Bad weather at your destination airport - How will this pilot handle that?

Most people in the USA have flown numerous times on the airlines since the advent of the jetliner in 1960. If you are old enough you flew when the airlines were equipped with the old propellor aircraft. On flights when the weather has been lousy at your destination airport, did you wonder what the guy in charge of this flight was doing in the cockpit? How did the pilot find the airport? Not only that, how did he find the runway? I'll try to explain it to you.

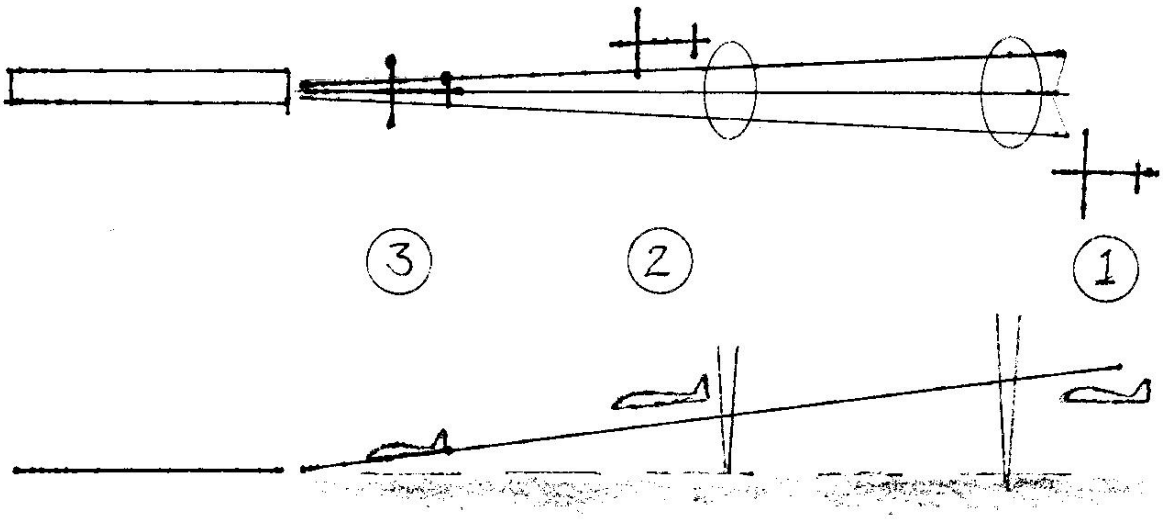
Since the late 1940's and all thru the last half of the twentieth century, in the first decade of the 21st century, even today, pilots find the runway at a civil airport using the **Instrument Landing System (ILS).** This is called a precision approach system. Work on ILS began in the late 1920s but the first actual approach in bad weather by a commercial airliner was in 1938 at Pittsburgh. Development on ILS was slowed by World War II. After the war, ILS installations expanded rapidly, first at major airports then to smaller airports. Many aircraft were equipped with the special radio receivers and instrumentation for ILS.

During this era, at military bases, refinements in radar led to another bad weather approach aid, **Ground Controlled Approach (GCA)**, also known as precision approach radar. GCA was perfected by the military in the 1940s and substantially contributed to the first successful encounter of the Cold War, the Berlin Airlift(1948/49). ILS equipment was installed in military transport aircraft beginning in the late 1940s. My first ILS approaches were flown in good weather, for practice, to Bradley Field at Windsor Locks, CT in 1949. Believe it or not, the ILS of modern times, 60 years later, is the basic system of the 1930s with some added features and sophistication.

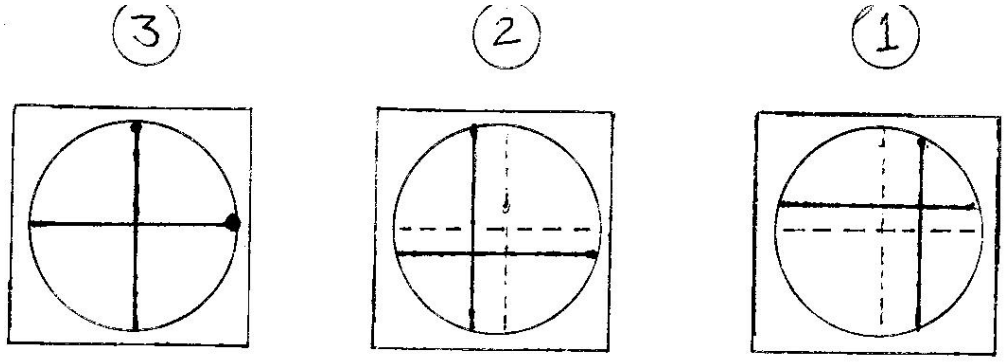
Before ILS, radio signals had been devised that could guide an aircraft to a location such as an airport, however they provided no vertical guidance, that is how high the aircraft should be in relation to the runway. ILS provides both runway alignment and glide slope information to the pilot in one instrument. Two separate radio transmitters, on the ground, broadcast signals which are received by special equipment in the aircraft. The runway alignment transmitter is called the LOCALIZER and the vertical guidance transmitter is called the GLIDE SLOPE. When the pilot selects the proper frequency for the Localizer at a particular airport, the equipment channels the correct frequency for the Glide Slope receiver. Range information (distance from touchdown) was originally provided by marker beacons that flashed lights and an audio signal in the cockpit. Outer, middle and inner marker beacons were installed. Range information today is provided by Distance Measuring Equipment (DME) on an indicator in the cockpit. Advanced runway lighting and approach lights are part of the ILS. Beginning with the prop airliners of the 1950s, the automatic pilot was coupled to the ILS instrumentation so that the airplane could make the approach "hands off" if desired. Modern jetliners with sophisticated ILS equipment can even land themselves at the end of an ILS approach.

During the first decades of ILS and GCA the minimum weather reported, to exist at an airport, before a pilot was allowed to execute precision approaches, was 200 feet ceiling and ½ mile visibility. During the final approach descent, if the aircraft reached 200 feet above airport elevation and the flight crew still could not see the runway, then the pilot had to execute the "missed approach" procedure. In the past few decades, refinements in equipment, both on major airports and modern airliners, have led to pilots being allowed to continue to descend below the old standard of 200 feet, in some cases zero-zero weather minimums. In order to execute these advanced "category" approaches the airport and the aircraft must be equipped with sophisticated equipment and the crew must undergo advanced training.

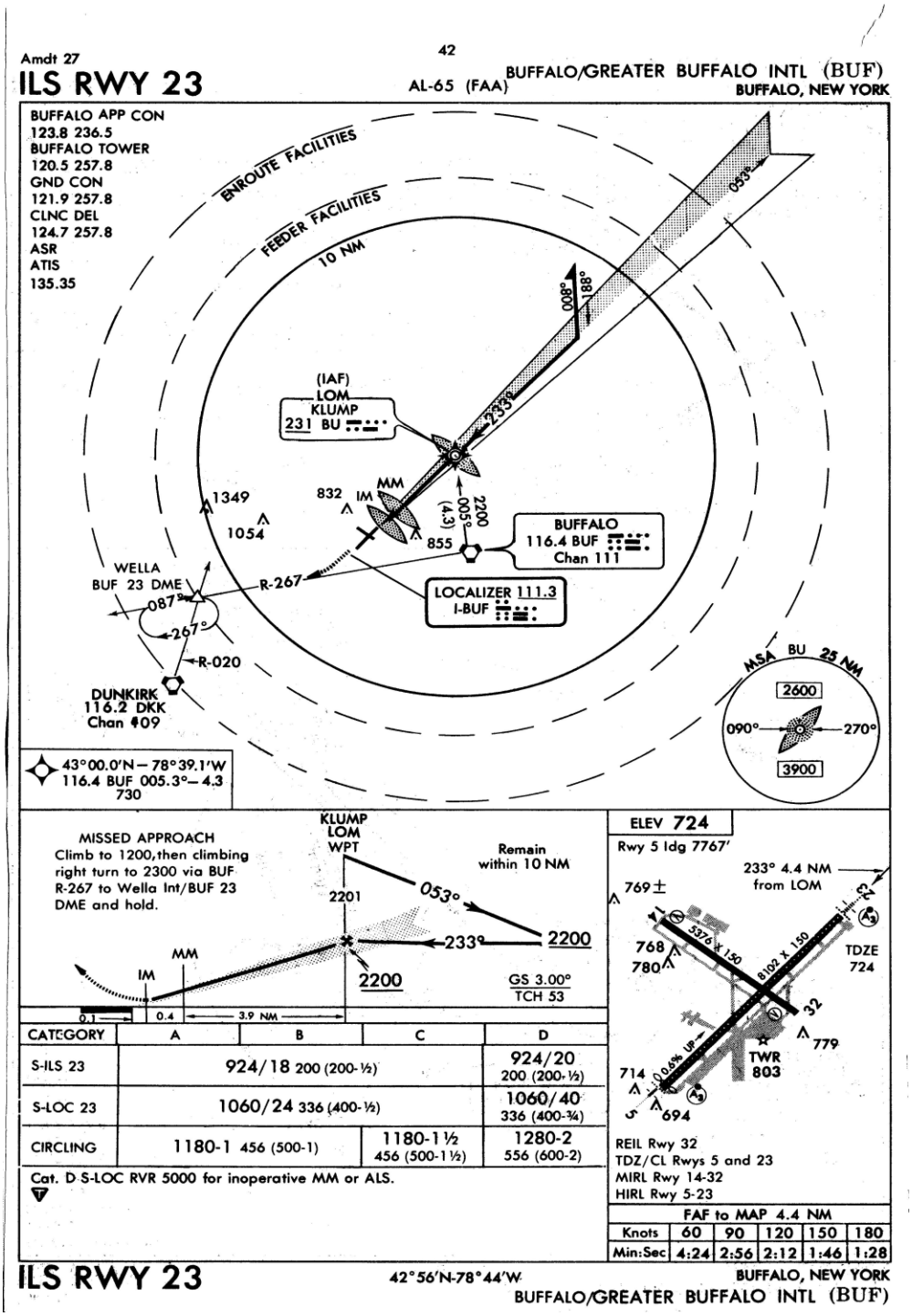
ILS Basics: The following drawing depicts an ILS to a runway. The upper portion shows the alignment with the runway (Localizer). Directly below that is the vertical presentation of the ILS called the Glide Slope. Also spaced along the approach path are two marker beacons, called the Outer Marker and Middle Marker. Generally the outer marker is located about 5 miles from the runway and this is where the precision approach begins. Three aircraft symbols are placed in the drawing and these will be related to the instrumentation in the cockpit.



Note that the three aircraft symbols are placed at various places in the ILS approach. The ILS instrumentation in the cockpit, originally called a "cross-pointer" indicator, tells the pilot whether he is right or left of the localizer and whether he is above or below the glide path. The drawings below show the ILS instrument presentation in these three positions. Position 1 shows the aircraft left of course and below glide path. Position 2 shows the aircraft right of course and above glide path. Position 3 shows the aircraft on course and on glide path.



ILS procedure: This is a chart like instrument pilots use to brief themselves before a bad weather approach to an airport. This chart is for the ILS for runway 23 at Greater Buffalo International Airport. Note that the upper portion depicts the final ILS course, leading to runway 23, and the marker beacons located on the final approach course. Elevations of obstructions in the vicinity are marked at height above mean sea level (msl). Note that runway 23's direction is actually 233 degrees magnetic. Runway numbers at airports are designated by rounding off the magnetic direction to the nearest ten degrees and dropping the zero at the end. The upper portion also contains all of the radio facilities, identification and radio frequencies that a pilot needs to contact before, during and after the landing, such as Tower and Approach Control (APP CON). When approaching Buffalo, the pilot tunes his ILS receiver to 111.3 megahertz then listens to the audio to make certain he is tuned correctly. The audio signal spells out I-BUF in Morse code. He also tunes his automatic radio direction finder (ADF) to 231 kilohertz, the radio located at the outer marker(OM). In this case, the OM has both a radio beacon and a marker beacon.



The lower right portion contains a blowup of the airport itself, shows the elevation, runway lengths and widths, and the elevation of obstructions.

The lower left portion contains a "cross-section" of the ILS procedure. It includes the altitudes that the aircraft should be at certain positions, distance from the runway at "fixes", the "decision height" and the MISSED APPROACH procedure. Note that decision height is given both in height above the ground and mean sea level.

Airport elevation is 724 feet above msl so decision height for this approach is 924 feet on the altimeter.

Air Traffic Control (ATC) radar would probably steer the pilot to the vicinity of the outer marker (KLUMP). ATC would advise the pilot to maneuver the aircraft so as to intercept the localizer at less than a 45 degree angle.

ATC would clear him to descend to approximately 2,200 feet, then clear him to execute the ILS approach. The aircraft would be in level flight, below the glide path before the outer marker so the pilot can "intercept" the glide path from below as the approach begins. Experience and pilot skill play a definite part from this point on to the runway. Cross winds aloft can effect the track of the aircraft but an experienced pilot can correct for this and can execute a fine approach just using his ILS indicator and the flight instruments. Experience in type aircraft helps the pilot fly the glide slope smoothly.

In the old prop airplanes, the DC-6 and Super Constellation, we would slow up to maneuvering speed shortly before the outer marker, drop the landing gear when intercepting the glide slope and execute the final approach at approach speed (about 130 knots) with half wing flaps. My old friend Mike Lazarowicz who is a Delta Captain on the Airbus 330, tells me that he flies the ILS final at about 145 knots with landing gear extended and wing flaps and wing slats in position before the outer marker. Instead of the paper chart like we used Mike has the "glass cockpit" instrument panel on the Airbus. That means he has the ILS chart, combined with his instrumentation, on a TV like screen for easy viewing on his instrument panel. The Delta captain can allow the autopilot to make the approach with him monitoring or he can execute the ILS approach himself.

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