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"eight's the rate for 58"

There can be only one goal in the flight safety business. That goal is an accident rate of ZERO. This goal is certainly elusive and some say we will never attain it. Granted that they might be right, that "Acts of God," so called, will always account for some mishap. There is still no valid reason for not trying. For we CAN eliminate those accidents which result from "acts of man."

With this in mind, the word has been passed that "Eight is the rate for '58." Scoffers will say that a reduction of that magnitude is an impossible task. And they will be right if each individual in the Air Force doesn't do his part in the day-to-day effort. One or two voices crying in the wilderness won't even hold the ground we have won so far.

Let's be more specific. Just what must we do to get the rate down? In the fighter business, for example, supposing that we fly approximately the same number of hours in 1958 as we did in 1957, we must have 266 less major fighter accidents Air Force-wide than we did last year.

Taking this a step further, this means that each fighter squadron in the Air Force must prevent 1.5 more accidents in 1958 than it did in 1957. Breaking it down this way, it doesn't sound so impossible, does it?

You might recall Col. Russell Schleeh's article, "The Best Squadron in the Air Force" in last month's issue. He pointed out that SAC once believed a rate of 25 was the irreducible minimum. Actual experiences showed them to be extremely pessimistic. Their accident rate continues to go down. In 1957 their major accident rate was 5.1.

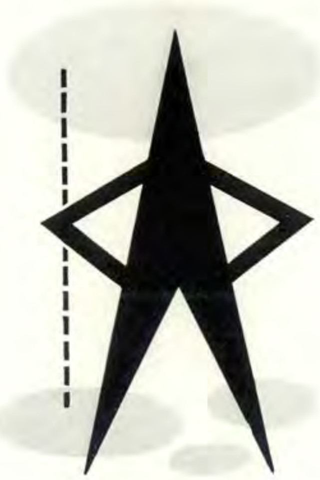
Naturally, each command and each unit has problems peculiar to its mission and type of aircraft. Some missions are inherently more hazardous than others but we believe any unit can substantially lower its accident rate.

Eight's the rate for '58!

Vernon R Stutts

Who... Watches the Wx?

. . . The Commander Air Weather Service



In common with others of the USAF team, the Air Weather Service is assigned a mission requiring worldwide operations. By its very nature, the problem of determining the present and predicting the future state of the atmosphere is of international scope.

As new and improved aircraft move from drawing board to airstrip, their greater speeds and higher altitudes require more accurate and more extensive knowledge of the atmosphere.

Not only must the Air Weather Service acquire new knowledge of the atmosphere but this knowledge must be delivered to the pilot in a readily usable form to fit his operational need when he needs it . . . and the pilot must know how to use this weather service.

In March 1958, the AWS was operating 300 numbered detachments with 113 of them overseas. Over 12,000 officers, airmen and civilians of the AWS operate weather centrals, forecast centers and weather stations in 30 countries of the world, for the express purpose of supporting USAF Flying and Flying Safety.

Within the pages of this issue and in following issues the various weather aspects of Flying Safety will be brought to you.

To assist you in translating weather service into Flying Safety and efficiency, the weather station at your base and at every Air Force base has people standing by. They are the "service" in Air Weather Service. Know your weather and your weather service to put safety in your flying.

Thomas S. Moorman, Jr.
Major General, USAF
Commander

Major General Thomas S. Moorman, Jr., Commander of the Air Weather Service, graduated from West Point in 1933 and received his pilot's wings in 1934. He received his Master of Science degree from the California Institute of Technology in 1938 and did further graduate work in Meteorology at the Massachusetts Institute of Technology in 1940. He assumed command of the Air Weather Service in 1954 and now has twenty years of U.S. Air Force weather service experience.

A. . . REVISE THE CURRENT AREA OF ADVISORY NO. 425 TO BE VALID CURRENTLY UNTIL MIDNIGHT GMT. THE AREA IS BOUNDED BY A LINE FROM 60 MILES SOUTHWEST OF CHICAGO, TO 50 MILES WEST OF GREEN BAY, WISCONSIN, TO 20 MILES NORTHEAST OF ALPENA, MICHIGAN, TO 60 MILES SOUTH SOUTHEAST OF SELFRIDGE AFB, AND BACK TO THE STARTING POINT. WITHIN THIS AREA, SCATTERED THUNDER AND HEAVY RAINSHOWERS WILL OCCUR WITH ¼ TO ½-INCH HAIL AT THE SURFACE. THERE WILL BE ISOLATED STORMS OF GREATER INTENSITY WITH ONE INCH HAIL AT THE SURFACE. WINDS WILL BE LOCALLY SW TO WNW, 35 KNOTS WITH ISOLATED GUSTS TO 65 KNOTS. SEVERE TURBULENCE WILL OCCUR ABOVE 5000 FEET MSL.

B. . . VALID TIME FROM 1700Z TO 0000Z. THE AREA IS ALONG AND 75 MILES EITHER SIDE OF AN AXIS FROM 50 MILES NORTH OF TULSA, OKLAHOMA, TO INDIANAPOLIS, INDIANA. THERE WILL BE SCATTERED THUNDERSTORMS WITH HEAVY RAINSHOWERS AND ¼ TO ½-INCH HAIL AT THE GROUND. ISOLATED SEVERE THUNDERSTORMS AND RAINSHOWERS WILL PRODUCE ONE-INCH HAIL AT THE SURFACE. WINDS LOCALLY WILL BE SW TO WNW, 35 KNOTS WITH ISOLATED GUSTS TO 55 KNOTS. SEVERE TURBULENCE WILL OCCUR ABOVE 5000 FEET MSL.

C. . . VALID TIME FROM 1800Z TO 0000Z. THE AREA IS ALONG AND 70 MILES EITHER SIDE OF AN AXIS FROM 50 MILES NORTH NORTHEAST OF MINNEAPOLIS TO DES MOINES. THERE WILL BE ISOLATED THUNDERSTORMS WITH HEAVY RAINSHOWERS AND ½ TO ¾-INCH HAIL AT THE GROUND. WINDS LOCALLY WILL BE NW, 30 KNOTS WITH ISOLATED GUSTS TO 50 KNOTS. SEVERE TUBULENCE WILL OCCUR ABOVE 7000 FEET MSL AND FUNNEL CLOUDS ALOFT ARE LIKELY.

Exactly what does the weatherman mean when he says "Severe Weather?" Well, sir, like the fella sez, "It all depends on how you look at it!"

For example, Mr. Webster sums it up this way:

"Se-vere: 1. Trying to one's power of endurance; hard to bear; rigorous. 2. Causing sharp pain or anguish; distressful; extreme. 3. Rigorous in the judgment, government or treatment of others; devoid of mildness; unsparing, sometimes, harsh or merciless, etc."

Anyone who has tangled with weather on the "severe" side will agree that Mr. Webster has touched all the bases, as it were. All of the definitions fit singularly, and on occasion, collectively.

Many a pilot—tired and tattered from having his head rattled around in the cockpit like a cue ball in a game of snooker—has stopped in at the weather station to leave a portion of his scrambled mind with the forecaster.

It is impossible to reproduce any of these one-sided conversations here, because, after all, some of our readers take the magazine home to show the kiddies. Suffice to say however, we can assure you that the conversation usually deals with non-notification of some "severe" weather.

A man will only take (can only take) so many of these friendly talks before he does something about it.

...Severe

The Air Weather Service found that it could reduce the number of these chats if it turned the job of finding the hairy ones over to a specilized unit. The Severe Weather Warning Center at Kansas City, Missouri, is that unit. It is organized and manned to provide warnings of severe thunderstorms for all continental bases and operations. It does this through the Severe Weather Advisories.

Let's look at what is in an advisory first and then see how it is put to use. For an example we have included a translation of an actual advisory as transmitted last June. The advisories are in four parts and they always contain the same type of information. (See left margin.)

Part A. General Information. This is a discussion of the thunderstorm forecast for the United States. While it is general in nature there is some really key information in this part. Specifically, the information on current and forecast locations of squall lines and zones of thunderstorms is of vital importance to the timing of local warnings and flight planning. A careful look at this information will add a great deal to the usefulness of the severe and tornado areas given later in the advisory.

Part B. Severe Weather Areas. This shows the areas in which the potentially most severe thunderstorms are expected. The boundaries are not magic lines which contain all the severe thunderstorms, so be careful when your flight is near a severe storm area. The expected weather in terms of gusts, hail and turbulence are indicated, along with the expected timing of this activity.

Part C. Tornado Areas. This contains the areas in which tornadoes are expected. Again, caution is called for, even though you are just outside the tornado area. In the example there is shown one of these areas.

Part D. Additional Information. This is the catch-all. A summary of reports received is frequently included to let the forecasters and pilots know how well or poor the forecast is verifying. Indications of expected developments beyond the time of the current advisory are added when possible. (Not shown.)

Now let's see how advisories are put to use. Your local forecaster applies the information in preparing local forecasts, route forecasts or briefings. He uses his own knowledge, the advisory and developments as reported by surface and radar observations to fill the gap between the area treatment given in the advisory and the details required by a local base forecast or the route forecast for your flight.

Suppose your flight were planned to depart Offutt Air Force Base at 1400 local time and arrive at Scott one hour later. Your destination is in severe weather area No. 2 and tornado area No. 2. The advisory was issued at 0930 local time, by 1300 some of the storms have become active and are reported on the hourly sequences, others are de-

Weather

veloping as indicated by cloud and radar reports. Details of what you are likely to encounter will be furnished you by the base forecaster.

The advisory tells him to warn you away from thunderstorms because of their severity. He, in turn, can tell you about where in your flight you may have to circumnavigate or perhaps where you will be able to do so and where the storms will be too close together to get around. And there is the terminal forecast: Will there be a storm over Scott on arrival? Should an alternate be chosen? What would be a good alternate, one to the north of the severe weather zone or one beyond it, south of Scott?

There is always the possibility of selecting another route. The advisory tells what areas are safe by limiting the severe weather areas. This area No. 2 could be circumnavigated to the northeast or to the southwest. The local forecaster can provide you with the weather on the two alternative routes and estimate the comparative hazards involved.

Of course, you may have taken off before the advisory was issued. Prior to 1 May 1957 there was a serious gap in the Severe Weather Warning Program. All to frequently aircraft would depart on a flight and subsequently a Severe Weather Advisory would be issued concerning the route or destination. Severe Weather Advisories were not available to the CAA Air Traffic Control facilities and the pilot was left to his own devices. The need was obvious.

The U. S. Weather Bureau and the Civil Aeronautics Administration agreed to use the Severe Weather Warnings in conjunction with the FAWS (Flight Advisory Weather Station) and INSAC (Interstate Airways Communications) systems to get the latest information to pilots in flight. The Severe Weather Advisories are used as the basis for Flash Advisories prepared by the FAWS Units.

The Flash Advisories are sent to the INSAC Stations where they are included in the scheduled weather broadcasts and are given to pilots when they contact the stations for normal air traffic control purposes. So if you did take off before the advisory, it is still available to you and can help you to arrive safely at your destination if you know what it is and will use it.

So far we have been treating the Severe Weather Advisories as if they were completely accurate descriptions of weather. But they are forecasts and we know that weather forecasts are not 100 per cent accurate. How good are these forecasts? They are pretty good as an examination of the figures in Table No. 1 will show. But the Severe Weather Warning Center thinks this can be improved and has a definite program to improve its product.

Locating dangerous storms up to 300 miles away and accurately measuring cloud heights, this AN/CPS-9 storm detector radar gives AWS important advance information on storms.

The program is concerned with two aspects of the work. First, the results of the past year are reviewed to find where and why forecasts were missed. Secondly, work is done on new methods of forecasting severe thunderstorms and their related phenomena.

With the decrease of severe weather activity in the fall, the Severe Weather Warning Center shifts a major part of its efforts toward product improvement. In fact, the opposite is true. The severe situations are few and far between, but they are dangerous because of this "lulled into security" aspect.

A quick look into the records shows many cases of thunderstorm and tornado devastation during the winter and a surprising number of hail and turbulence encounters in flight. The wintertime thunderstorm is dangerous from another point of view—speed of movement. The higher speed winds aloft during the winter move the thunderstorms at high speeds with extremely rapid changes in flying conditions. Even though thunderstorms aren't as frequent in winter as they are the rest of the year, they still occur and can make a pilot go back to all of Mr. Webster's definitions. ▲

The cover picture, shown here, was taken in South Dakota in 1884. It was the first tornado cloud to be photographed. It stayed in sight for more than two hours after being photographed. (Copyright by Library of Congress.)

TABLE I

Verification of Severe Weather Advisories

	No.	1956 Cumulative Per Cent	No.	1957 Jan.-May Cumulative Per Cent
Tornado Forecasts				
Areas Issued	247	....	190	....
Areas having tornadoes	165	67	148	78
Areas having tornadoes within 105 mi.	18	74	17	87
Areas having damaging WX.	37	89	15	95
Tornadoes reported	528	....	753	....
In valid area	342	65	606	81
Within 150 mi. of valid area	54	75	82	91
In a valid severe area	62	87	25	95
Severe Weather Forecasts				
Areas issued	755	....	341	....
Areas with gusts to 50 kts etc.	542	75	295	87
Thunderstorms only	161	97	39	97

During the period beginning 1 January 1956 and ending 31 December 1957, the Severe Weather Warning Center issued more than 1500 Advisories plus hundreds of unnumbered Outlooks for the continental United States.

We shall never know how many accidents were prevented and lives saved thereby. We know only that 43 inflight accidents took place within severe weather areas over these two years. Just seven of these accidents happened in unforecast severe weather areas.

Unfortunately, these figures indicate that 36 USAF pilots mistakenly believed they could engage in aerial combat with severe weather and win.

Wx Briefing

The booths are equipped with displays of weather maps and the latest sequences.

At Maxwell, the Base Weather Officer was faced with a difficult problem: How to brief adequately the large numbers of pilots filing out daily on DD Forms 175. Superimposed on fairly heavy transient traffic were the flights of students of the Air War College, the Command and Staff School, and the Squadron Officers' School, as well as staff officers assigned to Hq Air University, Hq Air Force Reserve Officers Training Center, staffs and faculties of the service schools, and officers assigned to the various units of the Air Base Wing.

Weather briefings for the 1800 to 2500 DD Form 175 clearances each month would have been relatively easy to provide, had takeoffs been evenly spaced. Unfortunately (and this is where our problem begins) the traffic load came in spurts, with rather slack periods in between.

The "spurts," as anyone who has flown much out of Maxwell is aware, were usually caused by the scheduling of students. The initial reaction, of course, was to try to schedule fewer students at a time. The large numbers of students (about 1500 among all three schools) made this impossible.

On the other hand, hopeless traffic snarls were occurring frequently at the Base Weather Station, causing tremendous frustration to both the pilots and the weather forecasters. The usual weather display was used—weather sequences posted on sequence display furniture along one wall and various facsimile maps along another of the same room.

On occasion, 30 pilots — or more—would fill this room to the bursting point while the harried forecasters, in attempting to brief pilots, would fight their way through the mass from weather sequence to weather sequence and from weather map to weather map. The confusion in such cases assured that weather briefings would be ineffective, that tempers would be edgy and that Maxwell would be long remembered and longer avoided!

Colonel Nicholas H. Chavasse, then Chief of Staff, Air Weather Service, came up with the following:

- Seat the pilot and the forecaster side by side in a semi-private booth to reduce interruptions to a minimum.
- Equip the booth with displays of weather maps and sequences.
- Position UHF Channel 13 (Pilot-to-Forecaster Service) microphone and speaker within arm's reach of the forecaster.
- Provide for some semblance of orderliness in the flow of pilots to the briefing forecasters.

This was done and the results were approved by over 90 per cent of the pilots assigned to Class of '57, Command and Staff School.

What are the advantages?

- The forecaster is assured of ready access to the latest weather maps and the latest weather sequences, having a copy of each map and sequence for his own use.
- The pilot is assured of a briefing at one location with no elbowing of other pilots in order to follow the forecaster from one briefing aid (maps, charts and weather sequences) to another.
- The forecaster has Channel 13 (Pilot-to-Forecaster Service) at his elbow, enabling him to converse immediately with any pilot who calls him. His convenient supply of current maps and weather sequences enables him to provide quickly any information a pilot may want.

In the writer's opinion, the system works quite well, although there are a number of detractors. Crowding near the forecasters' booths still occurs, but, in the words of those who saw it *before*, "That's no crowding. You should've been here before we got these booths." ▲

Interruptions are reduced to a minimum when pilot and forecaster sit together.

. . . the easy way

Maj. C. E. Lambert, Commander, 6th Wx Gp
Maxwell AFB, Alabama

Got the

How many times have you taken off, bright-eyed and bushy-tailed, only to land during bad weather and find the ceiling and visibility different from the weather report given you by the tower? If you are an average Air Force pilot, this has probably happened to you many times. Then you've walked away from base ops muttering about the quality of weather types in general, and the local yokel in particular.

Yet, if you have ever taken the time to check the ceiling and visibility as the weatherman saw them and as measured by the best instruments available, you've generally found (probably to your amazement) that the weatherman was right from *his point of view on the ground*. This is the crux of the whole problem: The groundbound weatherman's observation is not the same as what you see from the air.

This situation has become increasingly serious during the past few years, partly because operating minimums for landing aircraft have been cut to the bone and partly because of the increasing use of high performance aircraft. In the old days, if the pilot could see the runway from altitude, he landed. If he couldn't, he didn't!

Today, however, instrument landing aids can bring the pilot to a minimum altitude by which time he must have transitioned to visual reference. The pilot must know what altitude and at what distance from touchdown he can transition from instruments to visual reference.

The requirements of an all-weather

$S^2 = H^2 + V^2$. This is the "mathematical" computation of slant range visibility. Is it so?

Right *Slant*?

CWO John F. Gaillard, Hq 2d Weather Group, Langley AFB, Va.

Air Force, together with the problem of landing high-speed jets under marginal conditions, have increased the pressure on the weather observer to report ceiling and visibility more precisely. The demand to "Report the weather which the landing pilot will see!" is becoming ever more pressing. Unfortunately, this is not easy to do.

The problem is most acute when the sky is obscured by fog, rain or snow. Under such conditions, there is almost always a discrepancy between the official weather observation and the pilot's report. Why? Simply because the weather observer has no way of determining the slant range visibility when a surface-based obscuration is present, and because he cannot see what the pilot will see.

When the sky is obscured, the ceiling reported by the observer is the estimated vertical visibility upward into the obscuration. At this reported ceiling, the pilot should be able to see the ground directly below him. However, this is not the ceiling height which the pilot is interested in.

In the first place the pilot is not looking at the ground directly below him. He is flying down a sloping path and is interested in the visibility along that path.

Second, even if he makes vertical contact at the reported ceiling height, unless he is flying a whirly-bird, he is still on the gages and cannot complete a VFR approach from that altitude. The ceiling he will report is the altitude at which he first can see the ground at sufficient distance ahead of the aircraft to allow him to remain VFR throughout the remainder of his approach and landing.

Slant range visibility is defined as the distance from the pilot's eye to the farthest point on the ground, ground marker, approach or runway light, that he can see.

The altitude at which slant range is sufficient for the pilot to continue VFR and complete his approach and landing may be called the threshold contact height. As mentioned above, these are not the values of visibility and ceiling which are included in airways weather reports. Further, there are great difficulties in the way of translating airways weather reports into what the landing pilot sees.

The visibility through the atmosphere depends on a number of factors. Obviously, the characteristics of the atmosphere itself play a large part. Fog, precipitation, smoke, dust and haze all reduce visibility to some extent. Then too, the amount and distribution of light have a significant effect. Visibility is also affected by the kind of objects you are looking at or for.

You can't tell how far you can see unless you are looking at something. Finally, your own visual ability enters the picture. In the case of the pilot, this includes the effect of such factors as varying cockpit cut-off angles; the shape, size and slope of the windshield; the condition of the windshield; the degree of the pilot's adaptation to darkness, fatigue, and similar factors.

The first of these factors (the characteristics of the atmosphere) is meteorological in nature, and it is the weatherman's job to measure and report them. He even takes the second factor into account in his observations, but unfortunately there is no way that the weather observer on the ground can put himself in the pilot's seat and duplicate the pilot's view of the runway through the murk.

There is a great deal of difference between the horizontal visibility observed by a stationary observer on the ground and that observed by a tired flyboy peering down a sloping glidepath through a narrow, rain streaked windshield, while moving at "beau coup" knots down that path.

Anyone who has looked through a rain streaked window or has driven a car in the rain knows that everything appears blurred and distorted. This effect is even more marked in the case of the landing pilot. The most difficult viewing tasks for the pilot occur during his final approach and landing, especially at night. That's when he is dependent upon a pattern of lights which he must be able to see and interpret correctly. Any distortion of the lighting pattern will hinder the pilot's effort and may delay or even prevent his landing.

Visual difficulties arising from heavy rain can be assumed to result from the following factors:

- The rain in the atmosphere between the pilot and the lights.
- The layer of water on the windshield of the airplane.
- The effect of the airstream on the water on the windshield.

Rain in the atmosphere between the airplane and the lights will reduce visibility. In addition to the reduction in visual range, individual raindrops will cause scattering of light and tend to produce a halo around each light source. This condition is particularly apparent when the droplets become small enough to be classified as drizzle or fog rather than rain.

Distortion resulting from water flow over the windshield is caused by the varying thickness and non-uniform surface of the water. Refraction of light by the curved water surfaces distorts and partially obscures the images formed by the lights. This condition is magnified in a moving aircraft because the windshield intercepts a

Fog, precipitation, smoke, dust and haze all reduce visibility to some extent. Visibility also is affected by the kinds of objects you are looking at, or for. (See upper left.)

quantity of water that is nearly proportional to its forward speed.

The airstream blowing across the windshield during flight has two counteracting effects. The air motion tends to blow the water off the windshield, thus tending to prevent the formation of a thick layer of water.

With suitable flow lines, the airstream can even prevent some of the water from striking the windshield by deflecting the raindrops. However, the effect of the airstream on water which does reach the windshield is to produce streaks which reduce the uniformity of the layer of water on the windshield.

The overall effect of water in the atmosphere (fog, drizzle or rain) is both to reduce visual range and to distort the appearance of objects (particularly lighting patterns) within the visual range. It should be apparent by now that the weather observer's report will seldom coincide with the pilot's observation of ceiling visibility under obscuration conditions.

First, the weather observer can't get a visibility measurement along the glidepath because there is nothing to sight on. Even if he could, his measurement could differ from the pilot's visibility because of the opposite direction of sighting. The distribution of light up the glidepath will seldom be the same as the light distribution looking down the same path.

Second, the pilot's visibility is affected by the speed and structural characteristics of his aircraft. On the other hand, the weather observer and his instruments are stationary and his vision is not restricted by an inclosure. Thus, the visibility reported by an F-100 pilot would differ markedly from that reported by a C-47 pilot landing just ahead of him. Both probably will differ from the values reported by the weather observer.

Third, under obscuration conditions, the ceiling and visibility vary considerably from moment to moment and from point to point. For example, in a test conducted in 1950 at Washington National Airport, ceiling and visibility observations were made simultaneously from the terminal building and from a runway site 3000 feet away.

Ceiling observations between the two points varied by 100 feet or more in 61 per cent of the cases and by 300 feet or more in 12 per cent of the cases. Visibility observations varied by 1/8 mile or more in 70 per cent of the cases, and by 1/2 mile or more in 25 per cent of the cases. Thus, reported ceiling and visibility values depend largely on where the observer or the observing equipment is located.

Fourth, the ceiling and visibility vary just as much for the pilot as they do for the observer on the ground. The pilot is just moving too fast to notice it. The landing pilot is primarily concerned with seeing terrain details or objects near the runway. His ability to see these objects depends mainly on how much they stand out from the background.

When his windshield is swept by rain or coated by ice or snow, the pilot may not be able to see objects 100 feet away. This is true even though the actual visibility may be as much as two or three miles. Further, when he is tired or unfamiliar with the airport, his ability to see objects on the ground and know his distance from them is greatly reduced.

So much then for the problem of why the weather observer doesn't always "Report what the landing pilot will see." "Okay," you say, "so you've got a problem. What can be done about it?"

The problem, as the Air Weather Service sees it, is for the weather observer to duplicate as nearly as possible the situation in which a landing pilot finds himself and then to observe the ceiling and visibility in that situation. In order to accomplish this, each observing location has been surveyed and a site on the airfield selected where observations will be most representative of weather conditions for the airfield complex.

This chap's got the word. He's all lined up for "Eight for '58." How about you — all?

Air Weather Service is also locating a visibility measuring instrument (the transmissometer) and an improved ceiling measuring device (the rotating beam ceilometer) in the approach zone of the main instrument runway. Even with these improvements we still haven't exactly duplicated the pilot's situation.

Remember, we cannot slide these instruments down a 2½-degree glidepath to simulate the experience of a landing pilot. Also, we cannot adjust them for windshield obscurations, pilot fatigue or similar factors.

What these instruments will do is give an accurate, objective measurement of horizontal and vertical visibility in the approach zone of the instrument runway. In short, there are problems that the weatherman has not and probably never will solve.

There always will be variations between the report of the weather observer and the conditions experienced by the pilot. We are trying, by the use of properly sited, accurate instruments, to reduce these variations to the absolute minimum.

Is there anything that you — a pilot — can do to make up for these inherent limitations in weather observations?

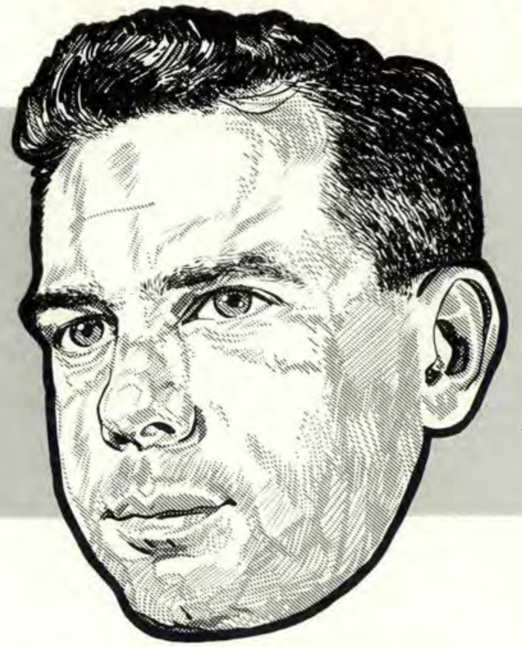
First, and most important, you should recognize these limitations and take them into account. When you hear such terms as "indefinite," "variable," "precipitation ceiling," or "obscured," be on guard for ceilings and visibilities lower than those reported. These words should start a flood of adrenalin; flash mental lights; make you wish you had left off those last four martinis last night.

In short, they mean, "Wake up, brother, approach zone and runway conditions are very changeable!" And the worse the weather, the greater the fluctuation.

When conditions approach landing minimums, the variations in ceiling and visibility are often of greater operational significance than the reported values.

So, any time the ceiling is reported as obscured, indefinite or precipitation, look out! You should expect to see the threshold at some altitude less than the reported ceiling, so be prepared to execute a missed approach. ▲

WELL ★ DONE



Captain

ROBERT C. KRAUS

357th Fighter-Interceptor Sq

Capt. Robert C. Kraus, Ops Officer for the 357th FIS, was flying an F-86D on a ferry mission from Hann to Nouasseur. His wingman was flying a T-Bird. They were cruising at 35,000 south of Sevilla, Spain, when the first surge occurred. A quick check revealed the trouble as zero oil pressure! Kraus reduced power to 98 per cent, switched to emergency "squawk" and then began comparing quickly the glide distances and distances to suitable emergency landing fields.

Over Gibralter the tachometer unwound to zero but no loss of tailpipe temperature or fuel pressure was indicated. Shortly thereafter, more surge occurred and finally, when he was 30 miles south of Tangiers, the engine flamed out. Airstart attempts were unsuccessful. He did some quick figuring and convinced himself that an attempted glide to Sidi Slimane (the nearest suitable military field) would end short by 40 miles.

The Tangier runway was listed to be 6900 feet, actually it was only 5736 at that time. Captain Kraus did a one-eighty and set up a flameout glide. Then he notified his wingman that he intended to land at Tangiers and was turning off his radio to conserve his battery.

With exceptional finesse and skill—aided by cool thinking—this fine pilot performed a perfect flameout pattern and landed on a short and unfamiliar runway, with no damage to his aircraft. Well Done, Capt. Kraus!

First Lieutenant

HAROLD E. WALLER

86th Fighter-Interceptor Sq

1st Lt. Harold E. Waller was on a cross-country from a Texas base to Davis-Monthan in Arizona. He had cleared 1000 "on top" and had just passed El Paso at 38,000, when he found it necessary to climb higher to clear the top of the undercast. As he passed through 41,000 feet, he heard and felt a loud explosion and severe vibration in the engine section.

He immediately turned back toward El Paso and in the turn, stop-cocked the throttle. He then transmitted "May-day" on Guard channel and placed his IFF on emergency. Contact was made with "Yonder" at Las Cruces and GCI control was used during his descent through the cloud cover.

At 10,000 feet, Lt. Waller was again in the clear and had Biggs Air Force Base in sight. A flameout landing was made with no further damage to his T-Bird.

Lt. Waller's decision to forego an attempt at an airstart proved to be wise. Examination of the plane by ground personnel at Biggs revealed a large hole in the side of the fuselage with a rapid fuel leak. An attempted airstart probably would have caused the engine to explode.

This is a heartening display of professional airmanship by one of our younger pilots. Excellent training is evident throughout this narrative. Well Done, Lt. Waller!

L-R-R-H

....OR ASSUMPTIONS CAN KILL YOU

Once upon a time there was a small doll by the name of Little Red Riding Hood. This name came about because of her proclivity for wearing red riding hoods as she drove around the forest primeval in her '58 T-Bird.

One day as she was heading for the home patch, she decided she'd pay a duty call on her old Granny, who lived just off the Hollywood Freeway. She hit the cloverleaf, did a 180, peeled off and screeched to a halt in front of Granny's eighteen-room hovel. (Needless to say — Granny was loaded!)

Unbeknownst to LRRH, Granny had been the honor guest at a banquet attended by one of the local wolves. Matter of fact, Granny had been the entree. The wolf, taking a nap after dining, as was his custom, was awakened by the sound of screeching tires.

He reached to the side of the bed, slipped into Granny's nightgown and donned her nightcap. Camouflaged thus, and concealed by the handknit quilt, the sly rascal feigned sleep, planning to convert LRRH to a frozen TV dinner, to be munched upon at his leisure.

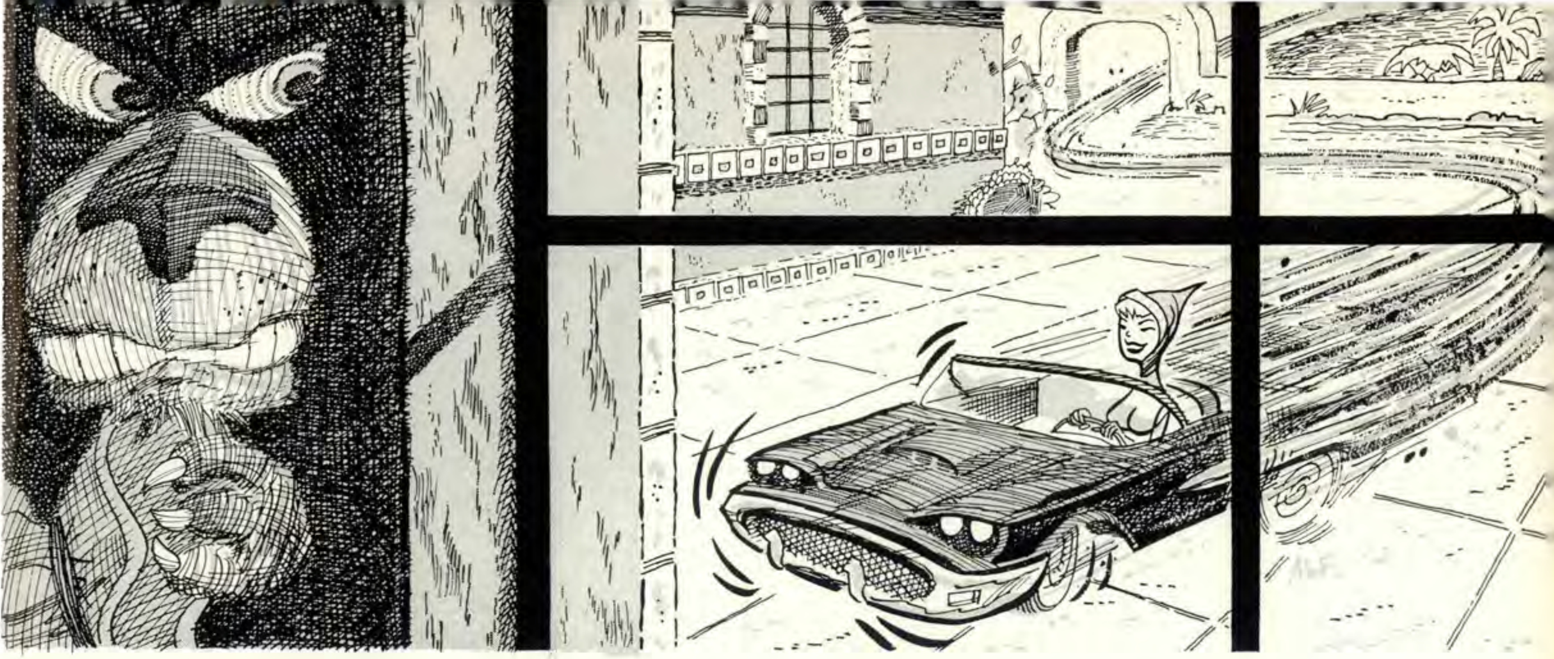
LRRH, being the shy, innocent Hollywood type, casually skipped into Granny's room. Since it appeared that Granny was catching a quick forty, LRRH reconnoitered the room for coin of the realm, of which Granny had much. She came up with nothing but a souvenir ash tray from the Chicago World's Fair, and a "Remember the Maine" button.

Piqued at her failure, she approached the sack and announced her arrival. The wolf opened one eye and LRRH told him she'd come a-visiting heavily-laden with a basket of goodies. The wolf allowed as how this was the best kind of visit and LRRH made herself comfy on a nearby *chaise longue*.

In response to a query as to the state of her health, Granny grunted that she was five-by-five in the health and welfare department.

The response was noted by LRRH to be in a voice that shouldn't be coming from a little old lady of 80. She assumed, however, that Granny had been taken by a touch of Asiatic Flu, causing a slight malfunction of the voice box.

Shrugging, she next commented on the red, beady eyes peering out from under the nightcap. The wolf denied sipping any cooking sherry and placed the primary blame on the smog. The wolf also allowed that he



was picking up the granddaughter on a 20-20 basis and what was better than that?

LRRH couldn't think of a thing. Fact of the matter is, LRRH wasn't too quick in the thinking department at all, as the next scene will illustrate.

LRRH started lifting goodies out of the basket and tossed a small pizza Granny's way. The taloned claw that reached for the tasty tidbit looked nothing like the wrinkled, work-worn hand of song and verse.

Her expression of childish amazement over Grandma's current manicure was easily countered by the wolf. He explained patiently that he had been forced to rinse out a few things, using—Heaven forbid—an old-fashioned detergent! He also explained that he had been biting his nails because of a slight nervous upset. He allowed as how a quick trip to the manicurist would put everything aright.

During the rather vociferous explanation, LRRH noticed that Granny's bridgework hadn't been turned out by Painless Pierpont, the friendly credit chopper-shaper.

"My! Granny, what big fangs you have. You didn't have them last time. Who's doing your work? And, by the way, Granny, speak to him about denture breath the next time, please!"

And that was the last ever spoken by LRRH, for, with a short leap, the wolf popped out of the pad and cuffed LRRH lustily about the head and shoulders, popped her into the freezer and popped back into the sack to contemplate his dastardly deed. (That was the part he liked best—contemplating!)

And so we come to the end of this admittedly ugly fable, and to our puzzled readers who may be curiously commenting that this story really gets you—down here—but has little or no bearing on Flying Safety. We beg to differ.

The demise of LRRH could have easily been averted, save for one factor: Her unfortunate habit of making assumptions. Viewed objectively from a safe stool, we would still be suffering with future adventures of the little monster were it not for her laissez-faire attitude. One assumption followed another and before you could say Jack Sputnikson, there she was, frozen stiff, even though adequate clues—both visual and aural—should have convinced her that Granny did not live there anymore.

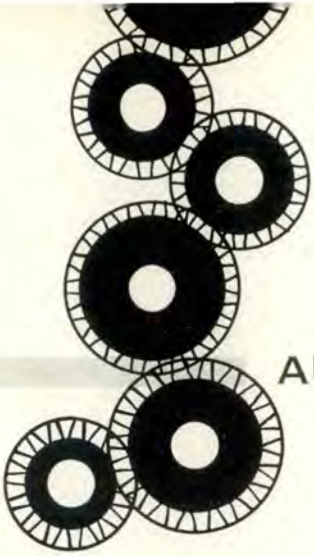
The precipitation ceiling, the indefinite ceiling, the obscuration, the variable visibility are all part of the same picture. If you assume that these clues don't mean anything, you too can become a vital statistic.

Further, if you assume that—

- You can land or take off with a thunderstorm overhead or nearby; or
- You can fly through a severe weather warning area IFR and without radar; or
- You don't have to obtain the latest terminal weather and forecast while en route; or
- You can penetrate in IFR conditions without a landing forecast; or
- Your cockpit visibility in precipitation will be the same for landing as reported from the ground, then, brother—

You're looking for trouble in exactly the same manner that LRRH did when she stuck her head in Granny's door, without adequate reconnaissance.

Elementary? Perhaps, but the majority of weather factor accidents in 1957 were caused by pilots making the above assumptions. ▲



Rube Goldberg, like Jules Verne, was 'way ahead of his time. He had automation reduced to its "simplest" terms 20 or more years ago. Remembering Rube's treatment, our artists show weather—the easy way.

AUTOMATION HITS THE WEATHER SERVICE

Maj. Harold A. Bedient, 9th Weather Group

In an Air Force of rocket missiles, jet aircraft and super electronic devices, any part of the service would feel left behind not to have some part in modern scientific advances. During the past three years, the Air Weather Service at Suitland, Maryland, has been participating in a jet-age development that reads right out of science fiction.

In the recent expansion of the Air Force from a domestic part of the Army to a modern global service the problems of the weatherman multiplied rapidly. He was forced to cope with more and more data. He was forced to forecast for unfamiliar areas. The time factor alone made his job impossible.

But science is beginning to catch up with some of the ills of the poor weatherman. Theoretical developments have been made in the field of meteorology which make it possible to handle weather patterns as one would handle a problem in aerodynamics.

The atmosphere is a thin layer of fluid covering the earth and if we know the motions in this layer today, and know the physical laws governing the fluid, we can predict the changes that will take place. Of course, since we know the state of the atmosphere today only imperfectly and since we have only an approximate knowledge of the governing laws, there still are important limitations.

One of these limitations always has been time, time to get out an operationally usable forecast before the weather data gets too old. All of the old meteorology masters have tried to think of ways to beat this.

You see, if you try to sum up atmospheric influences at hundreds of significant points in the Northern Hemisphere, you begin to use loads of manhours. Back in the 1920s an Englishman tried his hand at correlating all these points, mathematically and physically.

He concluded that it was an impossible task unless you could operate a large "weather factory" with about 64,000 employees. These men would be slide rule artists bound to a desk. They would constantly make computations and flash changing values that represented hundreds of points in the atmosphere. A director would harmonize the results like some atmospheric conductor.

The "weather factory," once so impractical, is being sired now by electronics. The giant calculating and memory machines that have been developed since World War II have made this possible.

In 1946 the late Dr. John von Neuman assembled a group of meteorologists in Princeton at the Institute of Advanced Study to prepare the problem for an experiment in the computer he was then building. The results of their experiments were so promising that in 1954 the Joint Numerical Weather Prediction Unit was established at Suitland.

This unit is the first of its kind in the world. It has the full use of a computer to explore numerical weather prediction on a daily basis. It is operated jointly by the Air Force, Navy and Weather Bureau services under the direction of the Joint Meteorological Committee of the Joint Chiefs of Staff.

Some idea of the speeds attained by these machines might be gained by a few figures. Machines available in 1953 computed runs at speeds of 20,000 additions per second. This is equivalent to adding up a column of 10 digit numbers written in normal handwriting on a sheet of paper 400 feet long, each second. At present, machines available are five to ten times that fast and capable of handling larger problems. Machines have been publicly announced that are expected to be 100 times as fast in effectively computing speed.

In the three years of operation of the NWPU the principal influence of the unit on the USAF has been indirect. All of the daily products are furnished to the National Weather Analysis Center where they are considered in preparation of the various "prognostic charts" (the basis of local weather forecasting) distributed on the national facsimile service. In addition, material is furnished directly to the facility at Suitland and to the various Air Force weather centrals and forecast centers.

Basically, the outputs experimented with so far are in the form of forecasts of the "large scale" wind and temperature distributions on levels from the surface of the ground to the tropopause. These quantities, together with the distribution of water vapor, are the fundamental building blocks of the "weather." Although the concept of "fronts" does not enter directly into the mechanics of the forecast, sharp wind shifts, strong temperature changes and areas of upward vertical motion often indirectly indicate where fronts should be expected.

Activity has been concentrated on improving forecasts of the above quantities during the existence of the Unit. Since the beginning, some of the effects of the mountains have been included. As mentioned earlier the changes at one point cannot be isolated from the changes at another point. So it has been necessary to continuously increase the size of the area over which the prediction is made. (New plans are under way to predict the whole Northern Hemisphere at once.) Other improvements are mainly in the mathematical approach since many things had to be done here for the first time and the first approaches were not always satisfactory.

For a period of about six months a prototype program was run which indicates what the numerical weather center of the future might be like. The incoming teletype data were automatically prepared for the computer—garbles, inconsistencies, errors and all. The computer picked out the usable reports, located them on the map, and meanwhile kept up a running commentary, on its attached printer, of things it was finding wrong with the data.

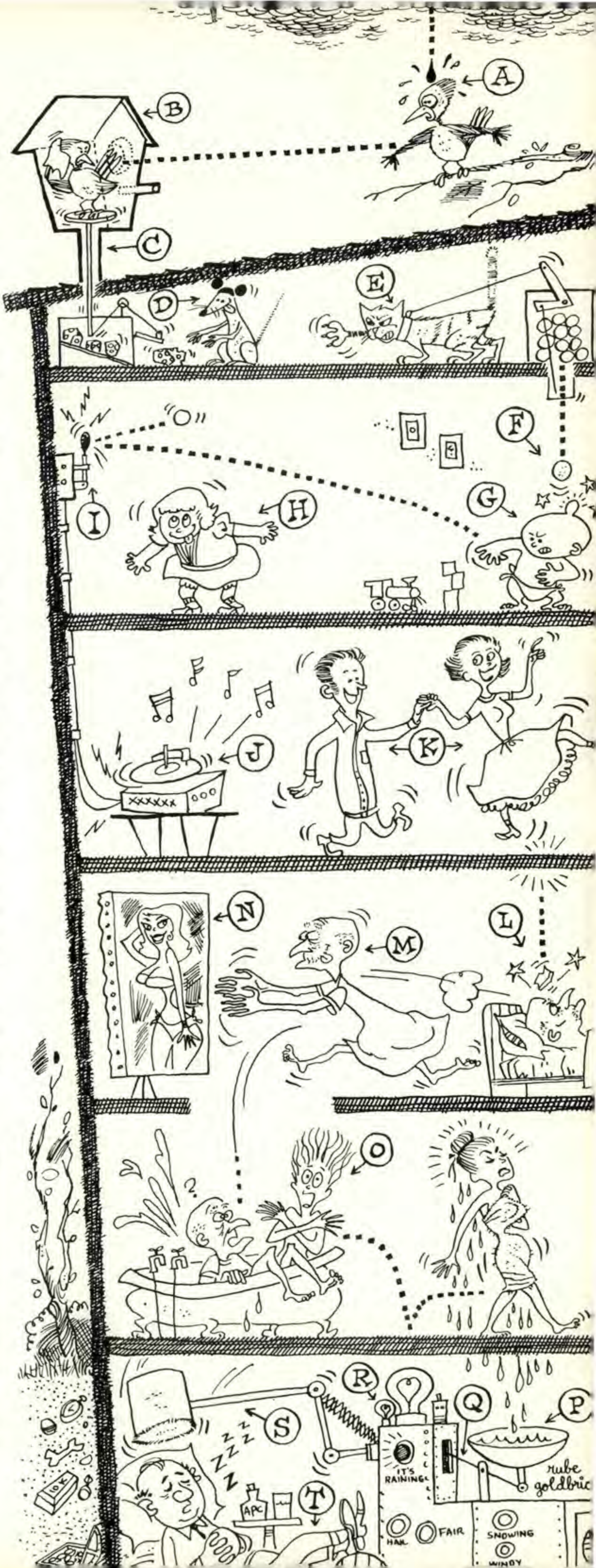
An analyst could look over this list of complaints and interrupt if he thought that things were being misinterpreted. The computer then digested this data and prepared graphical maps to inform the monitoring analyst of its conclusions about the initial distributions. It then would proceed to forecast, turning out from time to time maps of intermediate predictions.

When it was finished it would automatically prepare teletype message tapes, with the aid of auxiliary machines. So, without further treatment, the messages were all ready to transmit.

Some of the other projects that have been in development for preparation of directly usable material (in contrast to material requiring further treatment by conventional means) include:

- Experiments in forecasting the actual amounts of precipitation—here the results of the prediction of the wind fields are used directly while still in the computer to move the moisture field and predict where saturation, hence precipitation, must occur.
- Experiments in minimal flight planning—results of predictions of the wind field can be directly used to obtain exact solutions (within the limits of the forecast errors) of flight minimals including, if desirable, actual use of the attached printer to fill out the navigator's flight plan.
- Experiments in the tracking of hurricanes and other small sized phenomena. This could have wide application for the prediction of any small scale phenomena, such as atomic fallout clouds, which essentially move with the wind.

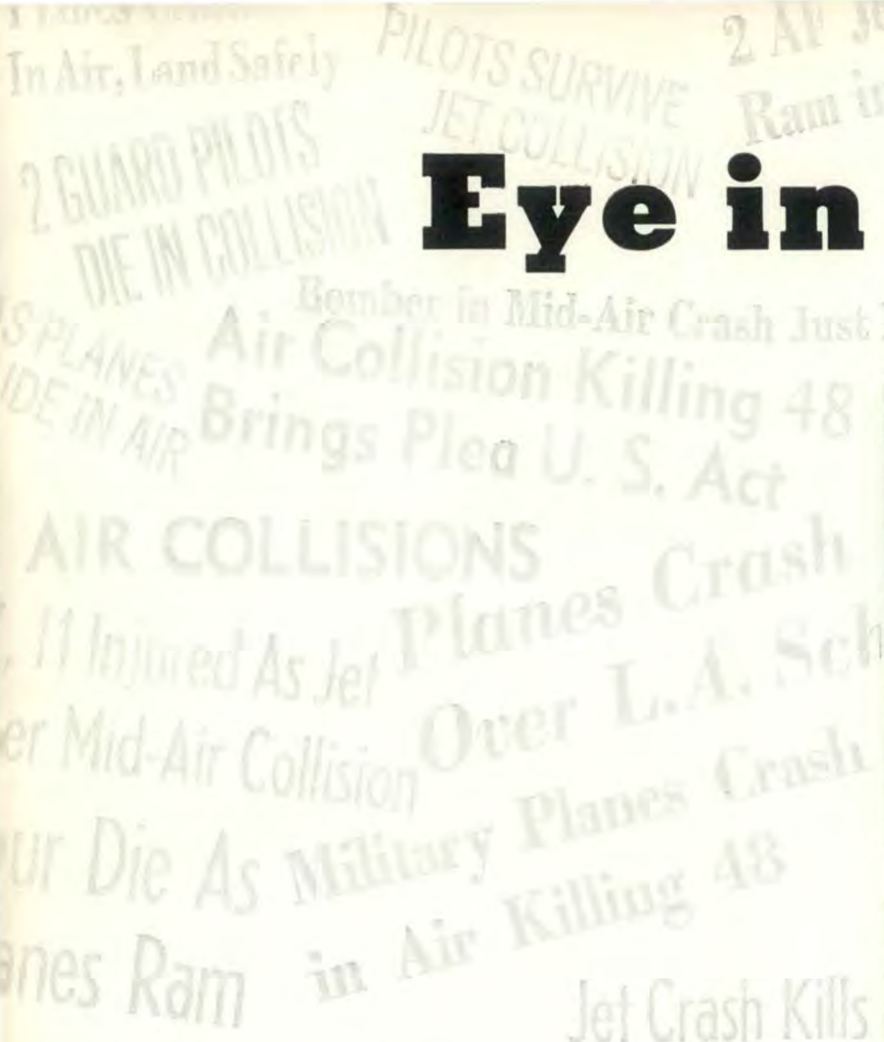
What is the outlook for the future? Will machines take over everything? Must you in the future push buttons to find out about that cross-country? Hardly likely. When you prepare for your flight or your operation in the future, you will still deal with your weather briefer or your consultant. However, he will have as his aid a constantly improving supply of pre-digested, scientifically prepared material which his training will enable him to adapt to your requirements. We hope that this will help him lose his harassed expression and contribute to the safety of flight. ▲



OPERATION OF AUTOMATIC WEATHER FORECASTING UNIT

Raindrops fall on bird (A) who flies into birdhouse (B), landing on perch, depressing plunger (C), releasing cheese to hungry rat (D). Cat (E) leaps toward rat, releasing lead ball (F) onto child (G) who throws ball at sister (H) striking electrical switch (I) starting phonograph (J). Dancers (K) knock plaster (L) onto sleeping grampa (M) who leaps up and runs toward painting (N) and falls through hole in floor into bathtub with bathing visitor (O) who jumps from tub, runs across leaky floor allowing water to drip into pan (P) depressing lever (Q) activating machine (R) which operates mallet (S) striking busy weatherman (T) informing him of local weather situation.

Eye in the Sky..



Dr. Walter F. Grether

(Ed. Note: This article originally appeared in the May 1957 issue of FLYING SAFETY. Since humans haven't changed a bit during the past year, and because the problem of mid-air collisions still exists, let's try it again.)

Whether you are the pilot, another crewmember or just a passenger, you probably feel safest when the weather is CAVU and visual flight rules are the order of the day. But there is one type of accident for which your chances go'way up when the weather is fair. That is the possibility of a mid-air collision.

IFR procedures are designed to keep you a safe distance from other aircraft. Under VFR you are depending on your visual powers and alertness for safe separation. Human vision is a remarkable and wonderful sense. But unfortunately it has certain weaknesses which make it unreliable as a collision warning device. This article describes the most important weaknesses of human vision as they relate to aircraft collisions. This information may help you to reduce your chances of colliding with another aircraft under VFR conditions.

Before digging into the subject of vision itself, let's take a closer look at the mid-air collision problem. Both military and civilian aviation groups have become increasingly alarmed about mid-air collisions and are working hard to find solutions. In November, 1955, the Civil Aeronautics Administration and the Illuminating Engineering Society jointly sponsored a symposium on mid-air collisions, held at Indianapolis, Indiana. From the papers presented at this symposium we can conclude that:

- Mid-air collisions and near-misses are on the increase because of increasing flight speeds and the density of aircraft traffic.
- Most collisions occur during daylight hours in VFR weather.
- A pilot may fail to see another aircraft on a collision course in time to avoid it, even though he is looking outside (rather than at his instruments) and visual conditions appear to be favorable.

It is obvious that a pilot cannot see an approaching aircraft if it is obscured by clouds or haze. Similarly, we cannot expect him to see an aircraft which overtakes from some other direction to which he is blind (above, below or behind a windshield post). But with clear air, daylight and an approaching aircraft not hidden by a blind spot, why can we not depend on the pilot's vision to detect the other aircraft in time to avoid a collision? In most cases, of course, one or both pilots will see the other aircraft in time to take evasive action. But there can be, and are, cases where even though the pilots in both planes are alert, their 20/20 vision is not good enough to avoid a collision. Let's see what there is about human vision which permits this to happen.

Seven Seconds

First, let's examine the question of how far away a

..AGAIN !

Aero-Med Lab. WADC

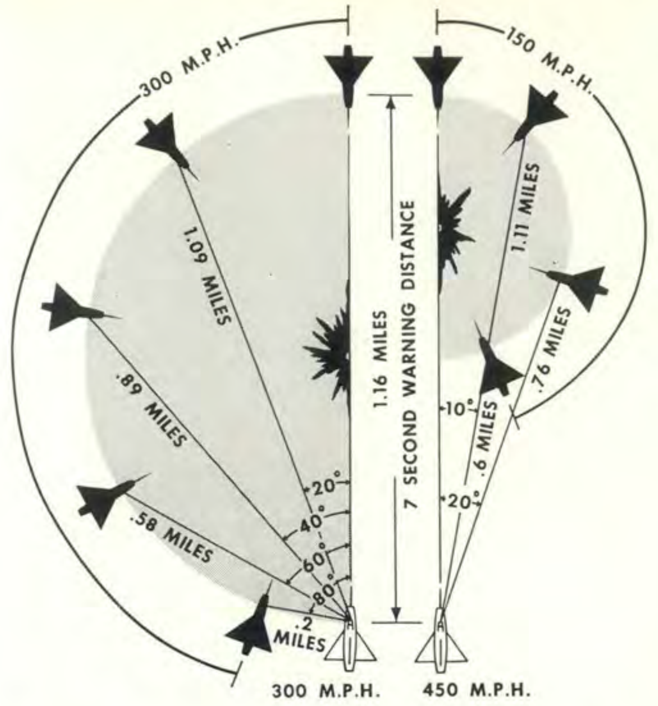


Figure 1. Distances at which other aircraft would appear seven seconds before inevitable collision for two-speed combinations shown.

pilot must detect another aircraft in order to avoid a collision. There is no easy or single answer to this question. The answer depends on several variable factors. There is a time lag for the pilot to make a decision.

There is further time lag for the aircraft to be displaced from the line of flight. Assuming we have a large aircraft, seven seconds is a rough but reasonable estimate for the combined pilot and aircraft lag. The other variables are the speeds of the two aircraft and the flightpath angles.

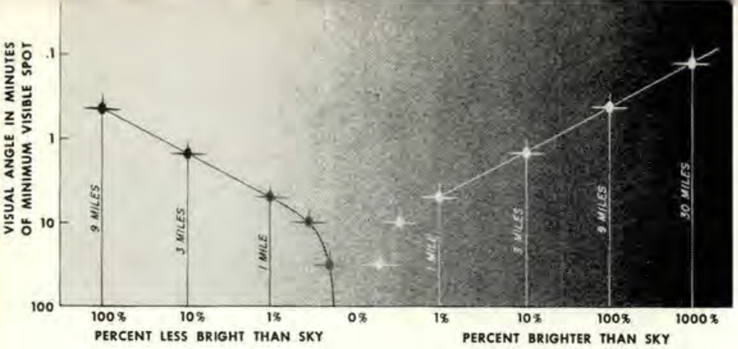
Distances between aircraft which will give seven seconds warning time are shown in Figure 1 for two speed combinations and a variety of flight path angles. Both speed combinations give a closing speed of 600 miles per hour for a head-on approach. At this rather conservative closing speed the head-on seven seconds warning distance is 1.16 miles. For many of our modern jets the closing speeds, and therefore the seven seconds warning distance, would be about double these values. Figure 1 further shows how the zone of greatest collision hazard changes with relative aircraft speed. The faster you fly, relative to other aircraft, the less you need worry about aircraft off to the side.

There are quite a number of factors which determine how far away a pilot can see another aircraft. Some of these factors are obvious and well known to pilots. Take size, for example. The larger the airplane the farther away you can see it. Even more important is the amount of daylight. In dim light, such as we have at dawn and dusk, aircraft are hard to see. At night we must rely on external lighting to make aircraft visible. Against the blackness of night external aircraft lights show up at a great distance and pretty well take care of the collision hazard. Against the brighter skies of dusk, dawn and daylight, however, external lights are much harder to see and are of little or no benefit for preventing collisions. Why aircraft visibility is increased by external lights at night but not in the daytime will be explained later. Some other obvious factors which cut down aircraft visibility are glare from the sun, dirty windshields and canopies and windshield angle in relation to the line of sight.

Visual Acuity

Seeing an aircraft is basically a problem in visual acuity. For an aircraft to be visible, its angular size (visual angle) must exceed the threshold angle for visual acuity. In this case we are talking only about visual acuity for seeing a spot against a uniform background. We call this minimum visible acuity as opposed to minimum separable acuity (which applies to the minimum gap the eye can resolve). As a rough rule of thumb we say that the threshold visual angle is about one minute of arc. This means that a round spot must have an angular size of one minute at the eye in order to be visible. At one mile distance, one minute of arc is 1.5 feet. As is so often the case, we encounter some difficulties when we try to translate this rule of thumb into size and distance for visibility of an approaching aircraft.

Aircraft aren't nice round spots and the size and shape depend upon the angle from which you see them. But let's say we have an aircraft with a 10-foot fuselage cross section, coming head-on. If we ignore the wings and tail, which add very little to visibility when seen head-on, we



come close to having a round spot. A ten-foot spot will give us a one-minute visual angle at about seven miles. Seven miles is about right for the maximum distance for spotting a small to medium size aircraft, such as a large fighter. For a large bomber viewed broadside, this distance may be more than doubled.

If we can see a fighter aircraft at seven miles, then why should we have a collision hazard under VFR conditions? The one minute of visual angle and seven-mile distance apply only when we have highly favorable conditions as follows:

- We have daylight lighting.
- The pilot's eyes are focused for distant vision.
- There is high brightness contrast between the aircraft and background (sky, clouds or earth).
- The pilot is looking directly at the other aircraft.

As we depart from the above conditions the threshold angle and visibility distance will change. Most changes will be in the direction of reduced visibility distance. Only conditions which increase contrast (such as glint from the sun and external lights at night) will increase the distance.

The need for daylight lighting conditions is obvious and well known. Visual acuity diminishes as the amount of light is reduced. At night we must rely on external lights to make aircraft visible.

Not so well known is the difficulty of the human eye in focusing for distant vision when looking into the sky. To focus for the proper distance, the eye needs sharply defined objects to focus on, which are lacking in a clear sky. This focusing difficulty is usually called "altitude myopia," since it results in the pilot being focused for near vision when he should be focused for distant vision to see other aircraft. When this occurs he will not detect aircraft at maximum distance even if all other conditions are favorable.

Contrast

Let us see how visual acuity and viewing distance are affected by contrast. The approximate realtionships are shown in Figure 2. By contrast we mean the brightness difference between a target spot and the background against which the spot appears. Normally, this difference is expressed as a percentage of the background brightness. If the spot is darker than the background, the contrast cannot exceed 100 per cent, and has a negative sign.

If the spot is brighter than the background, the contrast is positive in direction and approaches infinity as a limit. As will be seen on the graph, our rule of thumb of one minute visual angle holds only when contrast is at the highest point.

As contrast approaches zero the threshold visual angle becomes very large. At zero contrast the threshold angle becomes infinitely large, and the visibility distance for a target of fixed diameter becomes zero. As shown in the illustration the threshold visual angle becomes very small as high values of contrast are reached. In fact, the stars we see at night are effectively point sources, with no measurable visual angle.

Let's see now what kind of visual contrast values we can expect to meet when trying to see other aircraft for avoiding collisions. The background will either be earth, sky, clouds or haze, at or near the horizon. All of these may be relatively light or dark, depending upon weather, time of day, azimuth angle and other factors. Likewise, the brightness of the threatening aircraft can change through a considerable range. Likely as not the other aircraft will appear as a dark spot against a lighter background of haze.

If lighted by the sun the other aircraft may instead appear lighter than the background. Sometimes glint from the sun will make the aircraft appear as a very bright spot, visible at great distance. The main point is that under some conditions the aircraft and the background will have very nearly the same brightness. This condition of low contrast means very low visibility distance. Under some combinations of lighting conditions the visibility distance will be less than the 1.16 miles required to give a seven-seconds warning at 600 miles per hour closing speed.

There is another characteristic of human vision which is probably even more important in relation to the collision hazard. This is the reduced visual acuity in the periphery of the eye. In fact our threshold visual angle of one minute holds only for a few degrees at the very center of our visual field. Go out only ten degrees from the center of vision and the threshold angle has gone up to about 10 minutes of arc. At 30 degrees out the threshold angle is 'way up to about 30 minutes. Even this value is for high contrast. For lower contrast values the visual acuity becomes even poorer.

Viewing Angle

From Figure 3 we can see that the pilot will pick up another aircraft at maximum distance only if he happens

A detailed analysis was made of the conditions under which USAF-ANG mid-air collision accidents occurred during a six-and-one-half-year period. This evaluation indicated that almost 450 mid-air collisions were experienced during this time. This represents between five and six such accidents per month. This frequency dropped markedly during the last year considered. However the number of mid-air collisions has not declined commensurate with the number of major USAF accidents. Almost half of all mid-air collision accidents result in one or more fatalities.

Analysis of the conditions under which mid-air collision type accidents occurred indicated that the majority were occurring during contact conditions in daylight hours and within 20 miles of an airfield. The type of mission was not a critical factor. Faster aircraft in general were not overtaking and colliding with slower aircraft. The majority of the mid-air collisions occurred between aircraft of the same type and model. Only six mishaps were experienced which involved a USAF aircraft and a civilian plane; three of these

to look or fixate his eyes within a very few degrees of its position. In scanning the sky he may easily fail to look in the particular direction from which another aircraft is approaching. Each look or eye fixation normally takes about .5 second. At very high closing speeds this means a relatively few fixations between the time another plane could possibly be seen until it is too close to be avoided. It is easy to see that there is a considerable element of chance here as to whether a pilot will happen to look at the right place at the right time. Unless he does, another aircraft can sneak in close before he will see it. Even for very favorable contrast conditions the pilot must fixate within about five degrees of a target aircraft, of fighter size, to pick it up at our critical distance of 1.16 miles. The combined effects of low contrast and off center vision give us very poor visual acuity, to say the least.

From the foregoing, it is easy to see why a pilot's vision under VFR is not an adequate safeguard against mid-air collisions. Whether or not a pilot will see another aircraft in time to avoid it will depend on the particular light and contrast conditions and the way he scans the area ahead and to the sides.

were considered major accidents. Mid-air collisions which occurred during formation flying were primarily the result of faulty distance-rate-of-closure judgment on the part of the pilot.

Other mid-air collisions were usually the result of the pilot's inability to perceive a potential collision aircraft and to react in time to avoid contact. Violations were a negligible factor. It is believed that implementation of a multi-phase program should materially reduce the number of mid-air collisions. This includes more precise traffic control, particularly within 20 miles of an airfield, action aimed at increasing the conspicuity of aircraft such as the use of high intensity paints and high intensity anti-collision lights and expeditious action to determine the feasibility of a collision avoidance device and if found feasible, production and installation of such a device. It is considered that an effective mid-air collision avoidance program must involve cooperative action by all agencies concerned with the utilization of air space.

From the information about human vision presented here, what suggestions can we make for reducing the collision hazard through pilot scanning techniques, aircraft exterior points, lights or similar means?

Assuming that a pilot is alert and watching for other aircraft, there is not much more he can do, except to be sure that he makes good use of the time spent in scanning. He should scan systematically over the entire area from which threatening aircraft are most likely to come. Normally this will be the area fairly near the horizon. The distance he should scan on either side from dead ahead will depend somewhat on his own speed.

For very fast aircraft the greatest danger area is in a fairly narrow angle directly ahead. For slower aircraft the danger area extends much farther out to either side and includes the rear. The pilot should be careful to avoid spending too much time scanning a limited area, causing him to neglect other areas which should be covered.

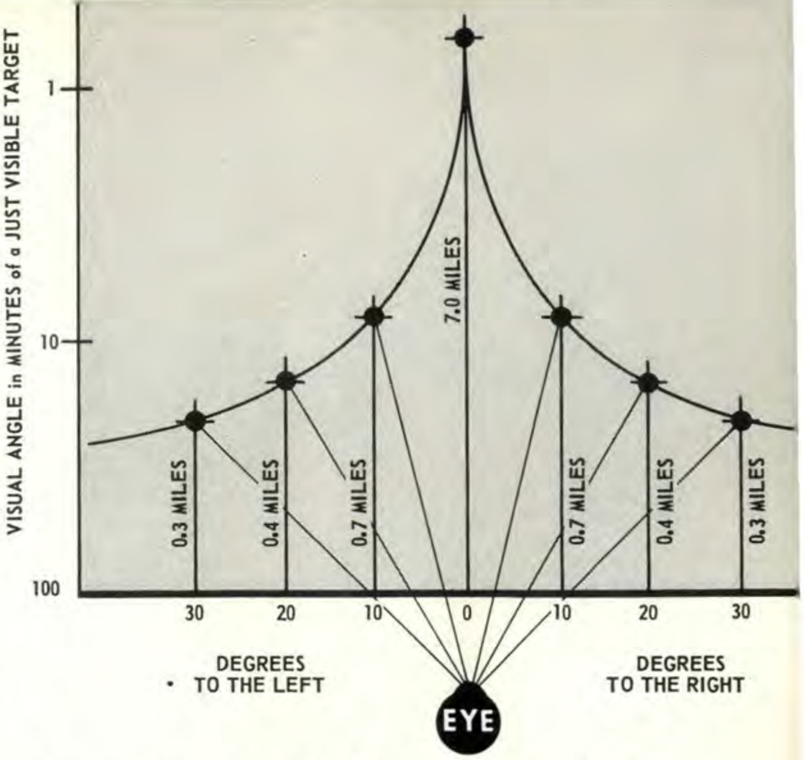


Figure 3. This is the effect of offset viewing angle on the detection distance for fighter size aircraft. Note minutes-mile ratio.

Although exterior painting of aircraft might be considered as one solution to VFR collisions, it actually has little to offer. Black paint would improve somewhat the visibility against light backgrounds, as would white paint against dark backgrounds. But for either the black or white there will be (as for natural aluminum) some conditions of light and background where the contrast (and hence the visibility distance) is too low for collision avoidance. Use of colors—such as red, orange or yellow—likewise would not offer sufficient gain to justify their use, since, at extreme distances, the color is not visible. Even at closer range the color may not be visible if the observer sees the shaded side of the aircraft. Under special conditions of low brightness contrast, there would be some improvement of visibility from the use of colors such as orange or neon (fluorescent) red. These colors show up better than aluminum against the blue of the sky. But the overall benefits of any possible exterior painting are rather minor.

External lights on aircraft, as already mentioned, can be seen at great distances at night. Especially with the new rotating beacon type of anti-collision lights there is very little problem about VFR collisions at night.

Can lights also solve the problem in the daytime? It doesn't seem likely. The intensities required for collision lights to give adequate collision warning in daylight appear to make this solution prohibitive.

In summary, then, the human eye has some basic limitations which make it unreliable as a collision warning device under daylight VFR conditions. Very little seems possible in the way of improvement of visual detection through new or changed equipment. A better understanding of these limitations should help to avoid the hazards of mid-air collisions. ▲

SCA

SECO

For a little more than a year now, you throttle-benders have been hearing a couple of new words coming from the mouths of the often-vague weather doctors.

You've been hearing the weather-engineer yell, "Where's that last SCAN?"

You wonder if they've invented another word to replace that hurried look out the window—sometimes called an "observation"—or if they are trying to replace the term "convergence aloft" as the excuse for everything that can't be explained.

You've overheard other under-the-breath dark mutterings, too, like, "Missing from the SCAN again—'be glad when we get SECO operating." You know a few short four-letter words yourself but none so unimpressive.

So hold your horsepower 'cause the answer will be buried somewhere in the jumble of the following statements of near-fact.

One of the prime functions of any weather service (including the USAF) is to provide accurate and timely weather observations. These observations influence decisions by both weather forecasters and pilots and are therefore essential for flying safety. The accuracy of the observation is continually stressed in the academic and practical training of weather observers. Almost equal in importance is its timely dissemination. It is in this area that SCAN and later SECO will pay the greatest dividends.

Eventually "automation"—that symbol of true push-button control—will almost completely eliminate the present observer of weather. Automatic observation instruments will read themselves and relay the readings to other automatic machines which instantly will transmit the observation to the user. In true science-fiction style, the pilot who wishes to be informed will be able to "read" the latest weather on dials in his aircraft-missile. Though this day is only a couple of corner-turns away, meanwhile—SCAN and SECO!

Until June 1956, the AWS weather observation was transmitted over long-lines as an "hourly" transmission. The complete surface weather observation was relayed via long-line teletype network to all receiving stations. In addition, during periods of lousy weather, special observations were transmitted as needed. As the vast network of observing stations increased, the demands for greater geographical area coverage also increased. It became more and more difficult to include in the transmissions all the weather information required for proper flight safety and planning.

Often local weather would deteriorate to a hazardous point, but because of the overloaded teletype circuits only local dissemination of the observation could be made. Other important weather information was likewise crowded off the circuits—pilot reports, radar reports, upper air data and similar operationally-useful information.

Clearly, some measures had to be taken, in the interests of aircraft operations and flying safety, which would provide additional time on the Air Force teletype network. One effective method to get more information transmitted in a given time is to speed up the rate of transmission. Prior to June 1956 our teletype equipment was tearing itself asunder at 75 words-per-minute on equipment designed to operate most efficiently at 60 wpm.

Since June 1956, our latest teletype equipment is capable of 100 wpm without faltering. (A glimpse into the future shows that equipment capable of 3000 wpm is not impossible!) But even the latest rate of 100 wpm could not gain sufficient transmission time to assure the reception of adequate weather information at all Air Force weather stations.

The concept of the "hourly" observation was studied. There seemed little or no operational need for hourly observations during periods of "good" weather. After considerable study, the plan adopted by AWS and put into operation on 5 June 1956, in the ZI, provided for the transmission of a complete hourly-type observation once every *three* hours. In order to provide transmission time for the special observations, corrected observations, severe weather radar reports and forecast amendments, the "20-minute Scan Program" was instituted.

Briefly, Scan provides central control of all weather teletype circuits comprising the Air Force network. Located at Tinker AFB, Oklahoma, the Weather Relay Center gives a teletype "roll-call" of all weather stations every 20 minutes. When a station's call letters appear on the roll, that station has two seconds to push the button that sends its weather onto the circuit. If nothing is transmitted, the Relay Center calls the next station in sequence. The completed roll call is the SCAN—since, by scanning the station listings, it is immediately evident which stations have had significant weather changes! Simple?

In practice for over a year, most of the bugs have been exterminated, but some inherent difficulties are built-in. The system requires forecasters to keep track of more pieces of paper. For example, a forecaster may have to thumb through as many as seven pieces of paper to be sure he's got the current weather. This procedure can slow up local utilization of weather information but the problem of getting the data *into* the weather station has been partially solved.

Initially, a few comments of a negative nature were received from pilots, especially when the pilot was performing self-briefing. In these instances, it has been a matter of education through flying safety and ground school lectures, through specific guidance for the individual pilots in the weather station or flight planning section, and finally, by training aids at the "Do-It-Yourself" console.

One of the bugs that just will not be exterminated is the "missing from transmission." As stated previously, the weather station has only two seconds to enter the "roll-call" with weather information. At stations remote from the Weather Relay Center, this time approaches *one* second!

Sometimes the observer responsible for the transmission gets the "fumbles" and misses his cue. At other times the press of abnormal station duties (usually his transmission during the SCAN periods will coincide with rapidly changing weather conditions) demands his presence elsewhere, and he misses a transmission. A solution to this problem is automatic transmission equipment—equipment which allows a remote control station to send the prepared transmission placed in a "ready" position at the local station. A name has been applied to this operation: SECO (Sequential Control Operations).

The use of SECO equipment has not yet started but it is expected soon and will provide a step toward complete automation of the weather observation.

Some of the advantages of SECO are obvious: freeing the observer from the teletype transmitter, positive control and faster transmissions. Not quite so obvious is the fact that under emergency conditions only those stations in the emergency area could be "chosen" to transmit weather information while the others could be "blacked out" until needed.

So, the next time you hear those unimpressive words SCAN and SECO, *do* try to be a little more impressed. Their purpose is to improve *your* flying safety. ▲

Cruise in

Archie D. Caldwell
Research & Analysis Div., DFSR

"Track Seven! Heading, two-four-zero. Eighty miles."

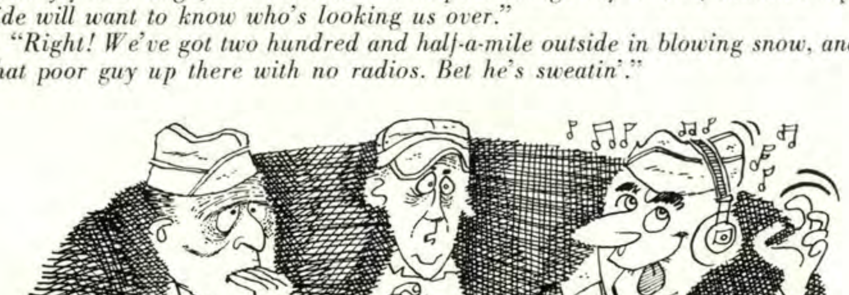
"That one is still unidentified. Could be that 'twenty-five' out of East Overshoot."

"ATC hasn't had a position report from him in over two hours. His radios probably are loused up."

"Yeah, you'd better alert the interceptor boys to move 'Gasmask Red' to a three-minute standby. Our bogey is heading straight for the prohibited area."

"Okay, but, brother, this is sure rotten weather to scramble in! If it's the 'twenty-five' though, he'll need all the help he can get. If it isn't, someone topside will want to know who's looking us over."

"Right! We've got two hundred and half-a-mile outside in blowing snow, and that poor guy up there with no radios. Bet he's sweatin'."



"Love me tender, love me long—nevver lay-yut me go-ah."

Captain Chauncey Zedock Chumley raised the earphone from his right ear and turned to his copilot.

"Not a bad song, what? Never think these radio compasses would pull in a radio station so far away, would ya'?"

"Nossir, Captain, but don't you think we might tune out Elvis long enough to try a range station in the area?"

"Say again your message."

"Figger we ought to try and get a range station. Dad always told me to know where I was and where I was going."

"Fret not, lad, fret not. Your Dad had a good point but you're ridin' with the world's best navigator. No sweat. 'Sides, ya' got a course check right after we took off."

"That's true, Captain, but that was four hours ago. And, the sergeant back there has had his Rosary out for the last half hour."

"Nothing to worry about, lad, however, I shall put his mind at rest."

Captain Chumley turned to the crew chief.

"Excellent machine, my boy, runs like a clock. Say, isn't this the same airplane you and I had when that fool parked the refueling unit where I couldn't see it?"

"Yessir, same aircraft, sir."

"Wouldn't even know it'd been scratched, would ya'?"

"We put a new wing on it, sir."

"Oh!"

"Yessir, took thirty-seven-hundred manhours."

"Thank you, sergeant, let's not discuss it any further."

Chumley turned back and peered into the murky, swirling night.

"What's the fuel situation, laddybuck?"

"These needles are bouncing 'round real good, Captain. Close as I can tell we got one-ten gallons in both front and rear mains. I figure that if we're on course we'll be on fumes on final."

"Never fear, friend, ol' C. Z. Chumley is at his best in the face of adversity."

Chumley turned.

"Sarge, did you fill all the tanks before we leaped off?"

"Yessir, Captain, filled 'em at oh-five-thirty. That was before you changed the oh-seven-hundred take-off to sixteen-thirty."

"Good work, Sarge. Just couldn't seem to get going this morning. Few words with the wife and all that. Bad night at the club too. Bad night indeed. Take over, lad, while ol' Chumley solves a minor problem in navigation. Hand me my Fac Chart."

"Gasmask Red off at two-three, heading one-seven zero-climbing to angels ten. Over."

"Roger, Gasmask Red, continue one-seven-zero to angels ten. Bogey now in prohibited area. Heading two-four-five. Bogey is ten o'clock, ninety miles. . . . Eleven o'clock, fifty, pass-

the Night

ing port to starboard. Bogey may be baker two-five. No radio. Now — twelve o'clock, eighteen, look up, look down. . . ."

"Roger, Gasmask Red one, tally-ho."

Chumley dropped the Fac Chart as if it were on fire.

"Did you see that fool? Those young whipper-snappers in those hopped-up fighters should be restricted to air shows. Bet that lad didn't even see me. . . . Hey! . . . What was that?"

"Left fan just stopped turning, Captain, and if I'm right, the right one's just about due. Yep, there it goes! Fuel gages must be off a little."

"Okay. Don't just stand there Sarge, let's leave this machine. After you."

"Thirty-seven-hundred manhours, thirty-seven-hundred hours."

"Jump! Sarge, 'less you want to get trampled by me and this lootenant here."

The nurse wasn't real pretty, but not bad, not bad at all. Chumley chewed reflectively on his thermometer. The nurse spoke.

"Lucky for you, Captain, the interceptor pilots followed your airplane down. The search party had a good idea where you'd be. The doctor figgers that you wouldn't have survived in just a flight suit and the low-cut shoes. It's well below freezing out there. Oh yes, Captain, you have a visitor. You may come in now, Colonel."

The nurse took the thermometer, glanced at it and left the room. Both men watched her leave. Chumley managed a weak smile.

"Good morning, sir, had a bit of trouble."

"Yes, Chumley, I'd say you had a bit of trouble. And you ain't seen nothin' yet! You pulled one darn fool stunt after the other. And, the unit is stuck with a big, fat prohibited area violation. What excuse do you have? And it'd better be good."

"There was a lot of weather, Colonel. I couldn't see where I was going. Got a few miles off course."

"A few miles? Chumley, the airway you were SUPPOSED to be on is exactly eighty-six miles distant from the point where the fighters jumped you. I have a copy of your one-seven-five, and it's going to take a lot of explaining. Your copilot and the crew chief filled me in on some other interesting details, too.

"To begin with, the alternates you listed were not within the fuel limits of your aircraft. The bases within the limits were at or forecast to go below minimums at your takeoff time. In short, you shouldn't have been permitted to get out of operations!"

"Sir, I'm my own clearing authority. . . ."

"Your own clearing authority does not give you the right to jeopardize the aircraft, the lives of your crew and maybe some civilians. Had you checked the NOTAMS you'd have seen that the field you cleared for was restricted to official business only.

"The copilot told me that you had guessed at a groundspeed of one-eighty-five. Had you checked the winds-aloft chart, EVEN YOU could have seen that the quartering headwinds would put you off course and cut your speed."

"The Fac Charts were wrong, Colonel, I swear it."

"Yes, Chumley, they were. We found your Fac Chart in the wreckage. It was marked, 'Personal, C. Z. Chumley.' It was also seventeen months old. You were trying to get frequencies that are now probably located in the Solomon Islands."

"I guess I didn't prepare too well, huh, Colonel?"

"PREPARE! Chumley, listen! Summer flying clothing in an area of known freezing temperatures. A flight planned to last for six hours with only one candy bar per person. No flashlight on a night flight. A flight chart that takes in half the United States in fourteen inches. Chumley, I'd like to kick you all over this room."

"That wouldn't do any good, sir. I've got a cast on."

"A cast? . . . Down there?"

"Yessir, the doc said he'd never seen one broken before. Said he put the cast on by guessing."

"Well, when you get that plaster parachute off, I'm going to send you down to base ops for a while. Then you're going to go back to instrument school. Might even have you put in charge of Fac Charts and NOTAMS. Yes, Chumley, you're going to be the busiest Captain in this Air Force. Then, mebbe we'll talk about getting back on Flying Status."

"But, I'll be out of the hospital in a little while, sir, no sweat on the flying status deal. The regs say. . . ."

"Chumley, the regs say a lot of things. Things that could let me hang you. Hang you by your stupid fat head. And I'll be thinking about 'em all the time 'til you get back."

"Sir?"

"Yes, Chumley?"

"The weather WAS pretty bad. . . ."

The door slammed shut. Chumley was alone with his thoughts. ▲

The

Without Weather Recon flights, the Big Weather picture would have many voids in it. The boys who "drive" the B-50s give us immeasurable help.

Maj. Charles G. Markham, Hq 1st Weather Wing

Forecasting is based upon the axiom that future weather depends upon present weather. To the initiate, this means that existing weather conditions must be observed in order to make a reliable prediction of future occurrence. (As Mickey Mantle would probably sum it up, "If you can't see 'em, you can't hit 'em."). Naturally, it follows that the more observations obtained, the better the forecast product.

Heretofore, certain areas of the Northern Hemisphere, such as the oceans and the Arctic, were unsuitable for locating weather observing sites, without getting the feet wet or frostbitten. However, when the USAF started to make this vast region its ball park, these problem areas had to be surmounted — particularly if we wanted to stay on the winning team.

Here is where the AWS Reconnaissance Program first entered the big picture and became a reality. Its objective was to obtain otherwise unavailable weather data by aircraft, in peace or in war.

Aircraft are well suited for use as weather observing platforms. Speed makes it possible to obtain data in the horizontal. Data in the vertical are also easily obtained, by altitude changes or by dropsonde (radiosonde instruments which record pressure, temperature and humidity, and are parachuted from high-flying aircraft rather than sent up by balloon from the surface).

The present contributions of AWS Pacific Reconnaissance is illustrated on the next page. The circles show areas within 200 miles of a regularly reporting radiosonde station. The value of 200 miles is used to establish the minimum acceptable density of upper air reporting points.

Meteorologists generally agree that no area can be much more than 200 miles from an upper air reporting point if the weather charts drawn from these reports are to be representative of the true conditions. If weather predictions are based upon erreneous analysis, the basic assumption of the forecast becomes invalid. Obviously, erroneous forecasts result. The areas pictured in color are those in which AWS weather reconnaissance provides the sole source of regular upper air observations. Reconnaissance provides the bulk of data in two critical areas, the area above 25 degrees north latitude, and the tropical Pacific westward from Kwajalein. The first area is important because it acts as a hemispheric weather control, and because weather approaches from there to continental North America. The second is important because it is the region of typhoon development and danger.

The preceding discussion has been on weather reconnaissance performed in times of peace. In war, strike routes must cross the oceans. Information from shipping would diminish or cease. The task of providing regular oceanic weather data is placed upon weather recon. No adequate forecast for a strike against an enemy could be made without weather recon.

In war, oceans are not the only places on the weather map that would be blank, were it not for weather recon. The other blank would be enemy territory itself. We now receive weather reports from most parts of the world. It is inconceivable that an enemy would continue to provide these when such information allows us to magnify the destruction heaped upon him.

So, if we want weather intelligence from enemy territory, we must go after it with our own aircraft. This is the mission of the weather reconnaissance forces of SAC and TAC. Both commands have weather recon units equipped with first-line aircraft ready to go if the need arises.

Weather recon has another function—that is hurricane and typhoon recon—which is important in both peace and war. The majority of these violent storms are born in areas which have no weather reporting stations. Further, as they gather strength and move forward, shipping runs to escape rough seas or possible destruction.

When hurricanes and typhoons move inland, they may destroy weather observing and communications equipment. Thus, the area nearest the storm, where the data requirement is most urgent, may be completely devoid of its usual weather reports. Weather recon provides the answer.

It has been proven that by using special techniques and well-trained crews, it is possible to penetrate hurricanes and typhoons with relatively little risk. For example, Typhoon Trix, which occurred during the period 2-16 May 1957, and for a time was of unusual intensity, was penetrated 41 times by the 54th Weather Recon Squadron, flying out of Guam. A total of 257 flying hours were expended on this one storm.

Data gathered from the flights were transmitted to weather stations, analyzed and typhoon forecasts issued. Military installations in the path of

Big Pic—Wx Recon

Pacific areas in which Air Weather Service Reconnaissance aircraft provide sole source of regular upper air observations are shown in green. Circles show Pacific areas within 200 nautical miles of a regularly reporting radiosonde station. USAF has made this vast region its "ball park."

this typhoon had warning in sufficient time to evacuate aircraft and to take other precautions.

The value of hurricane and typhoon reconnaissance is not only military, but civilian as well. The U. S. Weather Bureau forecasts issued on hurricanes approaching the Atlantic seaboard are based upon data gathered by AWS weather recon aircraft. Similarly, local weather services, including those in the Caribbean area, the Philippines and Japan use AWS recon reports as the basis for their hurricane and typhoon forecasts.

The U. S. Air Force profits from reconnaissance in yet another way—the training of aircrews. Weather recon requires unusual precision in flying skills. Takeoffs must be made on time. Altitudes must be held to within just a few feet for the entire flight. Navigation must be of pinpoint accuracy. After all, what good is a weather observation if its position is unknown? Missions are long and require exact cruise control procedures. All-weather flying becomes routine.

When crewmembers become proficient in these things and are later reassigned to one of the combat commands, these commands profit from the flying skills learned in weather flying. It is not uncommon to hear the Commander of a SAC bomb squadron state that weather recon trained pilots and navigators are among his very best.

In addition to crewmembers normally required to operate a four-engine bomber type aircraft, recon crews carry a fully qualified weather officer and a dropsonde operator. The function of the remainder of the crew, and of the squadron, is to get these individuals to the place of observation.

Air Weather Service has seven weather recon squadrons which together have a sustained capability of approximately eleven missions per day. Five of these units are involved in the Pacific Recon Net:

The 55th WRS at McClellan AFB, Calif., 58th WRS at Eielson AFB, Alaska, 57th in Hawaii, the 56th at Yakota, Japan, and the 54th at Andersen in Guam.

When hurricanes and typhoons move inland, communications suffer.

The other two units comprise the Atlantic Net: The 59th in Bermuda (the well known "Hurricane Hunters") and the 53rd located in England.

All AWS recon units are equipped with WB-50 aircraft. Conversion from WB-29s was completed in December, 1956. SAC's obsolete B-50s were modified for recon use. Turrets and bombing equipment were removed and weather equipment was added.

New equipment includes the AN/APN-82 automatic navigator, of particular value to this exact type of flying. In addition to refining the accuracy of navigation, it provides a continuous and instantaneous report of wind direction and velocity. Also added was improved equipment to measure pressure, temperature and humidity, and dropsonde equipment to gather data beneath the aircraft.

The missions are planned to average 14½ hours duration. They are approximately 3200 nautical miles in length. Flight is conducted at the 700-millibar level, 9882 feet; the 500-millibar level, 18,289 feet, and the 300-millibar level, 30,065 feet—with emphasis on 500 millibars. Complete weather observations are taken at intervals of 150 nautical miles, with special observations when conditions warrant. Dropsonde ejections are made on every third observation, at intervals of 450 nautical miles.

At the observation point, the weather observer measures the pressure, temperature and humidity and looks around to obtain visual data. If he can see the ocean, he reports the surface wind and state of the sea. He reports the types, bases and tops of clouds, visibility, icing, turbulence and precipitation.

The navigator provides a spot wind measurement, and a report of any existing weather radar echoes. The dropsonde operator makes his drop to obtain measurements of pressure, temperature and humidity below the aircraft. All data are then coded and passed to the radio operator for relay to the ground station. From here it is disseminated to forecast agencies.

Weather has great effect upon the ability of the Air Force to accomplish its global mission. Whether it is an advantage or a detriment depends upon our knowledge thereof. Weather reconnaissance, providing the knowledge, is a necessary and integral part of the United States Air Force. ▲

Splash Department

• briefs of accidents involving weather

Two F-86Ds were scheduled for a practice mission from a western base. The briefing indicated that weather would be deteriorating to near-minimum conditions toward the end of the mission.

One of the pilots had difficulty with his airplane and had to get another one for the flight. This put him 20 minutes behind the first airplane so he flew alone. The first '86 landed okay, but reported to the tower that weather was below GCA minimums. Two minutes later the second pilot reported over a radio fix 50 miles from home station and requested GCI-GCA recovery.

The supervisor on duty in GCI ops relayed a pilot report of $\frac{3}{4}$ mile visibility to the '86 pilot, and at the same time directed him to land at home base. Two bases were in range of the airplane and they had seven miles or better of visibility at the time.

The F-86D was handed over to GCA when he arrived at his home base. He followed GCA instructions until half a mile from the runway. He then deviated to the left and said that he was initiating a missed approach and was declaring an emergency since he was low on fuel. About one minute later, after making a 90-degree left turn, his '86 crashed and burned.

Investigation showed that the weather station did not issue a report stating that the weather was below minimums until 20 minutes *after* it was reported by a pilot on GCA approach. Although the weather had deteriorated very rapidly, sufficient information had been received by the weather station and GCI personnel from pilot reports to warrant closing the field.

Supervisory error was the primary cause of this one. However, the lack of adequate automatic weather reporting devices in the approach zone, and, of course, the rapidly deteriorating weather itself were contributing factors.

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A flight of two F-86s were scheduled recently to depart Base "D" in the PACAF area on a local operational training mission which would include actual weather flying. A forecast of thunderstorms after 1800 caused the pilots to reduce their time en route to one hour, departing at 1700. Time to alternate base "X" zero plus 10 hours; fuel, one plus 30.

Takeoff was at 1706. At altitude the flight established an estimated approach time at 1755, and proceeded without incident. Meanwhile, weather personnel noted a heavy rainshower approaching the home station and issued an Advisory to all agencies concerned, particularly intended for the '86 pilots as per previous arrangements. This Advisory was not transmitted. At least the pilots did not acknowledge it.

When the pilots did report to Approach Control at 1755 there was some confusion in instructions because of another flight penetrating. At any rate they didn't (or couldn't) initiate penetration until 1811. At 1814 they were advised by the leader of the flight which had just landed, to expedite approach because a heavy rainshower in the approach complex was moving toward the field. This information was acknowledged.

Penetration and GCA pickup were normal until about four miles out on final when heavy rain interfered with the precision scope. At 1824 all radar contact was lost at one mile. The pilots continued their low approach by intermittent visual references to runway. In attempting to position the flight for a safe landing, the wingman became separated from the flight leader.

While reorienting himself, his airplane flamed out. It crashed at 1835, and he was severely injured. One minute later the flight leader's airplane also flamed out during an extremely low pass but he was able to crash-land on the runway, suffering superficial injuries.

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This one was a classified mission, and as the B-57 was climbing, the pilot was notified that the flight was cancelled because of weather.

He asked for and was given altitude of 22,000 so he could burn out fuel before landing. He was on instruments at this altitude and noticed that he was picking up ice. He then asked for a different altitude. He was advised to climb to 30,000 feet or higher. He climbed at 98 per cent and 230 KIAS, and was at 25,000 feet when he saw a bright, orange flash and heard a muffled explosion in the right engine. The '57 yawed to the right and its right fire warning light was on "steady." The pilot lost control momentarily but believes that he recovered straight and level.

After shutting down the right engine and right generator, he noticed that the flight instruments were erratic and the altitude indicator "Off" flag was visible. Also, he noticed all inverter lights were "On," and when he switched to "Standby," the instrument inverter warning light just stayed on. As he prepared to fire the extinguisher for the right engine, he noticed that the left fire warning light was on "Steady."

He retarded the throttle for this engine, told the observer to jettison the canopy, and ordered him to eject. A few seconds later he heard the rear seat fire. Then he ejected at an estimated altitude of 18- to 20-thousand feet.

The most probable cause was engine icing which resulted in reduced airflow and subsequent turbine failure.

Site Unseen

'Way back in the rimfire days a weather observer was able to step out the door and easily check the weather elements in all directions from the weather station. As the years have passed, administration has caught up with the good old Air Corps! Buildings, hangars and what all have practically obliterated base ops and its companion function—the Weather Station.

In late years, if the observer has been able to see half the sky and horizon, he's been lucky. (And don't accuse him of not looking out the window, for very often his shop hasn't any windows.) This undesirable situation has led on occasion to weather observations that failed to note a sneaky bank of fog or some "cumulus obnoxious" moving in.

In addition to this, the observer's duties inside the weather station have increased to a point where he has been unable to spare the time for more than a quick check of the weather situation. Teletypes now run faster with consequently greater output of weather data to be monitored and posted. The facsimile machine requires almost constant attention to insure that no maps from the big-brain repository in Washington are missed. The observer monitors inbound jet aircraft to advise the forecaster so that a terminal meteorological watch may be performed.

And last, but a long way from least, people have become conscious of the fact that there *is* a weather service. The telephone rings a great deal—particularly during bad weather—and it is during bad weather that the observer constantly must be on the alert for weather changes.

We frustrated weather watchers will gladly concede that a cozy apartment in the old bastille might provide as good an outlook as the present arrangement, but let me assure you that we have not been complacent about the situation. Our first attempt at doing something about this was our Runway Observation Program.

In brief, this involved stationing an observer at the approach end of the active runway where he could get an unrestricted view of the approach zone. This program was only partially successful, mainly because the observer had little instrumentation beyond his everloving eyeballs. In most cases he was so exposed to the elements that he became downright unhappy in bad weather.

In addition, this took an extra observer per shift and when you have only one observer per shift, he has an understandable reluctance to cut himself in half so that he can operate in both locations.

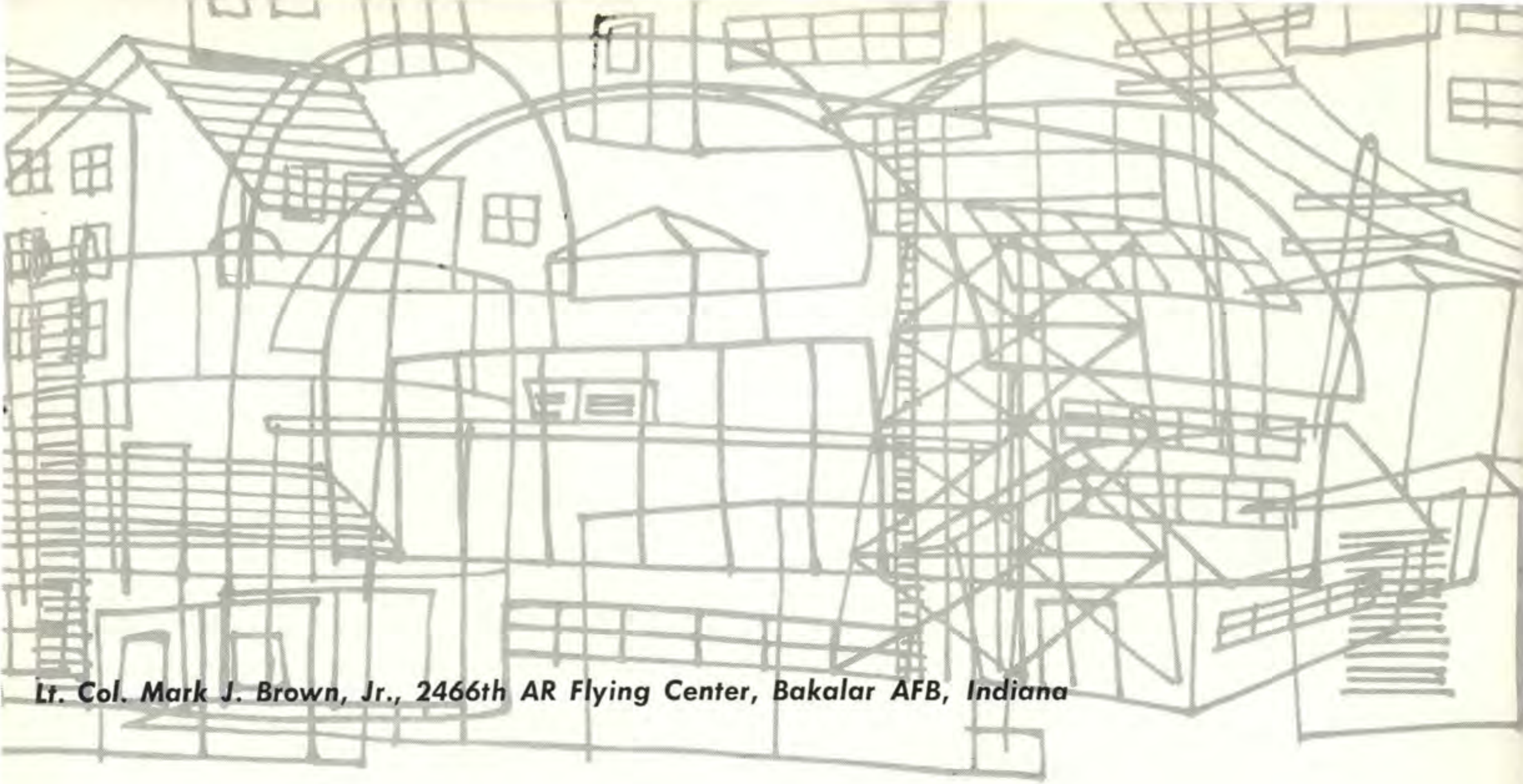
About three years ago a comprehensive program began to take shape which we now refer to as our Representative Observation Site Program or "continuous Weather Watch." The concept of this program is to station an observer with full instrumentation 24 hours a day at a location where he can see the entire horizon and particularly the approach zone. When this program is completed, it will provide an observation that is not only current but also completely representative of the weather conditions surrounding the airport including the approach zone, within the limits imposed by our measuring equipment.

Currency of the observation is guaranteed by the fact that this observer will have no duties other than watching the weather.

There is one small point; this ain't gonna happen tomorrow. As any "planner-type" knows, it will take time, money, equipment and personnel to make this program fully operational. Money is the most important, since we must relocate much of our present observing equipment to the chosen spot. In many cases we must build or renovate existing structures to support the program.

We need people to man these sites since we must still keep an observer in the weather station to handle all the duties mentioned above. It is not a question of personnel authorization since the "head shed" has bought the plan. It is a question of bodies.

Each U. S. Air Force Base throughout the world has been surveyed to determine the best location for this representative observation site. Base Commanders and



Lt. Col. Mark J. Brown, Jr., 2466th AR Flying Center, Bakalar AFB, Indiana

Major Air Commanders have bought the program and are now programming necessary funds and construction. In a great many cases the site will be in the active control tower.

This then gives us a couple of bonuses. Pilots can always get the very latest weather observation from the control tower since the weather observer will be in the same location. In addition, the observer will be on deck to receive and handle your pilot reports. You can be sure that any pilot reports you are kind enough to furnish the weather people, will not get lost in communications channels.

Okay. We know what we want and we have done the planning necessary to get it, but the complete implementation of this is still well in the future. The next question is, what can we do *now* to at least partially fulfill the requirement? Our answer is a recent program on a semi-crash basis where we spread our present observer strength even thinner and put observers in towers or other interim sites to assist us in getting a representative observation.

For the most part, equipment they do not have, but they do have the time and opportunity to maintain a continuous weather watch. They also have the training to interpret what they see. Almost all of our bases are at some stage in this crash program. Many of them have these interim sites manned 24 hours a day while others are manned only when certain weather conditions are forecast or observed.

For example, a weather station which does not have enough observers to station a man in the representative site 24 hours a day will put him there at weather values of 1000 feet ceiling and 3 miles visibility, or 2000 and 3, 5000 and 5, and so on. As rapidly as more observers are assigned to that station, these values will be raised until the time when the observer can be continuously stationed in the site.

This then is our program, but there is even more pie-in-the-sky. Continuous research goes on to design and produce better weather observing equipment. Some of the gadgets that were dreamed up some years back are now realities and other are beginning to come off the production line.

We have new wind equipment which is more accurate and which is located to give us the wind you will find on flareout rather than the wind on top of the tower. We have CPS-9 radar sets strategically located throughout the world which have a tremendous weather detection capability. We are beginning to get transmissometers which will give us an electronic visibility measuring capability rather than a pair of red eyes peering subjectively through the murk.

In a year or so we expect to receive our Rotating Beam Ceilometer which is essentially the same as our present ceilometer except that we can get a definite ceiling measurement every six seconds rather than two every 12 minutes as is now the case. There is other equipment including a radar-type gimmick to give us instantaneous reports of cloud bases and tops as well as the clear spaces between the layers.

We expect eventually to have an automatic capability for making weather observations. At that time the observer may have to crank in one or two items but good old electronics will make most of our measurements automatically.

We think that our program is a good one but don't postpone your weekend cross-country, waiting for it to be completed. It is on the way and some of the benefits are already being realized. We feel the weather observations being made now are far superior to those made a few short years ago.

We are even making some progress on the twin bugaboos of slant range visibility and ragged ceilings. As time passes and the program advances, more gains will be made until we have a weather measuring and reporting capability which is consonant with the needs of our modern jet Air Force. ▲

CROSS FEED
LETTERS TO THE EDITOR

PILOTzer Award, 1958

First, I want to nominate the two articles entitled "The Lady Speaks" and "Death by Degrees," (Feb. 1958) for the PILOTzer Prize for 1958 (if there is such an award).

Second, I'd like your permission to reprint your article, "The Lady Speaks" for inclusion in our Regional Newsletter published monthly by our office for distribution throughout our seven-State area. I will include your "Ed Note" comments, however, I intend to add a footnote to explain such things as RSDU, GCI, Gooney Bird, and so on. Some terms such as flyboy, Great Man, manly bosom, and friend husband are self-explanatory.

The article "Death by Degrees" brings to mind an accident in Europe in 1954 which followed a similar pattern to the identical ending. Many theories were followed, however, I still believe the accident resulted from someone's reading the Facility Chart wrong. Actually, it was read all right, the correct heading was followed but one turn too early. Result: One each C-47 with crew and passengers splattered all over the ALPS instead of landing safely in Bavaria. Incidentally, as far as I can determine my theory never was considered.

Keep up the good work. From where I sit, it looks like FLYING SAFETY is off to a roaring start for 1958.

Major William E. Burgin, USAF
Asst. Liaison Officer
AF-CAP, North Central Region
Minneapolis-St. Paul Int'l.

Thank you, Major Burgin. Be our guest.

★ ★ ★

Belgian Air Force Weatherman

I am chief of the meterological station of the Belgian Air Force Weather Service at Kamina (Belgian Congo) and an assiduous reader of your "Flying Safety."

In order to maintain and develop the "safety" mind considering the meterological phenomena, I should be very grateful if you could send me some photos or placards which could be posted on the walls of the briefing room and the Met Office: photos of typical clouds with or without aircraft, or placards which give the dangers of the isolated cumulonimbus, thunderstorms, frontal clouds or the best procedure to fly through dangerous clouds.

Lt. Rousseau R.
Kamina Base I
Belgian Congo, Africa

Glad to send you what we can. Sure good to know our magazine enjoys such a far-flung audience.

Wing KARUP

Recently I became Flying Safety Officer for Wing KARUP, Royal Danish Air Force. At this base we are still flying the good old F-84G but it is not possible for me to find any old copies of your "Flying Safety Magazine" dealing with our type of bird. As I am not the type who grasps the ideas right out of the air, I ask you—if at all possible—to help me with some back issues of your magazine. If you have any and are able to forward them to me, I should be very grateful.

M. Vikstrom
FSO, 1/Lt
Wing KARUP
Kolvraa, Denmark

Back issues of FLYING SAFETY *are scarce these days; however, we just happened to have spares which contain articles about '84 aircraft. Copies of the Feb '54, Jan. '55 and Sept '55 issues have been mailed.*

★ ★ ★

Feeding the Super-Hog

I refer to your "Splash" Department (F-84F Accident) in the September issue. In this case a ground refueling switch was left pulled after refueling and was missed on walk-around by the pilot. This accident probably could have been averted if the following cockpit procedure had been followed:

- Pressurize the external tank or tanks to be fed.
- Pull the circuit breaker entitled IFR Test & Fuel Shut Off (AR Test & Fuel Shut Oc on -61 RE aircraft and later). This CB is located in the panel by the pilot's right leg and is the fourth one from the front in the top row of vertically placed CBs.

This procedure is applicable only to '84Fs with single point refueling capabilities and undoubtedly most Super Hog drivers are aware of it but since no mention is made of it in the Dash One, maybe for the famous 10 per cent, it wouldn't hurt to repeat it. * * *

Lt. John L. Wagner
IP, 3605th CCTS, Luke AFB.

Famous or infamous, we agree. It probably won't hurt.

★ ★ ★

Chain of Events

Have read with interest your "Chain of Events" story in the October issue which concerns a fatal T-Bird accident.

Recently I've read several articles about pilot error accidents and note particularly the catch-all manner in which this phrase ("pilot error") is handed out.

The "Chain of Events" narrative seems to me a perfect example of unjustified pilot error, from a pilot's point of view.

First of all—in the past a pilot was on his honor to check the en route and destination weather. However, experience proved to the powers that be that this wasn't practical, so weather information was made mandatory on the Form 175 before clearance is signed. Also, a flight log is required. Why not require a complete test booklet covering en route, destination, and alternate facilities?

Having been an airline pilot, I know first hand that every pilot is required to complete a "route exam" on every route he flies. This, besides a flight check over the route. The airlines have found this necessary to insure a completely safe flight for its passengers and its expensive equipment.

I realize this recommendation would not be popular; however, Air Force jets are expensive and cross-country flights are supposed to build proficiency in airways and cross-country procedures. This questionnaire would consume some time but it would help the Air Force insure a safe flight and pilot proficiency.

When the radio compass needle indicated 80 degrees off track, why didn't the T-33 pilots try loop and antenna? Chances are they had not used either since their last 60-4 check and just plain didn't think of it.

Why didn't they know to contact GCI before continuing their letdown? Why didn't they know of the DF station in the area and the lack of one at their destination? Why didn't they think to try flying the beam or using the aural null?

I say it is lack of proper supervision. This improper supervison is a hold-over from old Army school of thought that "an officer is a man of honor. He is expected to do his duty, i.e., in flying, remain proficient."

The airlines trust their flight crews (and they also pay them twice what we make), yet every six months a Captain is required to pass one of the stiffest flight checks I've ever witnessed plus periodic route flight checks. The copilots are reported on by the Captains as well as getting training flights. Both Captains and copilots are required to get a certain amount of time each month in the simulator or procedure trainer—practicing airways procedure.

My point is: fighter pilots, behind-the-line pilots and bomber pilots are all human. We get lazy at times, lax and careless, so we need strict supervision on every cross-country flight.

A good example of good supervision in the Air Force is found in basic flying schools where each student cross-country flight is closely monitored. The same pattern should follow into all flying operations. Fighter outfits and behind-the-line pilots are especially poor in cross-country and airways procedures.

To summarize all I've tried to state: The fatal T-33 accident was five per cent pilot error and 95 per cent supervisory error.

Pilots are human and need constant practice and constant supervision to insure use of proper procedures and flying techniques. The bit about attention to duty is like the ostrich with his head in the sand. The airlines pay twice the money to fly and have three times more supervision—all to protect their passengers and equipment.

Let's quit labeling everything "pilot error" and get to the *real cause*: "Poor supervision of us humans."

Name withheld by request.

At first look a guy would be justified in ignoring the threat implied by the armament this gal carries. He might get carried away and assume she wouldn't shoot him nohow even if she knew how. And he just might end up being impaled like an olive in a martini. Assumptions can be dangerous. See page 10 if you need to be convinced.

*U.S. GOVERNMENT PRINTING OFFICE 441794