Introduction

Some 40 years ago, aviation gasoline was *the* aviation fuel. It was the high point of piston engine development culminating in the Wright Turbocompound and the Pratt and Whitney Wasp Major engines. There were five grades of gasoline catering to all octane appetites and ranging from a clear 80 octane to the highly leaded 115/145 grade for the largest high compression engines. General aviation used the three lower octane grades, rated from 80 to 100 octane. Volumes were large, large enough for pipeline shipments, particularly for the airline fuels. But a large shadow loomed over this picture, the jet engine. The military started its use in the early 1950s with the airlines beginning some ten years later. The first aviation gasoline to disappear was Grade 108/135, a special fuel for the Wasp Major, a 36 cylinder monster prone to lead fouling of its 72 spark plugs. The reciprocating engines of the commercial airlines ran on ever decreasing volumes of 100/130, while the U.S. Air Force burned 115/145 as long as it operated piston-engined aircraft.

For general aviation, Grade 91/98 faded out in the late 1950s, leaving a lightly leaded 80/87 grade and a more heavily leaded 100/130 grade. This situation persisted into the late 1960s when a new grade, 100LL, was introduced. By cutting the tetraethyl lead content of the regular 100/130 grade in half, but making no other specification changes, this grade is intended to serve both the 80 and the 100 octane market. The resultant disappearance of the 80 grade, the increased cost of the new fuel, as well as some performance difficulties ascribed to the higher lead content encouraged the certification of unleaded motor gasoline for low compression aircraft engines. Today, special type certificates are available for virtually all such engines. Some use of premium motor gasoline in high compression engines is also taking place. However, the trend toward motor gasoline has not been without its difficulties. The quality control normally exercised by the aviation gasoline supplier may be missing and, possibly more important, the specification compliance and the gasoline composition required for aircraft use may be difficult for the user to establish. Resistance to the trend by fuel suppliers and a number of engine and airframe companies is also a fact of life.

In the meantime, the larger business aircraft have increasingly switched to engines requiring aviation turbine fuel. This trend was recognized by a 1981 NASA workshop that recommended that future engines for general aviation be developed around jet fuel to eliminate the need for high-octane aviation gasoline. However, this recommendation does not have universal support, particularly for lower horsepower engines.

ASTM has played a key role in these developments by creating timely specifications reflecting industry trends. Since 1947, ASTM Specification for Aviation Gasolines (D 910) has described commercial aviation gasoline, while ASTM Specification for Aviation Turbine Fuels (D 1655) has done the same for commercial aviation turbine fuel since 1959. ASTM Specification for Automotive Gasoline (D 439) has covered motor gasoline since 1937. However, at this time the fuel requirements of future small engines for general aviation are not clear. The impact of ongoing motor gasoline development, particularly the increased use of oxygenates and new additives, requires assessment as does the experience gained on motor gasoline to date. The future availability of aviation gasoline as well as the possible use of alternative fuels in general aviation deserve discussion at this time.

ASTM Subcommittee J of Committee D-2 has authorized this symposium intended to develop a wide spectrum of information and predictions on future general aviation fuel requirements and availability. The information, in turn, will indicate the need for changes in existing specifications or for new specifications in the future.

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