# Accident Prevention Program

## Thunderstorms - Don't Flirt ...Skirt'Em

### Thunderstorm

Pilot's Beware! Within the route you intend to fly may lie a summer hazard in wait for the unwary--the Thunderstorm.

The thunderstorm, nature's uncontrolled "heat engine"--often encompasses some of the worst weather hazards known to flight. To refresh and update the pilot's knowledge of thunderstorms and associated weather hazards, we offer the following:

The basic requirements for formation of a thunderstorm are:

1. Unstable air
2. An initial updraft
3. High moisture content of the air

Why, you may ask, with these same conditions present, do we have fair weather cumulus clouds one day and thunderstorms rampant the next? There is no simple answer, however, it is known that latent heat released by condensation of existing water vapor may increase the buoyancy of a rising air column until that rising air column becomes self-sustaining. The Updraft then becomes the "burner chamber," drawing fuel from below until its fuel source is exhausted or an intermediate layer of dry stable air is encountered. The by-products of this uncontrolled "heat engine" are clouds and precipitation and sometimes vertical currents strong enough to literally disintegrate the ordinary light aircraft.

The general aviation pilot must contend with thunderstorms of varying intensities in virtually all parts of the country and should be aware that all thunderstorm cells progress through three distinct stages which are more commonly called the lifecycle. These stages are:

1. Cumulus
2. Mature
3. Dissipating

The severity of any thunderstorm is governed by the make-up of the mature stage. While most cumulus clouds do not become thunderstorms, the initial stage is always the cumulus cloud. The main feature of the cumulus cloud which will develop into a thunderstorm, is the predominate Updraft. This updraft may extend from the earth's surface to several thousand feet above the visible cloud tops During the cumulus stage, tiny cloud droplets grow into rain drops as the cloud builds upward. When these droplets become so large they can no longer be supported by the existing Updraft, they begin to fall. This marks the beginning of the mature stage and Usually occurs some ten to fifteen minutes after the cumulus cloud has built upward beyond the freezing level. Thunderstorm cells which progress rapidly through the mature stage are said to be "limited state" thunderstorms.

In the "limited state" thunderstorm, the mature stage is self-destructive until the updraft will no longer support the rain drops, and precipitation begins to fall through the updraft. The buoyancy of the air is decreased until the updraft becomes a downdraft. The cool precipitation tends to cool the lower portion of the cloud and thus its fuel supply is cut off, the cell loses its energy and the storm dissipates. When all water droplets hove fallen from the cloud the dissipating stage is complete.

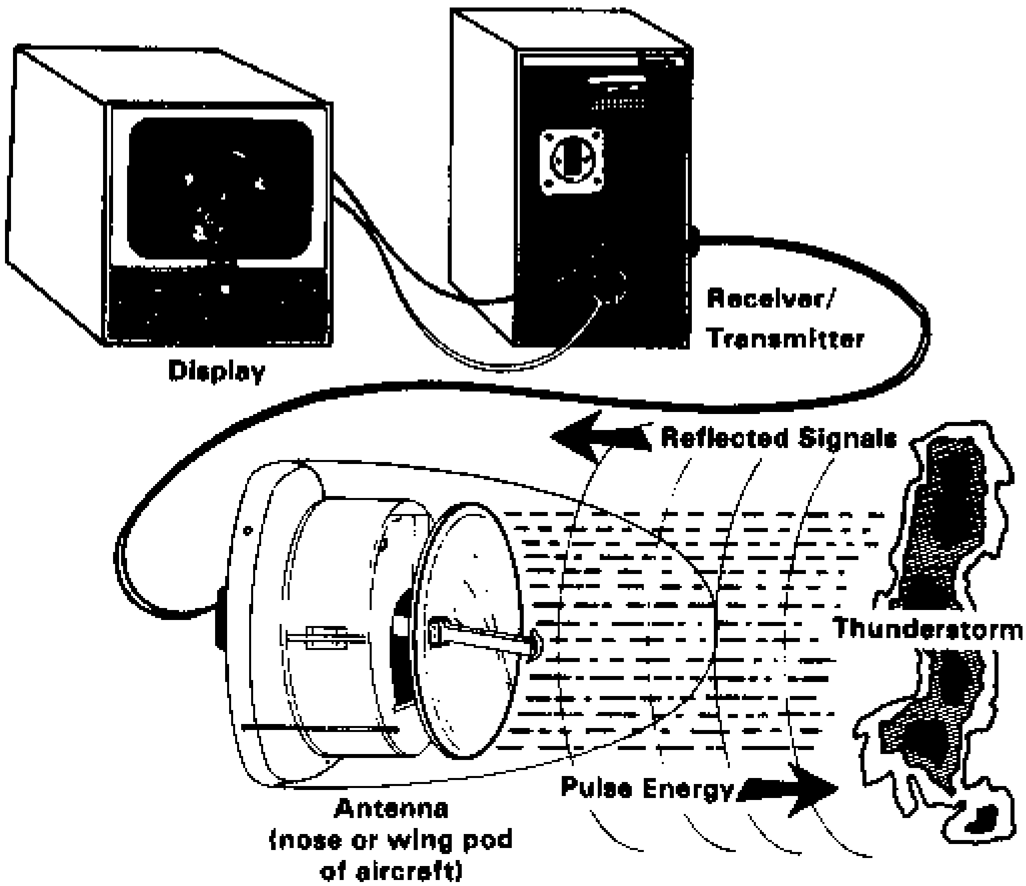
If, in the mature stoge, the updraft and downdraft areas remain equally balanced, the mature stage may then become a "steady state" thunderstorm cell in which extreme turbulence and large hail may predominate. The "limited state" thunderstorm cell may last from twenty minutes to one and one-half hours while the "steady state" thunderstorm may last as long as twenty-four hours and travel for one-thousand miles.

Many pilots have flown through "limited state" thunderstorms with little or no damage to the aircraft or passengers. They can only consider themselves extremely fortunate for any thunderstorm is, again, an uncontrolled "heat engine" and may produce any or all of the most violent weather hazards, such as hail, ice and turbulence, a pilot will ever encounter.

The information we have presented here should be considered minimum basic knowledge on the subject of thunderstorms and is presented in an effort to alert the pilot to the potential hazard of flight in or near thunderstorm activity. We suggest further that the pilot obtain a thorough weather briefing for the area involved and seriously consider the following in making a Go/No Go decision:

1. Pilots, particularly those flying light aircraft, should avoid all thunderstorms.
2. Pilots should never venture closer than five miles to any visible storm cloud with overhanging areas because of the possibility of encountering hail. Hail and violent turbulence may be encountered within 20 miles of very strong thunderstorms.
3. Pilots should be extremely cautious in attempting flight beneath all thunderstorms, even when visibility is good, because of the destructive potential of shear turbulence in these areas.
4. Pilots flying in the vicinity of thunderstorms should, at the first sign of turbulence, reduce airspeed immediately to the manufacturer's recommended airspeed for turbulent air penetration for a specific gross weight.
5. Maintain a straight and level altitude on a heading that will take you through the storm area in the minimum time.
6. Do not let compulsion take the place of good judgment--the first decision need not be your last if it's a one-hundred-eighty degree turn--Safety is Always Professionalism.

TYPICAL WEATHER RADAR SYSTEM




## WEATHER RADAR

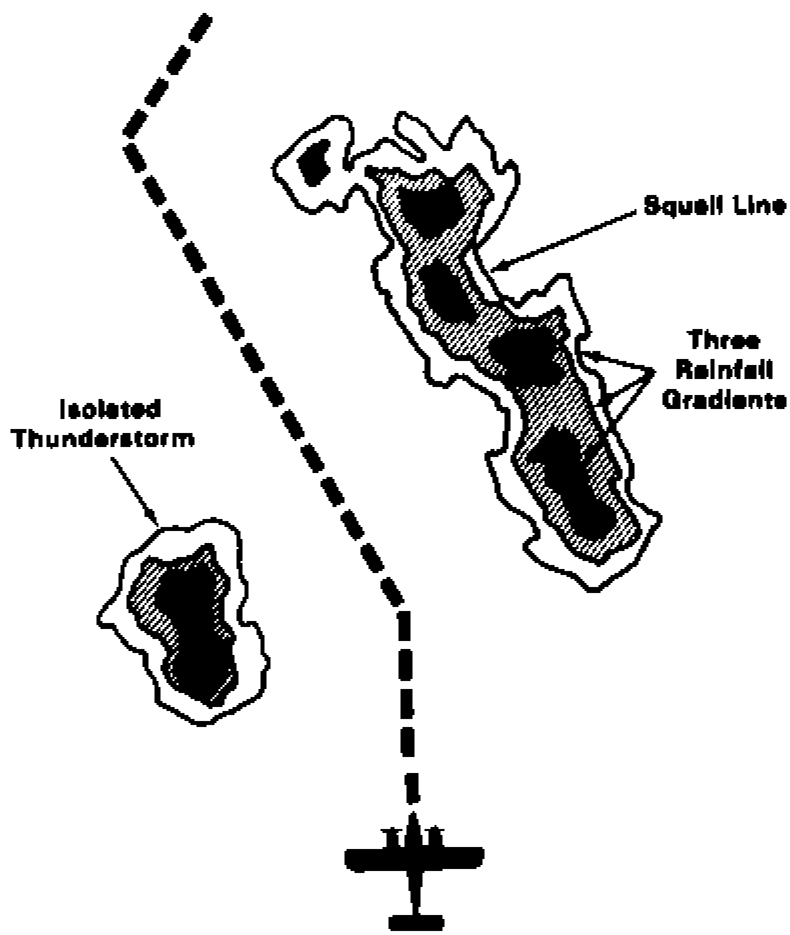
### ITS CAPABILITIES:

- Detects and displays significant weather within a specified sector related to the route of flight.
- Precisely measures rainfall density of targets under observation. This can frequently be related to turbulence associated with rainfall gradients.
- Provides greater comfort for passengers and crew.
- Substantially increases aircraft utilization.
- Promotes safer all-weather flying.

### AND ITS LIMITATIONS:

- Weather radar cannot directly detect turbulence even though it might be related to thunderstorm activity.

- Utilizing radar for weather avoidance requires operational experience and expertise. Interpreting the display is not an exact science but depends largely on the operator's general knowledge of thunderstorms as well as his knowledge of the forecasted weather. It also requires the operator to have an intimate acquaintance with his own radar system, its capabilities . . . and its limitations.
- Don't expect weather radar to detect dry snowfall, cloud icing (unless associated with precipitation) or other aircraft.
- Detects weather targets only when they are illuminated by the radar beam. Tilt management of the radar antenna is, therefore, very important.

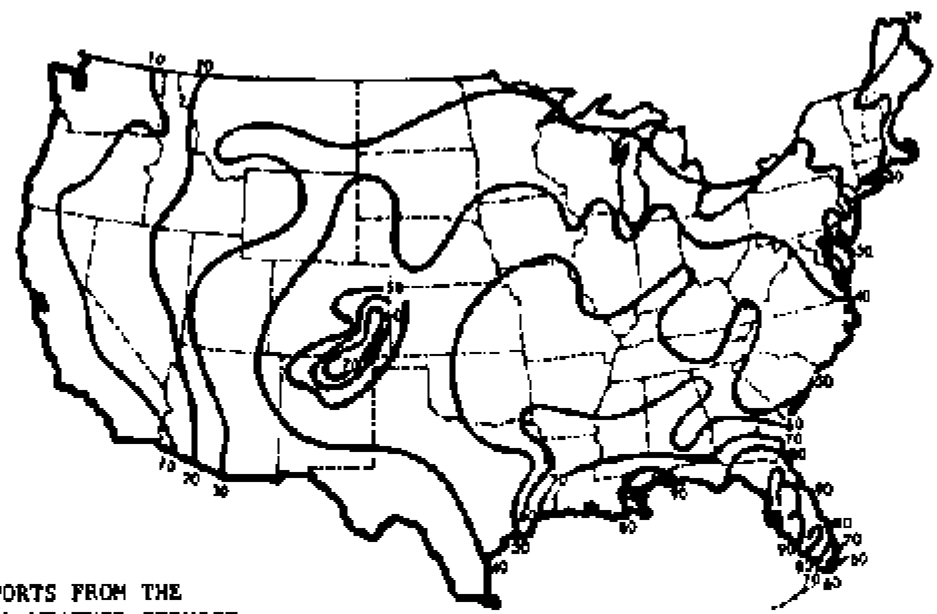



**OPERATIONAL FUNCTIONS AND FEATURES:**

- Weather radars available today usually provide good to excellent terrain mapping capability.
- Some weather radars also detect surface targets on water, such as ships, buoys and oil drilling rigs.
- Some systems provide radar homing beacon capability. That's the ability to "home in" using radar with a particular cooperating (transmitting) ground station.

- Digital memory technology permits continuous nonfading displays, similar to home TV.
- In addition, multi-function color displays provide three levels of rainfall intensity in discrete colors, along with HSI/RNAV/VOR navigation profiles in a "moving map" presentation. Programmable check lists, RNAV waypoint data, pilot controlled electronic azimuth track line, and many other types of information can be programmed and displayed in the new multi-function airborne weather information systems.
- Installations in certain single engine aircraft, utilizing wing pods, are now available. Look for continued developments in this area.

**Average number of THUNDERSTORM DAYS per year**



BASED ON REPORTS FROM THE
U.S. NATIONAL WEATHER SERVICE

(END OF DOCUMENT FAA-P-8740-12 AFS-800-09-78)