# Managing an Oxygen Contingency
# Part 1

Almost every year the company generates some type of information concerning aircraft oxygen systems. We receive more information pertaining to this system than most others and rightfully so, as the oxygen system is perhaps the most important system to be managed.

Unfortunately, the oxygen system is also one of the least recognized systems from an operational perspective. Most of the training is lumped into a decompression scenario when, in fact, there are other aspects we should concern ourselves with as well. Oxygen management, which includes all facets of onboard oxygen, ranges from smoke and fire to medical emergencies to POB's, PBE's, partial loss of cabin pressure, oxygen concentrators, cracked windshields, faulty outflow valves, flights above FL410 and many others that can be considered an oxygen contingency. Ultimately, it is the flight crew who has the burden to manage these situations.

In the old days, travel to a distant destination could require several fuel stops and as a result, time aloft for each segment could have been as long as 4-5 hours. Today's aircraft far exceed those numbers and we sometimes see pairings in excess of 16 hours. That is a long time to be in an aircraft; particularly if you have to deal with any combination of "Oxygen Contingencies".

Each pilot should consider how you might handle the variety of oxygen problems that could and have occurred on board our aircraft given the information we are currently provided in the AFM. It is essential to start the thought process here, using the information we currently have available. It certainly is not a good time to start thinking about this on a very dark, stormy, cold night over the North Atlantic in an unpressurized jet.

Before I get started, I would like to remind the short-haul pilots that although we fly shorter legs than our B-777, B-767 & B-757 colleagues, an oxygen contingency on a 75 minute ETOP's flight in the Western Atlantic can yield just as complicated a situation as a wide-body over the North Pole.

Each aircraft has a minimum dispatch oxygen pressure chart in chapter 1 of each aircraft flight manual, as well as a copy in the QRH (Quick Reference Handbook). Have you ever wondered what the conditions are that comprise these values?

As we are aware, all of the company's aircraft passenger oxygen systems have oxygen generators which provide the "get down to 10,000 feet capability". The crew oxygen system on the B-737, B-757 and B-767 consists of one 114 cubic foot bottle of compressed aviator's oxygen and the B-777 has two 115 cubic foot oxygen bottles installed. The oxygen system pressure on all the company's aircraft, when full, will indicate 1850 NTPD (nominal temperature, pressure, dry) at 70 degrees Fahrenheit. This raises an interesting question. The B-777 has two 115 cubic foot bottles installed, yet when the system is full, it indicates the same pressure as a system that has only one 115 cubic foot bottle on board. On the B-747 we had seven 115 cubic foot bottles on board and when that system was full…..it also read 1850 psi! The point to be made here is that oxygen bottle pressure (psi), although indicative of system quantity, does not provide the pilot with a tangible number to accurately manage or assess an oxygen contingency. More planning is required to get that data into a useable format for the pilot. Another consideration is the number of certified jump seat riders allowed. This number will dictate how many oxygen masks are connected to that system. If you take the time to notice, some aircraft have a variety of different masks (full face or an oxygen mask and smoke goggles) with, of course, different flow rates at the various altitudes. All these variables affect the duration of your oxygen system.

Notice, I mention duration which is indicative of time, however, the oxygen quantity is read in pressure which certainly could complicate our lives. On top of that…..oxygen consumption is calculated in liters per minute (LPM) and the volume of the oxygen bottle is measured in cubic feet. How many liters are there in a cubic foot of oxygen? This becomes complicated.

I suppose now would be a good time to remind the flight crew and especially the PIC that when he/she signs his/her release that he/she is acknowledging that he/she has sufficient oxygen to safely complete the flight for both crew and passengers. We, of course, count on the OEM's (original equipment manufacturers) and the company to help us out with this information, but in the end, it all comes down to the pilots' responsibility……as always.

Initially, if we develop an oxygen contingency and are forced to a lower altitude, let's say to 10,000'where oxygen is not required, for all intents and purposes our oxygen emergency is over. However, fuel now becomes the immediate concern. Vacillating at a lower altitude may further compromise the safety of your flight whether it is due to increased fuel consumption or perhaps mountainous terrain. You should have good solid information to draw from. The decisions you make are time critical, particularly when nearing the equal time point. This can be a subject of discussion for a future LEC Times article. For now, I would like those who may find this topic of interest to, as you fly over long areas of uninhabited terrain such as the polar route, consider what tools you have available for coping with an oxygen emergency (contingency).

Think what you would do to manage the situations below with the current information made available to us and your knowledge of the oxygen system. As pilots, ditching an aircraft is always a last resort; second only to loss of life. Neither is ever an acceptable choice.

Consider the following:

This first scenario happened to me many years ago flying from Manus to New York. On this particular trip while at FL 450 the inflatable door seal ruptured and the cabin started to decompress. We began the descent and were able to catch the cabin altitude some where close to 13,000' and the aircraft altitude was approximately 35,000'. We had comprehensive information available to assess our oxygen system and knew that at a cabin altitude of 13,000' we had an adequate oxygen supply to continue our flight safely. Our fuel consumption was slightly impacted but not nearly as much as if we had to descend to 10,000. Having such a plan in this type of situation was paramount. Planning is essential, know before you go!!

Put yourself into this situation: you are on a night flight from HNL to SFO and the aircraft is approaching the equal time point. Smoke begins to envelop the flight deck. Oxygen masks and smoke goggles are donned and attempts to isolate the origin of the smoke are made, but the smoke continues. The oxygen system is at full tilt by now, having selected 100% and in the emergency mode. The cabin altitude is about 8,000'. How much time do you have before the oxygen supply is depleted?? If you remain at altitude and run out of oxygen while fighting smoke/fire, control of the aircraft becomes questionable. If you descend to a lower altitude, then fuel becomes a consideration especially if you hesitated picking the appropriate direction in the vicinity of the Equal Time Point. Having some idea of oxygen duration under various oxygen contingencies is essential information that pilots should have available.

Normal oxygen flows range between 1.5LPM to 4.5 LPM (liter per minute) per occupant however, in the emergency mode one mask can flow as high as 14 LPM. This becomes a very critical situation and one that requires some careful thought. From an oxygen management perspective, much like you would do for fuel or electrical conservation ….. download. It may not be a popular decision but one that should be strongly considered. Any jump seat rider or IRO could be directed not to use the crew system oxygen and especially not in the emergency mode. Depending where the smoke is coming from, consider asking him/her to use a PBE but certainly not a POB as that system allows ambient air to enter the rebreather bag and you would simply be inhaling exactly what you are trying to avoid. That is the same for the passenger system, *never* deploy the passenger oxygen system to cope with a fire.
Time/oxygen management becomes very real at this point. How much time do I have to fight this smoke situation at this extremely high flow setting before I run out of oxygen? What would you do? What could you do? Probably the best thing you could do in hind sight would be to note, as soon as you start using the oxygen system, the pressure and time. If nothing else, you will have a very rough estimate as to how much time you have remaining in your oxygen system by simply noting how much time has lapsed and where your current pressure is. eg . When I started using the system my oxygen bottle pressure was 1600psi :30 minutes ago. My oxygen bottle pressure is now 800psi, I can estimate I have :30 minutes or less time remaining
A tough situation to manage by anyone's standards, but it is important to identify your options.

These scenarios pose some interesting questions. In the first 6 months of 2006 there were 5 recorded decompressions/ deviations from altitude crossing the North Atlantic, as reported by the Central Monitoring Agency. Not a lot, considering approximately 210,000 movements in that time frame, however these problems do occur and it is our responsibility to be prepared to manage and cope with such situations.

We may have raised more questions than answered. I hope it has, that is the intent of this article, safety and awareness. Oxygen contingencies happen more often than reported. The key to a safe operation is knowledge and our goal today is to begin that thought process.

There is a link, a common denominator between fuel and oxygen which can provide you with the ability to balance these resources efficiently in the event of a decompression or any other oxygen contingency.  Also, think about managing this situation. It's not simply about oxygen, but in many cases it can impact fuel remaining ergo: the safety of flight . In the next edition of The LEC Times, I will continue to provoke the thought process and provide you with many of the answers to the questions we have raised in this issue.  Until then, fly safe.