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AEROSPACE INFORMATION REPORT

SAE AIR5354

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History of the SAE A-10 Aircraft Oxygen Equipment Committee

1. SCOPE:

   The following is the history of SAE Committee A-10.

2. HISTORY:

   The SAE Committee A-10, Aircraft Oxygen Equipment, started its existence in the early to mid-1950s as a subcommittee of the A-9 Aerospace Environmental Control Systems Group. It was during this period that Boeing, Douglas, and later Convair announced the development of their new jet-transports which were for the first time to regularly fly to the "horrendous" altitude of 40,000 ft. de Havilland's "Comet" Transport was already flying at these altitudes, but with disastrous explosive-decompression consequences.

   Because of concerns that cabin pressure decompression in these new transport aircraft could be a recurring hazard, a mid-1950s meeting of Industry and Government Regulatory Agencies resulted in the decision that emergency standby oxygen equipment for passengers would be provided. The Federal Aviation Administration (FAA) then recognized the lack of commercial oxygen systems rules for crew and passenger hypoxia protection covering these altitudes. Therefore, they were going to have to promulgate new Civil Aviation Regulations for these new aircraft. They asked for help from the Society of Automotive Engineers. An SAE A-9 Subcommittee, then known as "Aircraft Air Conditioning," responded to FAA's request. This group formed a central forum of industry experts. In an all-night session at Denver's Brown Palace Hotel, an ad-hoc subcommittee of A-9 produced a "minimum physiological requirements" proposal, which was subsequently adopted by FAA. Concurrent with this effort, A-9 labored over what was to later become AIR505, "Oxygen Equipment, Provisioning and Use in High Altitude (to 40,000 ft) Commercial Transport Aircraft", a system performance specification.

   Recognizing the need for a separate Oxygen Committee in early 1957, the SAE split-off the group from A-9 and designated it A-10. Later in 1957, they met as the newly-formed A-10 Committee to revise and finalize AIR505. It was completed and presented to FAA, who wrote their jet-transport CAR (Civil Air Regulation) around it. Inexplicably, AIR505 did not finally "issue" until 1961. The reason for this delay is lost. Issued or not, it was acknowledged to be "the only authoritative guide" of the time.

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2. (Continued):

Some of the principals (and early A-10 members) who participated in the drafting of AIR505 were: Art Miller (Scott Aviation), Vince Blockley (North American), D. R. Good (USAF), W. P. Hannan (American Airlines), Carl Jonasson (Boeing), R. Maddock (Douglas), Bob Stringer (Firewel), A. C. Princeau (United Airlines), and others. Guidance on physiological needs was provided by Dr. Charles Barron (Lockheed), and Dr. Thrift Hanks (Boeing).

AIR505 established the physiological requirements and operating rules for passengers and crew members to 40,000 ft. Still needed were crew and passenger mask-equipment specifications. Concurrent with the AIR505 effort, Aeronautical Standard AS452 for the commercial transport flight deck crew masks (demand and pressure-demand) was developed and published.

Until then, continuous flow systems for the passenger were generally limited to below 30,000 ft. Therefore, it was realized that a standard for an extremely lightweight "get-me-down" passenger mask from 40,000 ft was needed. Many of the A-10 experts who were responsible for AIR505 undertook the writing of an equipment specification for commercial continuous flow masks. NAS 1179, a National Aerospace Standard published by Aerospace Industries Association, was the result, and the efficient "phased-dilution" mask system was introduced to provide short-term hypoxia protection to 40,000 ft.

The jet-transport manufacturers later wrote their passenger mask specifications around NAS 1179. Later on, the SAE A-10 Standard AS8025 superseded NAS 1179 as the basis for FAA TSO C-64a (TSO meaning: Technical Standard Order).

The completion of these basic documents provided the FAA and the oxygen equipment manufacturer with the oxygen specifications necessary for the commercial jet age.

The highly respected Art Miller (a Scott Aviation Vice President) was made "permanent" Chairman of the new A-10 Aircraft Oxygen Equipment Committee. Under Art's leadership, the committee was off to a flying start. His interesting meetings were punctuated with real oxygen equipment demonstrations of especially slow opening oxygen shut-off valves the need for which he was totally committed. He even demonstrated the explosive results of mixing oxygen with oil. Under Art a period of prolific committee activity followed. Several of the early documents were:

AIR822: Oxygen Systems for General Aviation

AIR825: Oxygen Systems for Aircraft (This document covered not only systems, but outlined physiological requirements which the oxygen systems are designed to meet. Through the years it has become the standard for the industry.)

AS845: Smoke Protection for Crew Members

2. (Continued):

In 1962, after chairing the committee for five years, Art Miller handed the reins over to Dick Coulter (United Airlines).

After Art's death in January 1972, fellow A-10 member Dudley Grimm (Puritan Equipment Incorporated) wrote a moving tribute to him: "The world of oxygen breathing equipment will benefit for years to come from the contributions of Art Miller, a scientist, a leader of men, and a humanist".

Following Coulter, came Bill Trammell (Lockheed-Georgia). The next Chairman-appointee was Jules Duval (TWA) to 1976. Following them in order were George Hanff (Lockheed and later Boeing), Kay Nakagiri (Lockheed), Bob Richter (Puritan Aerospace), Ken Lorenz (Douglas), and Ken Warner (Interspiro Corp.). Starting with the spring meeting of 1999, Burt Parry (O_2 Corporation) has chaired the committee.

Throughout the life of A-10 both as a subcommittee of A-9 and under its own identity, over forty AIRs (Aerospace Information Reports), ARPs (Aerospace Recommended Practices), and ASs (Aeronautical Standards) have been written and published. As expected, they cover all aspects of oxygen physiology, systems, components, and regulations.

Notable amongst these documents are:

AIR171C: Glossary of Technical & Physiological Terms Related to Aerospace Oxygen Systems

AIR1059A: Transfilling & Maintenance of Oxygen Cylinders (1968). Sponsored by then Chairman Jules Duval of TWA. This report was undertaken following a series of oxygen-induced fires caused by improper maintenance and recharging of aircraft oxygen systems

With the advent of the Douglas DC-10 and Lockheed L-1011, a major departure from the cylinder-stored high pressure oxygen occurred. Then A-10 members George Hanff (Lockheed) and Bob Maddock (Douglas) participated in the development and qualification of a new and different source of oxygen for aircraft passenger systems. A-10 member Bob Bovard (Mine Safety Appliances Corp. and later Puritan Aerospace) was the chemist who led the way in the formulation and controlled chemical generation of oxygen. Dr. Charles Baron (Lockheed) provided much of the required physiological expertise. "Chemical" or "solid-state" oxygen was generated by decomposition of chemicals sealed in metal canisters. This concept precluded the need to "top-off" or to continually re-charge the old gaseous oxygen cylinders. In fact the chemical generators could remain installed in-place in the aircraft for a minimum of ten years. Many newly-designed passenger carrying transports following the DC-10 and L-1011 utilized this passenger oxygen system.

Committee A-10 published AIR1133A: "Chemical Oxygen-General Information," AS1303: "Portable Chemical Oxygen," and ARP1304: "Continuous Flow Oxygen Generators."

2. (Continued):

The commercial jet-age also caused the crew oxygen mask systems to undergo a series of evolutionary changes. They were necessary because the jets were regularly flying to altitudes of 40,000 ft or more, and an increased emphasis on smoke protection. Committee A-10 and its members were a significant influence in not only writing the SAE documents for the equipment, but were also actively engaged in developing the hardware as well.

The documents were:

AS452, which later became AS8026, "Crew Member Demand Oxygen Mask for Transport Aircraft."

AS1194, superseded by AS8027, "Regulator Oxygen Diluter Demand, Pressure Breathing."

AS8031 and AS8047, "Protective Breathing Equipment (Smoke) for Flight-Deck & Cabin Crew Members." (1980 and 1987) These two specifications were the first A-10 documents to become FAA TSOs (Technical Standard Orders).

These evolutionary system changes were:

In the 1950s most of the masks were slow-donning, i.e., simple strap suspension. The first of the quick-donning masks was the so-called "horse collar" which was hung in stand-by position (a major restrictive nuisance) around the crew member's neck. It included the first of the mask-mounted diluter demand regulators. In the 1960s with the advent of the commercial jets (DC-8 and B-707), because these aircraft were flying at plus 40,000 ft, in event of aircraft decompression the length of time required for oxygen to reach the user was of vital importance. At pilot insistence, FAA allowed that the mask could now be moved from "stand-by" (around his neck), to be hung nearby in the cockpit so long as he could be donned in less than 5 s with one hand over glasses and headsets. This change became known as the "five second rule," and the masks became known as the "hanging quick-donning" (HQD) type. Concurrently, mask-mounted demand regulator designs were also significantly improved. With the advent of the HQD-type, these systems also underwent major improvement of their smoke protection capabilities. Ex-A10 members Dudley Grimm (Puritan Equipment Co.), Aaron Bloom (Sierra Engineering Co.), and Bob Stringer and Bob Hamilton (Robertshaw Corp.) each had a significant role in HQD development. Finally, from the 1970s until today, the mask/regulator is neatly "boxed" or stowed in "standby" to be grasped by the user and donned in accordance with the 5 s rule. It also represents a hygenic improvement in that, where it was previously tested by each crew member by actually donning it and breathing into it, it is now pre-flight tested "in-situ" while remaining in its stowage box. One of the A-10 members who led the way in development of these latest mask/ regulator systems was George Gutman (Eros/Intertechnique).