OXYGEN PLANNING AT THE E.T.P.

Assumptions and Conditions:

Several assumptions or conditions are necessary to define the "worst case" scenario. We will outline "worst case" and hopefully clarify the terms used and the conditions the flight crew must address or will be operating under.

Worst Case Condition:

These are the conditions that the FAA has used to define the most critical operational problem that ETOPS operators face when applying for, and qualifying for ETOPS certification. Worst case was defined as a two engine aircraft experiencing an engine rotor burst where debris from the engine rotor has penetrated the pressure vessel. The flight crew is suddenly faced with the single engine, unpressurized operation of their aircraft.

Equal Time Point (ETP):

The point in an extended over water or over land flight where the distance between "suitable" landing airports can be critical. If an emergency occurs prior to reaching the ETP the aircraft will reverse course and return to the "coast out" airport, in the case of an over water flight, or return to the departure airport, in the case of an overland flight. Consequently, if the emergency occurs after the ETP has been passed the aircraft will continue to the "coast in" or the destination airport as appropriate. The prudent pilot always calculates an ETP for his over water or long overland flights where the lack of a suitable airport may affect the safe conduct of his flight. If you have not established an ETP and you continue to fly for fifteen minutes while you are calculating one, only to discover that you must reverse course, you will have flown for thirty minutes and be in the same spot where your contingency developed. Definitely not in your best interest!

Identifying and Coping With the Problem:

The most important, of the many facets for oxygen planning that the flight crew must identify and address is, **the amount of fuel on board at the ETP!** The most critical flight will be the flight that consumes the most fuel *before* starting the over water leg.

As stated many times, "If you have enough fuel available to safely complete your flight at 10,000 feet, the immediate problem (oxygen emergency) is over!" However, if the fuel on board is insufficient to complete the flight with necessary reserves, you must consider climbing to a higher altitude where the aircraft specific range is increased sufficiently to safely complete the flight. This brings our fuel-oxygen "balancing act" into play. Remember, the lower the fuel state at the ETP, the higher the aircraft must climb to sufficiently increase the specific range. This higher altitude now impacts the oxygen system flow rate, the flight duration and the on board oxygen supply requirement.

Oxygen System Design:

When the manufacturers first addressed international flight requirements, they discovered that they needed to design an oxygen system that would meet the criteria for the longest over water flight *required.* (Required is italicized to indicate that there are certainly longer flights possible but there are alternate routes that can be flown to shorten the over water leg) The longest over water flight required is San Francisco to Honolulu. The maximum wind experienced over the KSFO-PHNL route was a minus 90 knots. This became the route and wind condition that drove oxygen system design.

The Balancing Act:

As the oxygen system design evolved, it became evident that the fuel available at the ETP dictated the on board oxygen requirements. With more fuel available, a lower cruise altitude could be tolerated. This of course reduced the oxygen required. If fuel available was not sufficient to make your "coast in" airport at 10,000 feet, then the aircraft had to be climbed to increase the Specific Range (SR) so that fuel available equaled the fuel required, including reserves, to reach our destination. When the altitude and SR are sufficient to reach the destination, the oxygen available and rate of consumption must be addressed.

Points to Ponder:

- If you have enough fuel to continue flight at 10,000 feet your oxygen emergency is over.
- If you must climb to increase SR, oxygen on board and consumption rates must be addressed.
- The higher the altitude required the more oxygen will be required.
- What cruise mode should I use?
- What temperature should I expect and use for my computations?
- What will my TAS, Fuel Flow and Specific Range be at this aircraft weight, using this cruise mode?
- How long will it take me to get there? (ETE)
- How much reserve fuel will I have overhead the destination airport?

The problem is very complex as you can see. If you have not done an "in-depth" analysis of your aircraft and addressed the "worst case" scenario, the time is now. Don't get to your ETP and discover that your homework is not complete.

Most Important: ***"KNOW BEFORE YOU GO!"***