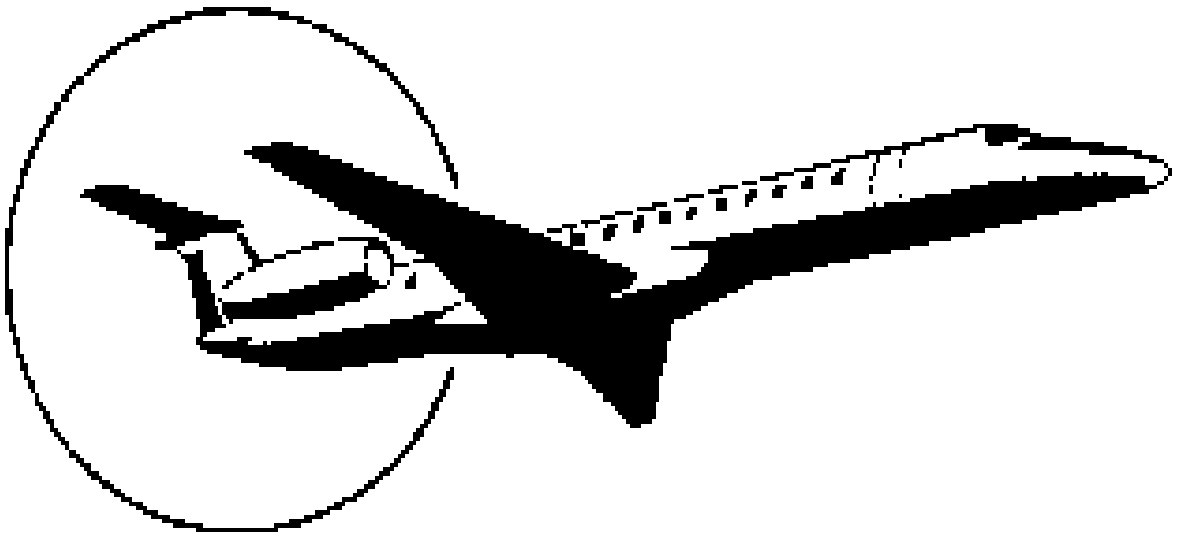
ERJ – 135/140/145

PANEL PROJECT



FLIGHT DECK MANUAL

Designed by Bill Grabowski

Freeware Panel Designers Association

ERJ – 135/140/145

PANEL PROJECT

Panel Design, Art, and Programming
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Manual Creation and Chief Inspiration
Bruce Ullyot

Manual Contributing Author / Documents Editor
Lou Kostyo

Chief Test Pilots
Kevin Au
Andreas Fuchs

Test Pilots
Christoph Winkler
...
The rest of the gang

Airlines whose pilots made major contributions to this project
Continental Express
Crossair
American Eagle

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IMPORTANT!! MANY OF THE PROCEDURES AND FUNCTIONS OF THE ERJ PANEL MAY NOT BE FAMILIAR TO MOST FLIGHT SIMULATION PILOTS. IT IS HIGHLY RECOMMENDED THAT THIS MANUAL BE READ IN ITS ENTIRETY AS THE PANEL IS COMPLEX AND VERY REALISTIC (within FS2000 limitations).

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PREFACE / ACKNOWLEDGEMENTS

This project started out as a simple request from Bob Klemm and Chris Grall to modify my previous Emb-120 panel for the Embraer Regional Jet. It subsequently took on a life of its own and took over seventeen months to develop. I actually released an initial panel for beta testing about halfway through the development after modifying some of the default Lear gauges, since the Learjet also uses the Honeywell Primus 1000 system. The response I got was less favorable than the nice response I had received from the Emb-120 effort, so I figured I had some major work to do.

Little did I realize however!

One of the most enthusiastic contributors from the initial beta test (never underestimate enthusiasm) was Bruce Ullyot, who had just introduced himself to me as a fan of the 120 panel. He was subsequently to become the *greatest influence* on the ERJ panel and project. He maintained a keen interest in the panel, saw it's potential worth, and constantly prodded me to do "more." He ultimately became *the* constant motivator for improvement. I started calling him my "handler." Bruce had been the author of Espen Oijordsbakken's impressive Fokker F-50 panel documentation (in my opinion one of the finest panels ever created and one of the few panels which I hold in awe), so when Bruce offered to write the documentation for the ERJ, which at this time was really taking off (no pun intended) and getting very complex, I could not believe my good fortune. I immediately accepted. During the many months that Bruce and I have collaborated on this project, he has been the most delightful person to deal with in what sometimes were truly trying situations, especially when I was trying to teach myself C++ programming as applied to Flight Simulator (which has many quirks of its own), solve difficult programming problems far beyond my capabilities, and maintain motivation which *frequently* flagged. Bruce was always there with encouragement, humor, and prodding. He kept me moving forward. When I was finally able to meet him and his son Cameron during their visit to Seattle, I found both he and his son to be as fine a gentlemen as there are. I am proud to call Bruce a friend. Canada can be proud. Still, I don't understand his "thing" for hockey when baseball is *so* superior. But then, I have the Mariners to watch.

There were many contributors, but one stands out. Andreas Fuchs sent me an unsolicited email during the middle stages of the project stating that he had heard that I was working on an ERJ panel and that he wanted to help. I was delighted to get his offer because I was having great difficulty getting information from Honeywell and had only gotten limited information from other pilot sources. It didn't hurt that he was an ERJ driver for Crossair, the Swiss regional airline. After a few weeks, Andreas asked if I could use an ERJ pilot's manual. Dubious, but thrilled at the possibility, I said, "Are you kidding? Of course!" Six weeks after he said it was "In the mail" ☺ it arrived in my mailbox MUCH to my surprise and joy. There is no way I can say "Thank you" enough to Andreas. The manual he provided has been marked up and has more post-it notes attached than you can imagine. And he has continued to provide feedback and "tweaks" to improve the panel and bring it into line with the real one. THANK YOU ANDREAS!

Programmers

I don't program C or C++ for a living. So guess what? I needed help, and that's what I got in spades from some great people who were more than willing to share their expertise with an amateur. Some areas of programming really gave me problems, number one being the radios. I couldn't have accomplished any of this without a lot of assistance. My first line of help would always be the Panel Design Forum at **www.flightsim.com**, where Arne Bartels and Brian Kostick hang out. These two gave me so much help that I'm almost embarrassed, but incredibly grateful. Their responses to my pleas were always quick, pleasant, and accurate. I love these guys. Kosta Prokopiu, founding member of the Freeware Panel Designer Association (FPDA), is responsible for teaching me how to add sound to the panel. I cannot emphasize what a great addition that is. Sound is an integral component of the real ERJ cockpit. Kosta was unselfish and a great teacher. He can put things in a form that is understandable, a rare quality. Andi Jaros, another member of the FPDA, needs no introduction. His Airbus panels and programming are legendary, and his freely given wiper and pushback gauges cannot be matched. Plus, he's a nice guy. Dai Griffith needs to get a special award for lifetime achievement for volume and quality of contributions to Flight Simulator gauge programming. His gauge help files on programming for Flight Simulator are a must. I couldn't have done anything without them, and many others agree. Additionally, he sent me whole blocks of code as reference, especially on radios, an area of complete mystery to me (still!). Wade Chafe of FPDA, now very famous for his programming work on 767 Pilot in Command, was very helpful in solving particularly thorny failure code problems. Darim Rahmatallah unselfishly supplied explanations, code, and instruction on night lighting.

Thanks guys. Consider yourselves co-authors of this panel.

Photographers

These are the people who went out of their way to provide me with much needed photos of the cockpit interior, which is especially important because I don't have access to ERJ's and have never seen the cockpit personally. The very first person to send me pictures was Gaston Roca, a Fokker 50 driver from Germany. That got me going. After this, I decided to add the side art. This was subsequently improved upon with great pictures from Chris Southern and Joe Weatherby of Continental Express. Joe's picture of himself in the pilot seat was so good in fact, that I decided to add a copilot to the right side art modeled after his picture. That is why the copilot is known as "Joe". ☺

ERJ pilots

I cannot say enough good things about these gentlemen and one lady who told me what needed to be done to make the ERJ panel more real and how they kept after me to make it so. There were representatives first from Crossair, then Continental Express, and finally American Eagle. Andreas Fuchs from Crossair supplied the pilot's manual. By far the largest contingent was Continental Express. They did everything from supplying pictures, faxing pages from manuals, captain's flows, diagrams, to checklists and V-speed charts. You name it, they got it. The pilots and maintenance representatives of these airlines were the second wave of testers who provided the professional and technical input. While I had the manual and got much information from it, applying the information to my panel was not always on the mark. That's where these people came in to make "mid-course" corrections, and in the performance of that task they far exceeded my expectations. As good as everyone was in helping me, three from Continental Express deserve special mention. ERJ driver Kevin Au volunteered after I put a request on the Continental Express crew forum and subsequently became the most prodigious, ceaseless, astute, and relentless critiquer of my panel of anyone. Every time I put out an upgrade, usually in response to his observations, he would come back within a day or two with even more corrections and observations. This went on for many weeks. The intricacies of operation of this panel are largely due to his efforts. He was *incredible*! If there is realism in the panel, thanks go largely to him. Chris Southern was close behind with operational, maintenance, and technical observations, in addition to sending very nicely done pictures that I found quite useful. Henry Cisneros, a new hire for Continental Express, saw my request on the forum and wrote to ask if I was the same guy he'd known in San Antonio, Texas twelve years previously when he used to work in an Amiga computer store that I used to visit. Guess what? I was! I remembered him because he had come over to my house to see my flight simulation set up. And now he was about to go into ERJ training! What luck for me! And what support he provided! You can read his testimonial at the

beginning of the manual. Joe Weatherby was an enthusiastic contributor and, best of all, supplied some fine pictures.

Thanks to “Antflies”, Barbara Steinruck, Brian Magby, Charles Chen, Dave Altman, “duskim”, Marc Enzi, Greg Jensen, “gregatp”, “jetlink”, “JetPilot145”, John Holden, John Miller, Joseph Panford, Mark Normington, Matt Kranz, StevenDv01, Thomas Dilbeck, and “Tim”.

Sound

Many thanks go to Mike Hambly for his help with his gifts of sound, especially the APU sounds. Kosta Prokopiu taught me how to program sound. Daniel Steiner published his FSSound module and help file, which made all this possible. I used Christian Koegler’s sound for fasten belts and no smoking, and a big thank you to him for making these available to all. Thanks also to Andreas Jaros and Steffen Gerlach for the click and chime sounds.

Testers

Testers played a deciding role in the character and completeness of this panel, from the initial beta testers who evaluated the first edition (and gave it a thumbs down), to the ERJ pilots who functioned as the technical consultants and final testers who cleaned up the mess. Many, many Thank you’s to Bob Klemm, Chris Grall, Dave Bush, Felipe Taveira, Gaston Roca, Ian Grant, Jon Joseph, Lou Kostyo, Marc Muller, Michael Peterson, Michael Przybysz and the entire LOT virtual airline, Mike Blier, Mike Brown, Nick Harvey-Phillips, Rafael Hidd, Richard Dillon, Ron Freimuth, Sam Chin, Steve Lewis, Thomas Hjelm, Thomas Klein, and Tommy Tomov.

Documents Editor and Contributing Manual Author

Thank you to Lou Kostyo for serving as Documents Editor and Contributing Author of the ERJ Manual. Lou contacted me in April of 2000 with questions concerning my Emb-120 panel and has been aboard for ERJ panel testing from the start. Lou flew for ASA in Atlanta, Georgia for 9 years logging 5,000 hours of his 7,600 hours of total flight time as Captain on the Emb-120. Thank you for the professional input Lou.

NOTE FROM THE EDITOR

I was very impressed with Bill’s Emb-120 panel when I first began using Flight Simulator 2000 in the spring of 2000. Since most of my ASA flight time had been behind the yoke of the Emb-120 Brasilia, I was delighted to find a panel that I could fly in FS 2000 that so accurately represented its cockpit. Bill had just begun work on the ERJ panel at the time I contacted him with questions regarding the Emb-120 panel. Before I knew it, Bill contacted me to ask if I would be interested in participating in the ERJ Project as a tester. I did not have much time to donate toward the project at first, but followed the progress of the ERJ panel when I could with great enthusiasm. When I received notice from Bill at the end of June 2001 that Beta testing of the final ERJ panel was about to begin, I just had to find more time to participate. I agreed to focus on testing the FGC and Autopilot. However, as soon as I read Bruce Ullyot’s ERJ Manual that accompanied the panel, I asked if I could serve as editor to help polish its already outstanding presentation. Bill and Bruce both readily agreed to let me help out to that end. Then, after the Manual was completed, it was time to help refine the Tutorial Document, Checklist, and Takeoff/Landing Charts. As of this writing, I have dedicated in excess of 300 hours insuring that the content and graphics of the ERJ Documentation before you is as accurate and thorough as possible. I have donated this time with pleasure because of my passion for technical writing projects and firm belief that Bill would do whatever was within his power to make his ERJ panel the best freeware Regional Jet panel available for FS 2000. Bill has been incredibly open to all results of testing and has persevered through much frustration getting the ERJ panel to operate as close to the “real thing” as he could. Great Job Bill! I am honored to have been a part of this project and to have been able to work with such a great group of fellow aviation professionals and flight simulator enthusiasts. THANKS! Lou Kostyo

Flying the ERJ-145 - A New Pilot's Perspective

My name is Henry Cisneros, and I am a new First Officer with Continental Express Airlines. During May 2001, I completed training on the ERJ-145 and thought I would share my observations on what it is like to train to become an airline pilot and fly the jet.

Background
First, a little background on my flying experience: With my Private ticket in hand, I started flight training in 1995 at San Jacinto College, near Houston, TX. After completing an AS degree program I became a flight instructor. During my time as a CFI, I also flew pipeline patrol to build my multi hours. I left instructing for airline training with about 1200 total time and 190 multi-engine. Up until now, I've never flown anything faster than a twin-Commanche and had no turbine time. I'm 35, hold CFI, CFII, MEI, and Commercial-Multi-Instrument Airplane ratings.

Week 1 - Indoctrination
Indoc is a week of study of FAR's and company procedures and regulations. There is an exam at the end of the week. Week 1 is followed by a weekend of CRM training. There are 40 in our class, with half going to training in the ATR-42, the rest into the ERJ-145.

Weeks 2 and 3 - Systems Class
Our class is split up now, with 20 of us in 145 school. This is a very, I mean VERY intensive and in-depth study of the 145 and its associated systems. A typical day is class from 8 a.m. to 5 p.m., followed by dinner/personal time, home study from about 7 p.m. until 10 or 11 p.m. Everyone says because of the amount of information you have to learn, training is like drinking water from a fire hose. I thought it was more like drinking from Niagara Falls. Daily quizzes and a comprehensive written exam was given at the end of week 3.

Weeks 3 and 4 - CPT and FTD training

From this point on, training is conducted with two students per instructor. Cockpit procedures training (CPT) is done in a mockup of the 145 cockpit. A simple photographic mockup is used to help us learn the "flows" which are nothing more than an orderly and efficient way to operate the aircraft. Flows are done when a checklist is called for and while they don't take the place of the checklist, the items on the checklist are simply accomplished before the checklist is read, then double-checked by the reading of the checklists.

After two, four-hour sessions in the CPT, it is off to the Flight Training Device, or FTD. The FTD is a full cockpit simulator that does not have visual displays or full motion. It is a flyable sim that even runs the same software as our full-motion sims. The focus on our training in the FTD is cockpit procedures, call-outs and profiles. Callouts are the verbal commands and directions we use as we fly together as a team. You know, like "Positive rate---Gear up!" Profiles are the "how-to" procedures that address things such as procedures and speeds for takeoffs and climbs, speeds and flap settings for descents and approaches and emergency procedures.

So what was it like to fly the FTD? Well, my first impression was WOW! The displays in Flight Sim 2000 with Bill Grabowski's panel look just like the real thing. Sure, there were a few differences with where some of the items are displayed, such as the radios but the primary display is a dead ringer. I had been told before I got to the FTD that everyone has a little trouble on the first day because that is when you see the displays actually "moving" and telling you what is happening with the flight. It can be really distracting to simultaneously try and interpret what you are seeing on the panel, fly an airplane/jet/rocket for the first time, and remember all your call-outs and procedures. Needless to say, my sim partner and I had a hard time our first day, but at least I didn't have too hard of a time with the task of reading the instruments, and for that, my thanks go to Bill. My difficulty came with being able to fly, talk and remember all my procedures at the same time. We had 3 sessions in the FTD followed by a stage check on the 4th.

So what was the cockpit like? Well, incredible! Climbing into the seat is easy because the seats move outboard after they reach the end of their aft travel. It's easy to get comfy with dual adjustable armrests, multiple seat adjustments and rudder pedals the have electric fore/aft adjustment. Seat height is electric. My first impression of the 5 computer screens (CRTs) is that they were smaller than I imagined, but I quickly grew accustomed to them. The yoke is unique, with "rams horns" or what some call bicycle handlebars. At first I thought that they were wayyyy weird, but I learned to love them in about 10 seconds! They place your hands in a very comfortable 45 degree angle and the grips are molded to fit your hands very nicely. One odd feature of the yoke is that it is attached vertically to the floor (like a big airliner) but it does not rotate from side to side (aileron control) at the top. Instead, it pivots laterally from a point about half way from the floor, giving the aileron control an odd side-to-side arcing movement. That too, took about a minute or less to get used to. After that, the flight controls felt great. Elevator control is a normal, fore/aft movement.

Thrust levers are solely electronic controls, and feel no different than moving or turning a large volume knob on your home stereo. There is nothing to give you any feedback, just your engine displays on your EICAS. There is an idle stop where the levers stop when you pull them all the way back, a thrust detent about 90% of the way to max thrust, and of course, the max thrust setting at the top of the lever's motion. The detent is a special setting that you feel for as you advance the thrust for takeoff. It feels like a little "bump", or spot of resistance. This detent is set for takeoff and activates our Automatic Takeoff Thrust Control System, or ATTCS, which automatically sets your engine parameters (power) for takeoff and doesn't let you over-speed the engines. Neat, huh!

Cockpit illumination is great, with all the knobs and buttons backlit. We have a nifty spotlight about each pilot's head, and bright dome lights for use on the ground. There is also an illuminated chart holder on the yoke, but most pilots don't use it because of its poor clip design and proximity to the pilot when the yoke is moved aft.

The air conditioning and heating system is pretty good and is something we hear very few complaints about. Good for me, because I hate the heat! ;-)

Visibility is pretty good out the front and side windows. The side windows can be opened on the ground to let a little fresh air inside.

The overhead panel seems a little low and it is a fairly short reach for most of the buttons and switches, but I guess it has to be that way so we can get to the controls. I'm 5'8" and have never bumped my head getting in or out of the cockpit.

Ok, now back to training:
After our stage check in the FTD, we had our oral exam. It was a comprehensive three-hour question and answer session done on a one-on-one basis, or sometimes two students will take their oral simultaneously. I think I was the most nervous yet for this oral, but I was fortunate to have a great examiner who put me very at ease. After a successful oral exam, it's off to the full motion sim.

Weeks 5/6/7/8 - Full Motion Sim
(Because the sim is in such high demand and scheduling time in it is difficult, some students take 4 weeks or more to complete this stage. Training takes place both in-house and at Flight Safety. I trained in-house.)

Once you reach the sim, your excitement grows as you look back and realize how much hard work it has taken to get to this point. COEX uses CAE MaxVu sims just like the one described in Flying Magazine, June 2001, pp 51-53. I even saw the fire trucks just like in the picture in the magazine.

My impressions of the sim were, again, of awe. The graphics were so realistic, and the movement of the sim so well done that you would forget you are flying a computer, solidly bolted to the ground. There were a few times I even felt a little vertigo! The visual displays that show you the outside world wrap around through a field of about 180 degrees, so your peripheral vision picks up all the cues necessary for you to feel a sense of acceleration, deceleration, and speed close to the ground. Add the computer controlled motion into the mix and you have an extremely realistic impression of flying.

During our time in the sim, we practiced normal and emergency procedures, plenty of approaches, and the V1 cut. The V1 cut is an engine failure on takeoff, when the airplane has reached the point on the runway that there isn't enough runway to stop and the only safe choice is to continue the takeoff on one engine. It's a little tricky since the engine still developing power is at max thrust and is contributing to uneven thrust, which makes the airplane want to turn (yaw and roll). And don't worry about not having enough power to fly on a single engine. This airplane has so much power that you could climb (not as fast as on two engines) and fly around all day on one engine without any problems.

The V1 cut is not too difficult to control, as the airplane has near centerline thrust. You do have to be careful about using the correct about of rudder (less than many other airliners, and, for example, a lot less than 737s) to control the airplane's yaw. If you put in too much rudder and then correct by taking out too much, it is easy to get into pilot induced yawing oscillations, and will find yourself bicycle peddling the airplane. How do I know? ;-) Oh, and don't forget to turn off the yaw damper. If you don't, it will fight your trim corrections and you will just have a plain old hard time flying the airplane on one engine, which should really be fairly easy. Don't ask how I know about that either.

Single engine approaches are not too hard, just remember to use more power than what you are used to, and be slower at reducing power. The landings are pretty straight-forward. (More on landings later.)

The sim is where we learned our stall series and steep turns. The stall series is pretty easy but some new habits had to be learned. For example, I had to learn the call-outs and procedures for learning to do these maneuvers as a team. For example, the non-flying pilot will raise and lower your flaps as you direct, and can also adjust your thrust on steep turns to help you maintain airspeed.

During both stalls and steep turns, your Vertical Speed Indicator (VSI) becomes one of your most useful instruments. Now, this may seem contrary to what you learned flying light planes, but our VSI is a bit different. It is an Instantaneous VSI (IVSI) that reacts almost immediately to changes in altitude. I had a very hard time learning to rely on it, but once I did, I found it much easier to maintain altitude to fairly low tolerances.

The stall series is a little different too. Flying light planes, during the stall recovery, you were taught to lower the nose to reduce the angle of attack as the first part of your recovery. Do that in the 145 and you'll lose altitude quickly, 100-200' or more, in what seems like seconds. So how do we recover from the stall? POWER! In the stall recovery, we pretty much hold our pitch attitude as we add thrust, then add a little back pressure (yes, pull back on the yoke) to counteract the force of the thrust vector that tries to make the nose go down. Why does adding thrust make the nose go down? Well, the engines are mounted above the airplane's center of gravity. If you create a force above the airplanes CG and center of rotation, the plane will tend to rotate about its CG, and in our case, with high-mounted engines, the nose tends to head down.

Instrument approaches are not very difficult in the airplane when you have the incredible avionics you see in Bill's panel and two trained pilots to help each other through the approach. What I found difficult was learning to use the flight guidance control panel. The flight guidance panel is the set of buttons that you press to activate various flight director and autopilot modes. For example, this is where we direct the plane to climb to 12,000', or descend at 2000 feet per minute, or track a VOR/FMS or capture a localizer and glideslope and the fly the approach. As you can tell from the panel, there are many buttons, some of them labeled somewhat ambiguously. To add to my confusion, there are also different guidance modes that are used at different times. For example, if you want to descend from 10,000' to 6,000', there are many ways to do it. You could hand-fly the plane with no guidance from the computers. Or, chose FLC, or flight level change, which (below 10,000') gives you a 1,000 FPM descent. Or, hit the vertical speed button and dial in your own vertical speed with the speed knob. Or, use the speed hold button and descend at an indicated airspeed of your choosing. Oh, and don't forget to first dial in the altitude you are descending to. You have to rotate the ASEL (altitude select) knob to preselect it. Now, try to do all this while you fly an approach, taking care to not break any airspeed limitations or airspace limitations. And, don't forget your callouts and remember to configure the airplane at the correct time/place/altitude.

Now, for someone with experience in turbine aircraft or planes with flight guidance systems, this probably doesn't sound that hard. But it was for me. In fact, I can say that the flight guidance system was one of my major challenges during training, and now that I'm flying passengers I'm still learning the best way to direct the plane.

So, all this time spent and hard work and I haven't even flown the real thing yet. Keep with me, we are almost there.

Our last session in the sim was our check ride. The check ride is probably the biggest event in training, and for me, was the time when I was the most nervous. On our check ride, we must perform various instrument approaches, stalls, steep turns, V1 cuts, and rejected takeoffs. We are also thrown a variety of system malfunctions and emergencies. Our check ride went well, with me making a few minor mistakes, especially in the beginning of the flight as my nervousness was being displaced by the workload and concentration necessary to handle the plane. One thing that was pretty neat is that my examiner programmed a little surprise for my rejected (aborted) takeoff. Right around 90 knots, my nose gear collapsed! The sensation in the sim was incredible. The moment it happened, he heard a loud bang, we lurched forward and down, then be bounced and scraped our way down the runway. I had to be careful with the rudders to keep us on the runway as the airplane was wanting to weathervane into the wind and slide around. Heck, all we needed was sparks and the smell of burning and scraping fuselage and it would have been a perfect illusion. Thankfully, we came to a stop on the runway, declared our emergency and practiced our evacuation procedures.

I finished my session at about 11:45 p.m. and then it was my partner's turn. When we were done and our examiner shook our hands to congratulate us, I was so happy I was giddy. We left our exam in the sim at 2:00 a.m. My sim buddy and I were wiped out, but so happy and full of adrenaline that sleep was out of the question. What do you do after 2:00 a.m. on a weeknight in north Houston? Nothing. You smile, you laugh, you go back to your hotel and dream of flying at 37,000' in an EMB-145.

Weeks 9/10 - Aircraft Training

The next step in our training is all about flying the real thing. This training is done without passengers aboard. We get at least 4 hours flying and then a check ride. Our training was spread over one day and one night.

Day 1: We depart IAH (Houston) from a local FBO for the College Station airport (CLL). It was my sim partner's turn to go first, so I sat on the jump seat and watched. The jump seat is very small and lacks for leg room. Most guys seem to sit side-saddle to help with bumping their knees. My first impression is that the airplane accelerates spectacularly when it has no passengers or cargo aboard. The engines are also very, very quiet from the front of the plane. Even at takeoff power, you can't hear them very well from the front. I think part of that is contributable to the fact that we wear full coverage headsets to protect us from the wind noise at cruise airspeed.

Yes, you heard right, we wear full headsets, exactly like the David Clarks you wear in your Cessna or Piper. I did some tests with removing my headset and checking the sound level, and below 250 kts the airplane is eerily quiet, but as you go faster, the wind noise gets louder. At Mach .78, you can take off your headset and still converse with the other pilot, but it is a bit loud for normal conversation, and I found it got on my nerves after about 15 minutes without headsets.

Another thing that struck me as being odd was the amount of creaks, squeaks and rattles I heard on the taxi and takeoff/landing roll. It seems that there are a million plastic panels, doors and compartments. And they like to make noises as the plane accelerates! It's a bit unnerving, and I think we hear these normal noises a bit better due to the quiet engines and our headsets. Of course, the older the plane, the worse the little rattles are. FYI, last month I rode on the jump seat for three days on 737's, models 200, 300, and 700. They rattle too. They just sound "heavier".

Back to day one: After watching my sim partner do a great job on his approaches and landings, it was my turn. I was a bit nervous as I ran through my flows and checklists. Not having passengers was a big help, but countering that fact was a strong, gusty crosswind. As we taxi out to the runway, I'm grateful that the captain has the ground steering control (tiller) on his side. I use the time taxing to silently review my takeoff procedures and try to calm my nerves.

My first takeoff seemed to be a blur. We got our clearance to takeoff, the instructor taxied us on to the runway and transferred controls to me. I thought to myself, "OhmyGod, I'm really gonna fly this jet, this is for real!" As I advanced the thrust levers, I seriously had to suppress a great big "Yippee!" We reached rotation speed (can't remember the exact speed that day for the conditions, it was around 115) quickly and I moved my left hand from the thrust levers and used both hands on the yoke to rotate the nose up. After you break ground and the plane starts to accelerate, you must start to trim the nose down or you will overshoot the 14 degree nose up pitch target that we use for climbout. I thought to myself that the airplane is a little less sensitive than the simulator is, and is more stable and easier to fly. Takeoffs in the sim and the real airplane are actually very close to each other in feel.

As we climbed out, I noticed we were going up at greater than 4000' feet per minute. In what seemed like 5 seconds we were at our level-off altitude of 2,600' feet. Of course, I'm wayyyyy behind the plane, amazed at everything going on around me, and find myself late in leveling off. I have to push the nose down aggressively and still overshoot my altitude by 150'. The airspeed seems to be building in a mad rush for the redline as I aggressively reduce throttle and barely keep the over speed warning from coming on. I'm forgetting to trim as I feel like the airplane is flying me, not the other way around. After a few minutes, I start to settle down. I keep saying to myself, "Just like in the sim, just like in the sim". I also keep asking myself, "OK, what's next? Which checklist comes next? When am I going to slow down? Am I forgetting anything?"

Now we are on a wide downwind let, getting vectored for our first approach, and my instructor pulls the number 1 engine to idle. I realize my first approach and landing are going to be single engine. "Oh wow, great fun," I think to myself. Then I remember my training. That first approach went ok, only major problem was that I stayed about 10 knots too fast. I guess I was worried about getting too slow on one engine, a major no-no. The first landing didn't go too bad either, as my instructor coached me through the flare. Hmmm, very similar to the sim. Of course, I had no time to reflect on my first landing in the jet. Too many things to do.

The second takeoff and landing were done on both engines and I had a few precious seconds to make some observations about flying the plane. First, the control forces are not very light, yet they are not heavy either. Hard to describe, I guess I would say they are "just right". Second, there is a noticeable lag in throttle response. Flying a jet you must plan ahead for power reductions and increases. The lack of that big propeller and that recip. engine makes for fun moments. For example, I find myself 10 kts. too fast, so I chop the throttle. Our slippery airplane takes its time in slowing down. Since I'm so far behind in what I'm doing, I don't notice that the airplane has finally slowed down, and now it's 5 kts. too slow. Now I add a bunch of power, but nothing happens. Now I'm 8 knots slow. And then WHOOOSH! Here comes the thrust, and now we are back where we started, 10 kts. fast. After a while, you learn to compensate and plan ahead, and after a while longer, you do it subconsciously.

Still, I have the impression that this airplane is a beast, and that things are happening faster in the plane than they did in the sim. I guess it was just nerves.

Landing the plane isn't overly difficult but you must use good technique and apply proper crosswind correction, same as any other plane. The better and more stable your approach, the easier and smoother the landing is. Now one difference you will find between a light plane and the 145 is in the flare. In the 145, the main landing gears are about 50' behind the cockpit. So, there is a bit difference in the landing. Descending through about 100' AGL, we start slowing to our touchdown target speed, which is about 10 kts. slower than approach speed. The flare starts like any light plane, except that you have to stop adding back pressure before the mains touch down, or even add a little forward pressure to keep from flying out of ground effect. You can also apply forward pressure on the yoke to raise the mains and keep them from touching down hard. Weird, huh. Once the mains touch down, you can add a little forward pressure to start the nose down, then you start flaring again to keep the nose from crunching down and hitting the runway hard. Some guys will deploy the thrust reverser buckets as soon as the mains touchdown. This helps keep the nose up and also helps decel the airplane. In all, landing this airplane safely isn't too hard. Landing it well, and smoothly, is.

In fact, the flare is one area that I feel the full-motion simulator doesn't recreate all that well. Perhaps it is a lack of fidelity in the visual perspective, hindering the feeling of vertical speed. Of course, it could have just been my hard-headed self, trying to learn a new technique to land an airplane. I don't really know.

The next huge challenge was visual approaches and closed traffic patterns. It's one thing to fly a small piston trainer around the patch, yet another to fly this rocket. Again, after takeoff, it takes an aggressive level-off. By this time, it's time to turn crosswind and

start preparing for the approach and landing. The traffic pattern was flown at 1500' AGL and 180 kts. on the downwind. It seems as there is no time at all to call for checklists and configure/decel the airplane. But there is actually plenty of time. It just doesn't seem like it. During my turn at the controls, I'm learning to backup my visual descent with the glide slope. Part of the challenge is that closed traffic patterns are not practiced in the sim due to the lack of any field of view past about 90 degrees to either side.

After my turn at bouncing landings and approaches, we land for fuel. We had a few minutes to deplane and walk into the terminal. I can't express in words the feeling I experienced when I walked down the stairs and looked back at the shiny jet. Wow, I'm finally on my way.

We depart back home to IAH and I actually get to look out the window and marvel at the clouds rushing by. I'm faced with one last challenge as I return to the airport, a visual approach starting with a 6000' MSL (5,900' AGL) downwind leg. With some advice from my instructor, I fly the visual and make a safe, if not pretty, landing.

Night 2: We spend the entire next night with more training and our check rides. We brief at 9:30 p.m., are preflighting at 11:00 p.m. and finish around 6:00 a.m. My flight goes well, except that I feel the heat as I have not landed the real airplane at night yet. However, the sim has prepared me well for the challenge. My instructor has great patience and demonstrates a complete visual traffic pattern for me. We also practice single-engine approaches, which we simulate by reducing thrust on one engine to idle. During this part of the training I learn my hard lesson about disconnecting the yaw damper when flying single engine. In the end, I am able to pass my check ride and learn a lot from my instructor and examiner. I return to the hotel and collapse into bed at 7:00 a.m.

That's it. I've finished almost all my primary training and all my exams for now. Passengers are next.

Weeks 10/11 - Initial Operating Experience (IOE)

IOE is our introduction and training in real-world operations where we fly regularly scheduled trips with passengers aboard. It takes a minimum of 25 hours, which usually takes about 4 or more days of flying.

I'll never forget the nervous anticipation I felt when our passengers were loading up. I looked back and saw women, children, grandparents, all kinds of folks getting on our plane! I was in the cockpit with the captain, trying to figure out the weight and balance, run through my flows in preparation of our push back from the gate, and figure out what the heck came next. Trust me, it's nerve racking. It does get easier after a few trips. You finally start to figure what is expected of you, what needs to get done and when.

My first flight was to Columbia, SC. This was going to be the captain's turn to fly, which gratefully, and at the same time regretfully, put me in the position of non-flying pilot (NFP). Why regretfully? Well, it would delay my first chance to fly until the following day, as this flight was going to be our only one that day. So, my first time out would have me in the role of assistant to the flying pilot, making all the radio calls, running the checklists and backing up the FMS nav system with good, old-fashioned VOR navigation.

I was lost. And we hadn't even left the gate! You see, to taxi to a runway at a major airport like Houston's Bush Int'l., you must first get permission from Ramp Control (North or South side, different frequencies) to push from the gate. They will ask you to call them back when ready to taxi. Then, you call them back and they tell you to taxi to a holding spot, "spot 1, or 6" for example. Once you are at spot X, they tell you to call Clearance Delivery. The clearance controller may amend your clearance or just ask you to monitor ground. Then the ground controller gives you taxi instructions. And you can bet they talk fast. Once you are close to the runway, it's time to switch to the tower frequency. Did I mention there are multiple ground and tower frequencies? Confused? So was I. Gratefully, I had a very patient and understanding training captain that led me by the hand through this maze of confusion. Oh, and remember you are also running the taxi and before takeoff flows and checklists while you taxi and don't forget to keep an eye out for other traffic taxiing about the airport.

The trip to Columbia went uneventfully, with plenty of training and discussion going on once we leveled at our cruising altitude. One highlight of the trip was the takeoff. I couldn't help but contain a smile as I thought to myself, "I've finally made it." It took us 2:20, gate-to-gate, to complete our flight. The first flight was fun, but I did miss doing any flying.

The next day's schedule was pretty light, with nothing but a return trip to Houston on my schedule. I was doubly nervous as I knew I would be flying. While on the ground, we went through the same drill as before, with me completing the walk-around, getting the ATIS, checking our clearance, doing the weight and balance as our trusting passengers came aboard. Little did they know it was going to be my first time on an actual trip with them aboard.

Taxiing to the runway in Columbia was much easier than Houston and reminded me of my flying days at smaller airports. I was still pretty nervous as we lined up on the runway and the captain said "OK Henry, you've got the airplane, ready when you are." My heart was pounding as I advanced the thrust levers. I remember thinking to myself, "I can't believe I'm actually doing it," and then I remember nothing else but intensely concentrating on the task at hand. The next thing I remember was a magical moment when we were finally airborne with the gear coming up and me flying and trimming the airplane. All my nervousness went away, and was replaced with concentration and a little script in my head that told me to remember my training. It's another one of those things that is hard to explain, I guess it's similar to the feeling you get on a check ride when you forget that you are being examined and you just get to the task at hand of flying.

I couldn't tell a huge difference between flying the airplane empty and fully loaded. It did seem slower to accelerate and a bit heavier on the controls. Perhaps a bit of adrenaline took care of that.

The flight back to Houston went well. We spent most of our time in cruise with more training and review of some topics covered in ground school. I really didn't get any time to reflect and enjoy the trip at cruising altitude, as we were busy. I do remember looking inside the cockpit, down for a second, seeing a guy wearing an airline uniform and realizing it was actually me.

The first landing was an adventure. It seemed as if airplanes were lined up for miles on the approach into Houston. Again, we did the 6000' downwind leg. My captain was helping me out a lot, teaching me the best time configure and slow the airplane to help us blend into the other arriving traffic. I don't think I was emotionally prepared for how fast the controllers were talking and moving traffic. Things were happening quickly as we turned final and then were cleared to land. Keeping descent the speed and the rate of close to their proper values was not too hard as I did my best to remember my training. However, when it came time to flare, my old instincts of flying smaller, lower to the ground planes came out and I started to flare a bit late. A quick hand rose from the left side of

the cockpit to help me out and we ended up making a decent, if not pretty, landing. I think we both let out a sigh of relief as I made my first “real” landing.

The following week found me flying a three-day trip to complete my IOE. During this trip I also learned how rough the airplane flies in turbulence. With its relatively stiff wings, this airplane rides more like a sports car then anything else. I remember being at the controls and approaching Houston through some afternoon cumulous clouds and then getting pounded. The airplane suddenly bounced three times and I remember being thrown out of my seat into my shoulder harness, then pounded back into the seat. Funny how some details stick out, like I remember my heels also pounding against the floor panels. In seconds, it was over. Bumps in this airplane feel “sharp”.

Where am I today? Sitting reserve in Houston. I’m on call for the next few months until I have enough seniority to be able to hold a normal monthly schedule. I’ve got about 65 hours in the jet and things are coming together. I’m learning the in’s and out’s of the job. My landings are really improving, and I’ve been lucky to grease a few in. Of course, some of them have been less than pretty. I’m still trying to get better at my night landings. The display control panel has finally given up its secrets. As have the taxi procedures in Houston. I give a lot of credit to some very kind and thoughtful captains that have gone the extra mile to show me the ropes. And you know what? It’s getting to be more and more fun. I find myself smiling a lot in the cockpit. You know, I have the best job in the world.

I would like to take a quick moment to thank everyone who has helped me reach the point in my career. God, family and friends have always been at my side. A special thanks to my brother and all the instructors who worked hard to help me learn to fly. I can never say enough about the fine folks at Continental Express. They do a great job.

I hope you enjoy flying Flight Sim 2000 with Bill Grabowski’s panel. He has spent countless hours developing a great enhancement to our simulator and we all owe him our gratitude.

Please feel free to contact me with your comments or questions.

Henry E. Cisneros
F/O Continental Express Airlines
hecpilot@evl.net

INSTALLATION

Installation is quite simple. Make sure you have the option set which allows compressed .zip files to maintain directory structure during the unzipping process. Then…

Unzip ERJ_bg.zip with your FS2000 folder as the target folder. All files will be properly placed.

If you prefer, unzip ERJ_bg.zip into a temporary directory. Examine its contents and manually install the contained files into appropriate directories in FS2000.

SUPPORT

Send any comments, questions, suggestions, or reports of any bugs to:

wsgrabowski@home.com

IMPORTANT NOTICE

Because of the complexity of the panel, if you send an email with a question whose answer is covered in this manual, you will receive a curt email stating, "This procedure has been covered in the manual. Please consult the manual." This is to reduce time spent quoting the manual. ☺

Thanks for your understanding.

P.S. This panel is freeware, and did not cost you a thing, but it took Bill a lot of hard work and time, more than you can imagine ! So just remember that when you use this panel or are expecting something that may not be included, it wasn't for a lack of trying by Bill to include everything ! Enjoy……

Bruce Ullyot

ERJ-145LR SPECIFICATIONS AND PERFORMANCE

OVERALL LENGTH	98 ft 0 in	29.87 m
HEIGHT	22 ft 2 in	06.75 m
SPAN	65 ft 9 in	20.04 m

GENERAL SPECIFICATIONS

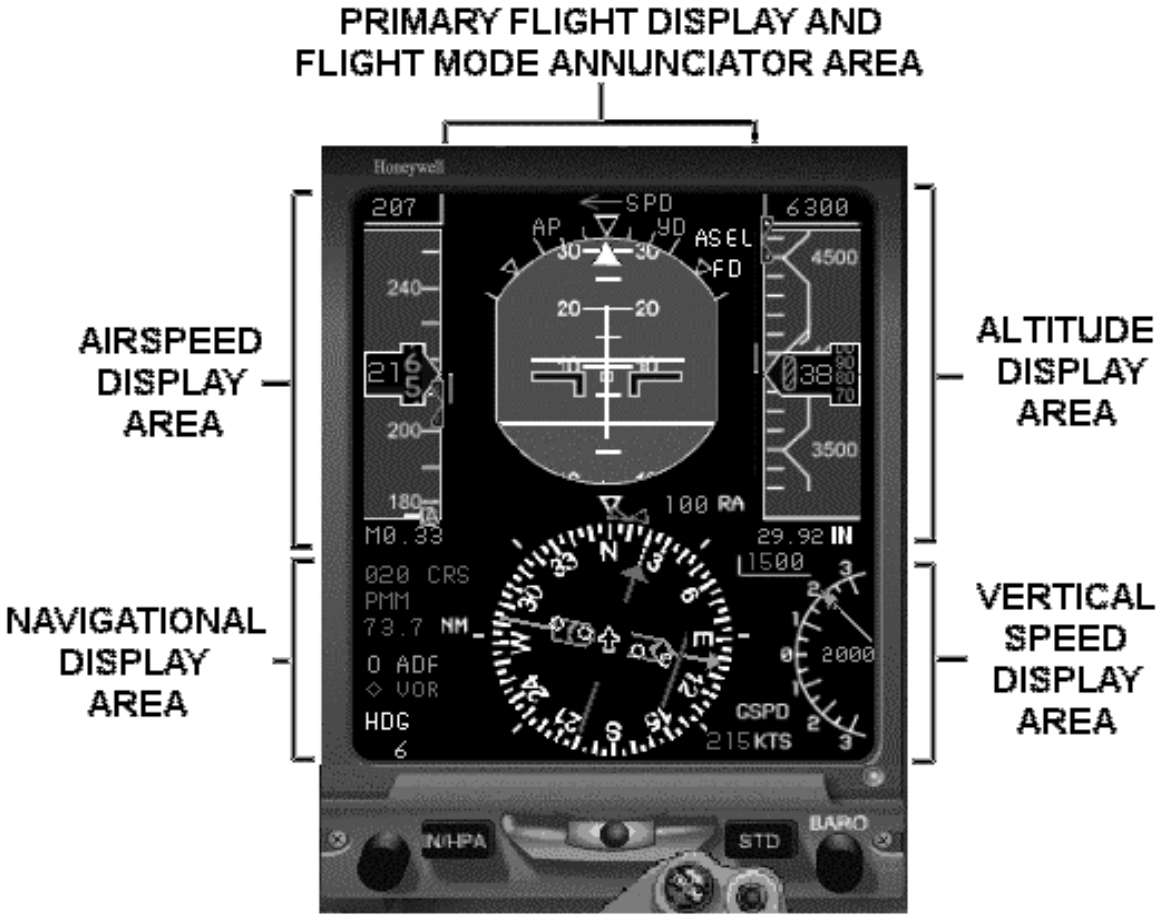
ENGINES - Two AE3007A1/2 turbofans with 7,580 lbs (3,438 kgs) static thrust

MAX TAKEOFF WEIGHT	48,500 lbs	22,000 kgs
MAX LANDING WEIGHT	42,549 lbs	19,300 kgs
MAX ZERO FUEL WEIGHT	39,462 lbs	17,900 kgs
BASIC OPERATING WEIGHT	26,470 lbs	12,007 kgs
MAX PAYLOAD	12,992 lbs	5,893 kgs
MAX FUEL LOAD	11,435 lbs	5,187 kgs
MAX BAGGAGE CAPACITY	2,646 lbs	1,200 kgs
BAGGAGE COMPARTMENT VOLUME	325 ft³	9.20 m³

PERFORMANCE

RANGE FULL PAX @ 220 lb (100 kg) LRC		
(Reserves 100 nm + 45 min) ISA	1,550 nm	2,870 km
MAX CRUISE SPEED (Mach 0.78)	450 kts	833 km/h
SERVICE CEILING	37,000 ft	11,278 m
T/O FIELD LENGTH (MTOW, SL, ISA)	7,448 ft	2,270 m
LANDING FIELD LENGTH	4,413 ft	1,345 m

PRIMARY FLIGHT DISPLAY – PFD

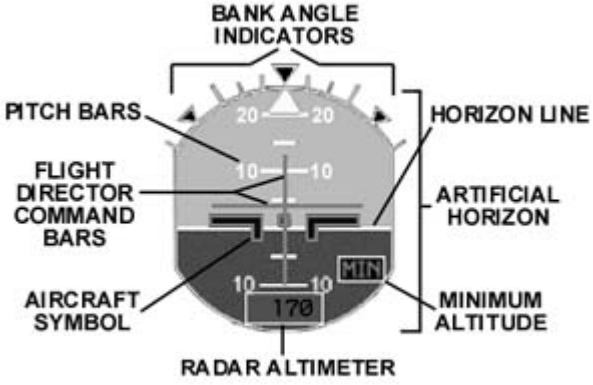


The Primary Flight Display, or PFD, is designed to incorporate all the standard flight instruments (attitude, airspeed, altitude, vertical speed, and heading) into a one-screen presentation. The PFD also displays navigational data along with flight mode status and selections.

ELECTRONIC ATTITUDE DIRECTOR INDICATOR – EADI

A. ARTIFICIAL HORIZON
This display provides pitch and roll information of the aircraft in relationship to the horizon line. The upper part, blue in color (light shaded area in diagram), represents the sky and the lower part, brown in color (dark shaded area in diagram), represents the earth. The white line where the two colors meet represents the horizon.

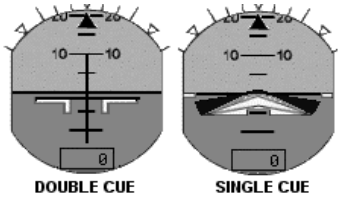
B. BANK ANGLE INDICATORS
Provides indication of the roll (bank angle) of the aircraft in degrees. Each mark represents degrees of bank: 10, 20, 30, 45, and 60 degrees of bank. The markings are fixed. The bank index (white triangle) moves with the Artificial Horizon.



C. PITCH BARS
Pitch bars provide reference for the pitch angle of the aircraft above and below the horizon line. Pitch bars are placed at 5-degree increments.

D. AIRCRAFT SYMBOL
A stationary symbol in the center of the EADI represents the aircraft and displays pitch and roll information as the Artificial Horizon moves. The aircraft symbol can either be two horizontally opposed “L” bars (as depicted) or a single “flying wing.” The two types of aircraft symbols may be selected with the ET button on the Display Control Panel (DCP).

E. FLIGHT DIRECTOR COMMAND BARS



The Flight Director command bars can be either double cue with 2 bars, one for lateral information (the vertical bar) and one for vertical information (the horizontal bar), or single cue (V-Bars), which shows lateral and vertical information in one unit. The pilot can choose between the two types of command bars by clicking the ET button on the DCP located on the glareshield. The pilot can use the command bars to fly the aircraft to the parameters input through the Flight Guidance Controller, with or without the Autopilot engaged. The command bars are especially useful in Approach Mode (APR) to track and display localizer and glide slope information on an ILS precision instrument approach.

F. RADAR ALTIMETER
Displays the height above ground when aircraft altitude is less than 2500 ft above ground level (AGL).

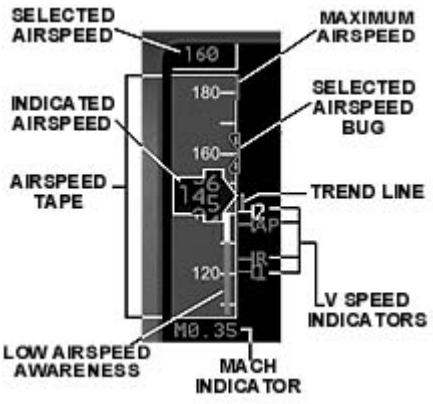
G. MINIMUM ALTITUDE
The MIN display will flash for 10 seconds upon reaching the selected Decision Height (DH) or Minimum Descent Altitude (MDA). Minimum Altitude is selected by using the RA–c–TEST rotary knob on the DCP. The selected DH or MDA is displayed numerically in the PFD at the lower left of the Altitude Display Area and appears as “100 RA” in the diagram of the PFD on page 17.

H. PITCH LIMIT INDICATOR
The Pitch Limit Indicator assists the pilot in determining when the angle of attack (AOA) of the wing is approaching a stall. The Pitch Limit Indicator works in conjunction with the Low Airspeed Awareness strip. The Pitch Limit Indicator will appear at the top of the EADI in three different colors:

- GREEN Pitch angle is approaching stall AOA
- YELLOW Pitch angle is very near to stall AOA
- RED Pitch angle is at or beyond stall AOA

AIRSPEED DISPLAY

A. SELECTED AIRSPEED
Shows airspeed selected by using the SPD rotary knob on the Flight Guidance Controller (FGC). Also shows airspeed presets from Autopilot FLC Mode and current airspeed when Speed Mode is selected on the FGC. A blue bug will be located on the airspeed tape at the selected airspeed. The airspeed bug will disappear when the Autopilot is in VS Mode, but will return at altitude capture. Above FL250, the selected airspeed readout will be displayed in Mach. Selected airspeed cannot be set greater than maximum airspeed (M0.78).

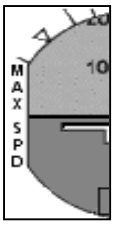


B. INDICATED AIRSPEED
Shows the current indicated airspeed in knots (KIAS) in a digital format.

C. AIRSPEED TAPE
A vertically scrolling numerical tape indicates the current airspeed in units of 10 knots.

D. MACH INDICATOR
Shows the speed of the aircraft in units of Mach. Maximum indicated Mach should not exceed 0.78. Mach number is the ratio of airspeed to the speed of sound, Mach 1.00 being the speed of sound.

E. MAXIMUM AIRSPEED (Vmo/Mmo)
The red vertical strip indicates the maximum allowable airspeed at current altitude. When the red strip reaches the indicated airspeed display area, the aircraft is exceeding the maximum allowable airspeed. Below 10,000 ft this red tape will be set to 250 kts which is the maximum airspeed allowed by regulation below 10,000 ft. When exceeding Vmo, an amber MAX SPD vertical text warning will be displayed to the left of the EADI.



F. SELECTED AIRSPEED BUG
The blue indicator bug shows the selected airspeed set with the SPD rotary knob on the FGC.

G. TREND LINE
Shows the increasing or decreasing speed trend over the next 6 seconds.

H. V SPEED INDICATORS
The four V speed indicators are set through the MFD Menu System and can be preset to show:

V_1 (Magenta)	Decision speed at which if an engine failure occurs below this speed the takeoff must be aborted. If engine failure occurs at or above this speed the takeoff MUST continue.
V_R (Blue)	Rotation speed, even with one engine inoperative.
V_2 (White)	Takeoff safety speed, based on one engine inoperative.
AP (Green)	Approach reference speed (V_{REF}) determined by landing weight and conditions.

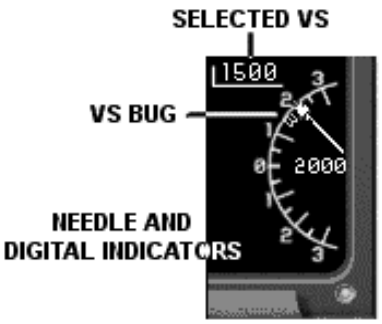
I. LOW AIRSPEED AWARENESS
Indicates when the aircraft is approaching maximum angle of attack (AOA) and approaching Vs. The Low Airspeed Awareness strip has three color-coded ranges:

- WHITE RANGE 1.23 Vs to 1.13 Vs
- AMBER RANGE 1.13 Vs to Vs
- RED RANGE Vs (Stick Shaker) Vs = STALL SPEED

If in the RED RANGE of the Low Airspeed Awareness strip, an amber MIN SPD vertical text warning will appear to the left of the EADI.

VERTICAL SPEED DISPLAY

Shows vertical speed data to indicate how many feet per minute the aircraft is climbing or descending. A digital readout and conventional needle indicator are displayed.

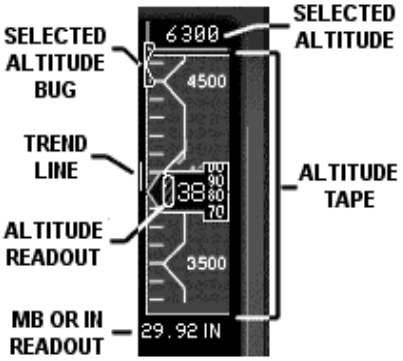


A. SELECTED VS
Vertical speed selected by using the SPD rotary knob when VS Mode is selected on the FGC. Also shows preset vertical speeds when FLC Mode is selected on the FGC. A descent or negative vertical speed will have a "–" before the selected value. If vertical speed is zero or set to zero, the selected vertical speed readout will disappear. Maximum selectable vertical speed is 7000 feet per minute for climb and – 6000 feet per minute for descent.

B. VS BUG
The blue VS bug shows the selected vertical speed as noted above.

ALTIMETER DISPLAY

The Altimeter display shows altitude data in relation to a selected pressure-datum (baro correction), either inches of mercury (IN) or millibars (MB).



A. SELECTED ALTITUDE
Displays the altitude selected by using the ASEL rotary knob on the Flight Guidance Controller (FGC). Maximum selectable altitude is 37,000 feet.

B. ALTITUDE TAPE
A vertically scrolling numerical tape indicates the current altitude of the aircraft in units of 100 feet.

C. SELECTED ALTITUDE BUG
A blue bug on the altitude tape indicates the altitude selected with the ASEL rotary knob on the FGC.

D. TREND LINE
Shows the climb or descent trend over the next 10 seconds.

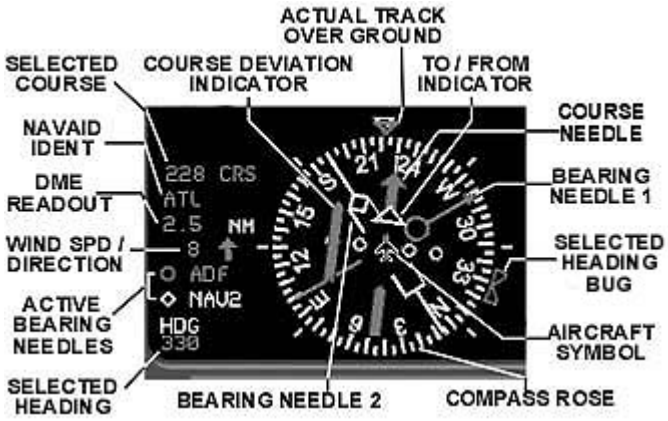
E. ALTITUDE READOUT
Shows digitally the altitude of the aircraft in tens of feet

F. MB OR IN READOUT
The barometric pressure readout is displayed in IN (inches of mercury) or MB (millibars).
The two settings can be selected by using the IN/HPA button on the lower left of the PFD.
The BARO rotary knob is used to adjust the numerical value of the pressure readout.
Select standard pressure setting (29.92 inches or 1013 millibars) with the STD button when the aircraft is at or above FL180.

ELECTRONIC HORIZONTAL SITUATION INDICATOR – EHSI

FULL COMPASS ROSE – NAV MODE

The following describes the EHSI in Full Compass Rose display mode and in NAV mode (as opposed to FMS mode, Arc display mode and NAV mode, or Arc display mode and FMS mode) as selected on the DCP (Display Control Panel). When in NAV Mode, the Course Needle, Course Deviation Indicator (CDI), and all navigational data in the PFD and MFD will be displayed in GREEN. When in FMS Mode, the Course Needle, Course Deviation Indicator (CDI), and all navigational data in the PFD and MFD will be displayed in MAGENTA.



A. COMPASS ROSE
The compass rose shows the magnetic heading of the aircraft.

B. AIRCRAFT SYMBOL
The aircraft symbol shows the aircraft's position in relation to the selected course and heading.

C. SELECTED HEADING BUG
The blue selected heading bug shows the heading selected by adjusting the HDG rotary knob on the Flight Guidance Controller. A digital readout of the selected heading is in the lower left corner of the EHSI display. The heading can be automatically set to the aircraft's current heading by using the PUSH SYNC function of the HDG knob. Click on the center of the HDG knob to activate sync.

D. COURSE NEEDLE
The green course needle is set to the selected course by using the CRS 1 rotary knob just underneath the FD1 button on the Flight Guidance Controller. The course can be automatically set to the current direct course TO the selected VOR by using the PUSH SYNC function of the CRS 1 knob. Click on the center of the CRS 1 knob to activate sync. A digital readout of the selected course is to the upper left of the EHSI. The course needle will turn magenta when in FMS mode.

E. TO / FROM INDICATOR
The white triangle shows whether the selected course, if intercepted and flown, will take the aircraft TO or FROM the VOR.

F. COURSE DEVIATION INDICATOR **–** CDI
The course deviation indicator shows the aircraft's right or left deviation from the selected course.

G. DISTANCE TO STATION **–** DME
Displays the distance in nautical miles (NM) to the selected navigational aid. The three or four letter code of the navigational aid (NAVAID IDENT) is displayed above the DME readout. The distance is displayed as slant distance to the navigational aid due to the aircraft's relative position and altitude.

H. WIND SPEED / DIRECTION
Displays digitally the wind speed in knots and the direction shown graphically by a magenta vector.

I. ACTIVE BEARING NEEDLES
Two symbols, one a circle and the other a diamond, combined with a source flag (NAV 1, NAV 2, ADF, FMS, or OFF) indicate the active bearing needles and their source.

J. BEARING NEEDLES 1 and 2
Shows the bearing TO the selected NAV Source as selected by using the two rotary switches on the Display Control Panel (DCP). The circle and diamond are located at the head end of the needles. Also see I above.

K. SELECTED HEADING
Displays the selected heading using the HDG rotary knob on the FGC (see C above).

L. ACTUAL TRACK
A magenta triangle bug displays actual track across the ground.

ARC DISPLAY – NAV MODE

The difference between the FULL and ARC modes of the EHSI is the ARC mode will display a digital readout of the actual heading and displays approximately 100 degrees of arc of the compass rose. The ARC or FULL modes can be selected by pressing the FULL/WX button on the Display Control Panel (DCP).

ADDITIONAL ITEMS IN PFD DISPLAY

RA DISPLAY (Preset minimum approach altitude for radar altimeter)

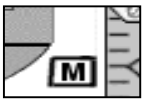
The DH (Decision Height) for a precision instrument approach or the MDA (Minimum Descent Altitude) for a non-precision instrument approach is displayed digitally at the lower left of the Altitude Display Area next to the letters "RA". To change the preset minimum approach altitude for the radar altimeter, use the RA–C–TST rotary knob on the DCP.

GROUND SPD (GSPD) / TIME TO GO (TTG)

These two indications are displayed at the bottom right of the EHSI. Only one indication can be displayed at a time. To switch between the two, use the GSPD/TTG button located on the DCP. Ground speed is measured in this order of priority:

1) FMS Computed
2) Speed from VOR if available (If not, then display is "0")
3) Speed using TAS and Wind Speed

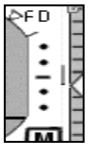
MARKER DISPLAYS



ILS approach marker beacons are displayed at the lower right of the EADI on an ILS precision instrument approach. Each Marker Display has a specific color as follows:

- O in a blue box for the Outer Marker
- M in an orange box for the Middle Marker
- I in a white box for the Inner Marker

GLIDE SLOPE DEVIATION SCALE



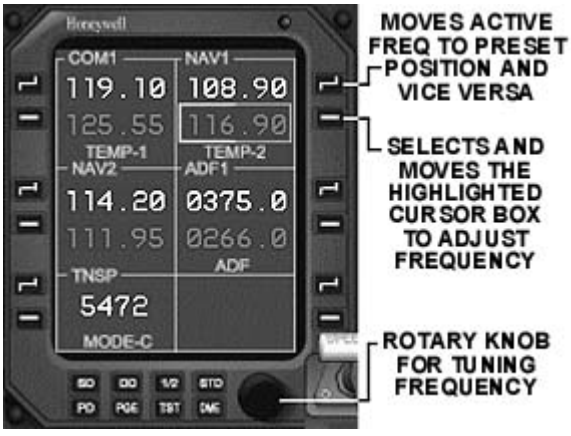
The Glide Slope Deviation Scale will appear when an ILS navigational aid is tuned into the NAV1 radio, the ILS navigational aid is being received, and the aircraft is within the active range of the glide slope. The Glide Slope Deviation Scale will appear on the right side of the EADI.

LOW ALTITUDE AWARENESS DISPLAY

This indication appears in the Altimeter Display when the aircraft is within 500 feet of the ground. The brown indication appears at the bottom of the Altimeter Display and rises with ground closure. When the aircraft is on the ground, the Low Altitude Awareness Display will cover the lower half of the altitude tape.

RADIO MANAGEMENT UNIT – RMU

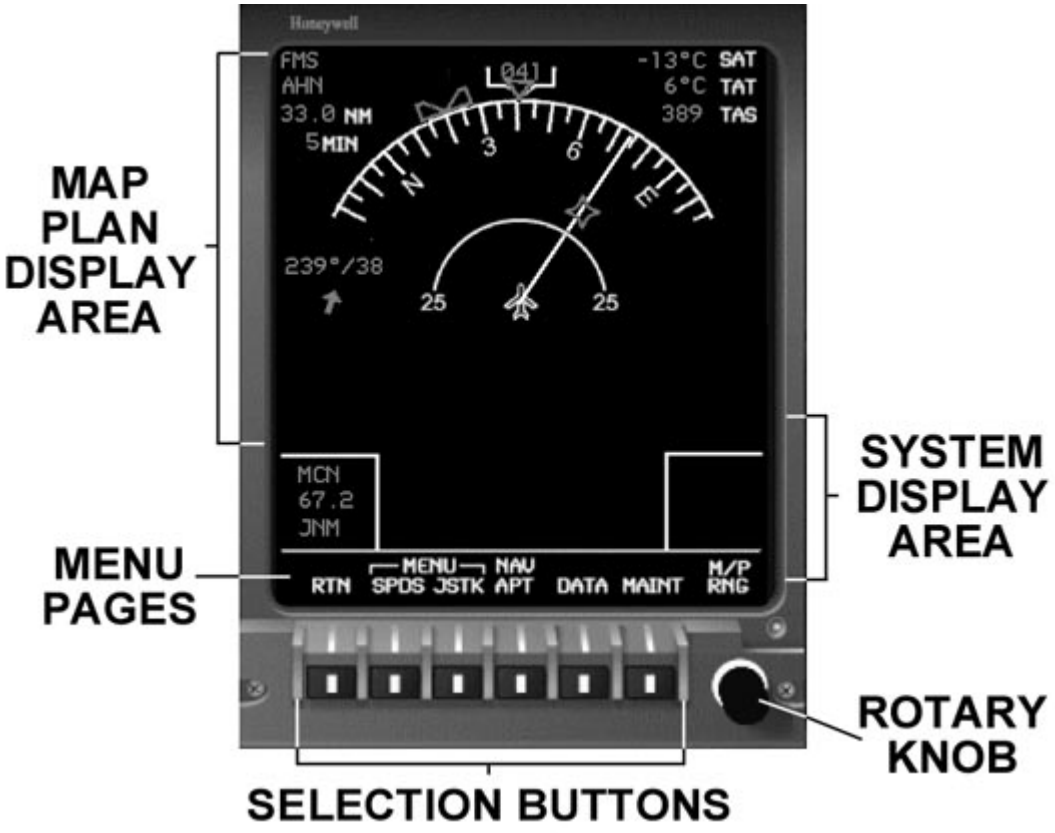
The Radio Management Unit allows tuning of navigational, communication, and transponder frequencies. To adjust a frequency, first select the specific radio's cursor button next to the lower preset frequency. A box will appear around the preset frequency highlighting the first part of the frequency (i.e. "116"). Then, use the rotary knob to tune the first part of the frequency. Next, push the cursor button again to select and highlight the second part of the frequency (i.e. ".90") and use the rotary knob to tune as before. Push the cursor button again to place the new frequency in preset mode.

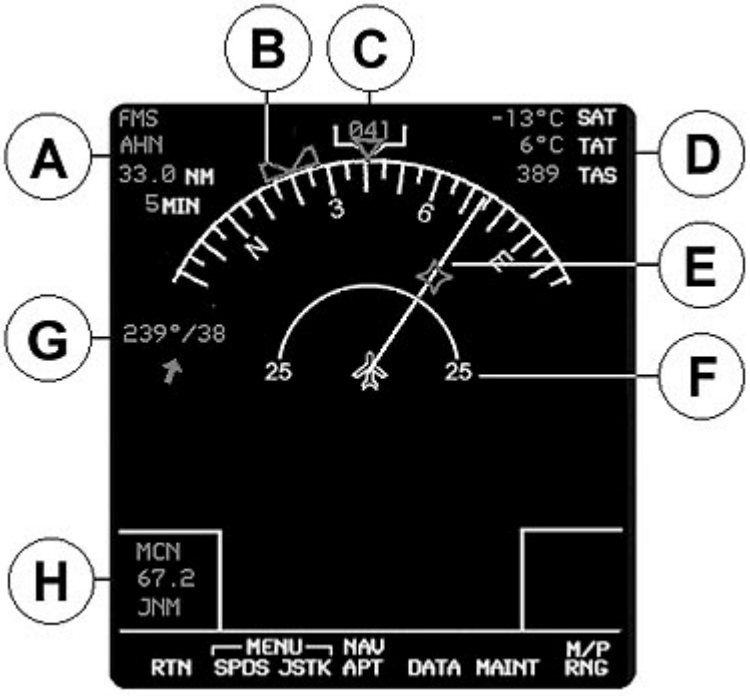


To move a preset frequency to the active position, press the active frequency button next to the upper active frequency and the preset frequency and active frequency will switch positions. The above procedure is used for COM1, NAV1, NAV2, and ADF1. The transponder code (TNSP) is adjusted in the same manner as the navigation and communication radios, but there is no preset transponder code.

MULTI FUNCTION DISPLAY – MFD

The Multi Function Display, or MFD, serves a dual role by providing both navigational and aircraft system information. The top area of the MFD is known as the Map Plan Display Area. This area displays navigational information from both the Flight Management System – FMS (GPS in FS2000) and information from navigation radios. The bottom area is the System Display Area, displaying information on various systems such as Fuel, Electrical, Hydraulic and Environmental. The system pages can be selected by using the Selection Buttons on the bottom of the MFD console. The buttons are arranged so that they align with the Menu Pages listed in the display. The Rotary Knob adjusts the nautical mile range of the Map Plan Display Area. The Rotary Knob is also used in conjunction with the Selection Buttons to adjust V Speeds as required in the PFD Airspeed Display.





The following layout is typical of both the NAV and FMS displayed modes of the MFD when either the NAV or FMS mode is chosen at the DCP as the active navigational mode. A green color indicates NAV mode and magenta indicates FMS mode.

A. Displays the following information from top to bottom:
   - NAV Source Mode – NAV or FMS selected at the DCP
   - Identification code of the navigational site or waypoint
   - DME distance to the navigational site or waypoint
   - Estimated Time of Arrival to the navigational site or waypoint

B. Heading bug positioned at the current selected heading using the HDG rotary knob on the FGC.

C. Arc Display showing approximately 120 degrees of the compass rose. A magenta triangle bug shows actual track across the ground and a digital readout of the aircraft's actual heading in degrees magnetic (compass heading) is displayed.

D. Displays the following information from top to bottom:
   - SAT – Static Air Temperature: Outside temperature minus the temperature of the aircraft skin
   - TAT – True Air Temperature: Actual air temperature outside the aircraft
   - TAS – True Airspeed: Airspeed corrected for compressibility and altitude air-density variation

E. The current waypoint or navigational aid being flown TO is displayed as a magenta star. In FMS mode (as depicted) a white line extending from the aircraft symbol to the waypoint will be displayed.

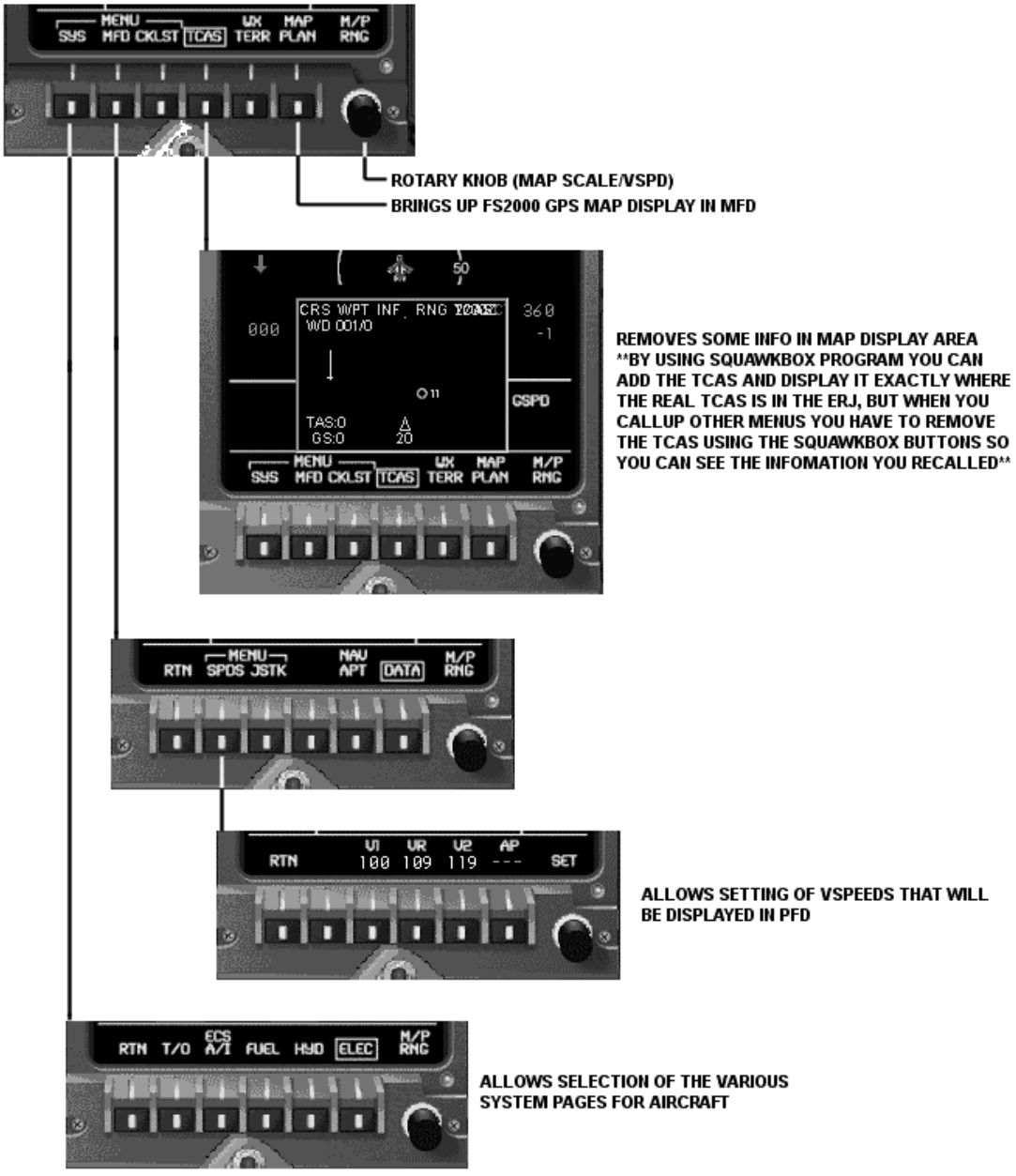
F. Inner ring of the selected scale of the map display. Inner ring distances of 10, 25, and 50 nautical miles are half the total selected range. Range distances are selected with the Rotary Knob at the lower right corner of the MFD console.

G. Current wind displayed in degrees and knots, along with a wind vector.

H. Secondary navigation radio information from top to bottom:
   - Identification code for navigational aid selected in NAV2
   - DME distance to the navigational aid selected in NAV2
   - ADF identification code

MENU PAGES

The Primary Menu allows selection of additional Menu Pages to obtain information for various aircraft systems, to change navigational information displayed, and to allow input of critical V speed information displayed in the Airspeed Display of the PFD. After selecting an additional Menu Page, you may return to the Primary Menu by choosing the RTN (Return) selection on the left.



SYSTEM PAGES

Various aircraft information and system pages can be recalled by choosing the SYS selection under the Primary Menu and then selecting one of the five individual system pages by clicking on the button under its heading. The information and system pages available for display at the bottom of the MFD are:

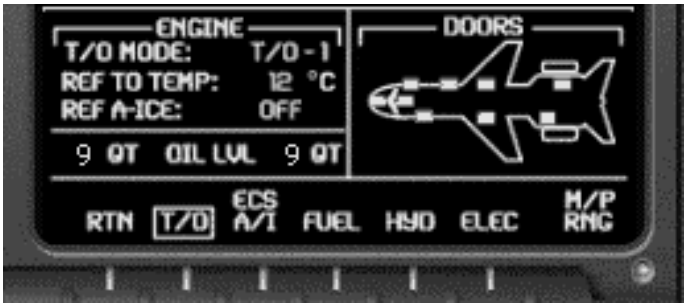
- Takeoff Page
- Environmental Control Page
- Fuel System Page
- Hydraulic System Page
- Electrical System Page

TAKEOFF PAGE – T/O

The Takeoff Page displays engine data for takeoff on the left side of the page.
This consists of:

- Takeoff thrust mode T/O - 1
- Reference Takeoff Temp
- Engine Anti-Ice ON / OFF

Also displayed are engine oil levels in quarts for each engine.

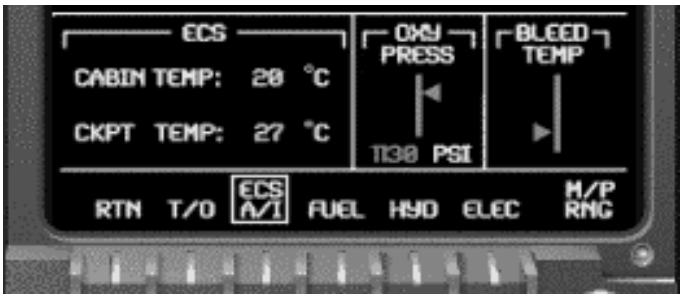


Aircraft Doors information is shown on the right side of the page, which graphically displays the status of all doors and hatches on the aircraft. A red indicator on the aircraft graphic with an associated red "Door Open" warning message, a red EICAS warning, and a flashing red Master Warning and amber Master Caution on the glareshield alerts the crew if a door or hatch has opened. A green indicator on the aircraft graphic represents a closed door or hatch. Door and hatch status indicators will all change to green, indicating closed and secure, when the rotating beacon is switched ON before engine start.

ENVIRONMENTAL CONTROL PAGE – ECS A/I

Under the ECS portion on the left, the Environmental Control Page has a digital readout for the cabin and cockpit temperatures.

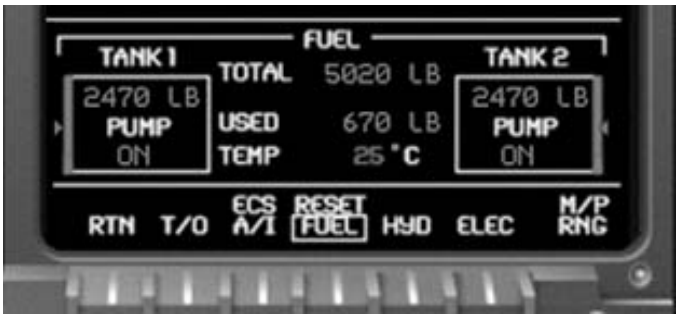
On the right side is the oxygen pressure in pounds per square inch (PSI) and the bleed air temperature displayed in linear form.



FUEL SYSTEM PAGE – FUEL

The Fuel System Page displays the following information:

- Total Fuel in pounds
- Fuel quantity each tank in pounds
- Total Fuel Used in pounds
- Fuel Temperature in degrees C
- Fuel Pumps status – ON / OFF
- Fuel quantity bug for each tank along the outer side of each tank
- Total Fuel Used RESET function



Fuel quantity readouts on the Fuel System Page and in the EICAS will be displayed in different colors depending on current fuel load. The quantity readout colors and associated fuel weights are as follows:

- GREEN Above 880 lbs
- AMBER From 450 lbs to 870 lbs
- RED Below 440 lbs

When TOTAL fuel quantity falls below 880 lbs, the Master Caution on the glareshield will flash and the amber FUEL LO LEVEL text message will appear in the EICAS. When TOTAL fuel quantity falls below 440 lbs, the Master Warning on the glareshield will flash and the red FUEL LO LEVEL text message will appear in the EICAS.

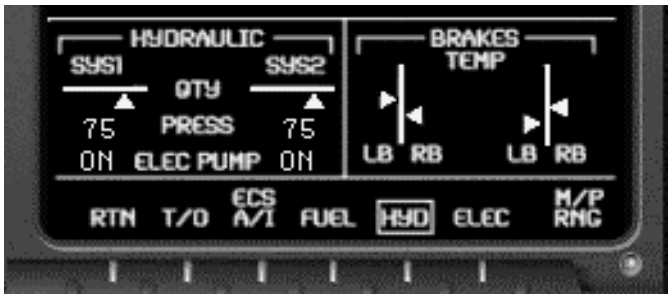
To reset the Total Fuel Used readout on the Fuel System Page:

- Click on the Selection Button under the FUEL heading at the bottom of the MFD.
- The white box highlighting FUEL will move up and highlight RESET.
- Click on the Selection Button again.
- Total Fuel Used readout will be reset to "0" and the white box will return to highlight FUEL.

HYDRAULIC SYSTEM PAGE – HYD

The Hydraulic System Page displays the following information for each hydraulic system:

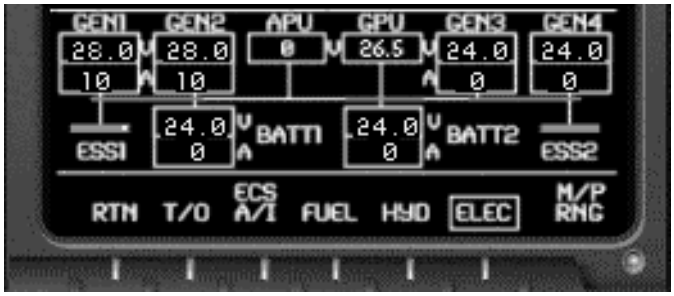
- Hydraulic fluid quantity
- Hydraulic pressure in PSI
- Electric hydraulic pumps status – ON / OFF
- Brake temperatures main gear LB = left brake RB = right brake



ELECTRICAL SYSTEM PAGE – ELEC

The Electrical System Page displays the following information:

- Generator voltage and current
- APU voltage (Auxiliary Power Unit)
- GPU voltage (Ground Power Unit)
- Essential bus 1 and 2 status
- Battery voltage and current

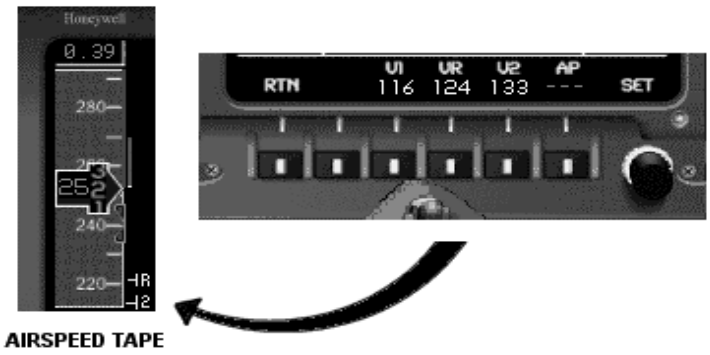


V SPEED PAGE

The V speed page allows setting of the required weight-determined reference speed bugs on the airspeed tape located in the PFD. To select a V speed to adjust, push the button underneath and use the rotary knob to enter the V speed. Each bug on the airspeed tape will move to the set speed.

The colors of the V speed bugs are as follows:

- V_1 – Magenta
- V_R – Blue
- V_2 – Yellow
- AP – Green



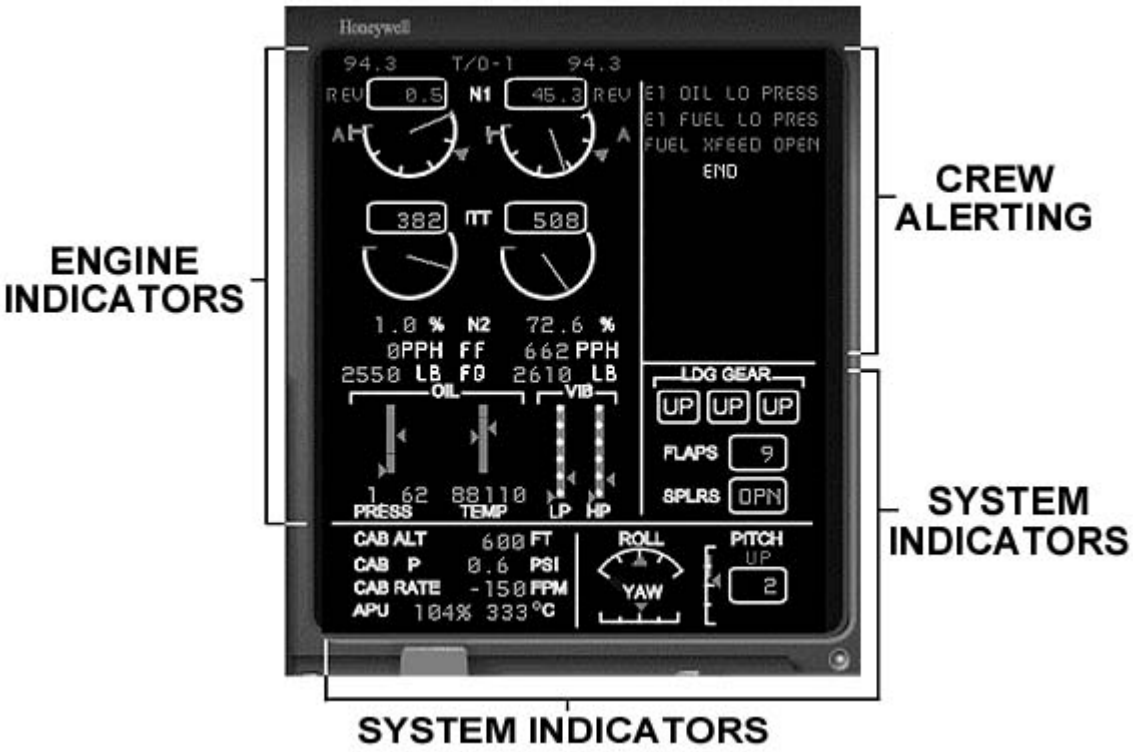
V_1 – Decision speed at which takeoff must be aborted or continued. If an engine failure or unsafe condition occurs before V1, the takeoff must be aborted. If an engine failure occurs at or after V1, the takeoff must continue as the aircraft is considered to be flying. After V1, it may not be possible to stop the aircraft on the runway remaining in the event of a rejected takeoff (RTO) attempt.

V_R – Rotation speed, even with one engine inoperative.

V_2 – Takeoff safety speed, or minimum safe flying speed should an engine fail immediately after takeoff.

AP – Approach reference speed (V_{REF}) is the target speed for final approach to landing and is based on landing weight and conditions.

ENGINE INDICATION AND CREW ALERTING SYSTEM-EICAS



The EICAS display format is always shown as above and is divided into three sections:

1) ENGINE INDICATORS – The Engine Indicators display all operational information for the ERJ's two turbofan engines.

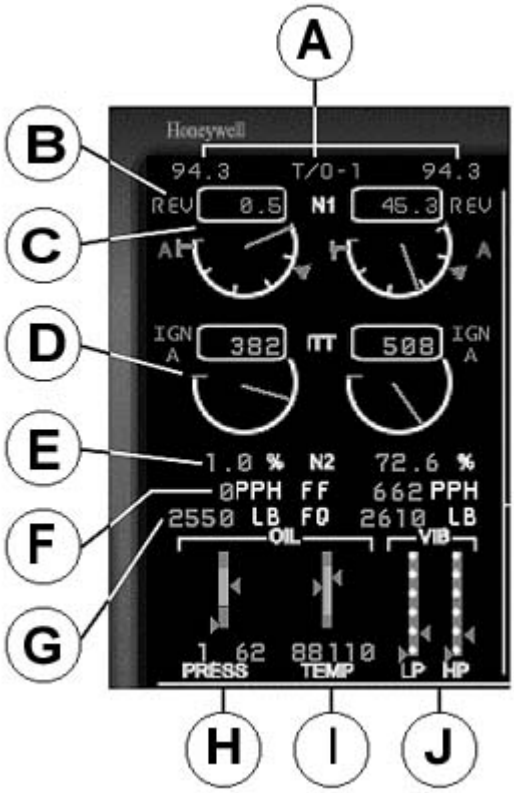
2) SYSTEM INDICATORS – The System Indicators provide information for the ERJ's Landing Gear, Flaps, Spoilers, Pressurization, Auxiliary Power Unit, and the three axes of Control Surface Trim.

3) CREW ALERTING – The Crew Alerting section of the EICAS provides critical aircraft system information for the Flight Crew. Color-coded text messages referencing many of the aircraft's Warning, Caution, and Advisory conditions are displayed.

ENGINE INDICATORS

A. Current selected thrust mode is indicated at the very top of the display. Thrust mode setting and the N1 value will be displayed. Thrust modes are selected on the Thrust Rating Panel accessed by clicking on the right footrest below the RMU. The thrust modes and their associated N1 values are:

- T/O-1 – Takeoff mode 1 – 94.3%
- CON – Continuous Maximum Thrust – 91.2%
- CLB – Climb mode – 88.6%
- CRZ – Cruise mode – 84.3%



B. REV – Two indications, one on each side of the N1 display, confirm engine reverse thrust has engaged. The indications will extinguish when thrust reverse is disengaged.

C. N1 – Engine fan speed at the front of the engine displayed as a percentage. A digital readout and analog needle indicate N1. When N1 is above 100% the digital readout turns from green to red. The green triangular pointer on the outer ring shows thrust lever position. The blue "T" on the outer ring indicates maximum N1 setting allowable for the current thrust mode selected.

D. ITT – Engine interturbine temperature shown in degrees Fahrenheit. A digital readout and analog needle indicate ITT. When ITT exceeds 868º the digital readout turns from green to amber, and when above 922º, the digital readout turns red. The IGN A annunciator will appear during engine start and will extinguish when engine light-off occurs at 20% N2.

E. N2 – Engine high-pressure turbine compressor speed displayed as a percentage. When N2 is above 102.5% the readout turns from green to red.

F. FF – Fuel flow for each engine indicated in pounds per hour (PPH).

G. FQ – Fuel quantity for each wing tank shown in pounds.

H. PRESS – Oil pressure for each engine shown in PSI. Also, a vertical graphical display with a pointer for each engine shows engine oil pressure in three different color areas:

- RED Nil to extremely low oil pressure
- GREEN Normal oil pressure
- YELLOW Abnormally high oil pressure

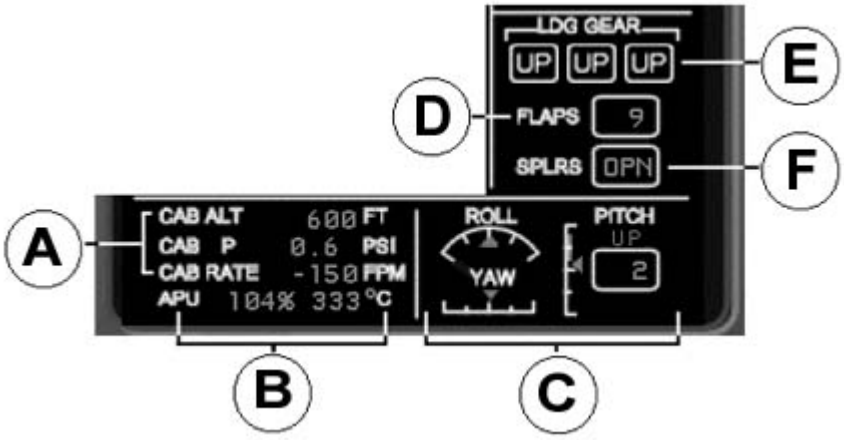
I. TEMP – Oil temperature for each engine in degrees Fahrenheit. Also, a vertical graphical display with a pointer for each engine shows engine oil temperature in three different color areas:

- YELLOW Nil to very low oil temperature
- GREEN Normal oil temperature
- RED Extremely high oil temperature

J. LP / HP – Two different items are displayed. On the left side is LP, or low-pressure spool vibration for each engine. On the right side is HP, or high-pressure spool vibration for each engine. LP and HP both have a vertical graphical display with pointers for each engine showing vibration levels.

SYSTEM INDICATORS

The System Indicator area displays six aircraft systems that should be monitored by the Flight Crew.



A. This area displays the three current values for the aircraft cabin pressurization system. The cabin pressurization system area has three different readings:
   - CAB ALT – Current cabin pressure altitude measured in feet above sea level
   - CAB P – Indicates the differential pressure between cabin pressure and outside air pressure, given in PSI (pounds per square inch)
   - CAB RATE – Indicates the rate the cabin pressure is rising or descending in feet per minute

NOTE: *The pressurization system is completely automatic so there is nothing to configure.*

B. APU – Displays the current status of the Auxiliary Power Unit. After the APU start sequence is initiated, the APU display area will show the operating temperature of the APU in degrees Centigrade and APU turbine speed in percentage. Below 95%, the readouts displayed are amber, and above 95%, the readouts displayed are green. The controls for the APU are located on the overhead panel.

C. A moving pointer on each scale displays graphically the setting of the three axes of flight trim.
   - ROLL – Displays the current aileron trim setting of the aircraft
   - YAW – Displays the current rudder trim setting of the aircraft
   - PITCH – A moving pointer on a vertical scale and a digital window displays the current elevator trim setting for the aircraft graphically, digitally, and with two annunciators. When nose up trim is set, a green positive digital reading and green UP annunciator will be displayed above the digital readout. When nose down trim is set, an amber negative digital reading and amber DN annunciator will be displayed below the digital readout. Units of pitch trim range from –15 nose down to +15 nose up. The green band on the vertical scale represents C.G. limits and is the normal pitch trim takeoff range.

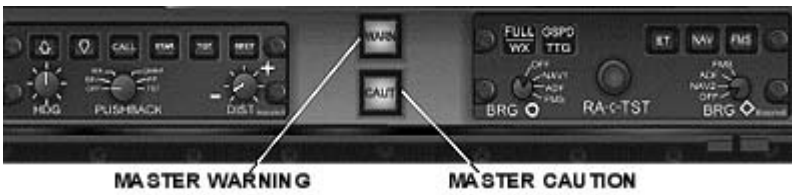
D. FLAPS – The selected flap setting is displayed digitally and has the following three settings:

   9 degrees 22 degrees 45 degrees

E. LDG GEAR – From left to right, the status of the left main, nose, and right main landing gear is displayed in a color-coded box around an associated UP or DN annunciator as follows:
   - GREEN DN annunciator – Gear is fully down and locked into position.
   - AMBER UP annunciator – Gear is in transit from one position to the other.
   - WHITE UP annunciator – Gear is fully up and stored.

F. SPLRS – The position of the spoiler panels is displayed with either a green OPN for deployed or a white CLD for down and stored.

CREW ALERTING



The EICAS continuously monitors the status of various aircraft systems and will display text messages to alert the flight crew of changes to the status of the systems monitored. Crew alert messages are displayed in three formats: Warning, Caution, and Advisory. When a new Warning or Caution condition and its message appears, the red Master Warning or amber Master Caution indicators on the glareshield will flash until cancelled by clicking the mouse cursor on them. Three aural chimes will accompany the glareshield Master Warning and one aural chime will accompany the glareshield Master Caution. If a Master Warning and Master Caution condition occurs simultaneously, only the three aural chimes will sound. If the message is an Advisory, only a text message will be displayed. Crew alert text messages are displayed in the Crew Alerting section of the EICAS with the following associated colors:

- RED Warning
- AMBER Caution
- BLUE Advisory

There are more than 150 messages that can be displayed in the EICAS of the real ERJ, but in this panel there are approximately 30 messages that can be displayed. They are as follows:

FUEL LO LEVEL	Warning	Red	Total fuel quantity is below 440 lbs.
GPWS	Warning	Red	Ground Proximity Warning System
MAIN DOOR OPN	Warning	Red	Main Fuselage Door is Open
NO T/O CONFIG	Warning	Red	Takeoff Configuration is incorrect
SERVICE DOOR OPN	Warning	Red	Lavatory servicing hatch is Open
1 – 2 OIL LO PRES	Caution	Amber	Low or No Oil Pressure
1 – 2 FUEL LOPRES	Caution	Amber	Low or No Fuel Pressure
AIL SYS 1 – 2 INOP	Caution	Amber	Aileron System 1 and 2 are inoperative
APU GEN OFF BUS	Caution	Amber	APU Generator is off electrical bus
BAGGAGE DOOR OPN	Caution	Amber	Baggage Door is not secure
BATT 1 OFF BUS	Caution	Amber	Battery 1 is off electrical bus
DFDR FAIL	Caution	Amber	Data Recorder off when beacon is off
E1 FUEL LO PRES	Caution	Amber	Engine 1 Low Fuel Pressure
E2 FUEL LO PRES	Caution	Amber	Engine 2 Low Fuel Pressure
E1 OIL LO PRESS	Caution	Amber	Engine 1 Low Oil Pressure
E2 OIL LO PRESS	Caution	Amber	Engine 2 Low Oil Pressure
FUELIN DOOR OPN	Caution	Amber	Fueling Bay access hatch is Open
FUEL LO LEVEL	Caution	Amber	Total fuel quantity is below 880 lbs.
GEN 1 OFF BUS	Caution	Amber	Generator 1 is off electrical bus
GEN 2 OFF BUS	Caution	Amber	Generator 2 is off electrical bus
HYD SYS 1 FAIL	Caution	Amber	Hydraulic System 1 no pressure
HYD SYS 2 FAIL	Caution	Amber	Hydraulic System 2 no pressure
PITOT 1 INOP	Caution	Amber	Pitot Heat is OFF or inoperative
RUD SYS 1 – 2 INOP	Caution	Amber	Rudder System 1 and 2 are inoperative
STEER INOP	Caution	Amber	Nosewheel Steering is disengaged

APU FUELSOV CLS	Advisory	Blue	APU Fuel Shutoff Valve is closed
CHECK A1 PERF	Advisory	Blue	Inform FADEC application is installed
FUEL XFEED OPEN	Advisory	Blue	Fuel Crossfeed is open
HYDPUMP SELC OF	Advisory	Blue	Hydraulic Pumps Off w/ engine running
SPS / ICE SPEEDS	Advisory	Blue	Stall Protection System has no info, or, Icing conditions encountered in-flight

NOTE: *If the message area is not full, the white END message will be the last message on the status line.*

AURAL WARNING SYSTEM

The ERJ has a variety of Aural (Voice) Warnings that are triggered by various programmed parameters. The warning system voice is affectionately referred to as "HAL" or "Bitchin' Betty". Aural Warnings that may be received other than warnings associated with the GPWS (Ground Proximity Warning System) or the Takeoff Configuration System are as follows:

APPROACHING MINIMUMS – advises the flight crew of 100 feet above the DH or Minimum Descent Altitude for an approach. The DH or MDA is set with the RA–c–TST rotary knob on the DCP and is displayed in the PFD digitally at the bottom left of the Altimeter Display, next to the letters "RA".

MINIMUMS, MINIMUMS – advises the flight crew of arrival at the DH or MDA for the approach and a decision to continue the approach or initiate a go-around procedure must be made.

AUTOPILOT – advises the flight crew the autopilot has been disengaged. Three chimes precede the warning.

BANK ANGLE – advises the flight crew the bank angle has exceeded 40 degrees of bank

HIGH SPEED – advises the flight crew the maximum airspeed for the aircraft at current altitude is being exceeded. Below 10,000 feet this warning will sound when airspeed exceeds 250KIAS.

FIVE HUNDRED (500) – will sound when 500 feet radar altitude above ground and NOT on a glide slope

TWO HUNDRED (200) – will sound when 200 feet radar altitude above ground and NOT on a glide slope

ONE HUNDRED (100) – will sound when 100 feet radar altitude above ground

ADDITIONAL AURAL ALERTS

ALTITUDE ALERTER – Three high-pitch chimes will alert the flight crew when the aircraft is 1000 feet from the altitude selected with the ASEL rotary knob on the FGC.

AURAL UNIT STATUS – When the BATT 1 rotary switch is turned to the AUTO position, the aural warning system will state, "AURAL UNIT, OK" indicating the aural warning system is fully operational.

FLAP / GEAR / POWER LEVER POSITION ALERT – A continuous tone will be heard when the flaps are set to 22 degrees, the landing gear is up, the aircraft's altitude is below 2500 feet above the ground, and the thrust levers are brought back to idle.

MARKER BEACONS – When an ILS approach is being flown and the aircraft passes over the Marker Beacons, the following aural indications will be heard:

- OUTER MARKER – Two "dash" tones per second
- MIDDLE MARKER – Alternating "dot and dash" tones at a rate of 95 per minute
- INNER MARKER – Six "dot" tones per second

PASSENGER SIGNS – When the FSTN BELTS or NO SMK cabin sign switches are operated, a tone will sound to alert the cabin crew and passengers.

GROUND PROXIMITY WARNING SYSTEM – GPWS

The GPWS monitors the flight profile and will give visual and voice warnings when the aircraft's flight path and position, with respect to the terrain, needs immediate attention from the flight crew. Warnings are given between altitudes of 50 feet and 2450 feet.

GPWS MODES

Excessive Descent Rate – In this mode the computer compares the descent rate versus the radar altitude. When the descent rate is too high, the GPWS warning is displayed in the EICAS, the red Master Warning light on the glareshield activates, and a voice warning "Sink Rate" and/or "Pull Up" will be issued until the descent rate is reduced to within standard program parameters.

Terrain Closure Rate – In this mode the computer measures how fast the radar altitude decreases. When the terrain is too high for a certain radar altitude, the GPWS warning is displayed in the EICAS, the red Master Warning light on the glareshield activates, and a voice warning "Terrain" and/or "Pull Up" will be issued until the closure rate is reduced to within standard program parameters.

Descent After Takeoff – In this mode the computer measures how much altitude the aircraft loses if the aircraft descends after takeoff. When the altitude loss is too high, the GPWS warning is displayed in the EICAS, the red Master Warning light on the glareshield activates, and a voice warning "Don't Sink" will be issued until the descent is arrested and a climb resumes.

Terrain Proximity – The GPWS computer will check for specific combinations of aircraft altitude, airspeed, landing gear position, and/or flap position before issuing a Terrain Proximity warning. There are three modes to the Terrain Proximity warning:

1) When the airspeed is above a certain value and the altitude is below 1000 feet, the GPWS warning is displayed in the EICAS, the red Master Warning light on the glareshield activates, and a voice warning "Too Low, Terrain" will be issued until the airspeed or altitude causing the warning is returned to within standard program parameters.

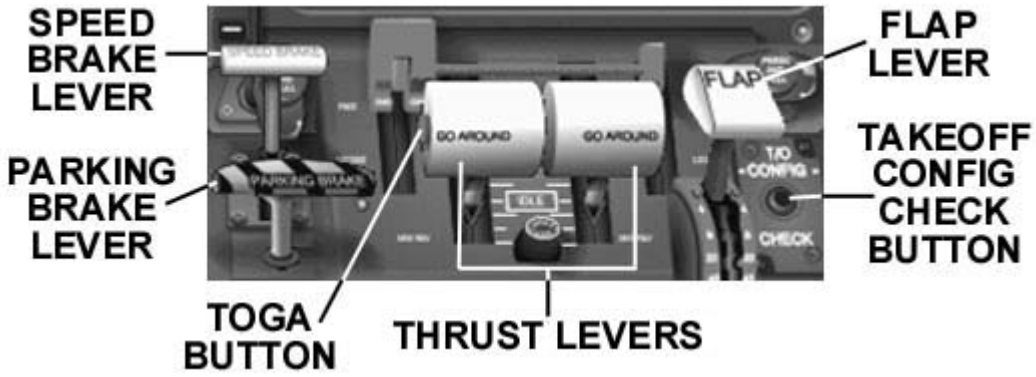
2) When the airspeed is below a certain value and the altitude is below 500 feet, the computer checks if the landing gear is down and locked. If not, the GPWS warning is displayed in the EICAS, the red Master Warning light on the glareshield activates, and a voice warning "Too Low, Gear" will be issued until the landing gear is down and locked or the airspeed or altitude causing the warning is returned to within standard program parameters.

3) When the landing gear is down and locked and the altitude is below 200 feet, the computer checks if the aircraft is making an approach and if the flap position is less than 16.6 degrees. If so, the GPWS warning is displayed in the EICAS, the red Master Warning light on the glareshield activates, and a voice warning "Too Low, Flaps" will be issued until the flaps are correctly positioned within standard program parameters.

Descent Below Glide Slope – Below 1000 feet and during an ILS approach, the computer monitors the glide slope. If the aircraft descends below the glide slope by a certain value, the GPWS warning is displayed in the EICAS, the red Master Warning light on the glareshield activates, and a voice warning "Glide Slope" will be issued until the aircraft is re-established above the glide slope value.

Descent Below DH or MDA – When the aircraft is between 1000 feet and 50 feet with landing gear down and locked, the computer monitors if the radar altitude descends below the DH or MDA set in the PFD. If so, the voice warning "Minimums" is activated.

CENTER CONSOLE



The center console provides various levers and buttons that are always visible when in the main panel. The levers and buttons consist of the following:

A. SPEED BRAKE – Deploys spoiler panels on each wing that help reduce speed of the aircraft

B. PARKING BRAKE – Sets and releases the parking brake. The parking brake BRAKE ON indicator light is located below the gear lever.

C. FLAP LEVER – Selects the three flap settings, which are:

9 degrees 22 degrees 45 degrees

D. TAKEOFF CONFIG CHECK BUTTON – Used just prior to takeoff to confirm the aircraft has been correctly configured within certain parameters and limits. If correctly configured, the aural warning system will state, “TAKEOFF, OK.” If the aircraft is NOT correctly configured, the aural warning system will sound three chimes, the red Master Warning on the glareshield will flash, the NO T/O CONFIG text message will appear, and one of the following aural warning messages will be issued:

- TAKEOFF, BRAKES – parking brake is still on
- TAKEOFF, FLAPS – flaps have not been set for takeoff
- TAKEOFF, TRIM – pitch trim is not correctly set for takeoff

E. TOGA BUTTON – The TOGA button is on the side of the left thrust lever knob. When pushed, the command bars of the Flight Director are set to 14 degrees positive pitch and wings-level to assist pitch and roll control for low-visibility takeoffs or rejected approach and landing go-around maneuvers.

F. THRUST LEVERS – Two thrust levers control the aircraft’s two turbofan engines. The left thrust lever controls the left engine and the right thrust lever controls the right engine.

THRUST RATING PANEL

Clicking on the right footrest directly below the RMU accesses the Thrust Rating Panel. The Thrust Rating Panel enables recommended N1 power settings in the EICAS for various phases of flight by selecting one of the four buttons. The Thrust Rating selections are:

- T/O – Takeoff mode 1
- CON – Continuous Maximum Thrust
- CLB – Climb mode
- CRZ – Cruise mode

NOTE: *The modes have generalized settings and do not vary with changes in temperature or altitude.*

GLARESHIELD – CONTROL MODULES

There are three control modules located above the main instrument panel on the glareshield. Each control module has buttons and switches that control various aircraft systems, functions, and displays.

The three control modules on the glareshield are:

- Pushback Control Panel
- Display Control Panel – DCP
- Flight Guidance Controller – FGC

PUSHBACK CONTROL PANEL

The Pushback Control Panel allows a simulated pushback from a passenger-loading gate. The Pushback Control Panel consists of the following selectors:

A. HEADING SELECTOR
Selects the desired roll out heading for the aircraft after the pushback has been completed relative to the aircraft's current heading at the gate.

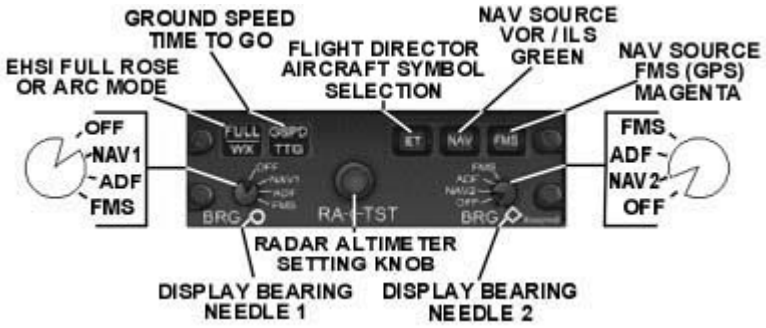
B. DISTANCE SELECTOR
Selects the distance the aircraft moves straight back before being turned to the selected heading.

C. CALL BUTTON
When pushed, the pushback process starts.

DISPLAY CONTROL PANEL – DCP

The Display Control Panel is used to change different display settings in the PFD and to change the source of the displayed navigational data. When the NAV Source is changed, the data within the EHSI and the navigational data info in the PFD and MFD change color. The color change is as follows:

GREEN **NAV Source is VOR / ILS data**
MAGENTA **NAV Source is FMS (GPS) data**



A. EHSI FULL / ARC MODE
Switches the display of the EHSI between the Full Compass Rose Mode and the Arc Mode. The button is labeled FULL/WX.

B. GROUND SPEED / TIME TO GO
This button will change the GSPD/TTG display in the PFD to either Ground Speed (GSPD) or the estimated Time To Go (TTG) as computed from the navigational site selected. If the aircraft is not headed directly towards the navigational site, Time To Go displayed will not be accurate. If the aircraft is not headed directly toward or away from the navigational site, Ground Speed will not be accurate.

C. FLIGHT DIRECTOR / AIRCRAFT SYMBOL SELECTION
Selects either the Single Cue Flight Director or the Double Cue Flight Director in the EADI. Also selects either of the two aircraft symbols in the EADI. The button is labeled ET.

D. NAV SOURCE – VOR / ILS
When pushed the NAV Source is taken from the Navigational Site (VOR, ILS) selected in the Radio Management Unit (RMU). All navigational information in the PFD, MFD, and EHSI will be GREEN in color confirming this selection.

E. NAV SOURCE – FMS
When pushed the NAV Source is taken from the FMS (Flight Management System, which is the currently loaded flight plan in the default FS2000 GPS). All navigational information in the PFD, MFD, and EHSI will be MAGENTA in color confirming this selection. When FMS is the selected NAV Source, a white FMS annunciator will appear in the PFD to the top right of the EADI.

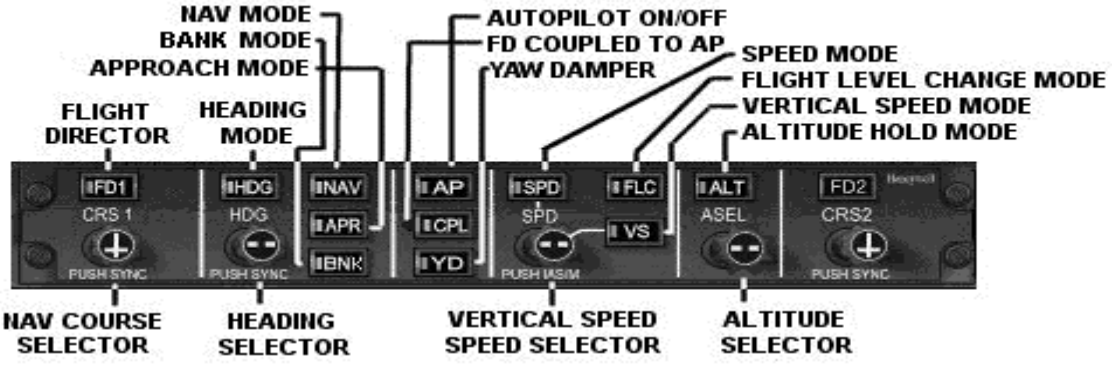
F. RADAR ALTIMETER SETTING KNOB
The rotary knob labeled RA –c-TEST is used to set the DH or MDA for an instrument approach and to arm the aural and visual Minimum Altitude alerts. The aural warning “Minimums, Minimums” and the Minimum Altitude MIN annunciator will flash in the EADI when radar altitude reaches the set value.

G. DISPLAY BEARING NEEDLES 1 and 2
Selects the NAV Source for each bearing needle. The needles will show the relative bearing TO the navigational source selected in NAV 1, NAV 2, ADF, or current waypoint (FMS).

***NOTE**: The FMS bearing selector will only work when the NAV Source is FMS. When the NAV Source selected is NAV, the FMS bearings will not work in the EHSI.*

FLIGHT GUIDANCE CONTROLLER – FGC

The FLIGHT GUIDANCE CONTROLLER (FGC) is responsible for controlling the Flight Director (FD) and Autopilot (AP) functions. Various buttons allow selection of the desired modes for both the Autopilot (AP) and Flight Director (FD).



The FD2 button and CRS2 knob are not used and are inactive

***NOTE**: In the following section the basic functions of the buttons and selectors on the Flight Guidance Controller are explained. Each Mode button will be explained in greater detail in the **AUTOPILOT** section.*

A. FLIGHT DIRECTOR
When pushed, enables or inhibits the Flight Director. When enabled, command bars will be displayed in the EADI and a white FD annunciator will appear in the PFD to the top right of the EADI.

B. NAV COURSE SELECTOR
The CRS 1 rotary knob is used to select the desired course for NAV 1. This adjusts the course needle in the EHSI and changes the selected course displayed in the PFD.

C. HEADING MODE
When pushed, selects or deselects Heading Mode for the Flight Director and Autopilot. Selected heading is set with the HDG rotary knob and is shown in the EHSI and PFD. Also see D below.

D. HEADING SELECTOR
The HDG rotary knob is used to select the desired heading. The heading bug moves and changes the selected heading displayed in the PFD. Clicking on the center of the HDG knob activates the PUSH SYNC function, which automatically syncs the heading bug to the aircraft's current heading.

E. NAV MODE
When pushed, selects or deselects Navigation Mode for the Flight Director and Autopilot.

F. APPROACH MODE
When pushed, selects or deselects Approach Mode for the Flight Director and Autopilot. This will allow the Autopilot to fly the airplane along a localizer and glide slope if an ILS frequency is selected in NAV 1. When the Autopilot captures the localizer, a white ILS annunciator will appear in the PFD.

G. BANK MODE
Limits bank angle of the FD and AP to 14 degrees from the normal 27degrees when in HDG Mode. Bank Mode automatically engages at 25,000 feet and will disengage below 24,750 feet. A green arc extending from 14 degrees left to 14 degrees right is displayed above the EADI. Bank Mode does not work in NAV, FMS, or APR Mode.

H. AUTOPILOT ON / OFF
When pushed, engages or disengages the Autopilot.

I. FD COUPLED TO AP
When pushed, couples or uncouples the Flight Director and the Autopilot. A green arrow pointing left appears above the EADI when the Autopilot is coupled to the Flight Director.

J. YAW DAMPER
Engages or disengages the Yaw Damper. The Yaw Damper is automatically engaged when the Autopilot is engaged. If the Autopilot is disengaged at the FGC, the Yaw Damper stays engaged until manually disengaged. When the Yaw Damper is disengaged, the Autopilot is also disengaged.

K. SPEED SELECTOR
The SPD rotary knob adjusts target Indicated Airspeed (IAS) or Mach when in Speed Mode or when no mode is selected by default. Adjusts the vertical speed when in Vertical Speed Mode. Clicking on the knob's center toggles IAS and Mach back and forth (Mach only above FL250). There are 2 mouse click zones for adjusting IAS. An inner zone adjusts speed in the ones position. The outer zone adjusts speed in the tens position for faster or larger changes. All speeds are shown in the PFD.

L. SPEED MODE
When pushed, selects or deselects Speed Mode for the Flight Director and Autopilot. When selected, the aircraft's current Indicated Airspeed (IAS) or Mach is the target airspeed. Target airspeed can be adjusted with the SPD rotary knob.

M. FLIGHT LEVEL CHANGE MODE
When pushed, selects or deselects the Flight Level Change Mode for the Flight Director and Autopilot. Flight Level Change Mode has preset airspeed and vertical speed settings, which are altitude dependent.

N. VERTICAL SPEED MODE
When pushed, selects or deselects Vertical Speed Mode for the Flight Director and Autopilot. Target vertical speed is adjusted with the SPD rotary knob and is shown in the PFD vertical speed display.

O. ALTITUDE HOLD MODE
When pushed, selects or deselects Altitude Hold Mode for the Flight Director and Autopilot. Target altitude is selected by using the ASEL rotary knob and appears at the top of the Altitude Display.

P. ALTITUDE SELECTOR
The ASEL rotary knob selects desired target altitude and is displayed in the PFD. There are two mouse click zones for selecting altitude: An inner zone for hundreds and an outer zone for thousands.

AUTOPILOT

The Autopilot's four servos (roll, pitch, yaw, and trim) position the aircraft's control surfaces in response to data received from the Flight Guidance Controller. The following information assumes the Autopilot is coupled to the Flight Director.

IMPORTANT! *TO BEST UNDERSTAND WHAT MODES ARE ENGAGED AND HOW THE AUTOPILOT HAS BEEN SET UP USING THE FLIGHT GUIDANCE CONTROLLER, YOU MUST MONITOR THE LATERAL AND VERTICAL MODE ANNUNCIATORS IN THE PFD ABOVE THE EADI. IF YOU DON'T USE THE ANNUNCIATORS AND RELY ONLY ON THE LIGHTED BUTTONS ON THE FGC, YOU COULD BECOME CONFUSED VERY QUICKLY.*

LATERAL MODES

The Lateral Modes are related to heading or roll control. Lateral Modes normally provide commands based on navigational sources. Visual Autopilot annunciators for active and armed Lateral Modes appear at the top of the PFD above the EADI to the left of the green FD CPL arrow.

HEADING MODE – HDG

Heading Mode permits the Autopilot to track the EHSI heading bug in the PFD. The HDG rotary knob is used to set the heading bug to the desired heading. Pushing the HDG button on the FGC engages Heading Mode. When Heading Mode is active, the green HDG annunciator is displayed in the PFD. Heading Mode will also be engaged when arming the NAV or APR modes.

Heading Mode will be disengaged when any of the following conditions occur:

- The HDG button is pushed while already engaged
- The NAV or APR modes are captured when armed

NAV MODE – NAV

Navigation Mode permits the Autopilot to automatically capture and track both inbound and outbound VOR radials for NAV 1 set by the CRS 1 rotary knob on the FGC. Pushing the NAV button on the FGC engages Navigation Mode. When the NAV button is selected, Heading Mode is automatically engaged to allow for intercept of the selected course, a green HDG annunciator appears in the PFD, and a white VOR annunciator appears indicating Navigation Mode is armed. Upon interception of the selected course, Heading Mode disengages, Navigation Mode engages, and a green VOR annunciator appears in the PFD indicating Navigation Mode is active.

NAV Mode will be disengaged when any of the following conditions occur:

- The NAV button is pushed while already engaged
- The APR or HDG modes are selected
- The NAV source selected at the DCP is changed (i.e. NAV to FMS)
- The NAV 1 frequency set in the RMU is changed

NOTE: *When the aircraft approaches a VOR, the sensitivity of the Course Deviation Indicator increases. Sync the heading bug to the aircraft's present heading when nearing the VOR and engage Heading Mode until the VOR has been over-flown to reduce Autopilot VOR course tracking oscillations.*

APPROACH MODE – APR

Approach Mode provides automatic capture and tracking of a localizer for precision and non-precision instrument approaches when the Autopilot is engaged. When a localizer frequency is the selected navigation source for NAV 1, pushing the APR button on the FGC will arm Approach Mode indicated by a white LOC or BC annunciator displayed in the PFD. If HDG is not already selected before selecting APR, Heading Mode will be engaged automatically and indicated by a green HDG annunciator in the PFD.

The Autopilot will first initiate a turn toward the heading bug. Therefore, it is very important to sync the heading bug to the aircraft's current heading or select the proper heading to intercept the localizer course before arming Approach Mode. Failure to set the heading bug prior to arming Approach Mode may result in a sudden and unexpected turn away from the desired heading or localizer course.

If NAV 1 is set to a localizer but is not yet receiving the signal, the white LOC or BC annunciator will not appear in the PFD when the APR button is pressed indicating Approach Mode is not armed. The APR button on the FGC will remain unlighted. Inability to receive the localizer could be due to insufficient altitude or being too far from the localizer transmitter. Once within range, selecting the APR button again will arm Approach Mode and the white LOC or BC annunciator will appear in the PFD. When the localizer is captured, Approach Mode will engage, the LOC or BC annunciator displayed in the PFD will turn green and a white box will appear around it for five seconds. Heading Mode is then disengaged.

Approach Mode will be disengaged when any of the following conditions occur:

- The APR button is pushed while already engaged
- The HDG or NAV mode is selected
- The NAV source selected at the DCP is changed (i.e. NAV to FMS)
- The NAV 1 frequency set in the RMU is changed
- The TOGA button on the thrust lever is pushed

NOTE*: The localizer is one half of an ILS (Instrument Landing System) precision approach, the other half being the GS (Glide Slope). Localizer-only and Back Course approaches are non-precision approaches. The Autopilot will not intercept and fly a Back Course approach.*

LNAV MODE – FMS NAV

First selecting NAV Source - FMS at the DCP, (which will change displayed navigation info to magenta), and then selecting the NAV button on the FGC engages LNAV Mode. LNAV Mode provides Lateral Navigation commands to the Autopilot from the FMS (default FS2000 GPS). The white and green LNAV annunciators displayed in the PFD operate similarly to the annunciators for NAV Mode above.

LNAV Mode will be disengaged when any of the following conditions occur:

- The NAV button is pushed while already engaged
- The APR or HDG modes are selected
- The NAV source selected at the DCP is changed (i.e. FMS to NAV)

VERTICAL MODES

The Vertical Modes are related to pitch, altitude, and speed control. Vertical Modes normally provide Autopilot commands based on information input through the FGC or through preset airspeed and vertical speed profiles associated with a Vertical Mode. Visual Autopilot annunciators for active and armed Vertical Modes appear at the top of the PFD above the EADI and to the right of the green FD CPL arrow.

ALTITUDE HOLD MODE – ALT

Altitude Hold Mode permits the Autopilot to maintain an altitude that has been selected with the ASEL rotary knob. A green ALT annunciator in the PFD indicates Altitude Hold Mode is active. Altitude Hold Mode is automatically engaged when a new altitude is selected with the ASEL rotary knob. Selecting a Vertical Mode (FLC, SPD, or VS) after selecting a new altitude with the ASEL rotary knob will disengage Altitude Hold Mode and engage the Vertical Mode selected.

Altitude Hold Mode will also be disengaged when any of the following conditions occur:

- The ALT button is pushed while already engaged
- The glide slope is captured on an ILS approach

ALTITUDE PRESELECT MODE

There is no FGC button for Altitude Preselect Mode. Altitude Preselect Mode is normally engaged automatically when selecting a Vertical Mode and is indicated by a white ASEL annunciator in the PFD. Altitude Preselect Mode permits the Autopilot to climb or descend to a preselected altitude using the ASEL rotary knob on the FGC. The preselected altitude is displayed at the top of the altimeter display in the PFD. When the Autopilot captures the preselected altitude, the ASEL annunciator in the PFD will turn green. Altitude Preselect Mode automatically disengages when Altitude Hold Mode becomes active.

FLIGHT LEVEL CHANGE MODE – FLC

Flight Level Change Mode climbs or descends the aircraft at preset airspeeds or vertical speeds to an altitude selected with the ASEL rotary knob. The preset speeds are shown in the PFD as Mach, Indicated Airspeed (IAS), or feet per minute. Flight Level Change Mode is selected by pushing the FLC button on the FGC after selecting the new altitude. An appropriate CLB (climb) or DES (descent) green annunciator will appear in the active vertical mode area of the PFD indicating FLC Mode is active along with a white ASEL annunciator indicating Altitude Preselect Mode is armed. Upon capture of the preselected altitude, the ASEL annunciator will turn green, followed by a green ALT annunciator indicating Altitude Hold Mode has engaged. Flight Level Change Mode and Altitude Preselect Mode are disengaged at that time.

The following table shows the altitude dependent preset airspeeds and vertical speeds used for climbs and descents when Flight Level Change Mode is engaged:

CLIMB	00,000 – 10,000 feet	Pitch maintains 240 KIAS
	10,001 – 12,000 feet	Pitch adjusts to accelerate to 270 KIAS by 12,000 Ft
	12,001 – 37,000 feet	Pitch adjusts to maintain 270 KIAS until Mach 0.56 Pitch will maintain Mach 0.56 after attaining Mach 0.56
DESCENT	Above 10,000 feet	2000 fpm
	Below 10,000 feet	1000 fpm

Flight Level Change Mode will be disengaged when any of the following conditions occur:

- The FLC button is pushed while already engaged
- The ALT, VS, or SPD modes are selected
- The preselected altitude is captured
- The glide slope is captured on an ILS approach

SPEED MODE – SPD

Speed Mode adjusts pitch to hold a selected Indicated Airspeed (IAS) or Mach number when flying to a new altitude selected with the ASEL rotary knob. Indicated Airspeed (IAS) is used below 25,000 ft, and Mach (M) is used above 25,000 ft. Manual power adjustment is necessary to adjust vertical speed rate during climb or descent as selected airspeed is maintained. Maximum vertical speeds for Speed Mode are + or – 4500 feet per minute. Speed Mode is selected by pushing the SPD button on the FGC and uses the aircraft's current IAS or Mach as target airspeed when engaged. The current airspeed will appear at the top of the airspeed display, a green SPD annunciator will appear in the PFD indicating Speed Mode is active, and the white ASEL annunciator will appear in the PFD indicating Altitude Preselect Mode is armed. Target airspeed can be adjusted during climb or descent with the SPD rotary knob on the FGC. Altitude capture and annunciator function operate similarly to FLC Mode. Disengagement of Speed Mode and Altitude Preselect Mode is also similar.

Speed Mode will be disengaged when any of the following conditions occur:

- The SPD button is pushed while already engaged
- The ALT, VS, or FLC modes are selected
- The preselected altitude is captured
- The glide slope is captured on an ILS approach

VERTICAL SPEED MODE – VS

Vertical Speed Mode is used to hold a selected vertical speed when flying to a new altitude selected with the ASEL rotary knob. The range of selected vertical speed can range from – 6000 fpm to + 7000 fpm, with a resolution of 100 fpm. Vertical Speed Mode is engaged by pressing the VS button on the FGC. After pushing the VS button, target vertical speed is selected or adjusted during altitude change using the SPD rotary knob on the FGC. A green VS annunciator will appear in the PFD indicating Vertical Speed Mode is active. Altitude capture and annunciator function operate similarly to FLC and SPD Modes.

Vertical Speed Mode will be disengaged when any of the following conditions occur:

- The VS button is pushed while already engaged
- The ALT, SPD, or FLC modes are selected
- The preselected altitude is captured
- The glide slope is captured on an ILS approach

NOTE: *Actual ERJ pilots typically utilize the FLC Mode below 10,000 ft for climb and the VS Mode above 10,000 ft for climb and descent. SPD Mode is used when ATC has issued an operational speed restriction, such as in the terminal area when being radar vectored for an approach.*

GLIDE SLOPE MODE – APR

Glide Slope Mode provides automatic capture and tracking of a glide slope for a precision instrument approach (ILS) when the Autopilot is engaged. When a localizer frequency is the selected navigation source for NAV 1, pushing the APR button on the FGC will arm Glide Slope Mode. Glide Slope Mode will be armed and indicated by a white GS annunciator in the PFD. When the glide slope is captured, the GS annunciator in the PFD will turn green and a white box will appear around it for five seconds. Glide Slope information is only valid when a valid localizer signal is being received during an ILS approach.

Glide Slope Mode will be disengaged when any of the following conditions occur:

- The APR button is pushed while already engaged
- The localizer signal is lost
- The ALT, SPD, VS, or FLC modes are selected
- The TOGA button on the thrust lever is pushed

ROLL AND PITCH MODES

Roll Mode and Pitch Mode are not selectable but are activated automatically when the Autopilot Master Button has been engaged and no selectable FGC modes have been selected. Selecting a mode will replace the ROL (roll) or PIT (pitch) annunciators in the PFD with the appropriate new annunciator.

Example: Autopilot is engaged with no lateral mode selected
ROL mode annunciator appears in PFD
HDG mode is selected on FGC
HDG annunciator replaces ROL annunciator

CAT II OPERATIONS

Category II ILS precision approaches are permissible with this aircraft. CAT II Operations are defined as precision approach and landing operations conducted with a DH of less than 200 feet but not less than 100 feet and an RVR (Runway Visual Range) of not less than 1200 feet. CAT II operations require special flight crew training, specific aircraft equipment, and an ILS equipped with an Inner Marker located between the end of the runway and the Middle Marker that transmits six dots per second. The Inner Marker indicates the CAT II DH, which is typically 100 feet above Touchdown Zone Elevation.
The following conditions must exist to enable CAT 2 approach mode in the PFD:

- Autopilot engaged / Flight Director coupled
- APR Mode selected on FGC with Localizer and Glide Slope captured
- DH between 100 feet and 199 feet set with the RA–c–TST rotary knob on the DCP
- Flaps set at 22 degrees
- Radar Altimeter less than 2500 feet

If all parameters above exist, the green CAT 2 annunciator should appear in the armed vertical mode annunciator area of the PFD indicating the CAT II operation can proceed. If the CAT 2 annunciator does not appear, the approach can only be flown to CAT I minimums. If the CAT 2 annunciator is lost at or below 300 ft shown on the radar altimeter in the EADI, an immediate go-around must be initiated and the published missed approach procedure should be flown. If the runway environment is in sight when the CAT 2 annunciator is lost, the approach and landing may proceed.

TOGA – TAKEOFF FUNCTION

TOGA is the acronym for **T**ake**O**ff **G**o-**A**round. The TOGA Button is on the side of the left thrust lever knob. Before a reduced visibility takeoff, pressing the TOGA button sets the Flight Director for the initial climb by placing the command bars at 10 degrees positive pitch. At V_R, the pilot should rotate the aircraft symbol into the command bars. After takeoff, the command bars will increase to 14 degrees. A green TO annunciator will appear in the active vertical mode position and a green ROL annunciator will appear in the active lateral mode position of the PFD when TOGA is selected on the ground prior to takeoff.

TOGA – GO-AROUND FUNCTION

Go-Around function of TOGA provides Flight Director pitch command to assist climb out at 14 degrees positive pitch angle and wings-level roll command when initiating a rejected approach. To discontinue an approach using TOGA, the Go-Around function is selected by pushing the TOGA button on the left thrust lever at anytime during the approach, or no later than “at” Decision Height or the Missed Approach Point. A green GA annunciator will appear in the active vertical mode position and a green ROL annunciator will appear in the active lateral mode position of the PFD.

NOTE: *Disengage TOGA before attempting to select another FGC vertical mode.*

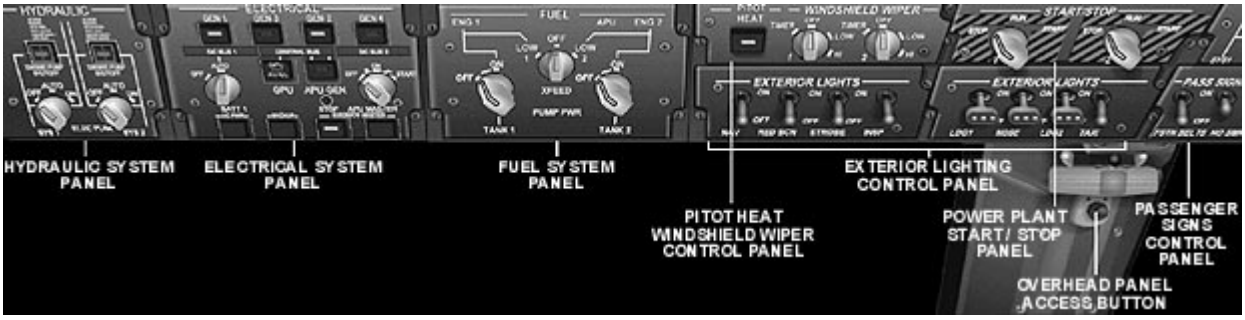
AUTOPILOT ANNUNCIATORS – PFD

Autopilot annunciators are displayed at the top of the PFD above the EADI on either side of the green Flight Director couple arrow. Autopilot annunciators confirm armed and active Autopilot modes and Flight Director commands input through the Flight Guidance Controller. It is very important to monitor what the aircraft is being commanded to do through these color-coded annunciators to avoid confusion.
Some important things to remember:

- The AP and YD annunciators will always be displayed in green when the Autopilot is engaged and will turn amber and blink for five seconds when the AP and YD are disengaged.
- The Yaw Damper engages with the Autopilot. The Yaw Damper does not disengage when the Autopilot is disengaged at the FGC. The Yaw Damper must be disengaged manually at the FGC. The Autopilot disengage button on the yoke will disengage both the AP and YD.
- When using the Autopilot, all annunciators in the PFD that are selected modes, captured, and active are green. All annunciators that are white are armed modes and not yet captured.
- When the glide slope or localizer is captured in APR mode, the LOC and GS annunciators will turn green and will have white boxes appear around them for five seconds.

Annunciator locations in the PFD

OVERHEAD SYSTEM PANEL



The overhead panel is accessed by clicking on the black button located just below the seat height adjustment sights and backup magnetic compass about midway up the center post of the windshield. Clicking this button brings up the modified overhead panel, which is divided into various aircraft system sections. There are pushbuttons, switches, and controls associated with each aircraft system located within the different sections. The various aircraft system sections of the overhead panel are as follows:

- Passenger Signs Control Panel
- Exterior Lighting Control Panel
- Power Plant Start / Stop Panel
- Pitot Heat / Windshield Wiper Control Panel
- Fuel System Panel
- Electrical System Panel
- Hydraulic System Panel

PASSENGER SIGNS CONTROL PANEL

The toggle switches on the Passenger Signs Control Panel operate the cabin passenger signs. The Fasten Seatbelts sign in the cabin is turned ON and OFF by clicking on the FSTN BELTS toggle switch and the No Smoking sign in the cabin is turned ON and OFF by clicking on the NO SMK toggle switch. An aural chime will sound when either toggle switch is clicked.

NOTE: *Smoking is prohibited on all commercial flights. The No Smoking sign should always be ON.*

EXTERIOR LIGHTING CONTROL PANEL

By clicking on a toggle switch, the aircraft's various exterior lights can be turned ON and OFF.

- NAV – Navigation Position Lights: Red at left wingtip, Green at right wingtip, and White on the aircraft's tail section. Night or day, NAV Lights should always be ON.
- RED BCN – Red Flashing Beacons. Turn ON before engine start, OFF at engine shutdown.
- STROBE – White Strobe Lights. Turn ON just before takeoff and OFF after landing.
- LDG1, NOSE, LDG2 – Landing Lights (All three switches function as one)
- TAXI – Taxi Lights

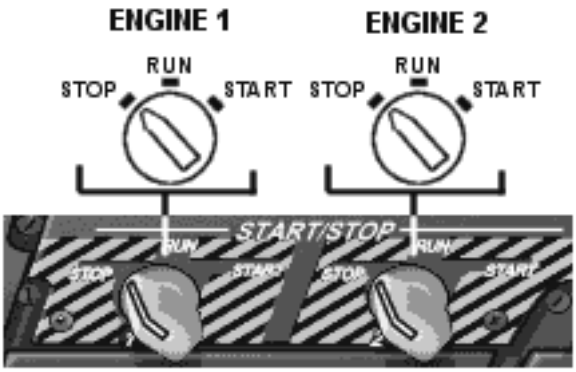
NOTE: *The Inspection Light toggle switch (INSP) does not function.*

POWER PLANT START / STOP PANEL

The Power Plant Start / Stop Panel controls engine starting and shutdown.

The rotary selector switch for each engine has the following positions:

- STOP – shuts down the engine
- RUN – engine in continuous run mode, switch automatically reverts to this position after a successful start
- START – initiates start sequence and begins engine spool-up. Engine should light off when turbine spool-up stabilizes at 20% N2. After a successful start, the switch will automatically revert to the RUN position when released



In order to accomplish a successful engine start:

- Turn on the engine's fuel pump
- Click on the START position of the rotary switch and hold down the mouse button
- A green IGN A annunciator appears next to the engine's ITT readout in the EICAS display
- N1, N2, FF, and PRESS readings rise indicating the engine is spooling up. N2 should momentarily stabilize at 20%, and then ITT will rise rapidly indicating engine light-off
- All readings will increase and the IGN A annunciator will go out
- Release the mouse button. The rotary switch will revert to the RUN position.
- Engine readings will stabilize
- Turn the engine's generator pushbutton ON. Check the Electrical System Page in the MFD for generator output of 28.0 volts.

NOTE: *If nothing happens after clicking on the START position of the rotary selector, there is either NO electrical power supplied for start or the fuel pump for that engine is not ON. If there is no power, select the GPU if the GPU AVAIL light is on; or, start the APU and select the APU generator. Check the engine's fuel pump rotary switch is set to ON.*

PITOT HEAT / WINDSHIELD WIPER CONTROL PANEL

The Pitot Heat pushbutton switch controls heating of the Pitot tube. The Pitot tube is located on the front side of the aircraft and supplies input data for airspeed. Normal operation is for the Pitot Heat to be turned ON at all times. The Pitot Heat pushbutton should be checked and set in the ON position during the Receiving checklist.

NOTE: *If airspeed is fluctuating rapidly or not functioning at all, check the EICAS for the PITOT 1 INOP crew alert, check the position of the Pitot Heat switch, and check the outside air temperature. If the temperature is below freezing and the Pitot Heat switch is not in the ON position, the malfunctioning airspeed could be due to a frozen pitot tube. Turn ON the Pitot Heat.*

The left Windshield Wiper rotary knob provides selection of two speeds for the left windshield wiper. LOW is used in light precipitation, and HI is used in heavy precipitation. The windshield wiper can be used on the ground, on takeoff, or on approach, but should not be used at cruise airspeeds.

NOTE: *The TIMER selection, the right rotary knob, and the right windshield wiper do not function.*

FUEL SYSTEM PANEL

The Fuel System Panel consists of a rotary switch for each engine's electric fuel pump and a fuel crossfeed valve rotary switch that allows fuel balancing between the aircraft's wing fuel tanks. Fuel pump status is indicated on the MFD Fuel System Page. Fuel pumps must be switched ON to accomplish starting of the engines. Fuel Pump Tank 2 must be ON to accomplish starting of the APU.

FUEL PUMPS TANK 1 and 2:

- OFF – turns fuel pump OFF
- ON – turns fuel pump ON

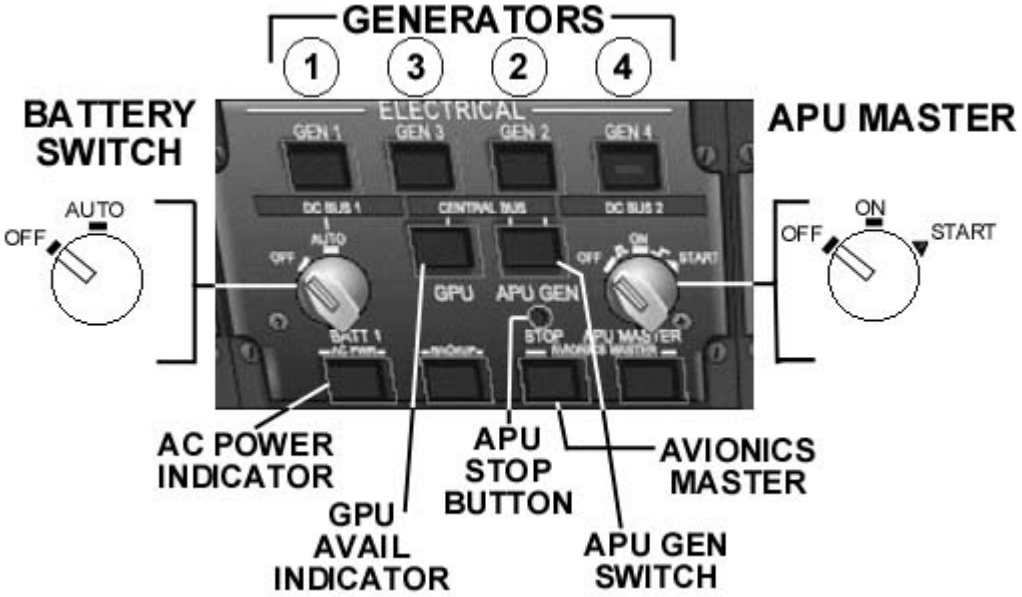
XFEED SWITCH:

- OFF – crossfeed valve is closed
- LOW 1 – turns Tank 1 fuel pump OFF and allows fuel from Tank 2 to flow to Tank 1
- LOW 2 – turns Tank 2 fuel pump OFF and allows fuel from Tank 1 to flow to Tank 2

  Associated EICAS Advisory message: FUEL XFEED OPEN

ELECTRICAL SYSTEM PANEL

The Electrical System Panel provides controls and indicators for Generators 1 thru 4, the Battery, Ground Power Unit (GPU), Auxiliary Power Unit (APU), and Avionics.



The following functions are available on this panel:

A. GENERATORS – GEN 1, GEN 3, GEN 2, GEN 4 – Pushing the GEN 1 and GEN 2 pushbutton switches allows manual selection of Generators 1 and 2 ON or OFF. If the white indicator lights on the pushbuttons are ON, the generators are not connected to the electrical bus or are not available. Generators 3 and 4 are automatically selected ON and cannot be manually selected.

   Associated EICAS Caution messages: GEN 1 OFF BUS GEN 2 OFF BUS

B. BATTERY SWITCH – The BATT 1 rotary switch turns the battery to AUTO and OFF

   Associated EICAS Caution message: BATT 1 OFF BUS

C. GPU AVAIL INDICATOR – GPU AVAIL indicates a Ground Power Unit is available for use. By pushing the switch in when the GPU AVAIL indication is lit, the GPU will be connected to the Central Bus. The white indicator light on the pushbutton will be ON when ground power is selected.
Associated EICAS Caution message: BKUP BATT OFF BUS

D. APU GEN SWITCH – The APU GEN pushbutton switch allows manual selection of the Auxiliary Power Unit generator. The APU generator will supply electrical power whenever the APU is operating. If the white indicator light on the pushbutton is ON, the APU generator is not connected to the electrical bus or is not available.
Associated EICAS Caution message: APU GEN OFF BUS

E. APU STOP BUTTON – Closes the APU fuel shutoff valve and shuts down the Auxiliary Power Unit

F. APU MASTER – The APU MASTER rotary switch activates the Auxiliary Power Unit. Click on the START position to initiate the start sequence of the APU. The rotary switch will revert to the RUN position after clicking START. Monitor APU start, status, and shutdown at the bottom of the EICAS display. After shutting down the APU with the APU Stop Button, turn the APU Master switch to OFF.
Associated EICAS Advisory message: APU FUELSOV CLS (appears for 10 seconds)

To start the APU:

- Turn BATT 1 rotary switch to AUTO
- Cancel the flashing amber Master Caution light on the glareshield
- Turn Tank 2 Fuel pump rotary switch ON
- Click momentarily on the START position of the APU Master Rotary Switch
- The APU Master Rotary Switch reverts to the ON position as the APU begins to spool up
- Observe turbine speed (%) and temperature of APU spool-up at the bottom left of the EICAS. Turbine speed and temperature readouts appear amber until 95%, and then should turn green. APU should stabilize between 100 – 104% and approximately 330ºC.
- Check APU generator voltage indication of 28.5 volts on the Electrical System Page of the MFD and check the EICAS for APU caution message (see D above).

To shutdown the APU:

- Click on the APU STOP Button. The APU generator will be disconnected from the electrical bus. Voltage reading for the APU generator disappears on the MFD Electrical System Page.
- The APU turbine speed begins to spool down and the temperature readout decreases.
- Turn Tank 2 Fuel pump rotary switch OFF. Leave Tank 2 Fuel Pump ON in-flight.
- When the APU turbine speed is below 10%, turn the APU Master Rotary Switch OFF.
- The APU FUELSOV CLS Advisory text message in the EICAS is displayed for 10 seconds.
- A green OFF annunciator appears in the APU area of the EICAS display
- Turn BATT 1 rotary switch to OFF. Leave BATT 1 rotary switch in AUTO in-flight.

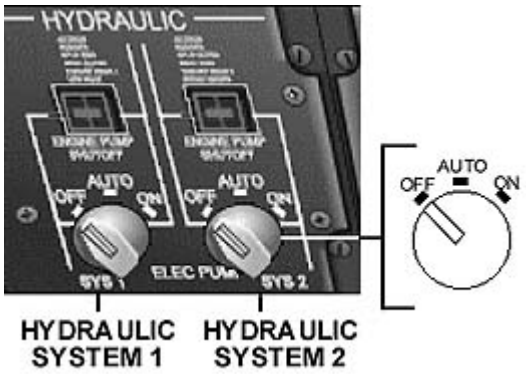
G. AC POWER INDICATOR – This is not a functional pushbutton.

H. AVIONICS MASTER – This pushbutton will turn the PFD, MFD, RMU, and EICAS displays ON and OFF. When OFF, all screens will be blank and the pushbutton will have a white indicator light ON.

NOTE: *The Avionics Master pushbutton switch will not function if the FSUIPC Module is installed.*

HYDRAULIC SYSTEM PANEL

The Hydraulic System Panel provides controls for the auxiliary electric hydraulic system pumps. The ERJ has two separate hydraulic systems to provide hydraulic power redundancy in case of engine failure. The auxiliary electric hydraulic pumps remain in a standby mode for backing up the engine's mechanical hydraulic pumps in case of engine or mechanical hydraulic pump failure.



The Hydraulic System Panel has the following functions for both Hydraulic System 1 and 2:

Two rotary switches, one for each electric pump, have three different selections:

- OFF – turns electric pump off
- AUTO – pump functions automatically and is the normal operation mode to select
- ON – continuous operation of pump

EICAS Caution messages if an electric hydraulic pump fails or is selected OFF with engines running:

- HYD SYS 1 FAIL
- HYD SYS 2 FAIL
- STEER INOP (System 1 pump)
- HYDPUMP SELC OF (Both pumps OFF)

The electric hydraulic pump is OFF when the rotary switch is in the AUTO position with the engine operating because the engine driven mechanical pump supplies hydraulic pressure. When the engine is inoperative or the mechanical hydraulic pump fails while the engine is operating with the rotary switch in AUTO, a sensor detects low hydraulic pressure and relays a signal for the electric hydraulic pump to turn on and restore pressure. When either hydraulic system's rotary switch is in the ON position, the electric hydraulic pump will operate continuously and supply hydraulic pressure to its respective hydraulic system.

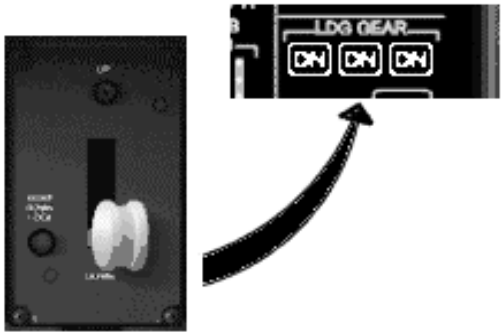
BACKUP GAUGES

There are two backup gauges to the right of the MFD in case of PFD failure. Clicking on the PULL TO CAGE button at the lower right of the ADI will cage or uncage the ADI gyro. When caged, the OFF flag will appear.
The backup gauges consist of the following:

- Attitude Direction Indicator – ADI
- Airspeed Indicator – IAS in knots

GOOD LUCK!

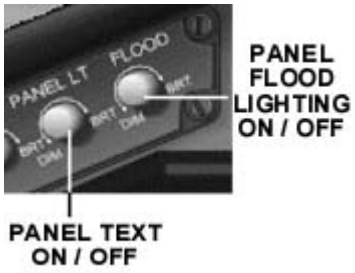
GEAR LEVER / INDICATORS



The gear for the aircraft is raised and lowered by using the gear lever located to the left of the EICAS display or by pressing the "g" key on your keyboard. The gear status is indicated on the EICAS screen by three indicators, one for each of the key assemblies, nose, right and left main gear. The color of the indicators shows the status of the gear:

- Green DN – gear is fully down and locked into position
- Amber UP – gear is in transit from one position to the other
- White UP – gear is fully up and stored

PANEL LIGHTING CONTROL



Two rotary knobs for panel lighting are located on the angled portion of the glareshield to the left of the Pushback Control Panel. The PANEL LT rotary knob turns the panel text lighting ON and OFF. The FLOOD rotary knob turns the panel flood lighting ON and OFF.

CLOCK

The Clock is located on the far left side of the instrument panel under the Panel Lighting Controls. Features of the Clock include a multiple selector switch, a chronometer button, and an elapsed time button. The Clock provides various chronological readings in several formats:

- Greenwich Mean Time (GMT)
- Local Time (LOC)
- Elapsed Time
- Date (CHR)

A. The CHR button or chronometer button provides the following by pressing the button in succession:

- START – Removes the elapsed time, resets to zero, and starts the chronometer
- STOP – Freezes the elapsed time and chronometer indicator
- RESET – Returns the pointer to zero and presents the elapsed time

B. GMT / LOC / DATE – The digital readout provides the following information:

- GMT – Greenwich Mean Time in a 24-hour format (hours and minutes) indicated by a decimal point between the two numbers on the left above GMT
- LOC – Local Time in a 24-hour format (hours and minutes) indicated by a decimal point between the two numbers on the right above LOC

C. CHRONOMETER POINTER – The needle displays seconds against an analog background.

D. ELAPSED TIME / CHRONOMETER INDICATOR – The digital readout provides the following information:

- ET – Corresponds to flight time in hours and minutes. ET is only activated when the aircraft leaves the ground and can only be reset to zero when the aircraft is back on the ground.
- CHR – When CHR is used the digital readout displays chronometer minutes from 0 to 99

E. MUTIPLE SELECTOR – Alternately selects between LOC and GMT time

F. ELAPSED TIME BUTTON – By using this button on the ground the following occurs:

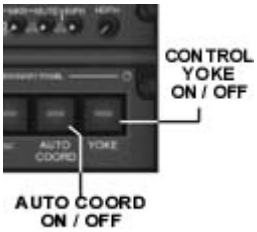
- Displays elapsed flight time
- Resets elapsed flight time to zero - set to zero just before takeoff
- Displays chronometer minutes, which is a second elapsed flight time - can be reset anytime

By using this button in the air the following occurs:

- Displays ET
- Displays chronometer minutes

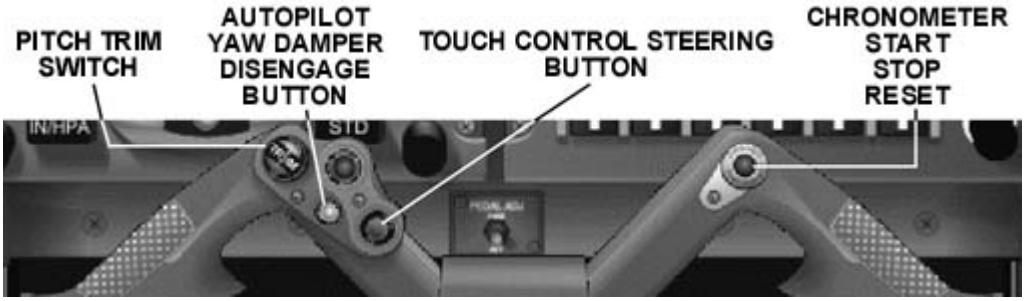
AUTO COORD / YOKE

The AUTO COORD and YOKE pushbuttons are located on the bottom left of the panel. The Auto Coord pushbutton synchronizes the deflection of the rudders and ailerons to automatically provide coordinated control surface movement and reduce slips or skids while maneuvering. A green light on the pushbutton indicates Auto Coord is engaged. The Yoke pushbutton removes or restores the control yoke.



CONTROL YOKE

The ERJ's Control Yoke is an unconventional design. Instead of a typical "U" shape found in many aircraft, the ERJ's Control Yoke has two ergonomically shaped handles angled 45º down from horizontal. This design, although visually radical, places the wrists and hands of the pilot in a natural, comfortable position. The Control Yoke can be turned ON and OFF using the YOKE switch located at the bottom left of the panel. Four functions can be controlled from the Control Yoke's three buttons and one switch.



The function of the buttons and switch are as follows:

A. PITCH TRIM SWITCH
Clicking on the top (elevator trim down) or bottom (elevator trim up) of this switch allows adjustment of the pitch trim.

B. AUTOPILOT / YAW DAMPER DISENGAGE BUTTON
Clicking on the red button disengages the Autopilot and Yaw Damper.

C. TOUCH CONTROL STEERING BUTTON
Clicking this button once or holding the button down will synchronize the Flight Director command bars to the aircraft symbol in the EADI by matching the current vertical speed of the aircraft with the selected vertical speed. When Speed Mode is selected at the FGC, Touch Control Steering will not work because Speed Mode has a program function for setting the selected vertical speed.

D. CHRONOMETER (CLOCK) BUTTON
Clicking this button will start, stop, and reset the Elapsed Time on the Clock. This button functions the same as the CHR switch on the Clock.

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