

Missing in Action

The Fine Art of Properly Executed Missed Approaches

by Matt McDaniel

It was our third approach into the hub that day; we'd been watching the storms roll through the area all day. But, we had always managed to skirt the storms by appropriate distances to get into the airport each time, if not exactly in the most direct fashion. Using on-board radar, our eyes, and the assistance of dispatch, ATC, and fellow pilots operating in the area, we were doing so yet again; this time at night. Even though we'd already flown this same ILS approach twice that day, we briefed it again, giving careful attention to discussing the possibility of a missed approach, given the volatile weather conditions.

My employer's Beech 1900 airliners (essentially a stretched King Air) had no autopilots, and my First Officer (F/O) was the Pilot Flying (PF). I warned my F/O to be ready for any indication of windshear and to execute a missed approach, if necessary. I added, "If things get ugly, we'll bug out, no questions asked."

We tracked the localizer and intercepted the glideslope in relatively smooth air and passed the FAF uneventfully. A mile inside the FAF, I noticed the F/O add a healthy dose of power to maintain on-glideslope; then everything seemed to go into slow-motion. The glideslope began to race towards the top of the scale and our vertical speed plummeted. In perfect harmony, we both screamed, "Windshear, missed approach!" Right on cue, my F/O called out, "Max thrust, props forward," and pushed the throttles to max continuous torque while I pushed the prop levers full forward. My eyes fell on the IVSI needle that was now maxed out at 3,000 feet per minute DOWN. My right hand came up behind my F/O's left hand and I called for "emergency thrust" while pushing the throttles to their stops.

It seemed like an eternity to me, but I'm sure it was only a few seconds before we were through the windshear and rocketing skyward again. The power was reduced to a normal climb setting and my F/O executed the missed approach, as published, while I ran checklists and reported the windshear and our intentions to ATC. We entered the missed approach hold at a nearby VOR and waited, allowing our adrenaline to subside along with the storms. It wasn't the first time (or the last) that I'd executed a missed approach "in anger," but it was definitely one of the most memorable.

Why So Rusty?

That was over a decade ago, yet that flight still reminds me of the critical importance of practicing, briefing and truly studying missed approach procedures. We were in a very busy terminal area and had not received any ATC instruction to follow in lieu of the published missed approach. So, the burden of complying with published altitudes, courses, and navigation facilities rested squarely upon our shoulders. To ignore those responsibilities would be to risk traffic and terrain conflicts, violations, and ATC confusion about our intentions.

There are a variety of reasons to initiate a missed approach. Some, like windshear, require you to focus first and foremost on regaining full control of the aircraft. When that has been accomplished, continued adherence to published or amended procedures is a must to avoid potential conflicts (such as terrain, obstructions, or traffic). Contrary to a common misconception, below minimums weather conditions are one of the least

common reasons for initiating a missed approach. Airline and charter operators adhere to company-specific, FAA-approved Operating Specifications (OpSpecs), which always meet and usually exceed basic Federal Aviation Regulation (FAR) requirements. Most fractional and aircraft management companies adhere to similar rules, known as Management Specifications (MSpecs).

OpSpecs and MSpecs almost always prohibit progression into the final phase of an instrument approach without at least the published minimum visibility being reported. Prudent private, corporate, and basic commercial operators adopt similar operating limitations; as such limitations just make good safety sense (but are not mandated for operations conducted under FAR Part 91). Therefore, most approaches which are initiated are also able to be completed to a safe landing. This means little opportunity for real-world missed approach experience and practice and, thus, a general state of “rust” persists in those procedures, even for professional pilots.

Rather than rapidly changing ceiling or visibility conditions, the more likely missed approach culprits are circumstances that prevent or disrupt stabilized flight conditions on the approach. Other common scenarios could involve runway incursions, equipment failures, navigation signal interferences, crew mis-coordination, in-flight traffic conflicts, or even loss of situational awareness. The point is, no matter the reason to abandon an approach, the decision to do so sets into motion a series of pilot actions that have a high probability of being executed less than ideally.

Hope for the Best; Plan for the Worst

The importance of briefing the Missed Approach Procedure (MAP) cannot be understated. It is probably the most important part of any approach briefing, as it is



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| | | |
|--|------------------------|---|
| WAAS CH 93600 W22A | APP CRS 218° | Rwy Idg 7178 TDZE 5076 Apt Elev 5102 |
|--|------------------------|---|

RNAV (GPS) RWY 22

CODY/ YELLOWSTONE RGNL (COD)

| | | |
|--------------------------|---|---|
| | DME/DME RNP- 0.3 NA. | MISSED APPROACH: Climb to 9600 direct AJKEV and left turn via 123° track to NICQE and hold. |
| AWOS-3 135.075 | SALT LAKE CENTER 133.25 285.6 | UNICOM 122.8 (CTAF) 0 |

Figure 1: The briefing strip as published on the RNAV (GPS) RWY 22 approach for Yellowstone Regional Airport in Cody, Wyo.

the portion of the approach that is least practiced and, therefore, the portion most pilots are least proficient with. All too often, pilots simply leave their approach briefings incomplete. They do a thorough and professional job of briefing the entire approach procedure from the first fix or radar vector to the minimum altitude, through the visual transition, and landing. But, commonly, an attitude that the procedure will always result in a landing prevails and the possibility of a missed approach is never even addressed. As a result, I've seen countless instrument pilots attempt to fly a MAP *while* trying to read the published procedure off the approach plate. Very rarely does it end up being a stabilized, well-executed, or successful maneuver. In fact, it generally turns out to be an ugly maneuver and an embarrassing display of airmanship.

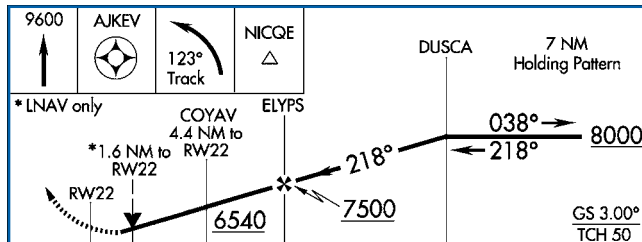


Figure 2: The Missed Approach Procedure "quick reference" graphic generally appears adjacent to the approach plate's profile view. In this example from KCOD, it is a four-block graphic in the upper left corner of the profile view and coincides with the textual Missed Approach description in Figure 1.

All instrument approach plates include a detailed description of the procedures to be followed in the event of a missed approach. This description is in textual form and situated near the top of the plate,

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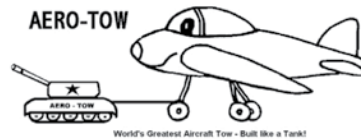
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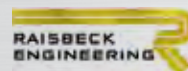
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above the plan view [Figure 1]. Jeppesen plates pioneered the addition of a graphic missed approach description. This graphic generally resides near the profile view and the minimums section [Figure 2]. Many years ago, the government-produced approach plates began to convert to a Jeppesen-style “briefing strip” format, which lays out all the critical information in a logical sequence across the top of the plate, to facilitate approach briefings [Figure 1]. This change in format also included a graphic missed approach description. While not every government approach plate has been converted to this format, the vast majority have.

Briefing nearly any procedure is best done in a logical and chorological fashion. Instrument approaches are no exception and, therefore, the textual missed approach procedure is situated at the end of the “briefing strip.” The

graphic version is a terrific quick reference guide to the missed approach procedure, but because it only highlights the procedure’s initial steps, it cannot be used as the sole source of information for briefing purposes. The textual description of the MAP should be the basis of the briefing and the pilot’s guide to complete understanding of the what/when/how of the MAP. The initial steps of the MAP procedure should be committed to memory, especially when operating single-pilot.

Fly-Over Fixes

In this era of GPS navigation, digital autopilots with GPS Steering (GPSS), and highly accurate moving maps, situation awareness has reached never-before imagined levels for pilots. Yet, the technology can create a false sense of security. During training sessions, I often see an over-reliance on electronic gadgetry and serious deficiencies in

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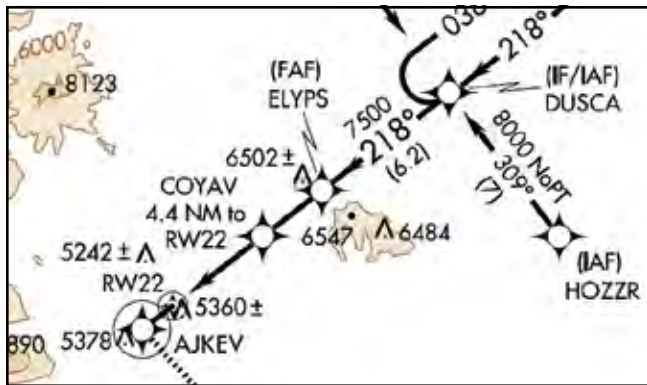


Figure 3: This snippet from the plan view of the KCOD GPS-22 approach depicts two mandatory fly-over waypoints. RW22 is the Missed Approach Point and is, thus, a standard fly-over waypoint on RNAV/GPS approaches. AJKEV is the subsequent fix beyond RW22, during the Missed Approach Procedure and is also designated a fly-over waypoint (an encircled four-point star symbol).

knowledge and skills related to both basic airmanship and operating rules.

While teaching experienced pilots in a variety of settings, I often discuss the difference between fly-by fixes and fly-over fixes (waypoints would be the more technically correct term, especially in reference to GPS approaches). Sadly, many are unaware there is a difference, when/how it would be applied, or how to determine one versus the other. Approach plates make

the determination of waypoint types simple. A standard GPS waypoint is depicted with a four-point star symbol and such waypoints are considered “fly-by” fixes. This means, if the waypoint forms the intersection of two courses, and the transition from one course to the next requires a turn, the turn may be initiated early enough to allow rolling out on the subsequent course without overshooting it. Thus, while in that turn, the actual waypoint is flown by, rather than actually crossed over. A fly-over waypoint is depicted using the same four-point star symbol, but the star also has a circle around it [Figure 3]. These waypoints may not be flown past, but must be crossed directly over before any transition to the next course may be initiated. In the United States, IFR-approach-certified-GPS may be used as the primary navigation source on instrument approaches which contain “GPS” or “RNAV” in their titles. The same type GPS may also be used in lieu of DME. Nearly every instrument approach where GPS may be used as a required component has at least one mandatory fly-over fix/waypoint – the missed approach point.

This is important for one major reason. Many missed approaches are initiated well before the missed approach point is crossed, due to instability, ATC conflicts, etc. While it is perfectly acceptable to initiate the climbing portion of the MAP prior to crossing the

missed approach point, it is not acceptable to begin any turns to intercept other courses or fly other headings in advance. The published course leading to the missed approach point should continue to be tracked until the missed approach point is crossed. All heading changes and courses published in the MAP are predicated upon crossing the missed approach point before such changes are initiated. Under certain conditions, ATC can amend a MAP to require course or heading changes prior to the missed approach point, but when this occurs, the entire MAP is effectively amended by ATC, negating the mandatory fly-over status of the missed approach waypoint.

How “Smart” is Your GPS/FMS?

The variety of flight deck configurations available in King Airs is seemingly endless. One thing we can say with some degree of certainty is that the vast majority of King Airs still flying were either built with, or have been upgraded to, an IFR-Certified GPS navigation system of some sort. Many have full Flight Management Systems (FMS) that incorporate such GPS systems. Others have relatively simple GPS units installed via STC. But, in reference to MAPs, the one item you should be aware of is whether or not your system is “altitude aware.” In other words, does your navigation system interact or communicate with the aircraft’s

altimeter system? If not, missed approaches are one particularly problematic area to be aware of.

Many MAPs contain instructions requiring a climb to a specific altitude before any heading or course changes may be initiated. The “gotcha” in a system that is not altitude aware is that it can begin to navigate to the next fix/waypoint before the minimum altitude published in the MAP is reached. Some systems sequence into the MAP procedure automatically. Other systems suspend waypoint sequencing until the pilot re-initiates it manually. In either case, the pilot must be aware of the beginning point of any missed approach course. If the system or the pilot re-engages waypoint sequencing prior to reaching the initial altitude, a resulting direct course will be initiated from the aircraft’s present position, not its position upon reaching the specified minimum altitude. This could create an inappropriate course to the waypoint, potentially conflicting with terrain, obstructions, or airspace. The solution, of course, is careful adherence to the published MAP and complete knowledge of your aircraft’s navigation system. A thorough understanding of your navigation system’s limitations and appropriate pilot actions required to compensate for them is a must.

Another area of similar concern is how the navigation system will react if the missed approach point is not

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crossed at all. This should really only happen when ATC has issued amended missed approach instructions that require an early termination of the approach, followed by a turn or radar vector which prevents crossing of the missed approach point. In such cases, the navigation system will not recognize what is happening and will continue to display the final approach course, waiting for the missed approach point to be crossed. If at any point thereafter, ATC directs the pilot to resume any portion of the published MAP, the pilot will need to activate the appropriate leg of the missed approach portion of the flight plan (a task that, in my instructional experience, is often far easier said than done by pilots flying with advanced avionics).

Going Missed During a Circle-to-Land Maneuver

Circling approaches are well known to be challenging. Not only do they require the aircraft to be maneuvered at low altitude, but also done so visually in marginal weather conditions within a specific circling radius of the airport. Even done perfectly, a circling approach can still occasionally lead to a MAP, initiated well inside of the missed approach point. The primary danger therein is getting from wherever you happen to be, to being established on a published portion of the missed approach. The easiest (shortest) route for doing so is not always the safest route. Regardless of where you are when the decision to go missed is made, one simple fact that should be at the forefront of your mind is that the safest place you can be is directly over the airport. In that position you know, for sure, that you are within the circling radius and, by climbing above Minimum Descent Altitude (MDA) as quickly as possible, you are assured of being above any obstructions within that area. Your first instinct (and action) should always be to CLIMB while turning towards the center of the airport [Figure 4]. Obviously, acute situational awareness is imperative. Once safely above MDA and above the airport, you can begin to determine the simplest way to establish yourself on the published missed approach procedure. If you have the luxury, utilize any available help from ATC and Radar Services in becoming established on the published missed or any alternate procedure authorized by ATC.

Reality Check

Every year pilots and passengers are involved in incidents and accidents related to missed approaches. Still more incidents/accidents stem from instrument approaches gone wrong, many of which could have been avoided had the pilot simply gone missed at the first signs of instability. Unfortunately, fatalities from such accidents remain the harshest of realities. It is easy to downplay detailed discussions of missed approaches (and other very specific aviation topics) as

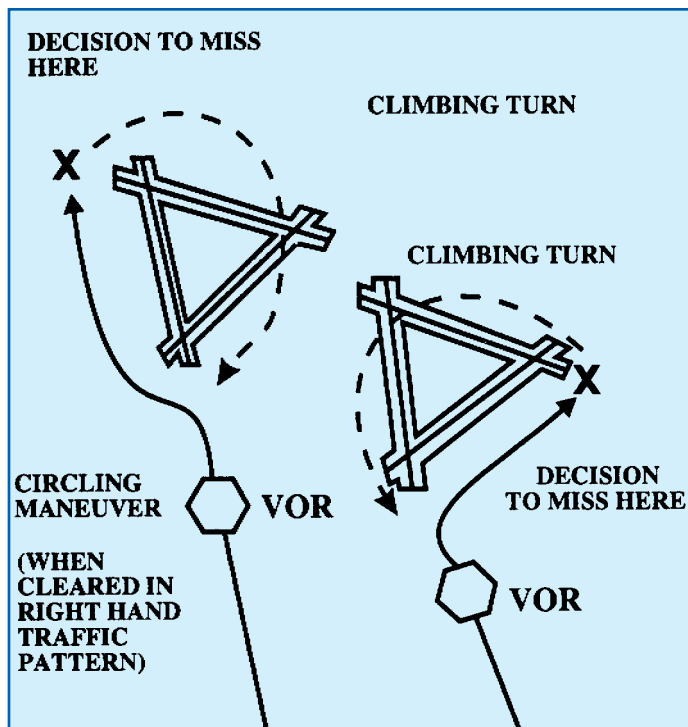


Figure 4: Examples of missed approaches from left and right-hand circling maneuvers, inside of the missed approach point (AIM Figure 5-4-28).

being purely academic. Fatal statistics, on the other hand, are harder to ignore.

No two missed approach procedures are created equally. The variations contained in MAPs are literally as large as the total number of approved instrument approaches available. But, with consistent training and practice, the foundational elements of all MAPs can become second nature. With a strong foundation, the unusual elements contained in so many MAPs can be studied, briefed, and flown with consistently successful results. As with so many skills in aviation, without a strong foundation, the house will crumble when conditions are the very worst for being left out in the cold. **KA**

About the Author: Matthew McDaniel is a 20-plus-year professional pilot with a background in airline, corporate, and charter operations. He's owned and operated Progressive Aviation Services, LLC (www.progaviation.com) since 2002, specializing in Technically Advanced Aircraft and Glass Cockpit training. He's been actively instructing for 19 years, has logged over 11,000 hours total; 4,500 hours of instruction-given and over 2,500 hours in the King Air and BE-1900. He holds five turbine aircraft type-ratings, and is one of only 53 instructors in the world to have earned the "Master Certified Flight Instructor" recognition four consecutive times. Mr. McDaniel can be contacted at (414) 339-4990 or matt@progaviation.com.