FLIGHT SAFETY FOUNDATION
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Summer Hazards

Every pilot should be well informed of the perils of summer flying. High temperatures often cause problems on airport surfaces and degrade aircraft performance.

Adapted from Eastern Air Lines

"Summertime — and the livin' is easy." So goes that memorable song by the American composer George Gershwin. Many pilots are quick to reply to that refrain with another well-known tune — "It ain't necessarily so" — for there is nothing easy, gentle or reassuring about summer storms or the blinding shafts of lightning that accompany them as they roll across the summer skies.

Once again, we are in that time of year when seasonal contrasts between cold and warm-weather fronts create lines of thunderstorms throughout the United States and in other parts of the world. This is also a time to be concerned with high temperatures and the problems of overheated brakes and tires, as well as the degradation of aircraft performance during all phases of flight.

To help you get through this summer with less strain, here are a few thoughts and some useful techniques.

Planning the Correct Pre-Flight

• **The Summer Walkaround.** Summertime preparation for flight, although more pleasant than a winter walkaround, is as necessary and time consuming as it is in the winter months. The items that must receive extra attention change somewhat with the season. Pitot heads and static ports, brake and tire condition and inflation, as well as aircraft skin and control surfaces, require renewed attention during the summer months. Wasps (mud daubers) and even birds have been known to quickly build nests in parked aircraft, clogging static ports and intakes. Tire and brake condition become more critical to safe operation during the hot summer months. Heat is still the most significant detriment to tire life.

• **Reports and Log Entries.** While checking the condition of lightning diverters on the radome, wings and tail, look for other evidence of lightning strikes and hail damage. Dents and other evidence of loss of "aerodynamic cleanliness" are of special interest for the purpose of fuel conservation.

Beware of High Temperature Damage

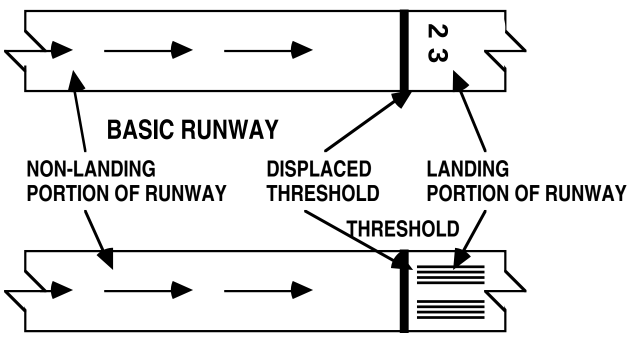
• **Ramp and Runway Temperatures.** Actual temperatures out on the ramp are often in excess of those reported for the airport. Strict adherence to weight and runway limitations is mandatory. Runway limitations become more critical during the hot summer months.

Macadam becomes soft; more employees, passengers and terminal spectators appear in the open; more baggage carts, equipment and light aircraft seem to be around; and more windows are open. All this means that there is a greater exposure to jet-engine blast and noise. Review and adhere to published procedures in the appropriate flight manuals regarding thrust limitations and noise abatement procedures.

Under the summer sun, taxiways and runways reach very high temperatures during the day, followed by cooler temperatures at night, leading to accelerated surface breakdown. This causes loose asphalt chunks to be reported, airport repair crews and vehicles to be avoided and heat-softened tar to be written up and cleaned from landing gear and wheel-well components. And there is the ever-present yellow tractor/mower cutting grass alongside runways and taxi strips.

• **Runway Markings.** Airport surfaces, which appear usable but are not, must be marked. One area may be "off limits" for operational requirements, or another may be restricted be-cause it is not structured to support the weight of heavy aircraft. These "stabilized," but relatively weaker, surfaces are particularly vulnerable during the hot summer months. Displaced thresholds, closed runways and taxiways are usually the results of operational needs. Over-run/stopways, blast pad and runway shoulder areas are commonly restricted for structural reasons. All of these areas can be identified by standardized, easily recognized markings.

A displaced threshold is a threshold that is not at the beginning of the full length of a runway. The surface from runway beginning to displaced threshold is called the "non-landing portion." Aircraft should not land short of the prominent displaced threshold markings illustrated in Figure 1.



Precision/Non-Precision Runway

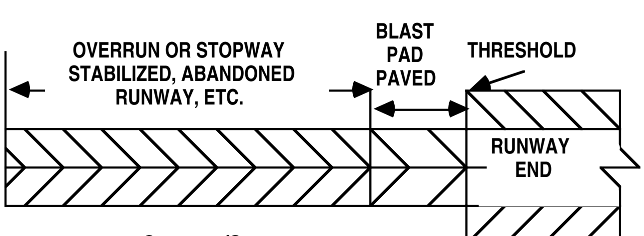
Figure 1

A runway or taxiway that is closed is marked by a large "X." See Figure 2.

Closed Runway or Taxiway

Figure 2

Any other surface or area which appears usable but, due to the nature of its structure, is unusable, will be marked by diagonal (Chevron-type) lines. These surfaces may be accessible but cannot be expected to support the weight of heavy aircraft. Figure 3 depicts several of these restrictive markings.



Overrun/Stopway and Blast Pad Area

Figure 3

• **Hot Brakes and Tires.** Brakes and tires that appreciate kind treatment during the cooler months demand it when the mercury climbs up toward the triple digits. Increased heat accumulation calls for more ample cooling periods. Good pilot technique can reduce total brake/landing costs, cut delays due to brake and tire changes and add a measure of safety to the operation. Flight crews can help a great deal by remembering that spoilers and reverse thrust are most effective at high speed, brakes are most effective at low speed, and those first taxiway turnoffs are expensive.

Characteristics of the Hazardous Thunderstorm

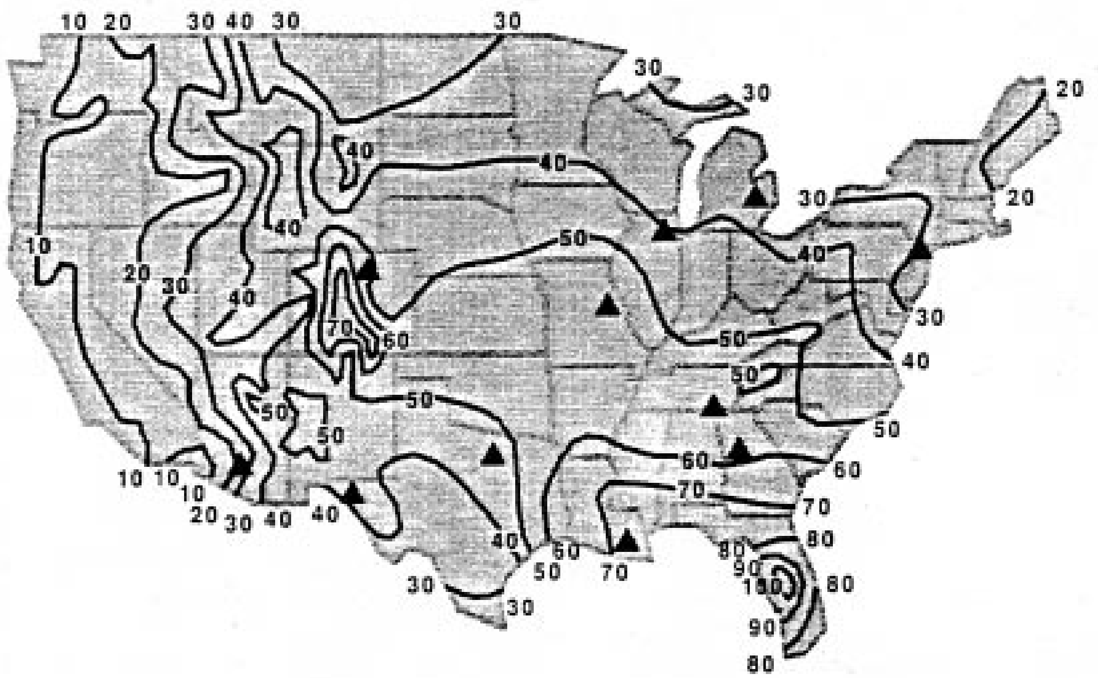
Thunderstorms present the most obvious potential summer weather hazards. The thunderstorm season in the latitudes that bracket the United States arrives in late spring, when the temperatures rise, and continues until early fall.

• **Thunderstorms and Squall Lines.** There is no reliable method by which a pilot can foretell whether a given thunderstorm is truly hazardous to flight. There are, however, certain signals that indicate an individual storm is especially perilous. We know to avoid storms with continuous lightning; hooked, scalloped or pointed echoes, and those with unusually great vertical development or rainfall. But we also know that these signals can appear and disappear in time intervals of only a few minutes. This is indicative of the rapid changes of severity possible in these storms.

Meteorologists can forecast thunderstorm areas,along with an overall assessment of severity prior to actual storm development. However, they cannot forecast an individual storm or cell until after it has appeared — and it is largely a matter of radar tracking and measurement.

Squall lines have their own distinctions. Thunderstorms that are part of a squall line tend to be more violent than "area" or air-mass thunderstorms. These line storms can form almost anywhere, but they are commonly found in the warm sector of a wave cyclone about 50 to 300 miles in advance of the cold front. Commonly called prefrontal squall lines, they are usually oriented parallel to the cold front and move in about the same manner. It is the prefrontal squall line that most often gives rise to tornadoes and damaging surface winds in the spring and fall seasons. Reaching their most violent stages in late afternoon and evening, prefrontal squall lines often dissipate at night and reform the next day. They can be forecast more accurately than the air-mass variety of storm.

• **Average Annual Storm Days.** The right combination of unstable air, high moisture content and lifting action occurs most often in the United States in Florida, especially in the center of the state around Tampa, which has about 100 thunderstorm days a year (See Figure 4). The illustration also gives a pictorial overview of the average annual storm days for the rest of the United States.



Average annual continental U.S. thunderstorm days. Close correlation exists between regions of higher thunderstorm activity and windshear-related accident/incidents.

Figure 4

• **The Average Storm Cell.** It has been estimated that an average storm cell may contain about 500,000 tons of condensed water in the form of liquid droplets and ice crystals. In terms of energy, it has been calculated that a typical squall line thunderstorm dissipates several times the energy released by the Hiroshima and Nagasaki atomic bombs.

• **Watch It On Takeoff.** When analyzing the weather situation, be sure to consider carefully the departure phase of flight. Several aircraft have been thrust violently into the ground by windshear/downburst conditions caused by capricious cells poised just off the departure end of the runway. If that cell is over the airport or in your departure path, take warning! Taking off into known thunderstorms should be avoided.

• **And On Landing.** The same conditions encountered on landing as on takeoff (thunderstorms above and in the vicinity of the airport) must be approached with extreme caution or be avoided.

We know the effects of heavy downdrafts from thunderstorms. An abrupt change in the direction or velocity of the horizontal wind component close to the ground is a threat to landing aircraft.

During an instrument approach to landing, an aircraft reported an experience with extreme wind shear. Upon encounter with the shear effect, the aircraft was driven downward and to one side, with an accompanying loss of air speed. This radical departure from the planned flight path was immediately noted on the instruments. Thrust was applied, and the aircraft was rotated to a nose-high attitude.

In spite of these efforts, the airplane was forced 120 feet below the glide path, and within 75 feet of the ground, before recovery was effected.

Under adverse conditions, such as a high rate of descent near the ground, the body angle required to establish maximum lift may exceed 15 degrees in extreme conditions. Even the flight director V-bars **will not** program sufficient body angle to stop descent and establish a rate of climb. **"Stop descent" requires the aircraft to be rotated until a rate of climb is established. Maximum lift will occur between 10 to 15 knots below Vref at 1.15 to 1.2Vs. This can cause stick shaker activation, which will provide warning of overrotation and too much speed reduction at approximately 1.1Vs.**

• **Missed Approach.** By definition, a missed approach and a rejected landing are two separate maneuvers; however, the procedures for executing these two maneuvers are identical. The decision to go around should be followed by **immediate application of takeoff thrust, with simultaneous back pressure on the yoke to stop the descent.**

• **Weather Avoidance.** Pre-flight familiarity with weather patterns should enable a crew to achieve an optimum weather avoidance profile during climbout and cruise. But do not allow complacency to enter the picture and have an effect on crew coordination and weather vigilance. Remember that even the best of weather forecasters have been humbled from time to time by freakish weather happenings.

Weather (airborne) radar is one of the best aids we have. When used with the available weather report, accidental penetrations of thunderstorms can be held to a minimum.

• **Hail.** Large hail is most often found in association with thunderstorms containing strong updrafts, lots of moisture and clouds of great vertical height. It is during the mature stage of the thunderstorm cycle when hail is most frequently encountered — usually between the 10,000- and 30,000-foot levels.

Hail of damaging size has reportedly fallen well outside of the storm cloud. It is especially hazardous to fly downwind of the storm cloud beneath the anvil overhang (See Figure 5). When possible, divert around the storm on the upwind side. When one must fly to the lee of a thunderstorm, give it a wide berth, allowing at least 20 miles separation and be prepared for turbulence.

How many ways can you think of high temperatures affecting performance? There are **takeoff** and **climb** — two, maybe three? How long a list can you compile? Try it and include even the remotest effect — even if not directly performance related.

Here are some examples:

• The demand for cooling may cause an overworked APU to "throw in the towel."

• Fuel tanks will not find room for the maximum placarded quantity.

• More thrust may be required to "break away" on soft parking ramps.

• Tires and brakes become hot from rolling friction alone — not to mention from needed braking.

• Heated air is thin. As a result, takeoff performance is reduced.

Storm Cloud with Anvil Structure

Figure 5

ACCIDENT PREVENTION

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