Flying with the Bendix/King EFIS

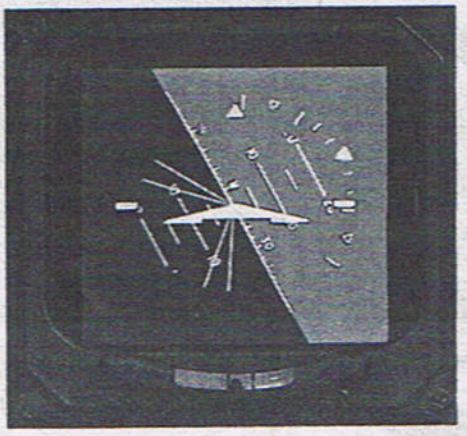

Figure 2. Left bank.

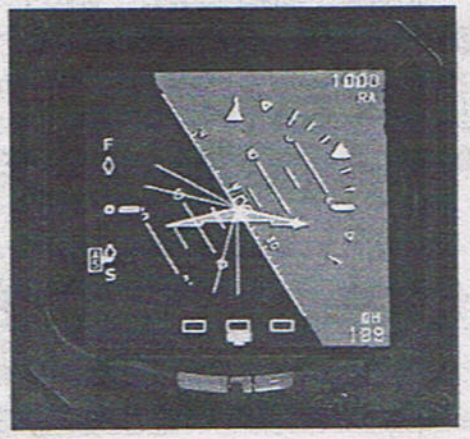

Figure 1. Left bank with clutter.

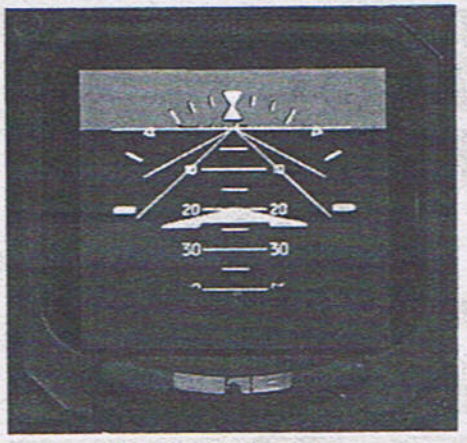

Figure 3. Pitch down.

By Harry Kraemer

Moving into an aircraft with EFIS (Electronic Flight Instrument System) can be very intimidating. The first thing you will notice when transitioning to EFIS is the large square displays. EFIS allows more information to be displayed when and where you need it.

Another difference you will notice is the attitude indicator or the EADI (Electronic Attitude Direction Indicator). Although the EADI may have several options for displaying roll attitude, the most common roll attitude for the Bendix 4- and 5-inch instruments is a fixed-roll scale and movable index. This is called a sky pointer, which moves opposite of your round 3-inch instruments. This difference may take some time to get comfortable with. You may have a tendency to bank in the opposite direction.

EFIS gives you the option of having a moving map displayed showing airports, navaids, radar, or even lightning strikes. DME also can be displayed on the EFIS. Each side (if equipped with pilot and copilot EFIS) of the cockpit has an EFIS control panel that allows complete and separate control of that side.

Another one of the "bells and whistles" of a glass cockpit is the addition of wind vector information displayed on the EFIS. If the aircraft has the appropriate equipment, wind direction and speed is displayed. Although this information is considered advisory only and is not intended for use during an approach, it is an asset when used properly with other information, such as ATIS or AWOS.

Gone are the days of a gradual vacuum pump failure in which the attitude indicator slowly starts to tilt and the heading indicator precesses. The failure can be so gradual that you do not recognize it until you are in an unusual attitude. With your new glass cockpit, the horizon display blanks out if you should experience an attitude indicator failure. "ATTITUDE FAIL" will be enclosed in red in a red box on the display. A failure like this usually is caused by the system (AHRS) that sends the information to the EFIS. It is for times such as this that we are still required by the FARs to have a gyroscopic pitch and bank indicator. The "AHRS" or Attitude Heading & Reference System provides the aircraft attitude, rate of turn, and heading information.

I recommend having two AHRS systems installed in the aircraft. If one fails, you can switch to the other. The aircraft I fly (Pilatus PC12) is equipped with pilot and copilot EFIS and two AHRS systems. I always fly with each side on a different AHRS (pilot's side on AHRS 1 and copilot on AHRS 2). I switch AHRS on each side after startup. This way, I always have a comparison for heading and attitude.

In the event of an EFIS tube failure, I have a "composite mode." The composite mode will display all information from the Electronic Attitude Display Indicator (EADI) and the Electronic Horizontal Situation Indicator (EHSI) on one display. It actually displays everything on both tubes. Whichever EFIS is still working determines which one that I will see everything on.

EFIS allows you to put a lot of information on one screen, if needed. You can have your navigation information displayed on your EADI. Sometimes, all of this information may be too much, like while trying to recover from an unusual attitude. Should you find yourself in an unusual attitude, most EFIS displays have a "declutter" mode when predetermined pitch and bank criteria have been exceeded. During the declutter mode, all nonessential information is removed from the display (EADI), including navigation information. Depending on the type EFIS, red or white chevrons will appear, showing the pilot which way to move the nose of the aircraft for the best unusual attitude recovery. (see figures 1 & 2.)

"EFIS can reduce your workload by putting more information in front of you, where and when you need it."

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EFIS

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It is on an approach with a transition, radials that define intersections, and where more than two navaids are required that a glass cockpit is a great tool. I can set up an entire approach well before I reach the IAF. On a recent trip from New York to Gaithersburg, Md. (GAI), I had to divert to Frederick (FDK) due to weather. The PC12 I was flying is a single-pilot aircraft equipped with Bendix/King 4-inch EFIS on both sides and a KLN90B GPS. I picked up the AWOS over Lancaster (LNS). The weather was below the VOR minimums, so I decided to shoot the ILS at FDK.

After I advised ATC of the weather and informed them that I wanted to divert to FDK, I was cleared direct to EMI, direct FDK. EMI is one of the initial approach fixes for the ILS 23 at FDK. I set EMI (117.90) in my number two nav radio. On my EHSI, I have dual RMI pointers. I am able to set the RMI to VOR one or two, the ADF, or the GPS. I set the #1 RMI to EMI and displayed this on the EHSI, which became my primary navigation for this phase of the flight.

My number one nav was set to the localizer (110.30) at FDK. I had my HSI pointer set to the localizer (110.30) with this displayed on the EHSI as the primary nav source with the course pointer set to 228 degrees (the inbound course).

The Bendix/King 4-inch EFIS will display a rising runway on the EADI when a localizer is the primary nav source. This is displayed as a runway with a centerline. The runway symbol moves left and right with the CDI needle. For the second RMI needle, I had this set to the GPS. I had my current flight plan (EMI to the FDK VOR) in the GPS.

With the GPS in the leg or auto sequence mode, it would sequence automatically to FDK after I passed EMI. With this, the RMI for the GPS would show my distance and direct course to EMI and then FDK automatically. I set in the FDK VOR, not the airport, because in the event of a missed (climb to 1,300, then climbing left turn to 2,800 via FDK R-047 to RICKIE Intersection and hold), I was set up to fly it.

My EHSI had three needles displayed on it, the HSI (LOC), RMI #1 (EMI), and RMI #2 GPS flight plan). I had the entire approach, including the missed, set up 15 minutes before reaching the IAF. I did not have any dials to turn or frequencies to set in the radios.

I was using the #1 RMI to navigate to EMI, and at station passage, I continued to use the #1 RMI to intercept and track out on the 293-degree radial from EMI. I followed this radial until I intercepted the localizer. If I choose, I can display the localizer and glideslope information on the EADI. This will simplify scanning. A glance at one display (the EADI) gives me attitude, radar altitude, DH, localizer, and glideslope information.

I tracked the localizer on the primary nav (HSI) set up on the EHSI. Using the #1 RMI needle, I was able to track my progress towards RICKIE with cross radials. The #2 RMI needle was now pointing to the FDK VOR. This told me my distance from the airport (the VOR is on the field). If I missed, I could use this needle to start the missed. Remember, that I was able to set all of this up an hour ago.

Altitude information also is displayed on the EADI (if a radar altimeter is installed). At or below 2,500 feet AGL, the EADI will give a digital display of your radar altitude. I monitor my radar altitude on the approach. By monitoring radar altitude, you can crosscheck and verify that your glideslope information is correct. The EADI has a display to set in your decision height, with a decision height alert feature.

For most of us, the IFR GPS is our first introduction to flying with glass. I'll set the same approach up with a mechanical HSI and an IFR GPS (KLN90B, a single-tube EFIS). First, enter the waypoints in flight plan zero (EMI, NUMBE, RICKE, and FDK). Second, activate the flight plan. Activating the flight plan is best accomplished while you are still in the flight plan page. After you have entered FDK and while the cursor is still on, scroll up to EMI. With EMI now highlighted, hit the DIRECT button. This activates the flight plan and, as long as you are in the "leg" mode, will start the auto sequencing of the waypoints. Use the moving map feature (NAV 5 page) of the GPS, for your primary navigation until reaching NUMBE. If you prefer flying with a CDI, the "super NAV 1" page on the 90B displays a CDI. This page also gives you your distance, ETE, ground speed, and bearing to each waypoint.

GPS and EFIS allow you to specify the range of the moving map. I prefer to use the "auto" mode on the KLN90B for the map scale while on an approach. The "auto" mode chooses the smallest map scale that will display the active waypoint and, if there is one, the waypoint after that. In this mode, the KLN90B also will show the airport runway layout (if an airport is the destination) as you approach the airport. This is especially helpful in orientating yourself with the landing runway.

Before reaching EMI, set the localizer frequency on the nav radio for your mechanical HSI. The GPS will navigate direct to each waypoint. After crossing EMI, the GPS will sequence automatically to NUMBE. Fly to NUMBE with the GPS (you may want to use the EMI VOR to verify that you are on the 293 radial). Fly this until you intercept the localizer with the HSI. After intercepting the localizer, continue the approach with your mechanical instruments. I use the moving map on the GPS to improve my situational awareness throughout the entire approach.

For the single pilot, flying IFR, GPS and EFIS are great assets, which can improve your situational awareness. EFIS also can reduce your workload by putting more information in front of you, where and when you need it.

Harry Kraemer is a corporate pilot flying a Pilatus PC12. He is an NAFI Master CFI and a Gold Seal Flight Instructor with more than 6,000 hours experience in more than 80 different aircraft.

BENDIX/KING