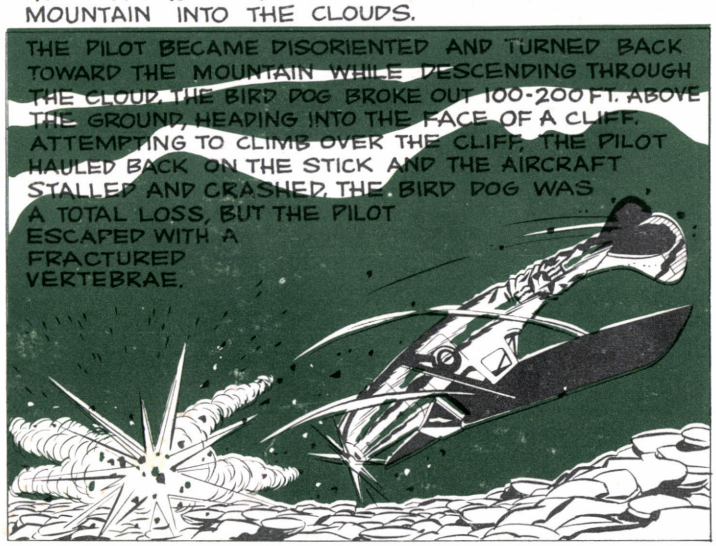
prepared by
THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

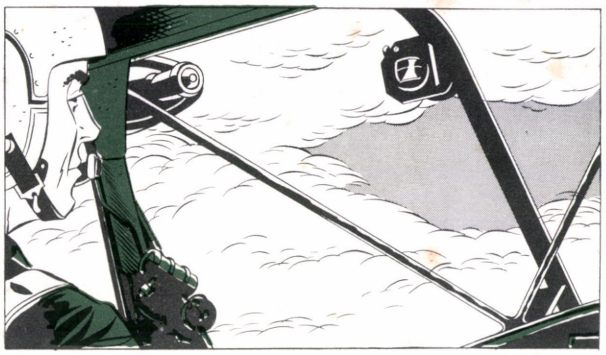


A BIRD DOG PILOT TOOK OFF FOR A LOCAL CLEARANCE VFR FLIGHT TO A DESTINATION ON THE OTHER SIDE OF A 13,000 FT. MOUNTAIN. THE WEATHER WAS OVERCAST TO THE EAST, SOUTH AND WEST, WITH BREAKS TOWARD THE NORTH.



HE CONTINUED CLIMBING THROUGH A CORRIDOR BETWEEN THE CLOUDS TO 12,000 FT. AT THIS POINT, HE NOTED A DROP IN RPM AND TURNED AWAY FROM THE MOUNTAIN INTO THE CLOUDS.





THE PILOT CLIMBED TO 8,500 FT., SPOTTED A PATCH OF BLUE THROUGH THE BREAKS TO THE NORTH AND BEGAN CLIMBING THROUGH IT, HOPING TO GET ON TOP.