Upgrading Supplemental Oxygen Will Lighten Your Load (Sep 2006)

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For thirteen years I hauled around a 35-pound oxygen bottle attached to my PA-30.As my family grew, I increasingly looked for ways to cut empty weight so that I could haul the additional payload without sacrificing fuel. Lightweight starters and alternators helped nip away at the empty weight. So did a huge box of excess wiring that I removed during a panel modification. When my son invited his180-pound roommate for our 2003 Thanks giving trip to the Bahamas, I looked at the large green steel cylinder behind the baggage compartment and decided it had to go.

Give up my oxygen? This seemed like the simplest solution – and the cheapest. Most of my flights are flown between 8,000 and 11,000 feet – not exactly nosebleed territory. But over the years, using supplemental oxygen has reduced my fatigue at the end of a full day of flying and has helped me feel better the next day. I also consider supplemental oxygen an essential for night flying. I determined giving up supplemental oxygen was not an acceptable answer. I considered a portable seat-back bottle but decided against it because a built-in system is totally out of the way until it is needed and then it is always available – even if you were not planning on needing oxygen. So, rather than chuck the built-in oxygen capability altogether, the search was on for a lighter built-in oxygen supply that would provide adequate support for my type of flying.

Oxygen supply and delivery has changed since the birth of the Comanche. Oxygen cylinders have evolved from the need for thick-walled containers to lightweight aluminum containers wrapped with high-strength carbon fibers. Flowrates for on-demand supplemental oxygen have also dropped dramatically by using delivery devices like the Nelson A-4OximizerTM shown in Figure 1. Scott Aviation (now AVOX) manufactures a line of Kevlar wrapped aluminum cylinders and regulators known as their 895 series that is a direct replacement for older units. I studied the weights and dimensions of these units and found that a 22-cubic-footbottle could be mounted between the existing fuselage mounts for the larger steel bottle. With a full charge of oxygen, the 22-cubic-foot cylinder weighed just 7.8 pounds. Would 22-cubic-feet of oxygen provide enough supply?

Figure 1: *Nelson A-4 Flow Meter*

The Nelson A-4 OximizersTM use just .3 liters per minute when set for 10,000 feet. Using flow rates for different altitude settings provided for the A-4 Flowmeter and doing some conversions from cubic feet to liters, I constructed **Figure 2**below to see how far 22 cubic feet of oxygen would go. The last column in Figure 2 shows the oxygen duration using standard constant flow masks at two liters per minute. With the Oxymizer's set to 10,000 feet, I could suck gas for 34hours or four of us could use oxygen for over eight hours – this seemed like a plentiful supply.

Cruise Altitude						
Users	**10,000**	**12,000**	**14,000**	**16,000**	**18,000**	**2LPM**
1	34.2	25.7	20.5	17.1	13.7	5.1
2	17.1	12.8	10.3	8.6	6.8	2.6
3	11.4	8.6	6.8	5.7	4.6	1.7
4	8.6	6.4	5.1	4.3	3.4	1.3

Figure 2: *OXYGEN DURATION (Hours) WITH 22 CU FT CAPACITY (1850 PSI) using Nelson A-4 OximizerTM Oxygen Dispensers*

I placed a call to Scott Aviation's technical support to find out which regulator matched the characteristics of the original installation. These characteristics included input and output pressures/flow rates and the actuating geometry. The original 63.5 cubic-feet cylinder and regulator assembly, called out on the Piper Drawing 25432, is Scott P/N 800112-12. Scott compared the characteristics of this original installation (shown in Figure 3) to their new line of bottles/regulators and recommended a bottle/regulator assembly (P/N 895-09022) that included a 22-cubic-foot capacity composite cylinder and a regulator (P/N 803214). New cylinder brackets (P/N 800644-00) would also be required because the new bottle has a much smaller diameter than the original. The final step in the plan was to design an adapter that would transition from the bolt-hole spacing of for the larger diameter bottle brackets to the bolt-hole spacing of the smaller brackets.

Figure 3

Figure 4 shows the new bottle brackets attached to the adapters.

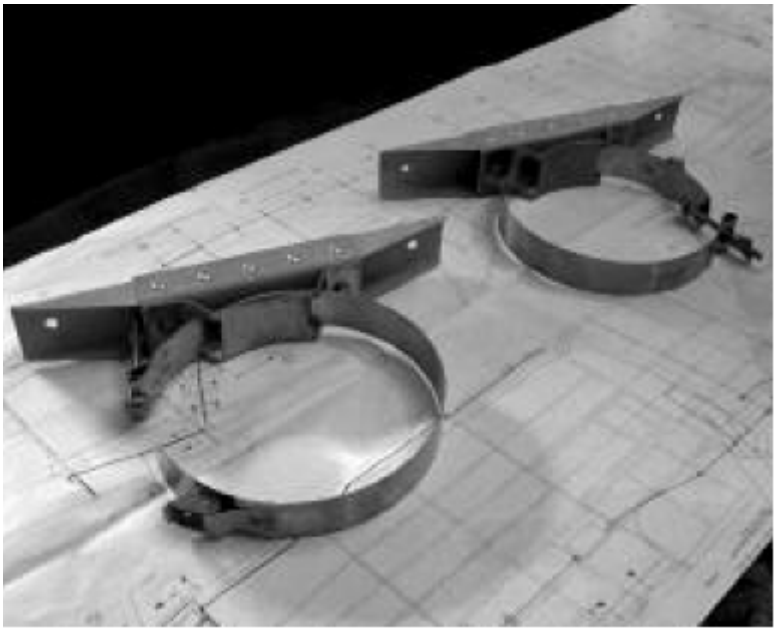

Figure 4

I brought the local FSDO into the project from the very beginning. They approved the submitted data for field approval and the new bottle and regulator assembly was ordered and installed with little difficulty. The fittings from the old regulator had to be transferred to the new regulator. The new regulator was fitted with a thermal discharge port and a short piece of aluminum tubing was fabricated to provide a discharge path in the event of thermal discharge. See **Figure 5** for the final installation.

Scott Aviation, one of the truly old aviation names, has gone through numerous changes since this project was undertaken. They were bought by TYCO International who kept their fire-safety line of products and spun off the aviation products to the French company Zodiak, S.A. However, the original Scott Aviation products are still sold and serviced by AVOX of Irvine, Calif. (www.avoxinc.com or 949-727-3844). For anyone who would like more details on this installation, please feel free to drop me a line.

Chris Burns has owned N8000, a 1965 PA-30 since 1991.
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Figure 5