

Single-Grade Avgas Reaction

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■ Individual aircraft owner and pilot reactions to the May PILOT article, "Single-Grade Avgas On The Way," were predictably large in number. And, almost without exception, the reactions were singularly opposed to such a move at this time. The article related how forces are at work within the oil industry to phase out Grade 80/87 avgas at some undetermined future date and supply only one grade of avgas. A new low-lead Grade 100/130 has been named as the prime oil industry candidate for the single grade.

"Disturbing," "distressing," "inexcusable," "monopolistic and price-fixing," were just a few of the views expressed in the sizable number of letters sent AOPA and The PILOT. A selection of the letters appears in the Vox Pilot department.

Many letterwriters took exception to reported results of a test conducted by the Shell Oil Company, a test that basically led the company to conclude elimination of Grade 80/87, in consonance with introduction of the new low-lead Grade 100/130, held more benefits than disadvantages.

Many letterwriters also expressed skepticism over reported claims that the use of the new low-lead Grade 100/130 in Grade 80/87-rated engines would not be harmful to existing Grade 80/87 engines, if proper care were exercised by the aircraft operator. Several persons detailed cases where, in the past, they had been forced to use Grade 100/130 in their Grade 80/87 engines due to nonavailability of Grade 80/87 and how they subsequently suffered engine problems. None of the cases, however, was said to have involved use of the new low-lead Grade 100/130 reportedly being marketed by most major oil producers.

Practically all those contacting AOPA were quick to grasp the significance of the information contained in the May article that the new low-lead Grade 100/130 still has four times as much tetraethyl lead (TEL), or lead content, as does the currently supplied Grade 80/87. The new low-lead Grade 100/130 reportedly is being produced with a maximum of 2.0 milliliters (ml) of TEL, while Grade 80/87 has long contained only ½ ml of TEL. Several persons noted the current national trend toward reduction of lead content in automotive gasolines to help eliminate pollution and said the move toward a single grade of avgas with a higher lead content than that now used by thousands of aircraft owners was out of step with the trend.

Suggestions for coping with the problem ranged from a call for AOPA headquarters to promote a campaign to encourage aircraft owners and pilots to patronize only those airports and fixed-base operators that supply both Grade 100/130 and Grade 80/87 to a request that the oil companies consider, if necessary and justifiable, a slight increase in Grade 80/87 prices instead of its removal from the market.

Only a minimal number of those expressing their concern recognized the possible "sleeper" in the overall subject of a single-grade avgas. That sleeper is legislative action by individual states and/or the Federal Government to set standards on gasolines that include maximum lead contents for all gasolines. Such legislative action, quite naturally, could make moot the question of whether the oil producers should or should not institute a program to sell only a Grade 100/130 with a 2.0 ml TEL content and eliminate the Grade 80/87 with its ½ ml of TEL. It would undoubtedly force oil producers to further reevaluate their profit-loss pictures, regarding avgas sales, to determine what future courses of action to take.

How important the states might become in this matter was debatable at press time, based on legislative actions taken in at least two states—Maryland and California. Maryland lawmakers recently adopted a bill (Senate Bill 94) that would have, as it was originally written, required the removal of all lead content from all gasolines sold and distributed in that state by Jan. 1, 1975. Prior to becoming law, the bill was amended to specifically exclude gasolines used in aircraft, pleasure boats, work boats and farm and construction equipment. It was also amended to establish a maximum level of "1.0 grams of lead per gallon" in all other gasolines by Jan. 1, 1976.

A California bill (Assembly Bill 399) appeared to be following a similar course at press time. As initially pro-

Move toward single-grade avgas, with possible elimination of Grade 80/87, precipitates concern by 80/87 users. Engine manufacturers detail recommendations on using fuels other than those for which engines are rated

posed, AB 399 would have required fuel suppliers to reduce the lead content in all of their gasolines down to a maximum of "not more than 0.5 grams on and after July 1, 1977" [May PILOT, page 83]. As of press time, the bill had been heavily amended in the Assembly and had been sent to the State Senate. One of the Assembly amendments had the effect of excluding avgas from the maximum lead contents provisions, according to a spokesman for the California Department of Aeronautics.

Evaluations of a no-lead avgas for existing lightplane engines will, of course, have to remain in the area of theory until such time as a no-lead avgas is produced and actually tested in flight and ground operations. A measure of information on this subject, as well as the often-suggested idea that oil producers should supply an avgas usable in lightplanes, was covered in an article entitled, "Autogas For Avgas," that appeared in the October 1969 PILOT. Those seeking further information on the avgas situation should find the article well worth researching. Likewise, the August 1970 PILOT article entitled, "The Lead Content Of Avgas." The 1970 article recounted results of a nationwide sampling and testing program conducted by AOPA on the lead content in Grade 100/130.

For the moment, however, those contacting AOPA on the single-grade avgas situation indicated a need and desire for additional details on the use of the new low-lead Grade 100/130 avgas in Grade 80/87-rated engines, since some major oil producers have already stopped supplying the lower octane avgas at certain locations. Most of the companies have insisted that any elimination of Grade 80/87 to date has been restricted to those airports where the request for such avgas has been almost nonexistent and sales have not been able to support the distribution cost.

Following publication of the May article on the single-grade avgas situation, The PILOT submitted additional inquiries to Teledyne Continental Motors Corporation and the Lycoming Division of Avco Corporation, the two major producers of lightplane engines now in existence. Both companies were asked to supply more information about their specific evaluations of the effects, if any, of using the new low-lead Grade 100/130 in their respective Grade 80/87 engines.

Among new facts provided were estimates by Continental that there are

Color Code Chart For Fuel Octane Rating*

Octane Rating	Fuel Color
80/87	Red
91/96	Blue
100/130	Green
115/145	Purple

* All aircraft owners and pilots should also know that jet fuel, which can not be used in piston-engine aircraft, is colorless.

Fuel Chart

Avco Lycoming Service Instruction No. 1070C

ENGINE SERIES	SPECIFIED FUEL *	ALTERNATE FUELS FOR CONTINUOUS OPERATION
O-235-C, -E, O-290-D	80	**80/87
O-235-F	100/130	115/145
O-290-D2	80/87	**80/87
O-320-A, -C, -E	80/87	***91/96 thru 115/145
O-320-B, -D	91/96	100/130 or 115/145
IO-320-A, -E	80/87	91/96 thru 115/145
IO-320-B, -D	91/96	100/130 or 115/145
IO-320-C	100/130	115/145
AIO-320	91/96	100/130 or 115/145
LIO-320-B	91/96	100/130 or 115/145
LIO-320-C	100/130	115/145
O-340-A	91/96	100/130 or 115/145
O-340-B	80/87	91/96 thru 115/145
O-360-A, -C	91/96	100/130 or 115/145
O-360-B, -D	80/87	91/96 thru 115/145
HO-360	91/96	100/130 or 115/145
IO-360-A, -C, -D, -F	100/130	115/145
IO-360-B, -E	91/96	100/130 or 115/145
AIO-360	100/130	115/145
HIO-360-A, -C, -D	100/130	115/145
HIO-360-B	91/96	100/130 or 115/145
TIO-360	100/130	115/145
VO-360	91/96	100/130 or 115/145
IVO-360	91/96	100/130 or 115/145
O-435-A	80/87	80/87
O-435-K1 (O-435-4), -A2	91/96	**100/130 or 115/145
GO-435	80/87	***91/96 thru 115/145
VO-435-A	80/87	***91/96 thru 115/145
VO-435-B	100/130	115/145
TVO-435	100/130	115/145
GO-480-B, -D, -F	80/87	***91/96 thru 115/145
GO-480-C, -G and IGO-480	100/130	115/145
GSO-480	100/130	115/145
IGSO-480	100/130	115/145
O-540-A, -D, -E, -F, -G, -H	91/96	100/130 or 115/145
O-540-B	80/87	91/96 thru 115/145
IO-540-A, -B, -E, -G, -J, -K, -L, -M, -P, -R	100/130	115/145
IO-540-C, -D, -N	91/96	100/130 or 115/145
TIO-540	100/130	115/145
VO-540-A, -B	80/87	91/96 thru 115/145
VO-540-C and IVO-540-A	100/130	115/145
TVO-540	100/130	115/145
IGO-540-A, -B	100/130	115/145
IGSO-540-A, -B	100/130	115/145
TIVO-540	100/130	115/145
TIO-541	100/130	115/145
TIGO-541	100/130	115/145
IO-720	100/130	115/145

Note: Aviation grade 100/130 fuels in which the lead content is limited to 2 cc per gallon are approved for continuous use in all Avco Lycoming engines listed herein.

* Engines specified for use with 91/96 Grade fuel may also be considered to be specified for 100/130 Grade. See Service Letter No. L169 for explanation.

** O-235-C, O-290-D, -D2 and O-435-A2, -K1 (O-435-4) engines are built with solid stem exhaust valves. The use of higher leaded fuel such as 91/96 thru 115/145 must be limited to 25% of the operating time. If used for longer periods of time, the same 150-hour inspection requirement described in the following note is applicable.

*** Early production O-320-A, -C, -E; GO-435, VO-435-A; and GO-480-B, -D, -F were built with solid stem exhaust valves and their use with higher leaded fuels is limited to 25% of operating time. If specified fuel is not available and usage with high leaded fuel exceeds 25%, the valve stems should be inspected at 150-hour intervals for erosion, or "necking." This inspection is accomplished by removing the exhaust manifold and visually inspecting the valves through the exhaust ports. To determine if an engine has solid stem exhaust valves, remove the rocker cover and look for valve rotor caps which are used with sodium-cooled valves but not with solid stem valves.

about 75,000 of its Grade 80/87-rated engines now in use and "approximately 40,000 aircraft engines in use requiring 100/130 octane fuel." Lycoming said it was unable to estimate the number of its Grade 80/87 engines still in use. Both companies, however, disputed earlier estimates made by FAA officials that about 92% of all engines now being produced are rated for Grade 100/130 avgas. The ratio is running about 60-70% Grade 100/130 engines, they said.

As reported in the May PILOT article, the basic views of the two companies differ somewhat, regarding the potential harm to Grade 80/87-rated engines from using the new low-lead Grade 100/130. Briefly stated, Lycoming has given what amounts to an almost blanket approval for the continuous use of 2.0 ml TEL Grade 100/130 avgas in its Grade 80/87-rated engines, while Continental has shaded its approval with a number of stipulations, most of which revolve around the aircraft operator exerting greater attention to the "care and feeding" of his engine.

Both Continental and Lycoming have now issued new service bulletins that have been sent to their dealers and distributors on the use of the low-lead Grade 100/130 or any other fuel besides that for which their respective engine models have been designed. Pertinent portions of the bulletins accompany this article in chart form.

"Subsequent to the publication of our bulletin," said Continental, "we have learned that some oil companies intend to continue production of 80/87 fuel. It is conceivable that this grade fuel may be available indefinitely. It should be pointed out, in view of the worldwide membership of AOPA, that in some countries 80/87 octane fuel has not been available for many years. Our Bulletin M71-9 simply updates information that has been in existence for several years for airplane owners in those countries where the required fuel is not available.

"The only engine in TCM's [Teledyne Continental Motors] current production line requiring modification to tolerate continuous use of 100/130 fuel is the O-200. Earlier versions of this engine not currently in production will require the same care. Modifications per se are not required unless the engine is in difficulty from use of the 100/130 fuel. The bulletin simply stipulates additional care in monitoring the engine health and, when repairs are required, utilization of a better material intake valve and selection of a better spark plug. We are unable to state what the dollar cost [from continuous use of Grade 100/130] would be through the service life of this specific engine [O-200]."

Asked what effect use of the low-lead Grade 100/130 in Grade 80/87-rated engines would have on warranties issued on its Grade 80/87 engines, Continental stated, "We anticipate very little effect upon our engine warranty in consideration of instructions published in Service Bulletin M71-9."

Regarding time between overhaul

(TBO) schedules for Grade 80/87-rated engines that might have to use Grade 100/130, Continental added, "As stipulated in the service bulletin, continued

Continental Service Bulletin M71-9

"We continue to recommend use of 80/87 fuel where specified. When 80/87 fuel is not available, it is permissible to operate the engine on low-lead-content 100/130. **Owners and operators are hereby advised that continued use of the new 100/130 low-lead-content fuel could result in reduced service life of these engines.** Because of this consideration, we recommend that a compression check be taken and recorded at each 100-hour interval after initial use of 100/130 octane fuel. Results of each check should be carefully analyzed against the previous check to assist in detection of engine difficulty before failure occurs.

"Use of the 100/130 fuel can cause, but is not limited to, the following conditions:

1. Exhaust valve stem erosion in the hot areas
2. Intake valve burning
3. Spark plug gap erosion

"Changing the following components will assist in maintaining the service life of your engine. Upon indications of engine difficulty, or when the cylinders must be removed for any reason, we recommend use of the exhaust valve part number 629404 for engine models:

C75	O200	O300
C85	C125	
C90	C145	

"We recommend use of the exhaust valve part number 631639 for the GO-300 engine (See [Continental] Bulletin M64-14). Use of intake valve part number 531608 is recommended for all the above-mentioned engine models. This has been in use in the GO-300, both new and re-manufactured, for several years.

"Owners and operators are further cautioned that use of new fuels will require that the spark plugs be cleaned more frequently because of possible excessive lead fouling. We recommend use of spark plugs as follows:

C75	539433 (AC-S88-S-88D) or 625351 (AC-SR88-SR88D) or 630378 (Champion EM42E) 635863 (Champion EM41E) 627643 (Champion REM40E)
C85	"
C90	"
O-200	"
O-300	"
C125	"
C145	"
GO-300	627449 (AC-SR-87) 627643 (Champion REM40E)

"There are no special valves for use with 100/130 octane fuel available for the A65 and A75 models, since these went out of production over 20 years ago. The same compression checks described above at 100-hour inspection intervals are recommended for these models. Use only spark plugs on the approved list, selecting a hotter plug if excessive lead fouling prevails.

"We do not have any experience with the use of 100/130 fuel in W670 models. They do use a sodium-cooled exhaust valve which may not be adversely affected. We do not know the effect on the intake valves. No alternate valves are available. Here also, experience will have to be gained through periodic compression checks. Selection of a hotter spark plug from the approved list may be necessary.

"IO-346, E185, E225, O-470 and IO-470 models that are rated on either 80/87 or 91/96 fuel use valves that are compatible with 100/130 fuel. If excessive lead fouling prevails, selection of a hotter plug from the approved list may be necessary. In extreme cases, selection of a platinum or iridium fine wire spark plug may provide additional relief."

use of 100/130 fuel can have a deleterious effect on the engine service life (TBO). It was because of this factor, and an indication of valve distress through test, that the service bulletin was published recommending an intake valve of better material."

Lycoming reported the continuous use of low-lead (2.0 ml TEL) Grade 100/130 fuel in its Grade 80/87-rated engines would have no effect on existing warranties for such engines or the company's standard TBO schedules.

Queried on their specific recommendations as to what grade of fuel should be supplied should only one grade be made available in the future, both Lycoming and Continental recommended a low-lead Grade 100/130.

Lycoming's service bulletin is officially dated April 23, 1971, and is designated Lycoming Service Instruction No. 1070C. Continental's is dated April 5, 1971, and, as already mentioned, it is labeled Continental Service Bulletin M71-9. On June 4, 1971, Continental issued a supplement—"M71-9 Supplement No. 1"—to its basic service bulletin. The supplement changed the "subject" of the initial service bulletin to read, "Use of alternate fuels for engines rated on 80/87 or 91/96 octane fuel" and contained the following two statements:

"In order to correct an apparent misunderstanding with respect to the intent of this service bulletin, please be advised that the requirements of the bulletin as originally published apply not only to low-lead-content 100 octane fuel as an alternate, but to all fuels containing more lead than specified for 80/87 octane fuel. We might add that any problems experienced due to more lead in the fuel than specified might be expected to be proportionate to the amount of lead content."

A portion of the Lycoming service bulletin not included in the accompanying chart reiterates the longstanding aviation recommendation that "if the specified fuel is not available, the next higher octane fuel must be used." Regarding the accompanying chart, Lycoming said it shows "alternate fuels that can be safely used when the specified fuel is not available." The company added the following words of caution, however, on using fuels other than those for which its engines are rated:

"Additional precautions are noted [in the chart] for certain model engines that are limited in their operation on fuels of higher octane than that which is specified for the engine. It is recommended that these notes be strictly adhered to in order to obtain the best service from your Avco Lycoming engine. The chart in no instance permits fuels of lower octane rating than that which is specified, and it is not permissible in any instance to use an automotive fuel in aircraft engines, regardless of its octane or advertised features."

Both Continental and Lycoming indicated the information contained in their respective service bulletins represented their best recommendations to date on the use of low-lead Grade 100/130 in Grade 80/87 engines. □