Not so next generation approaches

John Morris

On September 30, I was making a morning airline stop in Salt Lake City (SLC), connecting to another flight for Billings (BIL). As is sometimes the case with Mother Nature it was snowing/freezing fog in BIL! The last day of September! The airline choose to delay boarding for an hour and half as the terminal forecast indicated improving conditions in an hour or so. Subsequently after two different aircraft and two different runway holds amounting to 3.5 hours I got on a late night flight to Bozeman (BOZ) and drove to Billings the next morning. Total time in SLC- 13 hours. The visibility at BIL for 9/30 varied between 1/8 -1/4 mile – mostly fog from 1400 until after 2100.

While "hanging" out in SLC I was constantly looking at the weather in BIL and watching the private flights in-bound to BIL but not the airlines. Did not monitor whether the GA flights successfully landed since it would not make a difference relating to airline operations. Should note that the second airline attempt, late afternoon to BIL, (appeared to) look good right up to the number one for takeoff when the Captain informed us the ILS had just gone out of service and no airlines would be making any further attempts into BIL until the following morning. Actual Notam, read later, was OTS from 09/30, 8:00 pm local until 10/03 7:00 pm – cancellation date showed no earlier time. Do not think the maintenance folks were expecting that kind of weather for dates! The captain had previously said the alternate, Bozeman, was probably where we were going to go and with the visibility not consistent that is what would have happened. Instead we taxied back to a gate, once one was available, since crew scheduling-duty time/passenger housing at the alternate airport makes for many more headaches-costs for the airlines.

Note: Part 121 has installed GPS but due to cost's WAAS is not, from queries made, a part of their approach procedures (my Billings trip).

So the experience got me wondering what the FAA/Part 121 has been doing to improve landing in low visibility since the last time I wrote about

approaches in 2012. Of course what the FAA does will also affect what we can/ do, currently in the PC12.

1st area of curiosity was the approaches into BIL. BIL has two instrumented runways, 10L-28R and 7-25. See table Fig 1

	Length	ILS	RNAV/ LPV	ALS	HEIL	REIL	ILS Mins	LPV Mins
Rwy 10L	10518	Yes	Yes	Yes	Yes	Yes	*200/1/2	*200/1/2
Rwy 28R	10518	Yes	Yes	No	Yes	Yes	250/3/4	250/3/4
Rwy 7	5501	No	Yes	No	No	Yes	-	250/3/4
Rwy 25	5501	No	Yes	No	No	Yes	-	250/1
*Rwy 10L	1800 RVR authorized if the use of AP or FD or HUD to DA							

Fig 1

As you can see from the Fig 1 the ILS 10L has something extra added, namely the RVR 1800 with AP, FD or HUD [Heads Up Display]. RVR 1800 is +200 from the ¼ sm/1600 RVR designation.

Can we execute this approach using the 1800 RVR authorization? Yes (Legacy aircraft with Pilatus Radar Altimeter) except must disengage autopilot at 200' AGL but can continue with Flight Director (FD).

We can also execute an RNAV/LPV minimums approach to Rwy10L, which has the same "authorized" minimums as the ILS. However, Legacy PC12's are NOT authorized, by Pilatus, to use the autopilot below 1000' AGL, NG operators not below 400'AGL but all can continue with the flight director.

Like the airlines, and using the Billings example, we should of course plan an alternate airport and fuel plus personal minimums (your "duty" day before initiating this type of approach, currency, and nutrition) before attempting either

the ILS or RNAV/LPV to 1800 RVR/200 AGL. It is challenging but with proper experience and using the PC12 to its fullest capacity I believe we have a much better chance to land since the full flap approach speed (assuming no visible ice) is quite low compared to jet aircraft giving us ample time to "see the lights" in order to continue the approach. And even if utilizing Pusher Ice Mode our approach speed is still quite sufficient for this type of approach and the increased runway needed for landing/rollout.

And if not able to complete the [ILS CAT I only approach to 200 AGL] how many understand that the PC12 community is authorized, from a coupled approach, to go-around using the autopilot and have done so in the past? If shooting the RNAV/LPV autopilot activation is approved at 400'AGL for NG's and 1000' for Legacy's. An important tool to be aware of and use if this procedure is executed to its fullest.

So what else is currently happening regarding lowering approach visibility requirements?

Quick info regarding Heads Up Displays – HUD's.

1st airline use of HUD's was around 1984. Use of the display allows lower CAT I, II, and III visibility minimums for landings. Having spoken with a just retired Southwest pilot he told me about the current ability to *hand fly* CAT III approaches with the HUD using the Flight Path Pointer coupled to the ILS (see Fig 2). The HUD also allows takeoff visibility minimums to be reduced to as low as 500 RVR versus the 1 SM minimum for 2-engine Part 121!

	≥DA*/DH	≥RVR	Visibility
CAT I	200 HAT	1800 or	½ statue mile
CAT II	100	1000	
DA is barometric – only used for CAT I, DH is radar for CAT II and III			
CAT IIIA	100	700	
CAT IIIB	50	150	
CAT IIIC	0	0	

Fig 2

What other devices for visibility reduction?

2001 Gulfstream was the first commercial operator to receive FAA certification for use of a Forward looking infrared camera or FLIR. Along with the already installed HUD the approved aircraft were then approved to 100' HAT (Height above touchdown zone) if no other restrictions. At the time the term EVS (Enhanced Vision System) had not been coined but in 2004 the FAA amended FAR 91.175 to include the term EFVS (Enhanced Flight Vision System).

Two years ago the regulation "FAR 91.176 Straight-in landing operations below DA/DH or MDA using an enhanced flight vision system (EFVS) under IFR" was added. The "short" version of EFVS is a guidance system using sensors to display electronically external imagery, through a HUD or like display, that will allow the pilot flying to look forward along the flight path and "see" better than un-added, natural visual scenes while having all relevant flight/speed parameters and path information to 100' above Touchdown Zone Elevation (TDZE)-the "a" version or with a flare prompt or flair guidance to landing rollout-the "b" version. Sounds a lot like CAT III C but with the pilot actually "seeing" the approaching runway.

The FLIR is considered an active EVS (Enhanced Vision System) since it can "see" through certain weather/fog with distance. Passive FLIR versions, also considered EVS, have been installed on PC12's over the years but would not qualify as an EVS combined enhancement. See CVS below

Synthetic Vision Systems (SVS) are a computer generated image of an external scene limited by data available such as terrain and navigation information. Also called a Heads Down Display type [HDD] therefore not qualified for EFVS. Quite a few PC12's have synthetic vision installed or are available as upgrades.

Combined Vision System (CVS) are both EVS and SVS and can be considered EFVS depending on types of sensors and flight/computer data integration. But the CVS must use a HUD to be considered EFVS. There are now several business aircraft manufacturers incorporating EFVS type systems.

To get a PC12 to the EFVS level appears to be quite expensive with a HUD and active FLIR system. Any other possibilities for the PC12's?

How about GBAS (Ground Based Augmentation System). Formally known as LAAS (Local Area Augmentation System) this system is actually operational, on a limited basis worldwide. Currently the FAA has suspended future funding and the only FAA approved system, built by Honeywell and first approved in 2009 and then an enhanced version 2012. The system has to be purchased by airports independently-KIAH and KEWR so far in the US. There are several GLS (GBAS Landing System) approaches to CAT I minimums worldwide while ICAO/FAA is working on the means to lower the visibility minimums.

GLS uses GNSS (Global Satellite Navigation Systems) but also three ground stations located near the landing area for precision information, like an ILS but much more! With the three antennas correctly located multiple runways can use the same "site" and up to 48 variations of approaches can be derived by simply selecting a different channel. It is a "close in" system of approximately 7 miles so several different types of navigation systems, including WAAS, can get you to the Initial Fix but WAAS is not part of the GLS. You can see from the financial side large savings potential using this system in aircraft as well as airports.

When I wrote the other approaches article in 2012 below was the then current ILS/LPV approaches available

- Number of US ILS approaches 2100-including military
- Number of US LPV approaches 2272

As of September 2018

- Number of ILS approaches –
  - lower 48states 1430 / 35 AK
- Number of LPV approaches total 3922
  - 250' HAT 1073
  - 200' HAT 1023
  - RVR 1800' 205
  - ILS Rwys 2008
  - Non ILS 1914

- Number of LP approaches total 668
  Non ILS 664

As you can see RNAV/LPV approaches are growing [FAA expecting to add 40-50 per year] while the ILS's are diminishing, mostly due to maintenance costs.

Currently the PC12 is capable of conducting smart, safe low visibility approaches.

So, be patient and be aware of yours and the aircraft capabilities.

"A safe pilot is always learning"

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