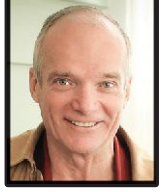


CHARLIE PRECOURT
COMMENTARY / FLIGHT TEST

So What in the World Is P-FOQA?

New CloudAhoy flight analysis tools can dramatically improve general aviation safety

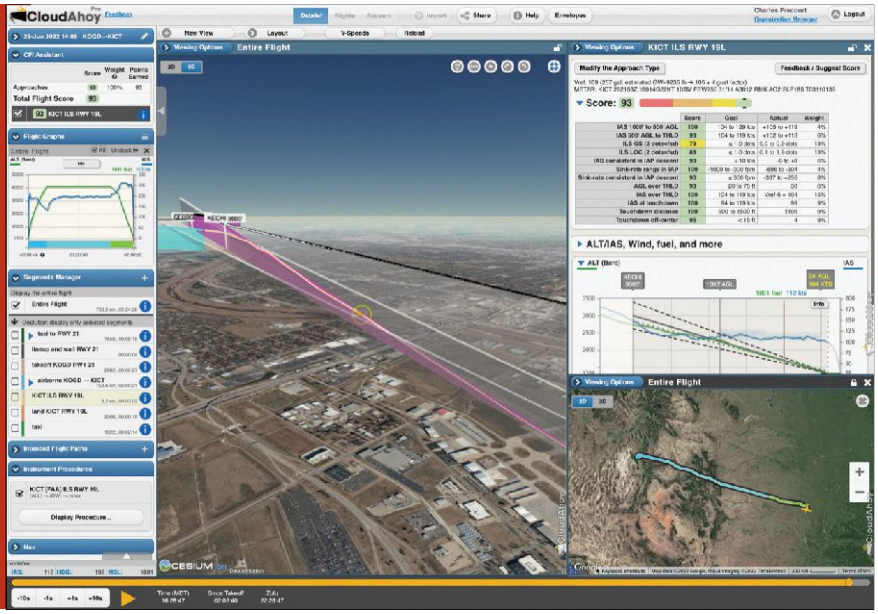
BY CHARLIE PRECOURT, SAFETY COMMITTEE CHAIRMAN, EAA BOARD OF DIRECTORS

FOR THE BETTER PART of the last two years, I've been involved in a beta test of a flight data monitoring tool from CloudAhoy. It's been an amazing learning experience. CloudAhoy calls its new system P-FOQA, or the pilot's flight operations quality assurance program.

That's a term partially borrowed from the airlines, which have made tremendous strides in flight safety using FOQA (without the P). The airlines gather flight performance data on every flight and analyze it for safety trends in their operations, cutting off accidents before they happen. However, in the airlines' systems, pilots rarely see the results of their individual flight performance. Instead, airlines emphasize analysis of their aggregated fleet, looking for common trends that are used to improve their standard operating procedures. But CloudAhoy's system adds the individual pilot data to the analysis (the P), and we can now see aggregated trends of a group of pilots as well as pilots' individual results immediately after each flight.

Two years into the beta test, it's becoming apparent that P-FOQA can dramatically lower accident rates in general aviation. Aircraft type clubs can form P-FOQA programs for their specific aircraft to analyze aggregated data among their members, and individual type club members can see the specifics of each of their own flights. CloudAhoy anonymizes the data that goes into aggregated trend charts for a community of pilots in a type club while sending the specific flight results only to the individual pilot. You can see examples of its reports in Figures 1 and 2. This also has the potential to help us lower the costs of insurance with underwriters who are starting to appreciate the benefits of flight data monitoring.

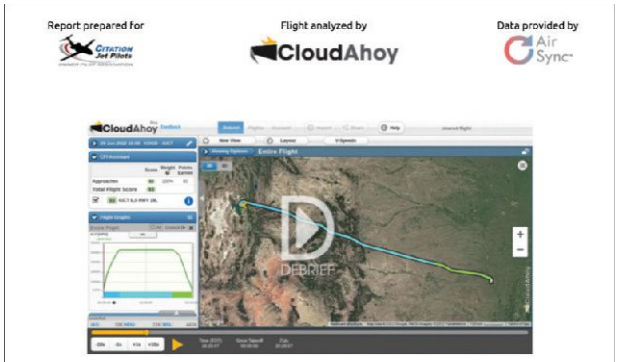
FIGURE 1: CLASSIC CLOUDAHOY DEBRIEF VIEW



I became a big fan of flight data analysis when I was in the space shuttle program. FOQA wasn't even a thing then, but we were essentially using P-FOQA in our training to land the space shuttle. There were certain parameters we deemed critical to a safe landing. We tracked those carefully in our flight training in the Gulfstream G-II that was essentially an airborne simulator for the shuttle. We would typically fly 10 approaches from 30,000 feet during each training flight in the G-II. The aircraft was modified to fly the approach with the same feel and performance as the shuttle. Computers recorded our flight control inputs and the aircraft trajectory result. Between each approach we could look at a printout of our performance and adjust as needed on the next approach. Have a look at my article in this column from the July 2020 issue for more details on how we trained for shuttle landings, including a look at some of our P-FOQA charts of the day.

Until recently, P-FOQA for general aviation was too costly and too cumbersome to implement. Equipment to record the data was expensive or not generally available. Analysis of the data was time-consuming and required entire teams of analysts (as at the airlines) to make sense of the results and create useful reports. But today, many of our avionics systems record data automatically and store it on SD cards. And third party systems like the AirSync aircraft connectivity devices can transmit the flight data automatically upon landing to analysts like the folks at CloudAhoy. Advanced computer algorithms and CloudAhoy's automated processing allow each flight to be fully analyzed, scored, and added to the aggregated pool of data from prior flights. Literally, within five minutes of landing, a full report on the flight is in an email in the pilot's hands. See Figure 3 for the beta test aggregated data dashboard view. Here's a summary of what the new P-FOQA can do for us:

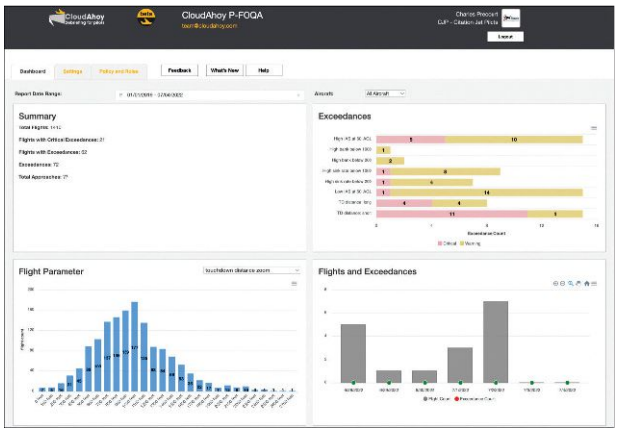
FIGURE 2: CLOUDAHOY DEBRIEF VIA IMMEDIATE E-MAIL



Airports		
KOGD RWY 21 *Ogden-Hinckley, UT*		wheels up 20:26:07 UTC
KICT RWY 19L *Wichita Dwight D Eisenhower Ntl, KS*		wheels down 22:29:30 UTC
Times		
Engine Start		20:10:23 UTC
Engine Stop		22:32:26 UTC
Engine Time		2:22:03 (2.4 hours)
Block Time		2:14:42 (2.2 hours)
Air Time (hobbs)		2:03:22 (2.1 hours)
Distances		
Air		757.8 nm
Ground		2.4 nm
Takeoffs and Landings		
Takeoffs		1
Landings		1
Approaches		
KICT ILS RWY 19L V_{ref}: 109 (257 gal, estimated GW=8235 lb ➔ 105 + 4 gust factor) METAR: KICT 292153Z 16014G22KT 10SM FEW250 31/14 A3012 RMK AO2 SLP185 T03110139		score: 93

	Score	Goal	Actual	Weight
IAS 1000' to 500' AGL	100	104 to 129 kts	105 to 119 kts	4%
IAS 500' AGL to THLD	93	104 to 119 kts	102 to 113 kts	6%
ILS GS (2 dots=fsd)	79	≤ 1.0 dots	0.0 to 0.9 dots	13%
ILS LOC (2 dots=fsd)	88	≤ 1.0 dots	0.1 to 1.9 dots	13%
IAS consistent in IAP descent	93	± 10 kts	-9 to 8 kts	6%
Sink-rate range in IAP	100	-1000 to -300 fpm	-896 to -304 fpm	4%
Sink-rate consistent in IAP descent	90	± 300 fpm	-337 to 255 fpm	6%
AGL over THLD	93	20 to 75 ft	38	6%
IAS over THLD	100	104 to 119 kts	Vref-5 = 104	15%
IAS at touchdown	100	94 to 119 kts	99	9%
Touchdown distance	100	500 to 1500 ft	1106	9%
Touchdown off-center	95	< 15 ft	4	9%

FIGURE 3: CLOUDAHOY P-FOQA AGGREGATED DATA DASHBOARD, SHOWING TYPE CLUB PARTICIPANT TRENDS



- Send immediate pilot feedback after shutdown to mitigate/reduce future errors.
- Provide an aggregated analysis of type club "fleet" performance.
- Enable type clubs to share lessons learned and best operating practices for their specific aircraft.
- Enhance insurability and lower costs for aircraft operators.
- Use aggregated data output to tailor training events.
- Enable feedback to aircraft and avionics manufacturers for system issues.
- Provide feedback to the FAA as appropriate for air traffic management issues and recommendations on pilot training and certification improvements.

Figure 1 shows a screenshot of a recent flight debrief in the classic CloudAhoy debrief format. This was a flight into Wichita that shows the 3D view of final on the ILS approach, and a number of other data fields with details on the flight. The upper right shows the approach scoring, with most elements in the green and one parameter, the ILS glide slope deviation, being yellow, off a bit from the goal. This view is well known to current users of CloudAhoy, but their P-FOQA program has now brought us the views in Figures 2 and 3. Figure 2 is an email report that arrives literally within five minutes of engine shutdown after the flight, providing immediate feedback for the pilot about the flight results.

Figure 3 shows the results of the aggregated data collection from more than 1,400 flights in the P-FOQA beta test. The upper left box shows the totals — 62 flights with exceedances (a parameter of interest exceeded limits during the flight) and a total of 72 exceedances in the 62 flights (meaning some flights had more than one exceedance). The upper right box shows the most common parameters that see exceedances. In other words, these are the most common areas where pilots experience issues during flight in these particular aircraft. You can see that high airspeed at the threshold as well as landing accuracy (both short and long of target) pop out as most common for this group of aircraft. The lower left box shows a particular parameter that is selectable with a pull-down menu (in this case the landing distance distribution among all landings). And the lower right shows there have been no exceedances in the last week, a good trend.

I wish we had access to this kind of data years ago. When I was flying a Mooney, we learned that landing fast leads to bounced landings and porpoising that can cause a prop strike. In the Malibu we learned that folks had problems with lateral control on landing rollout that led to excursions off the sides of the runway. Every aircraft has its own nuances and "gotchas." Having data like these allow us to share common trends and address the inevitable shortcomings in aircraft designs, improve training emphasis areas, and avoid accidents.

You may have noticed we made extensive use of CloudAhoy debriefs in the Redbird simulators at AirVenture Oshkosh this summer in the new EAA Education Center. If you haven't tried it in your own flying, you may check it out at CloudAhoy.com. And if you're part of a type club, you ought to look into setting up a P-FOQA program for your club's membership. It can make a huge difference in safety, no matter what aircraft you fly.

Fly safe. EAA

Charlie Precourt, EAA 150237, is a former NASA chief astronaut, space shuttle commander, and Air Force test pilot. He built a VariEze, owns a Piper JetPROP, and is a member of the EAA board of directors.