**USAF's 1110th Balloon Activities Squadron, located at Goodfellow AFB, Tex., is a unique organization. Building on a tradition stretching back to the eighteenth century, it performs functions no other Air Force unit can in gathering information about the upper air . . .**

# GOING UP UP . . . UP

MAJ. Keith Swisher strode vigorously into his squadron operations office at Goodfellow AFB, Tex. The operations sergeant looked up from his desk.

"Another high flight today, Major?" he asked.

"Looks like it, Sergeant," Swisher answered. "If we don't get cloud cover over eastern Oklahoma, we'll be able to get to 120,000 feet before we have to bring her down."

The sergeant nodded matter of factly and handed the major some flight-plan forms. "Taking the Gooney and the chopper on this one?" he asked.

The major nodded affirmatively and filled out the forms. He put down takeoff time as 0530 hours and forecasted landing time as 1245. The destination was listed in longitude and latitude instead of by place name.

"Think the weather will hold, Major?" the sergeant asked.

The major nodded again. "It's scheduled to start kicking up some dust around 0500 this morning, though. If the surface wind gets over twelve knots, we'll have to call it off."

An odd conversation for the space age? Not at Goodfellow, home of the Air Force's 1110th Balloon Activities Squadron.

Maj. Keith D. Swisher is Squadron Commander of the 1110th. The unit he commands is made up of nine officers and forty-two airmen, each with unique qualifications. Their job: launch balloons for the Air Force for scientific purposes. Their balloons are contributing to the Air Force of tomorrow in a way no other unit can.

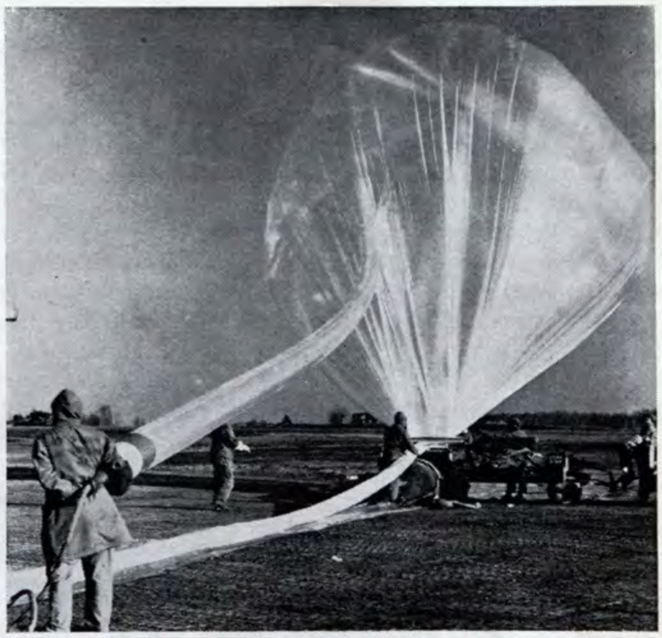
**Typical launching of an Air Force balloon shortly after dawn at USAF facility in California. Balloons perform important high-altitude scientific data-collection for USAF throughout the world. There is no cheaper way for man to explore the unknown.**

Ever since the first manned balloon flight in 1783, military men have been interested in balloons as research vehicles and a means to reconnoiter enemy forces. During the Civil War, Yankee forces used balloons to observe deployment of Confederate forces. During World War I, they were again used as observation vehicles, but with only limited success because they could be shot down fairly easily—as "balloon-buster" Frank Luke proved. In World War II, balloons were widely used for gathering upper-air data.

And today they are still used for this purpose; for even in the space age there is no cheaper way to explore the unknown above than with the faithful balloon. It can get up to altitudes above 100,000 feet, travel slowly, stay up for significantly long periods of time, and come back with valuable data for the use of later high-flying aerospace explorers. Knowledge on cosmic and other radiation temperatures, air composition, pressures, and other phenomena which was collected by balloons months and years before will help X-15 pilots

Lt. Col. Carroll V. Glines, USAF

# IN THE SKY



Here balloon in launch arm is being inflated prior to launch. "Bags" are made of polyethylene, are filled with helium. Balloons cost between $750 and $3,500, the helium used in one flight in the neighborhood of $500.

and their successors on the road to space.

It has been estimated that more than 4,000 balloons are released daily in the United States—almost all of them to obtain information about the upper air. The US Weather Bureau accounts for most of them, with its balloon soundings for routine data on winds aloft traveling to 60,000 or 70,000 feet. Also, many balloons are launched by research organizations seeking knowledge about the still relatively unknown air at 100,000 feet and above, where the X-15 and other experimental vehicles will operate. The balloon, far from being a relic of the past, has become one of the most useful helpmates to the burgeoning aero and astronautical sciences.

I asked Major Swisher what kind of data the 1110th gathers on its balloon missions.

"Scientists want to know everything possible about the upper atmosphere," he answered. "They want information about ozone content, infrared transmissibility, cosmic rays, water vapor, temperature, pressure, and the distribution of the elements. They want actual samples of the atmosphere and the 'particulate debris' that is floating around, so they'll know exactly what's up there and how it varies from day to day, week to week, and season to season."

Does the 1110th have any special problems in flying the balloons that other Air Force units don't have?

"You bet we do," replied Capt. M. E. Johnson, operations officer for this unique Air Force unit. "We have to plan each flight to avoid penetrating areas of high-density air traffic or highly populated regions. This problem alone can be a tough one when you consider how crowded our airways are today. There are very strict regulations concerning balloon flights—regulations that are necessary for the protection of all aircraft.

"But our biggest problem is predicting the point of landing of a balloon that goes up to 120,000 feet or more. We've got to figure our upper-air trajectories so that we can tell as accurately as possible where it is going to land. This requires quite a bit of mission preplanning, as you can imagine."

Predicting balloon trajectories is a specialized science. For that reason a weather officer and two full-time airman assistants are assigned to the 1110th. They must make a continual analysis of the upper air, sky cover, and surface-wind velocities both at the launch site and en route to and at the predicted recovery site.

"Let's review an actual mission to see what must be done by the balloon crews to gather some routine data," Major Swisher suggested. "As with any other Air Force unit, our missions are laid on by our headquarters, which is Headquarters Command at Bolling AFB, near Washington. Let's say we are to gather some air samples at 120,000 feet during daylight hours over Texas. Capt. Jim Taylor, our weather officer, is usually the first member of the unit to get in the act. He studies the general weather picture and comes up with a probable launch date.

"He must try to choose a day when the cloud cover will not be over five-tenths, ground winds not over twelve knots, and upper winds such as not to take the balloon over a populous area, through a heavily traveled airway, or out of the country. When he announces probable launch date, the rest of the unit's sections begin a series of preplanned actions.

"Captain Johnson works up his operations order. He figures a flight profile, decides the kind of plastic bag to be used, the type of payload to be carried, amount of gas needed, and the crews to be alerted for the mission. He must then coordinate the mission with the FAA, giving them location of the launch, estimated launch date and time, forecast time of penetration of the 44,000-foot level, and the predicted airspace involved in the ascent and descent.

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"When the mission is firm," Major Swisher continued, "each section coordinates with each other and works out the respective plans. Instrumentation personnel get the electronic brain of the payload together; launch crews gather their equipment and rig the packages. When everything is assembled, thorough checks are made of the entire assembly separately and then together to make sure there will be no malfunctions.

"When the day comes, if the weather is as forecast the crews are called out at 0200, eat their breakfast, and report to the launch site about 0300, ready for a long day. The gas trailer, launch truck, tugs, and other vehicles are placed in position. The polyethylene bag is carefully laid out on a ground cloth to protect it from abrasions. No watches may be worn, and all men wear gloves to keep from snagging the delicate plastic. The various pieces of the 'balloon train' such as the twenty-eight-foot parachute, separation blocks, safety timer, suspension bar, and ballast hopper, the 'grab bag' with its collection blower, and the instrumentation package with its radio transmitter are all attached. The helium trailer is driven up, and the inflation hose is hooked to the manifold. The helium then is passed into the main bag through a ninety-foot sleeve, and the bag starts to inflate. Slowly but surely the lifeless plastic takes shape and rises. Meanwhile, the weathermen watch the surface wind because launches are not usually made if the ground wind gets over twelve knots.

"If the weather is OK, if the balloon doesn't tear, if the instrumentation package passes the final check, if the FAA doesn't have aircraft traffic in the area, if all equipment functions, then we're ready to launch. In fact, there are more *ifs* in balloon operations than in almost any other kind.

"At the launch officer's signal, the release man holding the launch arm down snaps the lever, and the balloon snaps upward. The driver of the truck holding the instrumentation package and other gear slowly drives under the bag and in the direction it's drifting. At the precise moment the bag and all its load are fully stretched out overhead, the balloon is released from the truck and begins its ascent," Major Swisher said.

"But takeoff is not the end of our responsibilities," he added. "In fact, it's only the beginning of a long and sometimes exciting day because we've got to follow that balloon through its entire flight. We do this by using theodolites, helicopters, a C-47, and radio-compass equipment. As soon as a balloon takes off, we have a helicopter follow it usually as long as it is in sight. Sometimes we use the C-47 on long missions to keep following while the chopper is refueling at some intermediate stop. When it gets too high to see easily with the naked eye, we use our radio-compasses tuned to the balloon's transmitter while the theodolite men watch it through their telescopes back at the takeoff point.

"When it reaches the planned altitude, a multicam control unit with extremely accurate synchronous motors starts the blower, and air is drawn into the collection bag. When the mission is complete, an electronic signal opens a gas-escape port, and the balloon begins its descent. As the load descends, the air in the collection bag is transferred to a 'grab bag' where it is sealed off automatically.

"According to regulation, we must make track notifications to the


**Instrument load to be borne aloft under balloon. Instrumentation can vary widely according to object of the particular high-altitude mission.**

FAA Air Traffic Control Center. When cut-down time comes, we'll tell the FAA of the balloon's track, ground speed, position, forecast position when penetrating the 44,000-foot level, and the expected time and location of impact. So, again, you can see how many variables can creep into a seemingly simple balloon flight and can imagine how meticulous our flight planning and flight following must be."

When the balloon nears a landing, the recovery crews go into action. They follow it to its impact point and land nearby to stop the balloon train from dragging across the ground and causing damage to private property or the delicate instruments. If air samples have been gathered, the recovery crew must immediately hook up a compressor and force the air into a small container at prescribed temperatures and pressures to be sent to the laboratory for analysis. By this time, at least eight hours may have gone by from launch time to recovery time, depending on the mission. Occasionally, two or three days may have passed before the balloon is brought down. The flying crews may have been in the air much of that time and are anywhere from 2,000 to 3,000 miles from the launch point.

Do the crews ever have any unusual experiences?

Some of the landings have been extremely interesting. The hope is that a balloon will come down in a nice, wide pasture. But they often do not. Crewmen have picked them from trees, lakes, swamps, snowdrifts and, once, right off a busy Los Angeles freeway. They have been chased by bulls, irate farmers, and school kids asking for autographs. In South American operations, they have had to fight the Brazilian jungle, snakes, ants, dust, heat, and language barrier to recover their gear. On occasion natives have ripped balloons to pieces.

Once a crew recovers the all-important payload, the plastic bag is generally destroyed or given away. One flight is all each bag can take. Each contains enough plastic to cover half an acre. They

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are highly prized by ranchers and farmers to cover haystacks, furniture, barns, and chicken coops.

The cost of ballooning depends on the mission. A large balloon with a highly instrumented load required to go to very high altitudes for a long time may cost $10,000 per flight. Helium, which costs $6,000 per tank-car load, is used exclusively. About 15,000 cubic feet fill the average balloon; there are about 200,000 cubic feet to a car. The polyethylene bags cost about $3,500 each for large ones with prices scaling downward to about a $750 minimum. Collection devices and the delicate instruments, many of them expensive, are used many times before they have to be replaced.

The chances of anyone being hit by a descending balloon, incidentally, are one in 8,000,000. Since 1950, when the squadron was first formed, no one has ever been injured by a balloon.

There have been minor claims against the squadron for such things as flowers being trampled or tree limbs broken. In one case, a farmer put in a claim for a cow. He said that his cow ate some of a polyethylene bag and died. A veterinarian checked the cow's stomach and found some "poly" inside. The government paid the bill.

Over the past ten years, the 1110th Balloon Activities Squadron has made several thousand flights from many parts of the world. Its contribution in this dawning space age has been immense, perhaps fittingly so since balloons were the vehicles that got men off the ground in the first place.—END

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*The author, Lt. Col. Carroll V. Glines, is Chief, Planning Team, Monitoring System Group, Directorate of Operational Requirements, Hq. USAF. He was formerly Chief, Plans and Analysis Branch, Quality Control, at Headquarters of the AMC. Colonel Glines is the coauthor of the recent book on the Douglas DC-3,* Grand Old Lady, *as well as the author of two earlier books and a regular contributor to the pages of this magazine.*