



# **ROTAX®**



## **Warum ROTAX?**

# ROTAX Anniversary

# 40 YEARS

## ROTAX AIRCRAFT ENGINES



# 2015

• 175,000 ENGINES PRODUCED

• 40,000 ENGINES IN OPERATION

• 45 MILLION TOTAL FLYING HOURS\*

• 5 MILLION FLYING HOURS PER YEAR\*



2005

1995

1985



# 1975

\*of 4-stroke fleet



ÖKF Jour Fix: ROTAX Aircraft Engines overview  
DI Christian Mundigler, 12.12.2015

More information on: [www.flyrotax.com](http://www.flyrotax.com)

**ROTAX.**  
AIRCRAFT ENGINES



# Rotax created the Ultralight Aviation Industry

Rotax propelled Ultralights in the 1970s/1980s

Lazair - Twin Engine Rotax 185



Adams CA-2 – Rotax 277



Loehle Spad XIII – Rotax 447

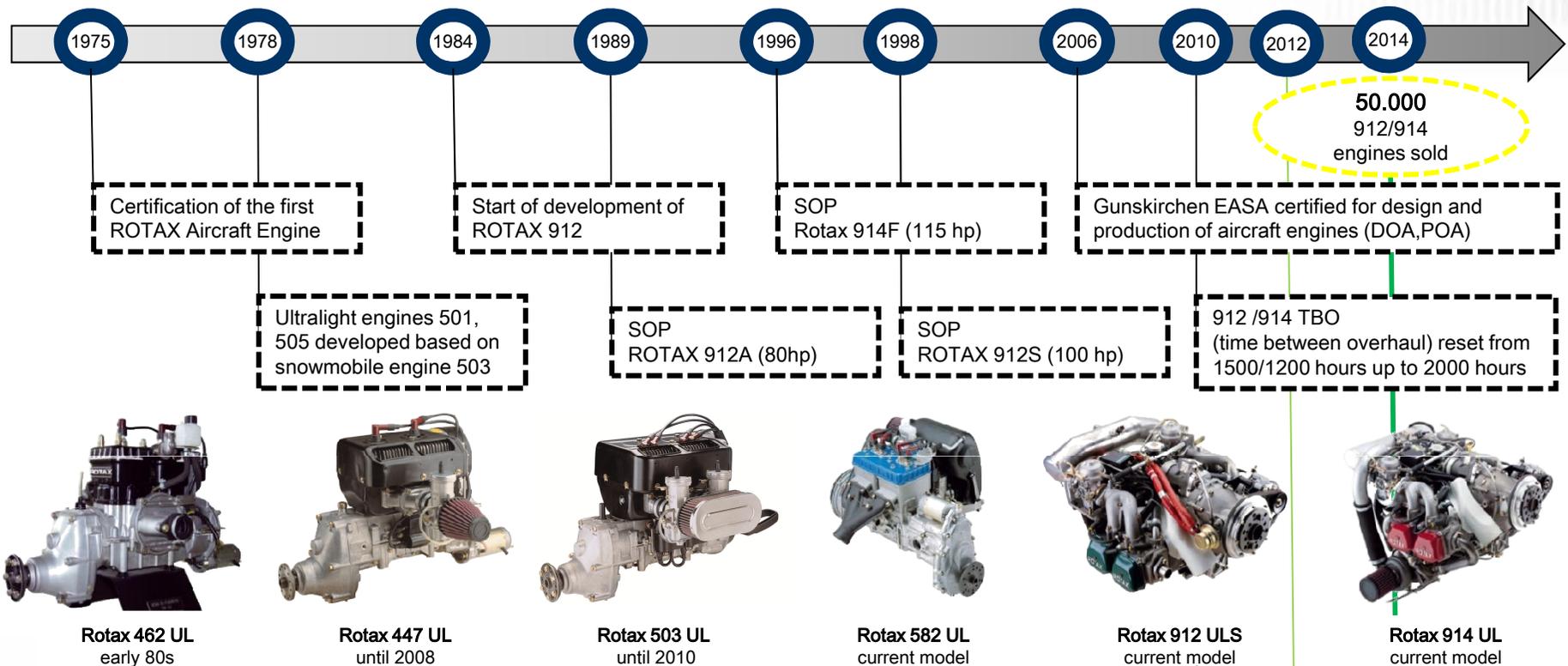


Why we became the benchmark for the industry...

- High Power-to- Weight ratio
- Low cost, good reliability through snowmobile application (economies of scale)
- Easy maintenance (Experience from snowmobile)
- Double ignition

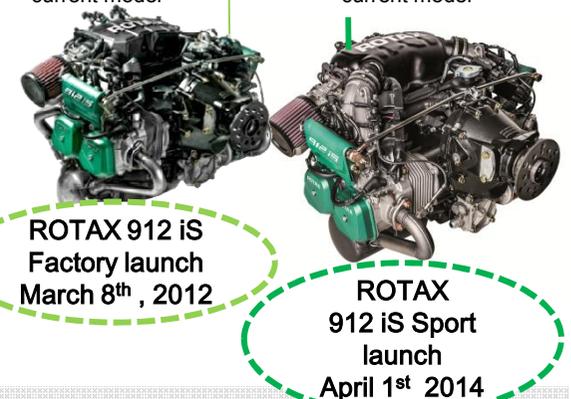


# Rotax Aircraft Engines: ~ 40 years of experience



## Key Facts

- Around 175.000 aircraft engines sold since 1975
- Rotax network provides 200 points of sale worldwide - see [www.flyrotax.com](http://www.flyrotax.com)
- Used by more than 220 aircraft manufacturers worldwide
- Rotax is a well recognized brand amongst pilots
- OEMs use Rotax Aircraft Engine proven reliability and power to weight ratio as USP
- The newly launched Rotax 912 iS engine provides the best fuel efficiency in the industry





- NEARLY 400 PARTICIPANTS
  - 25TH ANNIVERSARY OF THE ROTAX 912
  - 50,000TH 4-STROKE AIRCRAFT ENGINE
- Gunskirchen, Austria, June, 2014 – BRP hosted nearly 400 Rotax pilots and Can-Am Spyder riders in Gunskirchen from June 5 to June 7, 2014 for the Rotax Fly-In and the Spyder Grossglockner Challenge.*



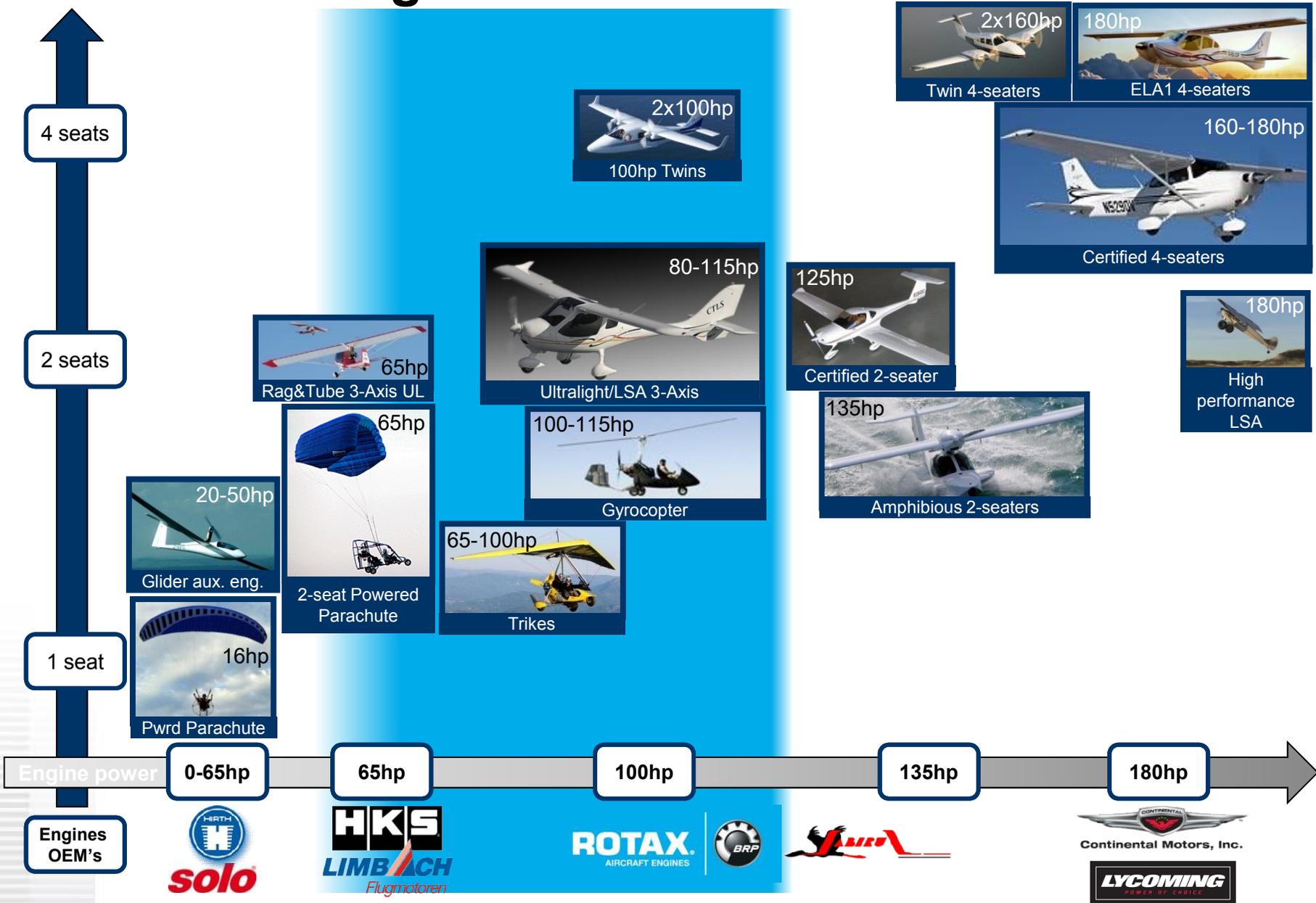
# Markets open to ROTAX engines

General Aviation			
Basic Aviation			
Product applications	Ultralight / Microlight / Experimental (Global)	LSA (only US)	Certified piston airplanes
	 <ul style="list-style-type: none"> <li>• HP Range: 20-115 hp</li> <li>• Maximum Take Off Weight (MTOW): 472,5 kg</li> <li>• Developed in 1970s</li> <li>• Low cost, basic flying</li> <li>• Little regulation (e.g. no aircraft registration)</li> <li>• Large portion of vehicles is home built</li> <li>• Ultralight / Microlight market represents the backbone of Rotax Aircraft engine sales</li> <li>• Many aircraft still rely on &lt;65hp engines</li> <li>• Price sensitive</li> <li>• Lightweight propulsion required</li> <li>• 2 stroke engines still viable option for many pilots</li> </ul>	 <ul style="list-style-type: none"> <li>• HP Range: 80-115 hp</li> <li>• MTOW: 600kg</li> <li>• Created by FAA in 2004</li> <li>• Developed to lift larger Ultralight planes into a safer, but still accessible regulatory regime.</li> <li>• LSA rules were adapted to Rotax engine line due to successful lobbying of our network</li> <li>• Rotax is a market a choice.</li> </ul>	 <ul style="list-style-type: none"> <li>• HP Range: 80-400hp*</li> <li>• MTOW: 5700kg</li> <li>• Certification mandatory for commercially used aircraft</li> <li>• Certified 912 and 914 engines open this market for Rotax</li> <li>• Due to current 115hp limitation, only sufficient power for 2-seaters</li> <li>• Most airplanes are manufactured by US OEMs</li> <li>• US OEMs still prefer US engines</li> </ul>
Future Potentials	Stable	Strong growth	Stable
	<ul style="list-style-type: none"> <li>• Boom during the 1980s, 1990s</li> <li>• More mature sector today</li> <li>• Stable base of enthusiasts</li> <li>• High cost and tight regulations of certified aircraft might increase customer base in the future</li> </ul>	<ul style="list-style-type: none"> <li>• Lower cost compared to certified aircraft,</li> <li>• Dedicated Sport Pilot License with lower medical requirements.</li> <li>• 12 countries already adopted US LSA regulation (incl. China, Brazil, S. Korea), 13 more are evaluating to do so.</li> </ul>	<ul style="list-style-type: none"> <li>• Many aircrafts are approaching their age limit</li> <li>• Strong need for modern replacement aircraft and engines</li> <li>• In Europe, new EASA regulations (ELA I &amp; ELA II) will create market segment between 600kg and 2000kg.</li> </ul>
Global Industry	unknown (no mandatory aircraft registration)	Total unknown 6,547 (US only)	~225,000
ROTAX Sales	~35.000 units 4-stroke & 122.000 units 2-stroke	~10.000	~8.000

\* More than 400hp with turbine powered engines

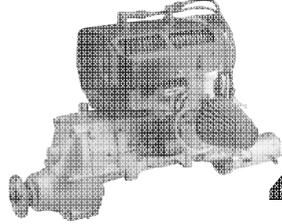
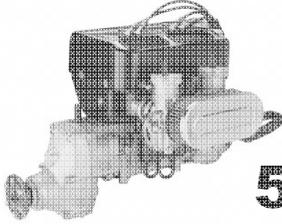


# Aviation Engine Market Overview 2015



# ROTAX Aircraft Engine lineup

## 2 stroke range

	<b>46hp</b>	<b>50hp</b>	<b>65hp</b>
			
	<b>447</b>	<b>503</b>	<b>582</b>
Displacement	Discontinued FY09 436,5cm <sup>3</sup>	Discontinued FY10 496,7cm <sup>3</sup>	580cm <sup>3</sup>
Description	Air cooled	Air cooled	Liquid cooled, two cylinder, 2 stroke engine

## 4 stroke range

	<b>80hp</b>	<b>100hp</b>	<b>115hp</b>
			
	<b>912</b>	<b>912S</b>	<b>912iS</b>
Disp.	1211.2cm <sup>3</sup>	1352cm <sup>3</sup>	1352cm <sup>3</sup>
Descr.	Naturally aspirated, dry sump lubrication	Big bore version of 912	Injected version of 912S
Versions	<b>912UL:</b> Non certified; <b>912F, 912A:</b> Certified	<b>912ULS:</b> Non certified; <b>912S:</b> Certified	<b>914UL:</b> Non certified; <b>914F:</b> Certified



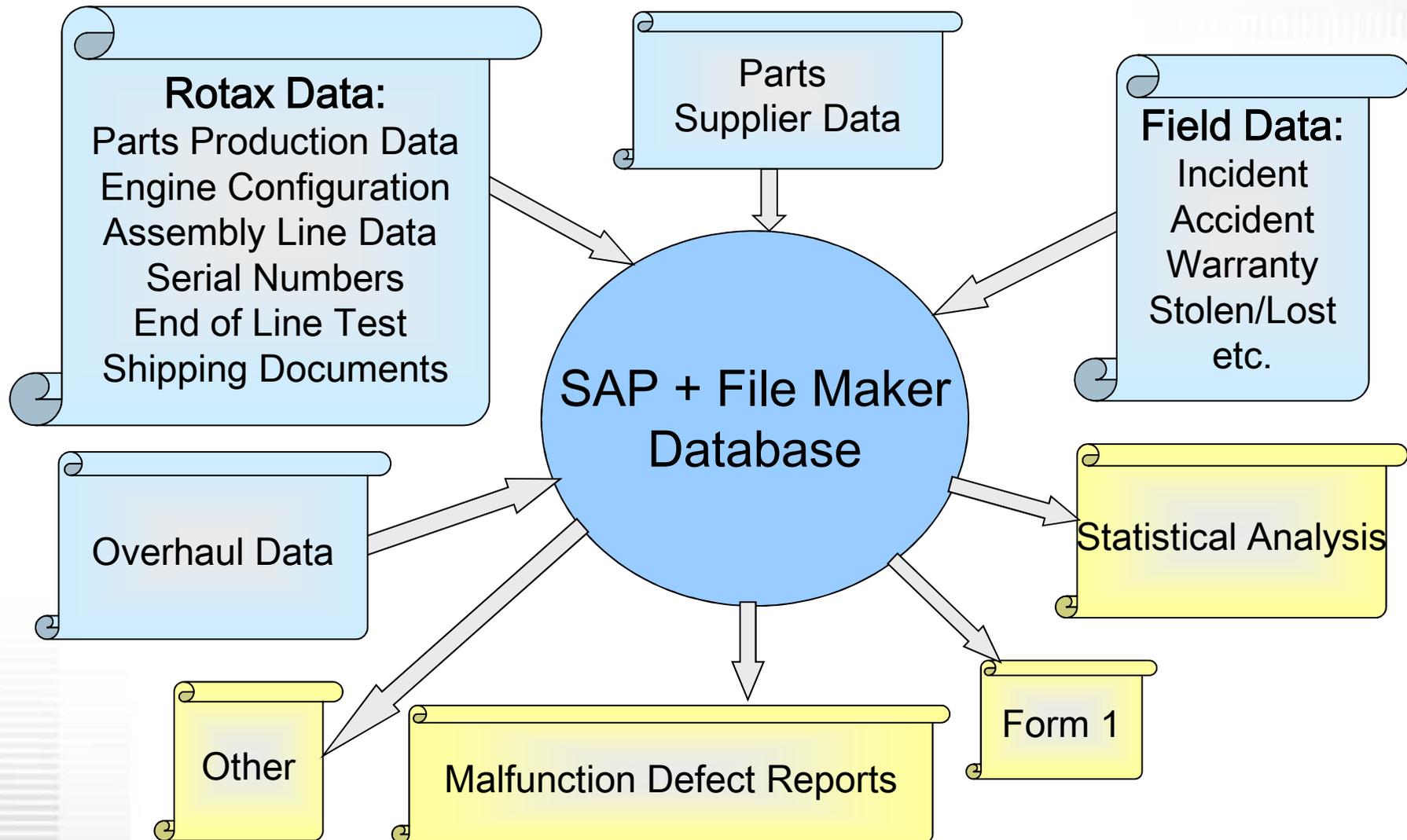
# All ROTAX aircraft engines are certified – that's unique

Version	Performance			Torque			Max	Certification
	KW	HP		Nm	Ft. lb.	RPM	RPM	
912 ULS	73.5	100.0	5800	128.0	94.0	5100	5800	Acc. ASTM F2339
912 S	73.5	100.0	5800	128.0	94.0	5100	5800	FAR 33 & Acc. ASTM F2339
912 iS	73.5	100.0	5800	121.0	89.0	5800	5800	Acc. ASTM F2339
912 iSc	73.5	100.0	5800	121.0	89.0	5800	5800	EASA CS-E & Acc. ASTM F2339
912 UL	59.6	80.0	5800	103.0	75.9	4800	5800	Acc. ASTM F2339
912 A	59.6	80.0	5800	103.0	75.9	4800	5800	JAR 22 & Acc. ASTM F2339
912 F	59.6	80.0	5800	103.0	75.9	4800	5800	FAR 33 & Acc. ASTM F2339
914 UL	84.5	115.0	5800	144.0	106.0	4900	5800	Acc. ASTM F2339
914 F	84.5	115.0	5800	144.0	106.0	4900	5800	FAR 33 & JAR-E & Acc. ASTM F2339
582 Mod. 99	48.0	65.0	6500	75.0	55.3	6000	6800	Acc. ASTM F2339

Certification means that both, design and production of ROTAX Aircraft Engines is audited by the European Aviation Safety Agency (EASA) including surprise audits multiple times every year.



# Engine lifecycle management and database



**Record Tracking acc. to EASA and FAA standards done since 1989**



# The ROTAX Aircraft Organization

## DESIGN ORGANISATION: Privileges granted under DOA

- BRP-Rotax takes over design responsibility of whole engine and parts
- BRP-Rotax takes over certification responsibility, e.g.: certification tests
- BRP-Rotax is entitled to approve changes
- BRP-Rotax is entitled to approve repairs to product
- BRP-Rotax is entitled to issue information or instructions for continued airworthiness

## PRODUCTION ORGANISATION:

- Quality system acc. ISO9001 / EN9100
- Rotax quality system must and does oversee supplier quality performance
- Privileges:
  - production of engines and parts
  - issuance of FORM1 for engines and parts

## Under both approvals:

- Requirement to monitor continued airworthiness of products in the field (failures, malfunction and defect reporting)

**ROTAX is a fully approved aircraft engines & spare parts  
DESIGN and PRODUCTION organization**



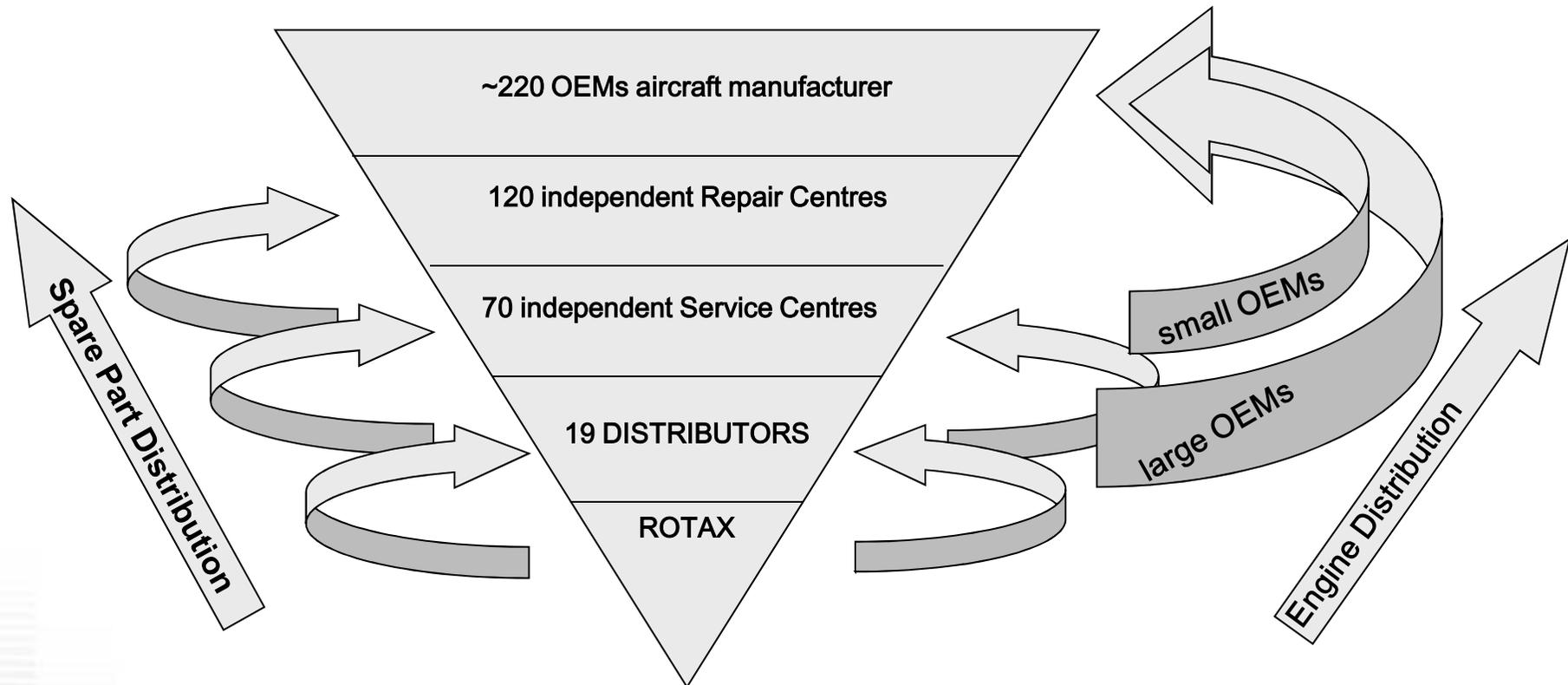
# ROTAX Aircraft Engines Distribution Network



More than 200 point of sales worldwide with 19 Distributors  
incl. independent Service & Repair Centres

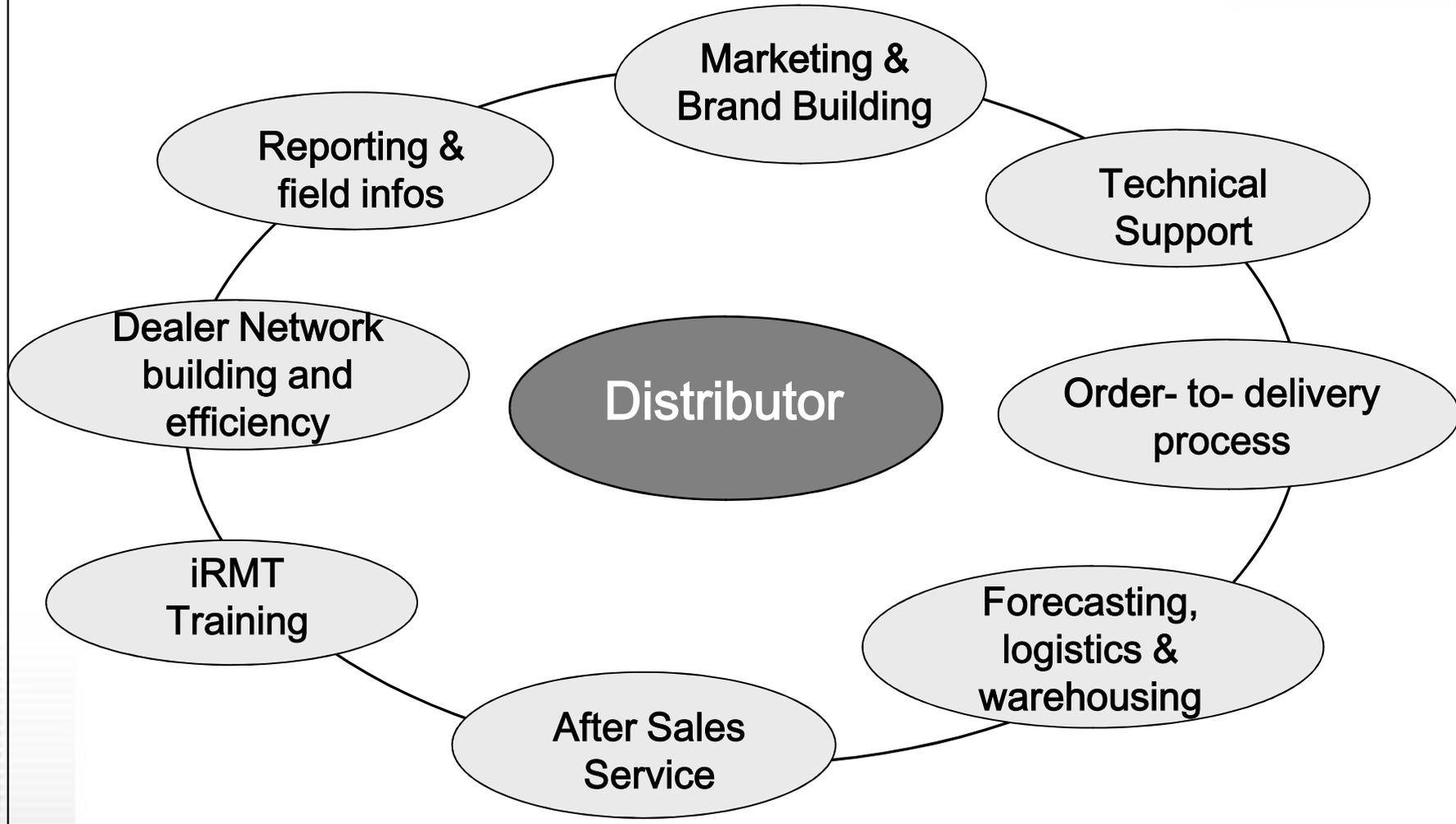


# ROTAX Aircraft Engines sales channel



# Distributor duties

## ROTAX Distributor Assessment System



# Networking by ROTAX

## iRMT (independent ROTAX Maintenance Technician)

Standardized designation of BRP-Powertrain approved training program beginning with low level service units up to heavy maintenance;  
Fulfilment score of minimum 70% at each level's examination;  
Scores must be submitted to BRP-Powertrain;  
iRMT licence is valid for 24 months;  
Actually 2.000 iRMTs were trained for America, Canada and the rest of the world within the last 4 years.

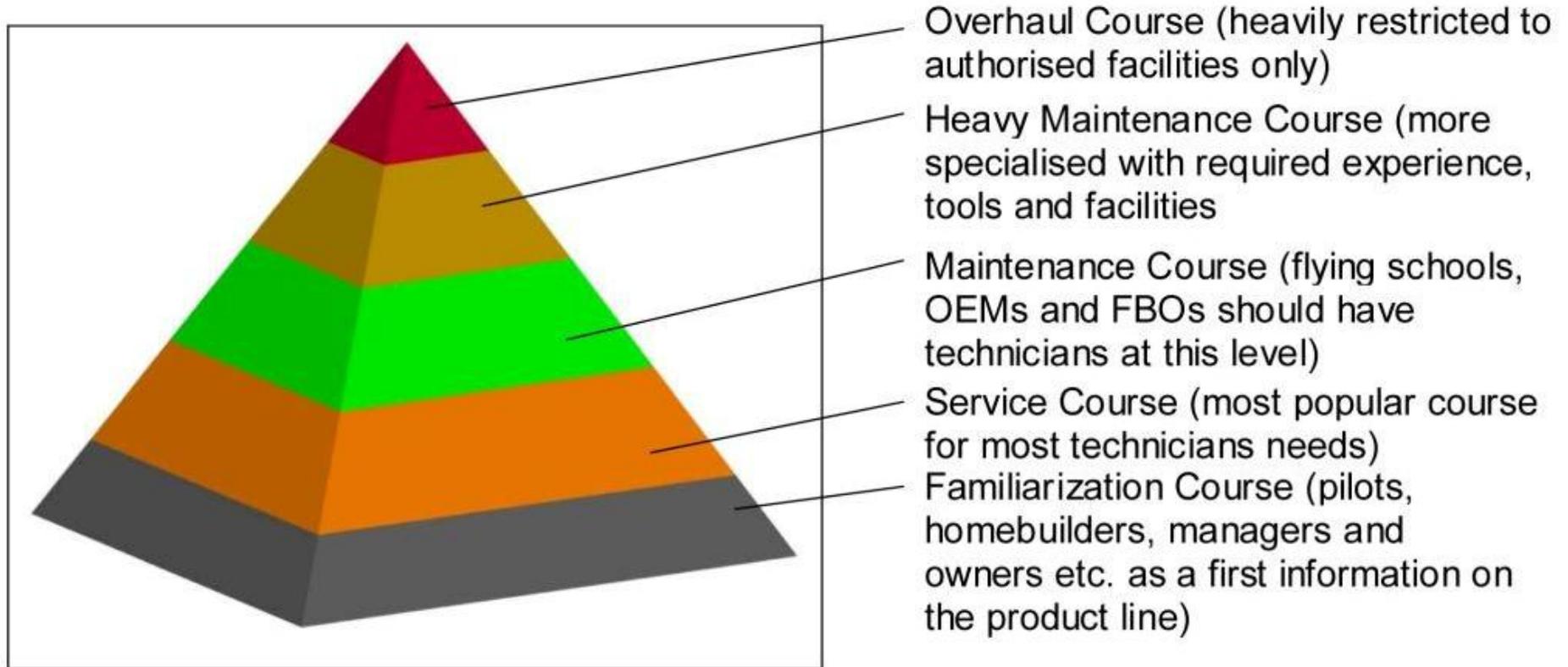
## R.O.A.N. (ROTAX Owner Assistance Network): [www.ROTAX-owner.com](http://www.ROTAX-owner.com)

Created and operated by our Canadian Distributor ROTECH;  
Authorized by BRP-Powertrain;  
Standardized powerful tool to format in INFORMATION distribution, EDUCATION programs and SUPPORT via the iRMT network;  
Provides all users worldwide links to their next ROTAX aircraft engine Distributor / Service Centre / Repair Centre / iRMT;  
Registered users : 20.000 already worldwide



# Rotax Standard „iRMT“ : independent Rotax Maintenance Training

- The training structure has been defined by Rotax and it's main distributors and training providers.



# ROTAX worldwide iRMT Training Standards

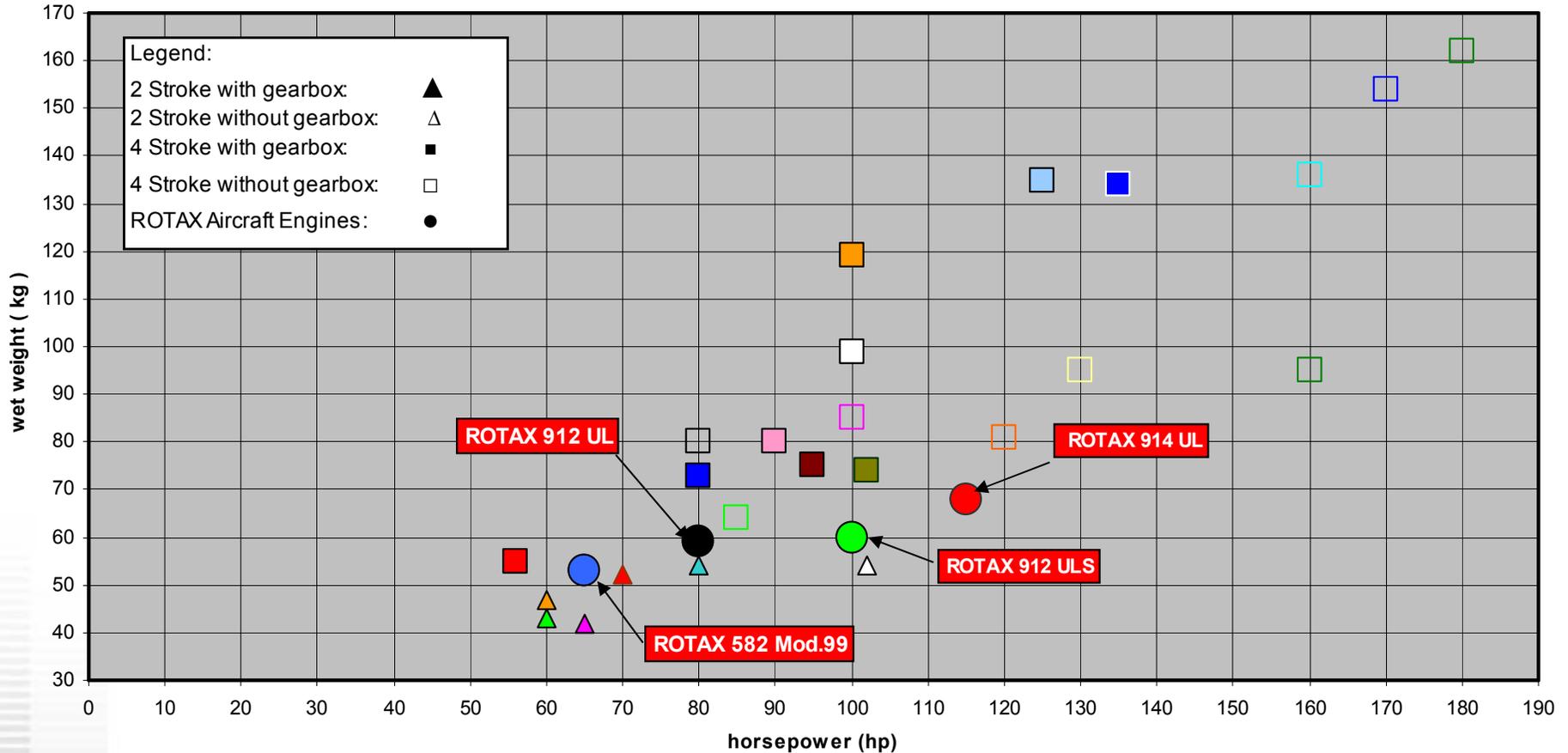
- **Service rating**
  - Basic program for service providers
    - 16 hours
  
- **Maintenance rating**
  - Extension of the Service Program for component exchange
    - 16hours (a combination of the Service and Maintenance program is minimum for the Repair Centre rating)
  
- **Heavy Maintenance rating**
  - Experienced Maintenance rated technicians that meet qualifications and work at qualified facilities
    - 16 to 24 hours, with minimum 2 years experience
  
- **Overhaul training**
  - For qualified facilities only, technical staff must have experience and all ratings before acceptance
    - Training will depend on experience, minimum 2 years experience in Heavy Maintenance
  
- **Instructor training**
  - Programs in development for professional educators expanding into ROTAX training programs
  
- **Accident investigation training**
  - In development to assist regulatory agencies in the investigation process



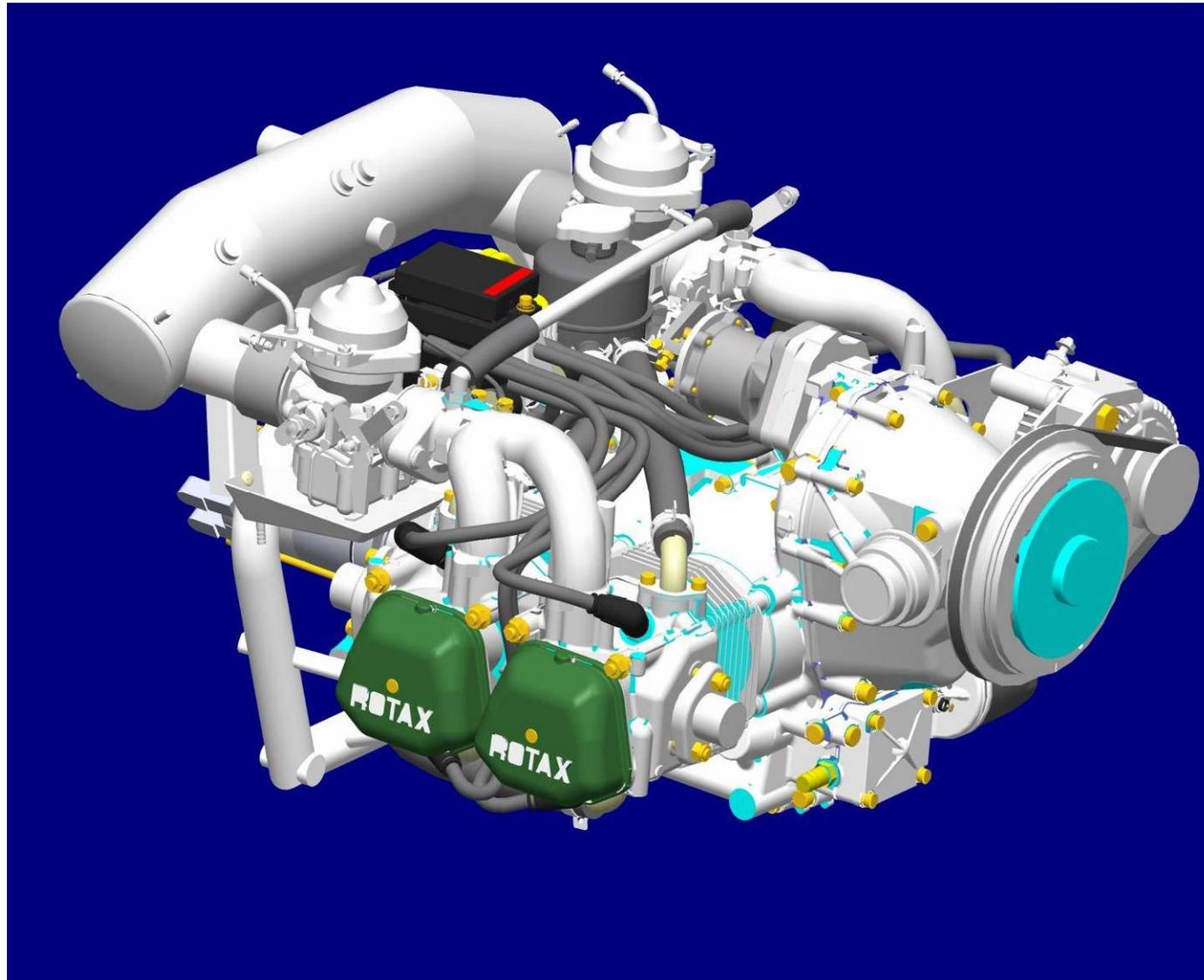
# Technical data: ROTAX vs. competitors

## wet weight vs. engine performance

Engine wet weight vs. hp ( 60-180 hp )



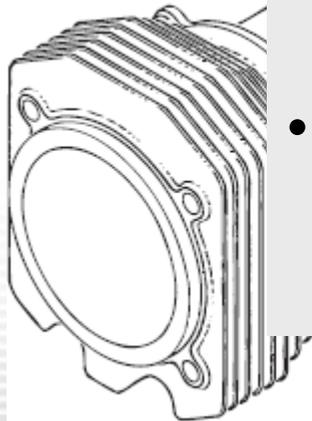
# The product: Rotax 912/914 – for detail press



# Why is it unique: crankshaft assembly



- Press-fit assembled crankshaft for a light-weight and compact design
- Connecting rod with plain bearings for durability and process stability
- ROTAX process know-how of approx. 80.000 press-fit crankshafts per year

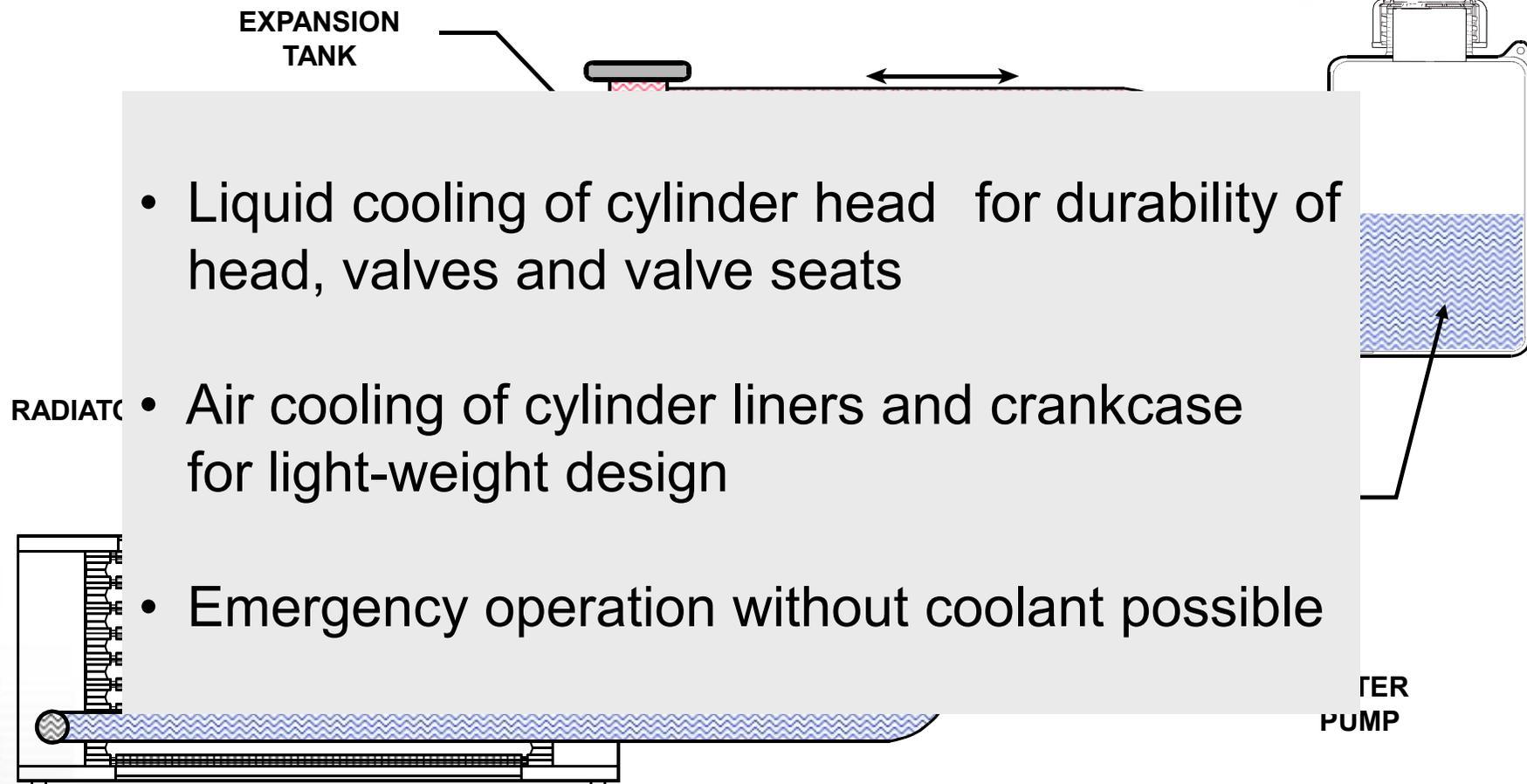


## Why is it unique: dry-sump oil system

- Compact engine design without the need for a deep oil pan
- External oil reservoir allows high engine tilt angles
- Pumping of oil by blow-by gases, no additional moving parts needed, no additional weight
- Easy installation of oil external oil cooler



# Why is it unique: cooling system



## Why is it unique: propeller gear-box



- Gear-box enables higher engine speed to achieve high output with smaller displacement in a light-weight engine – in the automotive industry known as down-sizeing
- Propeller speed can be adjusted to performance and noise requirements of the aircraft
- Overload clutch for easy maintenance after prop-strike
- ROTAX process know-how of approx. 100.000 gear boxes per year



# 912 iS Sport update

- 69 design-in projects completed
- 26 design-in projects in progress

- Since market launch appr. 1.000 engines have been sold worldwide
- The Rotax 912 iS Sport has been installed by all major OEMs



# 2014 aerokurrier INNOVATION AWARD



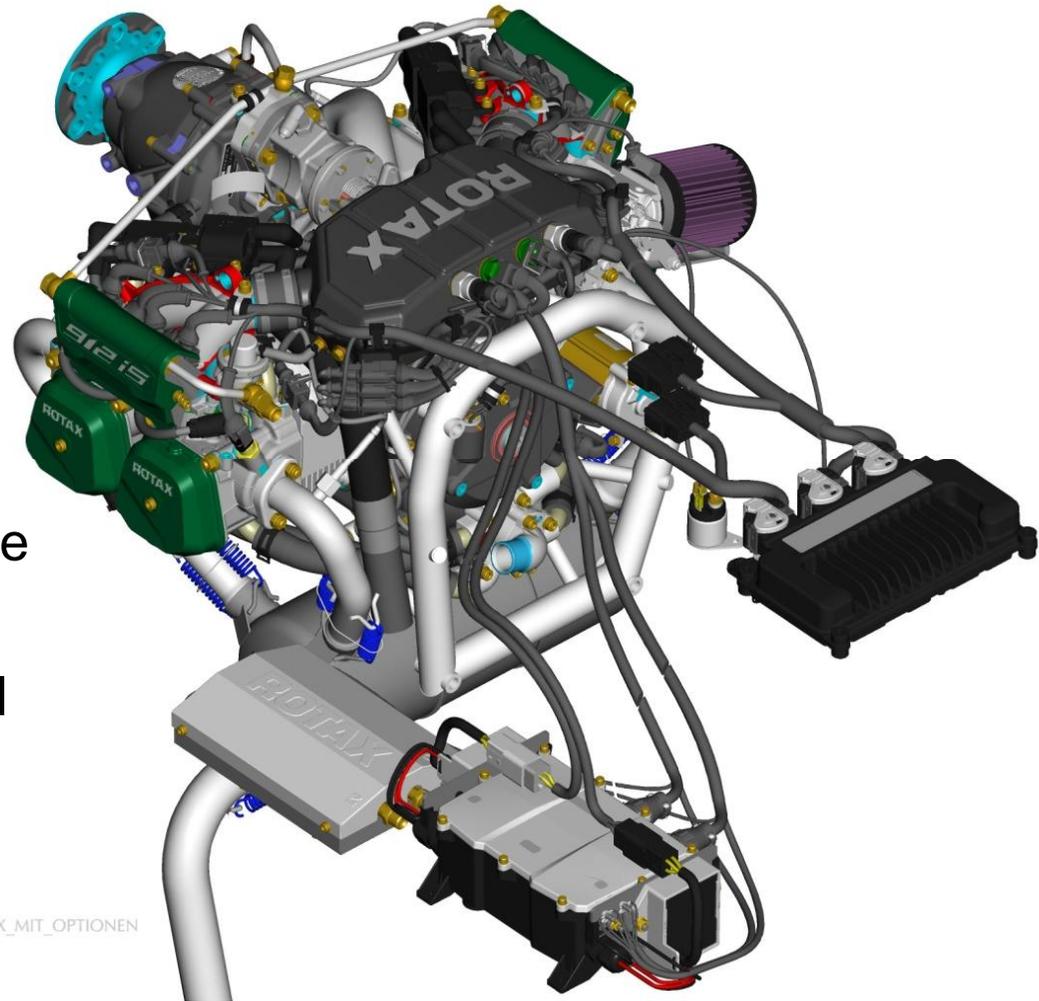
Friedrichshafen, Germany, April 9, 2014 – BRP received the German aviation magazine aerokurier’s innovation award in the category “powertrain of the future” for the Rotax 912 iS aircraft engine during AERO 2014 in Friedrichshafen, Germany, as selected by its readers.





# Expectations of the Rotax Team

- Confirmation of dyno-tests (-21% consumption on average)
- More than -21% consumption in ECO mode
- Substantially lower consumption in higher altitude
- Identical consumption at full throttle (Power Mode)



# Test results - Detail

## Cruise (Eco-Mode at throttle position below 96%)

FL	912 ULS (l/h)	912 iS (l/h)	%	absolut (l/h)
FL 20	20,37	15,00	- 26%	- 5,37
FL 40	20,37	14,28	- 30%	- 6,09
FL 60	20,73	14,49	- 30%	- 6,24
FL 80	21,42	13,73	- 36%	- 7,69
FL 100	22,41	14,32	- 36%	- 8,09
FL120	20,85	13,38	- 36%	- 7,47

## WOT (Power-Mode at throttle position 97% to 100%)

FL	912 ULS (l/h)	912 iS (l/h)	%	absolut (l/h)
FL 20	29,66	27,42	- 8%	- 2,24
FL 40	28,80	26,08	- 9%	- 2,72
FL 60	28,49	25,52	- 10%	- 2,97
FL 80	27,44	23,17	- 16%	- 4,27
FL 100	26,14	22,29	- 15%	- 3,85



# Long term consumption flight club



- During engine development, multiple aircraft were upgraded to the 912 iS. Usage patterns resambled flight club environment – both – before and after the upgrade.
- Consumption of test aircraft Tecnam P92 with 912 ULS: **17,6l/h (3 Jahre/250h)**
- Consumption of the same aircraft after upgrade to 912 iS: **12,3l/h (260hrs)**

**→ - 30,1% fuel consumption**



# Gyrocopters is a fast growing segment

## Developments in this segment



### Some growth drive explanation:

- Lower acquisition, operating and pilot license cost
- New product offering more consumer friendly and safer
- New commercial product application
- Exciting product to ride

## Gyrocopter Sales in Germany

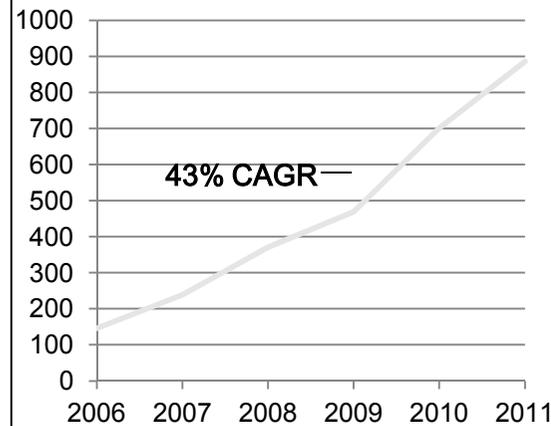
Germany is one of few countries that register all Gyrocopters in its jurisdiction



Within 7 years, Gyros captured a third of the German UL market (<450kg MTOW)

Source: Ultraleicht Statistik 2004-2011

## Gyrocopter Pilots licensed in Germany



Source: Daec, DULV

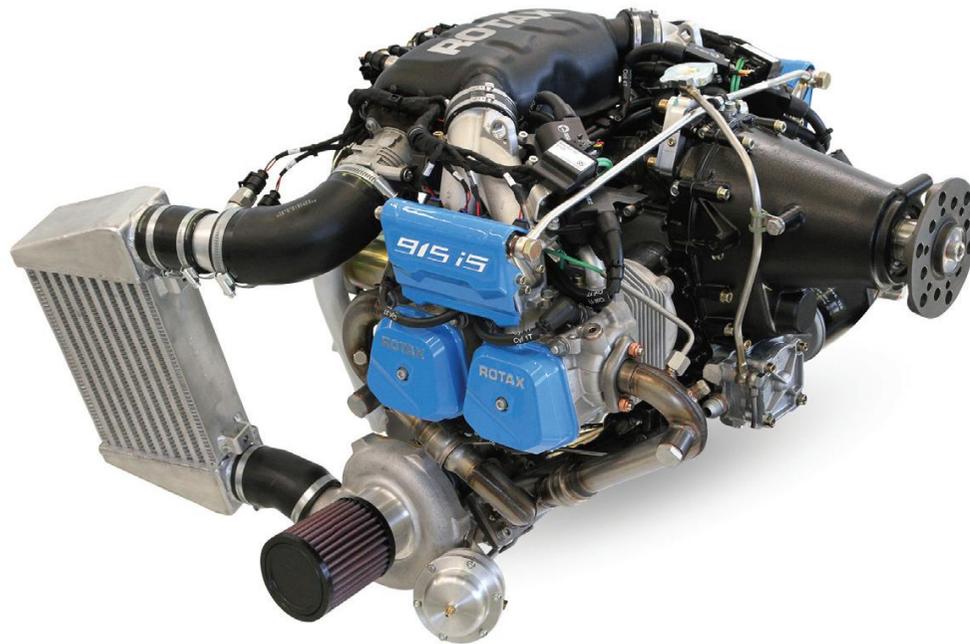
## Ownership ratio (Germany)

2011	Gyro	3-axis UL	Certified
Park	468	3648	21603
Licenses	886	16307	82554
Ownership ratio	53%	22%	26%

Source: Daec, DULV, LBA



# New: ROTAX 915 iS/iSc - key specs



**100 kW / 135 hp take off performance (5800 rpm)**  
95 kW / 127 hp max. cont. performance (5500 rpm)

Turbocharger with intercooler

Electronic fuel injection

4-cylinder / 1,352 cc

Efficiency: 260 – 290 g/kWh BFSC (5500 rpm)

TBO target of 2,000 hrs

**Available second half of 2017 (ASTM & cert.)**



# ROTAX 915 iS/iSc - unique features

- Best in class for power to weight ratio: **dry weight of 84kg (185 lb)**
- At least **15,000 ft** critical altitude with full take off power
- Extension of ROTAX 912 / 914 engine family
  - ➔ proven reliability with more than 50M flight hours
    - + additional 5M flight hours every year



# What's new?

- New Turbocharger with 1:3.5 compression ratio (914: 1:2) and intercooler
- Turbo Control Unit integrated into the ECU
- New gearbox improved for higher torque up to 160 Nm (118 ft x lb)
- New re-enforced crankshaft
- New forged pistons with oil jet cooling



Ski-Doo®  
Lynx®  
Sea-Doo®  
Evinrude®  
Rotax®  
Can-Am®



# Darum ROTAX !

**THE ULTIMATE POWERSPORTS EXPERIENCE**



© 2014 BRP. All rights reserved. / ™ ® and the BRP logo are trademarks of BRP or its affiliates.