

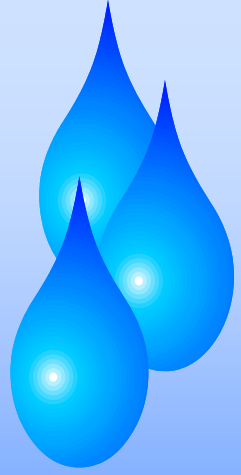
**Unleaded Avgas an alternative**

**Schönhausen May 15 2006**



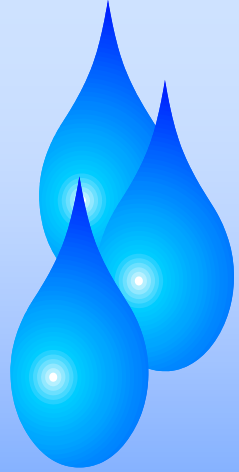
**Lars H. Hjelmberg**

**© Hjelmco Oil Inc.**



# From the beginning all Avgas was unleaded





# **EUROPE 1981**

**Unleaded Avgas used in**

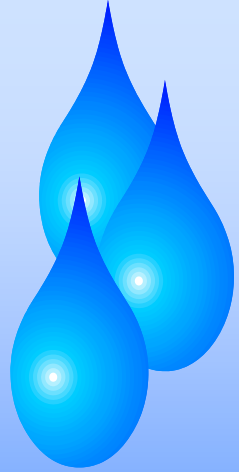
- **all Eastern Block countries**
- **Sweden**

**Production sites:**

**Germany (Böhlen)**

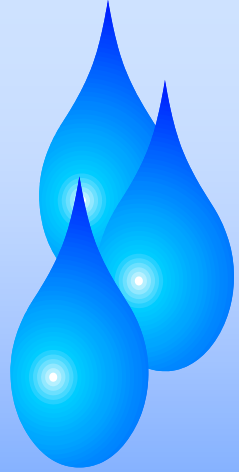
**Czechoslovakia (Litvinov)**

**+ more**



# Sweden 1988

**Unleaded Avgas 80/87  
used by  
Royal Swedish Airforce  
+  
c:a 30 % of GA fleet.**



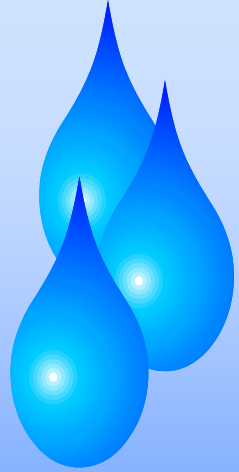
# Sweden 1991

**Hjelmco Oil introduced  
Avgas 91/96 unleaded**

**Reason:**

**80/87 UL potential market c:a 30 %**

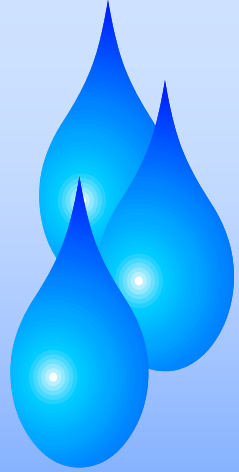
**91/96 UL potential market c:a 70 %**



# **Germany 1992**

**Unleaded Avgas  
production  
in Böhlen (Leipzig)  
ceased**

**Petition of maintaining production  
to the responsible German  
minister left without action**



**USA 1995**

**Textron Lycoming  
recognizes**

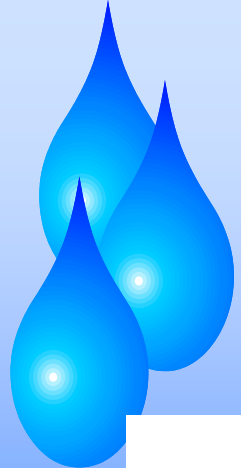
**Avgas 91/96 unleaded**

**as an approved alternate**

**Avgas for ~ 70 % of the GA fleet**

**in**

**Service Instruction 1070 L**



# Textron Lycoming SI 1070

Service Instruction No. 1070L

TABLE OF SPECIFIED FUELS (CONT.)

Engine Models	SPECIFIED FUELS		Alternate Military and Commercial Grades
	Certificated For Use With Grade	Commercial Grade Designation	
O-320-B,-D; IO-320-B,-D; LIO-320-B1A; AEIO-320-D; AIO-320-A,-B,-C; O-480-A; O-360-A,-C; IO-360-B,-E; AEIO-360-B,-H; VO-360-A,-B; IVO-360-A; HO-360-A,-B; HIO-360-B; O-435-A2; GO-435-C2*; O-540-A,-D,-E,-F,-G,-H; IO-540-C,-D,-N,-T; AEIO-540-D	91/96	100LL or 100	91/96 UL or ④100/130 or ④115/145



# AVGAS 91/96 UL



*Piper PA-23  
IO-540-C*

*Piper PA-30  
IO-320-B*



# AVGAS 91/96 UL

*Piper PA-28-161  
O-320-D*



*Robin 100 R  
O-360-A3*

*Rockwell 114  
IO-540-T*

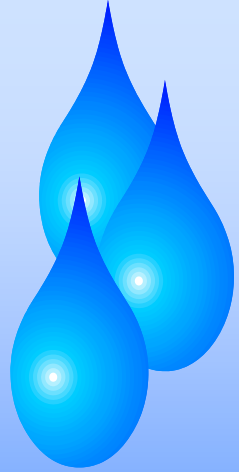


# AVGAS 91/96 UL

*Cessna 172*  
*O-300*



*Cessna 150*  
*O-200*



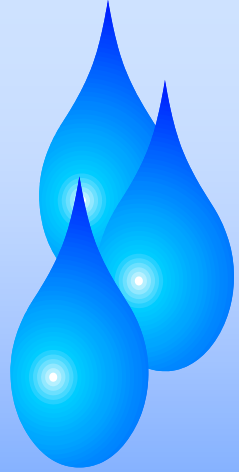
# Germany 1995

## Meeting LBA - Hjelmeo Oil

**PROJECT:  
unleaded Avgas for Germany**

**PROJECT FAILED**

**Reason:  
No political support**

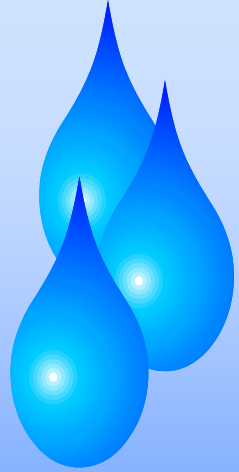


# **Political support failed**

**Unleaded Avgas requires new  
Airport infrastructure – i.e. tanks**

**When introduced  
unleaded car gasoline got tax break  
but**

**Why not unleaded or Avgas ???**



**Avgas 91/96 UL**

**Swedish CAA safety review  
1999**

**Fuel is safe to use**



# Unleaded Avgas 91/96

**Fuel is transparent to Avgas 100 LL**

- **made of similar components but of higher purity and quality**
- **100 % mixable with leaded Avgas**
- **just refill and fly**
- **follow Lycoming SI 1409 (correct engine oil)**



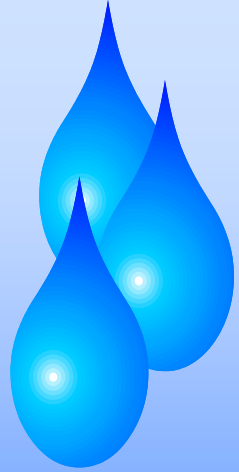
# **25 years of Unleaded Avgas in Sweden**

## **Avgas 91/96 UL**

### **today 2006**

- **Available at > 70 airports**
- **used by ~ 700 aircraft**
- **excellent technical history**





# **Avgas producers concern**

**100 LL**

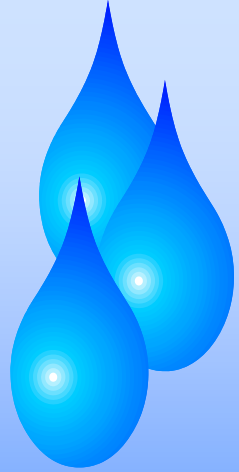
**A speciality product.**

**In volume**

**< 0.5 % of automotive gasoline**

**or**

**< 1/4 of automotive gasoline system  
evaporation**



# **Avgas producers concern**

**100 LL**

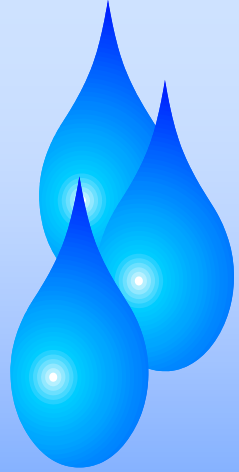
**The scavenger (lead-remover) =  
dibromoethane.**

**An ozone layer depleting substance.**

**Highly carcinogenic.**

**Listed in the Montreal protocol (1987)**

**= agreement exists to remove from use.**

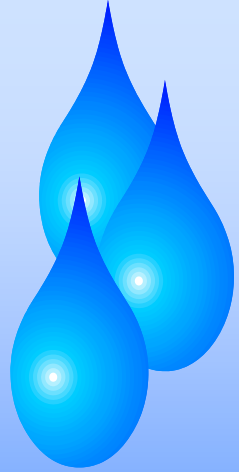


**Avgas producers concern**

**100 LL**

**Availability of tetraethyllead (TEL).**

**Only one production-site in the  
world**

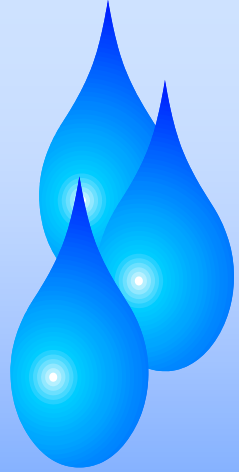


# **BAN OF AVGAS 100 LL**

**~ 30 % of the piston engine powered aircraft fleet is certified for 100/130 octane and consumes ~70 % of all AVGAS**

**but**

**there is no general replacement fuel available today for these engines certified and required to use 100/130 octane.**



# **BAN OF AVGAS 100 LL**

**~ 70 % of the 100 LL fleet can use approved substitutes such as**

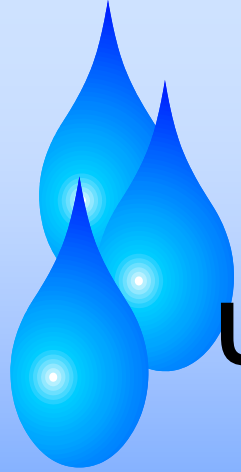
**AVGAS 91/96 UL**

**AVGAS 80/87 UL**

**AVGAS 82 UL**

**automotive gasoline**

**but consumes only ~ 30 % of the total AVGAS market**



# **BAN OF AVGAS 100 LL**

**Unleaded certified fuel replacements  
available today:**

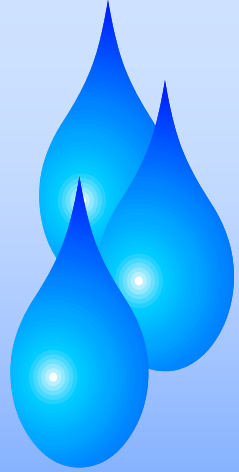
91/96 UL for all 91/96 and 80/87 octane engines

80/87 UL for all 80/87 octane engines

82 UL for certain 80/87 octane engines

**Nothing for 100/130 octane engines**

**Automobile gasoline for certain 80/87  
and 91/96 octane engines**



# **BAN OF AVGAS 100 LL**

## **Engine replacements:**

**Diesel engines from**

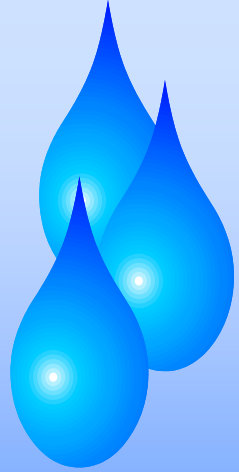
**Thielert      SMA**

**+ others**

**Gasoline engines from**

**Rotax      AES**

**+ others**

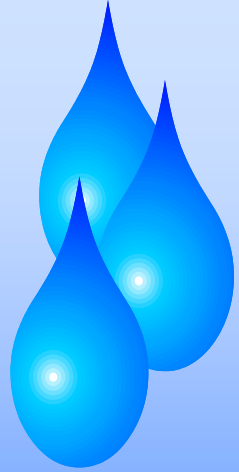


# BAN OF AVGAS 100 LL

## New Technology

- In March, 2002, observed by AOPA U/S staff, GAMI's PRISM system successfully operated a Lycoming TIO-540J2BD (Piper 31 – Chieftain) turbocharged 350 HP engine :
  - **on unleaded HJELMCO OIL AVGAS 91/96 UL**
  - at rated power (350 HP);
  - with the CHTs at redline (500° F);
  - at maximum induction air temperature
  - free of harmful detonation or pre-ignition
- This is a major milestone - as it demonstrates a known path to guarantee that even the most difficult general aviation piston engines can continue to fly when 100LL is no longer available.

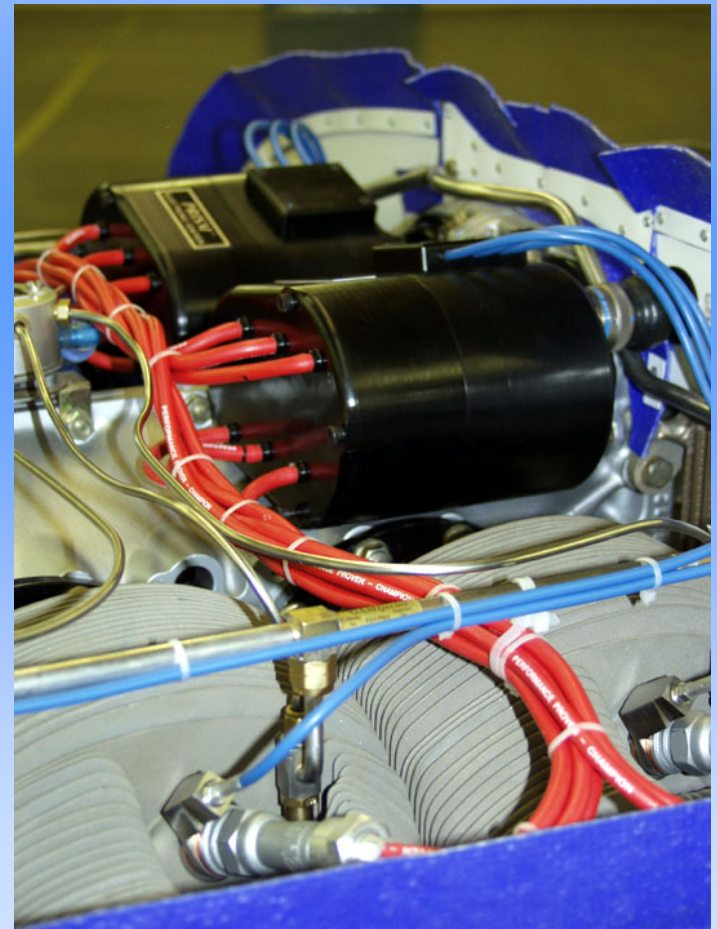
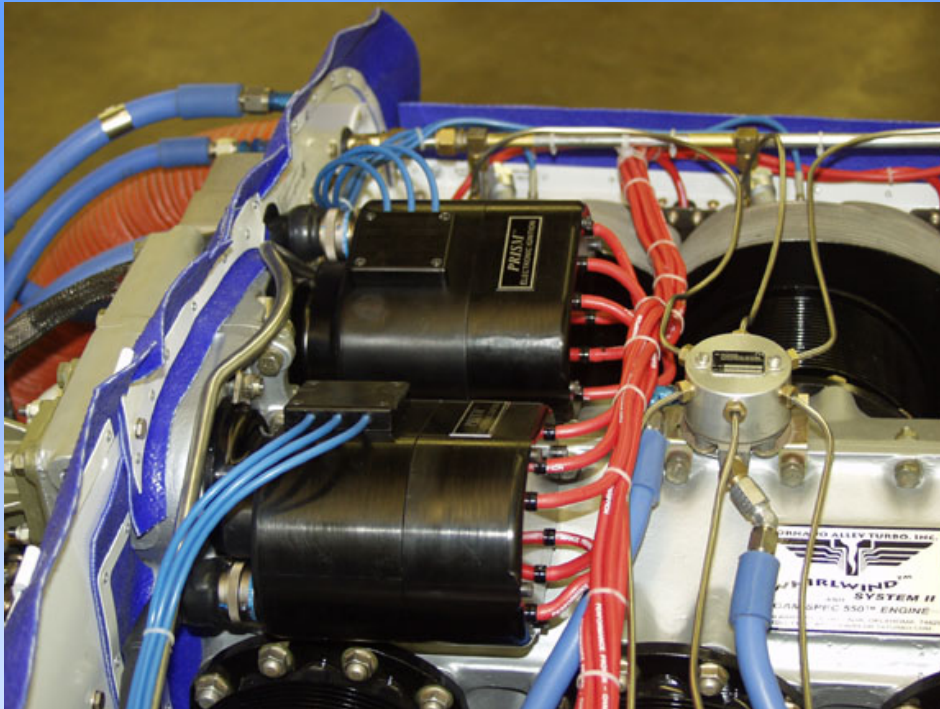


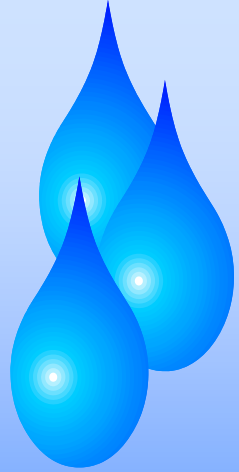


# BAN OF AVGAS 100 LL

## New Technology

**GAMI's PRISM System:**



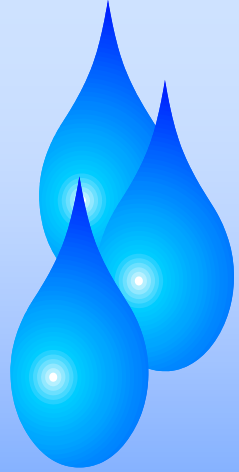


# **New Hjelmeo Avgas 91/96**

## **unleaded with ETBE**

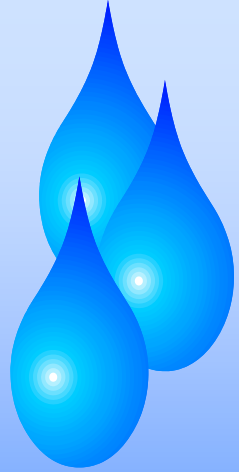
- **Superior environmental qualities compared to Automotive gasoline Eurosuper 95 RON or AVGAS 100 LL**
- **free from aromatics**
- **but more expensive to produce**

**Will be introduced if politicians will**



# **Homework for politicians**

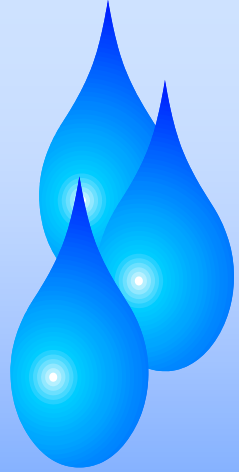
**Classify aviation  
fuel-products  
based on  
their  
environmental qualities**



# **Homework for politicians**

**With an environmental  
classification of aviation fuels**

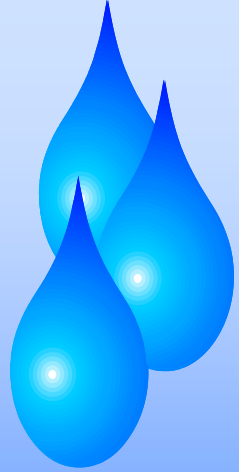
**allow tax-breaks  
for environmentally  
better products**



**Unleaded Avgas**  
**is not the only future**  
**for General Aviation**  
**but one**



2003.03.12



**Schönhausen May 15 2006**



**Lars H. Hjelmberg**

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