



Polish Technological Advanced Helicopter

PZL W-3A Sokół helicopter
modernization program

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PZL-Świdnik 56 years of experiences in aviation

Activities



HELICOPTERS



CO-OPERATION



MAINTENANCE



TRAINING



R&D



International co-operation





PZL-Swidnik main characteristics:

- *3920 employees*
- *400 000 000 PLN turnover (plan for 2008)*
- *>50% of co-operations*
- *38 international partners*
- *5th, 6th and 7th FP European Project participation*



PURPOSES OF W-3/W-3A HELICOPTER MODERNIZATION

- I. „Technically outdated” construction allowing deep modernization and increase helicopter performances**
- II. Users operating experience and remarks**
- III. Manufacturing problems**
- IV. Helicopter sales perspectives – competitive products**



General modernizations of PZL-Sokol helicopter

- ✓ **new main rotor design**
- ✓ **modification of tail rotor design**
- ✓ **the latest avionic generation application**
- ✓ **modern MR blades condition diagnostic system**
- ✓ **modification of gearbox design and its mounting**
- ✓ **change of driving unit and its control**

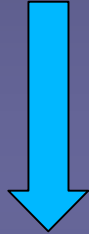


Objectives of W-3/W-3A helicopter modernization program

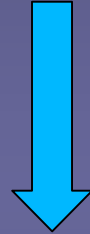
- ✓ helicopter performance improvement
- ✓ DOC decreasing
- ✓ high innovative solution application
- ✓ product quality improvement
- ✓ manufacturing ecological aspects improvement
- ✓ to make the product more competitive



NEW MR AND POWER PLANT AS AN „OPERATING PLATFORM” FOR HELICOPTERS DEVELOPMENT



**MODERNIZATION
OF EXISTING
HELICOPTERS
„RETROFIT”**



**NEW HELICOPTERS
WITH MTOW = 7000kg
WITHOUT FUSELAGE
DESIGN MODIFICATION**



**NEW ENLARGED FUSELAGE DESIGN
BASED ON COMPOSITE STRUCTURES**



**NEW HELICOPTERS WITH
MTOW=7500 kg AND ENLARGED
FUSELAGE FOR 14 ÷16 PASSENGERS
IN MULTIPURPOSE VERSION**



PROGRAM C - SCHEDULE

**Main rotor programme:
4,5 year**

**Prepreg tail rotor programme:
3,5 year**

Powerplant modernization programme: 4,5 year

**Fuselage modernization programme (including
landing gear and ERNO modification): 4,5 year**

**Avionics modernization
programme:
2,5 year**

2008

2009

2010

2011

2012



Main rotor

- **5-blade main rotor: improvement of MR blade flow separation, vibration reduction and helicopter performance improvement**
- **New main rotor blades with new generation airfoils and new contour: noise reduction, power required reduction, improvement of flow separation characteristics, maneuverability increase.**
- **New design of blade strength structure, introducing new generation materials, achieving high fatigue life = 12000hr.**
- **Operation according to technical condition: achieving high damage tolerance i.e. in combat conditions.**



Main rotor, cotinued

- **New anti – icing installation made of new composite materials: anti-icing installation, fatigue life no shorter than blade fatigue life.**
- **Leading edge made of modern materials stroke and erosion resistant.**
- **MR hub design change from hinged to elastomeric: simplification of construction and high reduction of critical parts with limited fatigue life, limitation of maintenance range (lubrication) and extension of period between maintenance.**



Main rotor hub statement

PZL W-3/W-3A helicopter

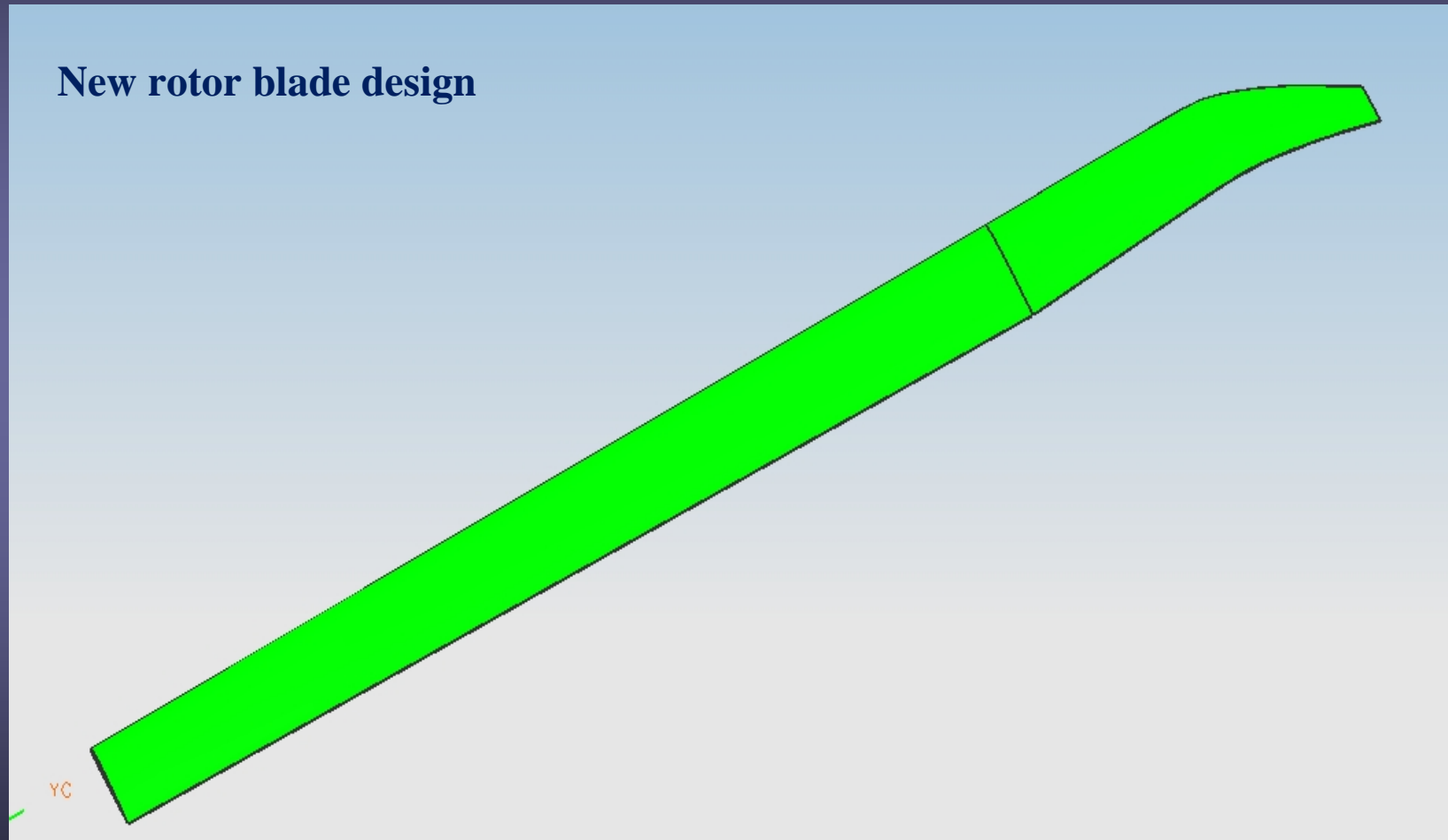
Weight	- 223 kg
Inter repair period	- 1500hr
Total service life:	
head	- 1900 hr
axial hinge elements	- 2300 hr
drag hinge pivot	- 3000 hr
connector	- 3600 hr
axial hinge pivot	- 3600 hr
blade clamping screw	- 2700 hr
Lubrication points	- 20 points

PZL W-3 II helicopter

Weight	- 190 kg
Inter repair period	- 3000 hr
Total service life:	- 10000 hr
During repair are replaced:	
	- elastomer bearings
	- ball bearings
	- hydraulic damper elements
	- pins, nuts etc.
Lubrication points	- 5 points

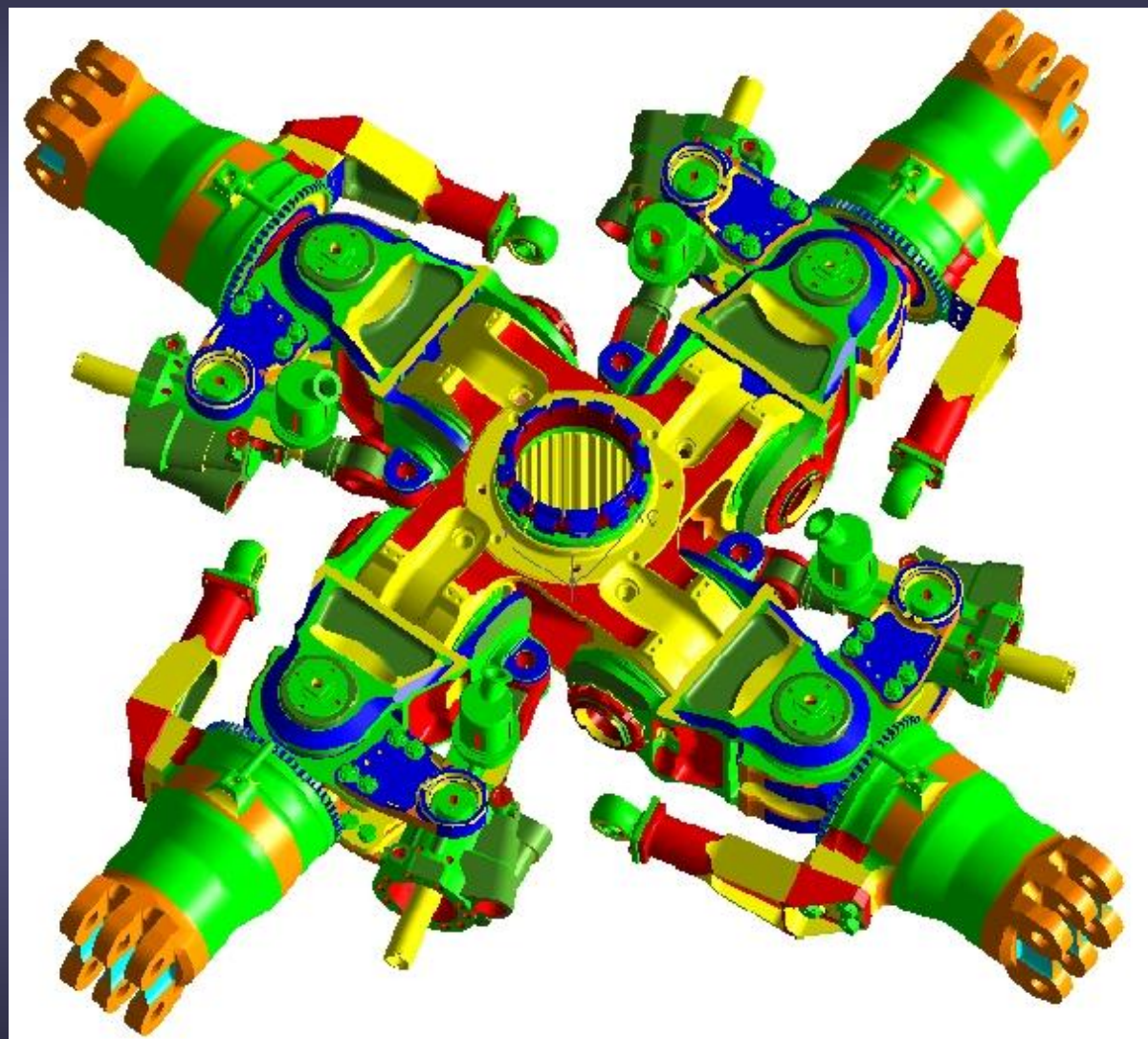


New rotor blade design



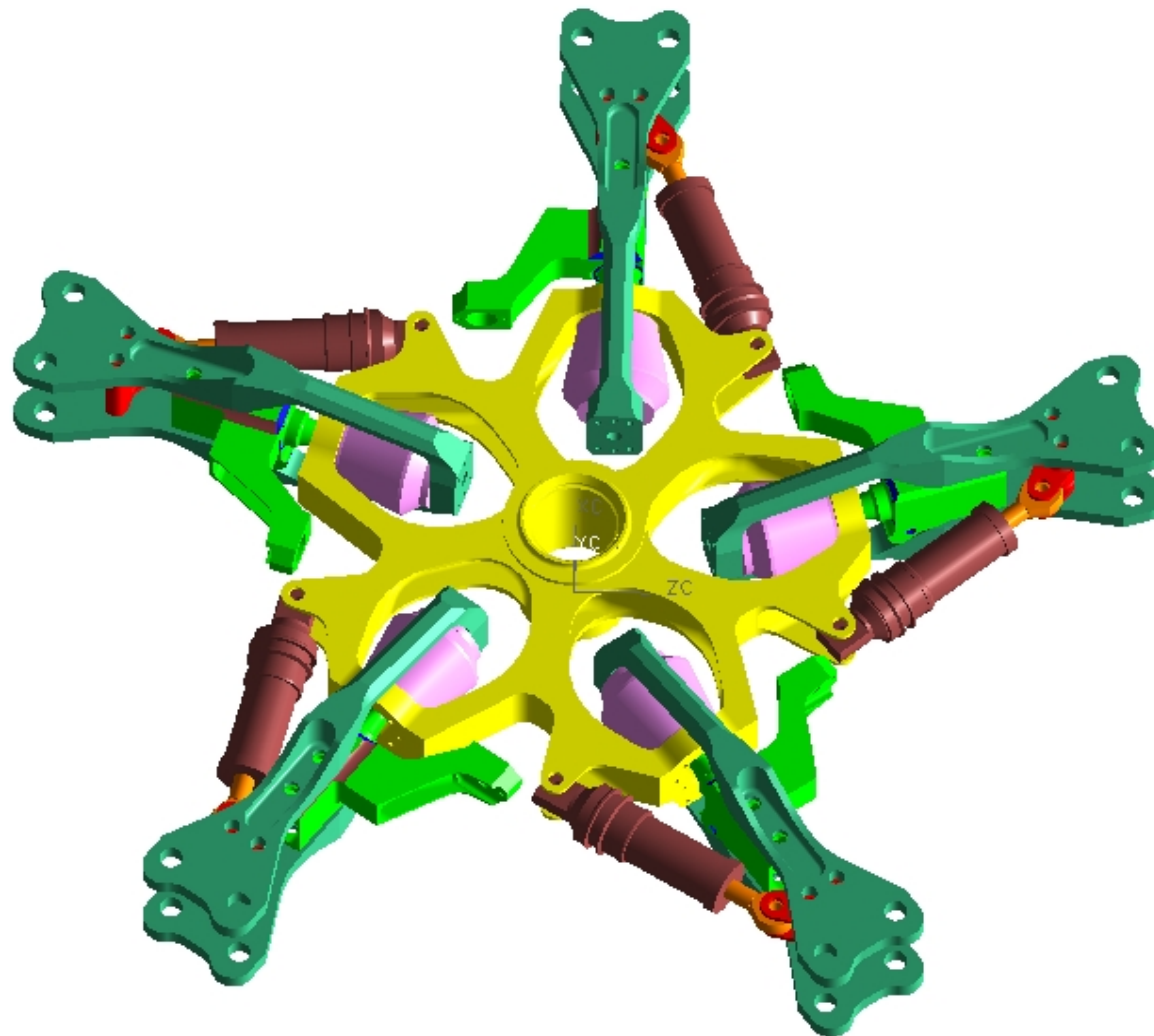


W-3 /W3-A
helicopter rotor
hub



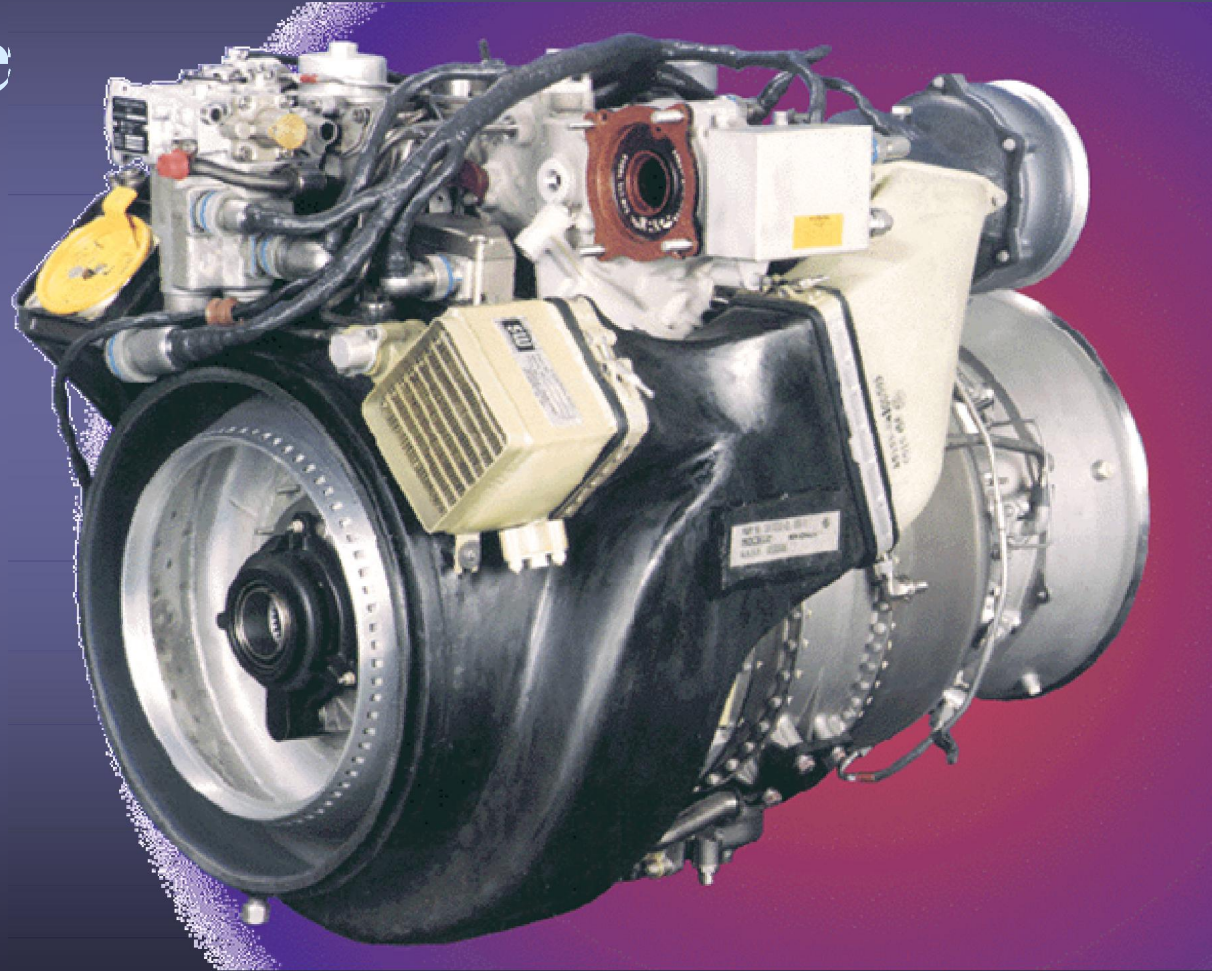


PZL W-3 Sokół-2 helicopter rotor hub





New power plant – CTS-800-4N engine



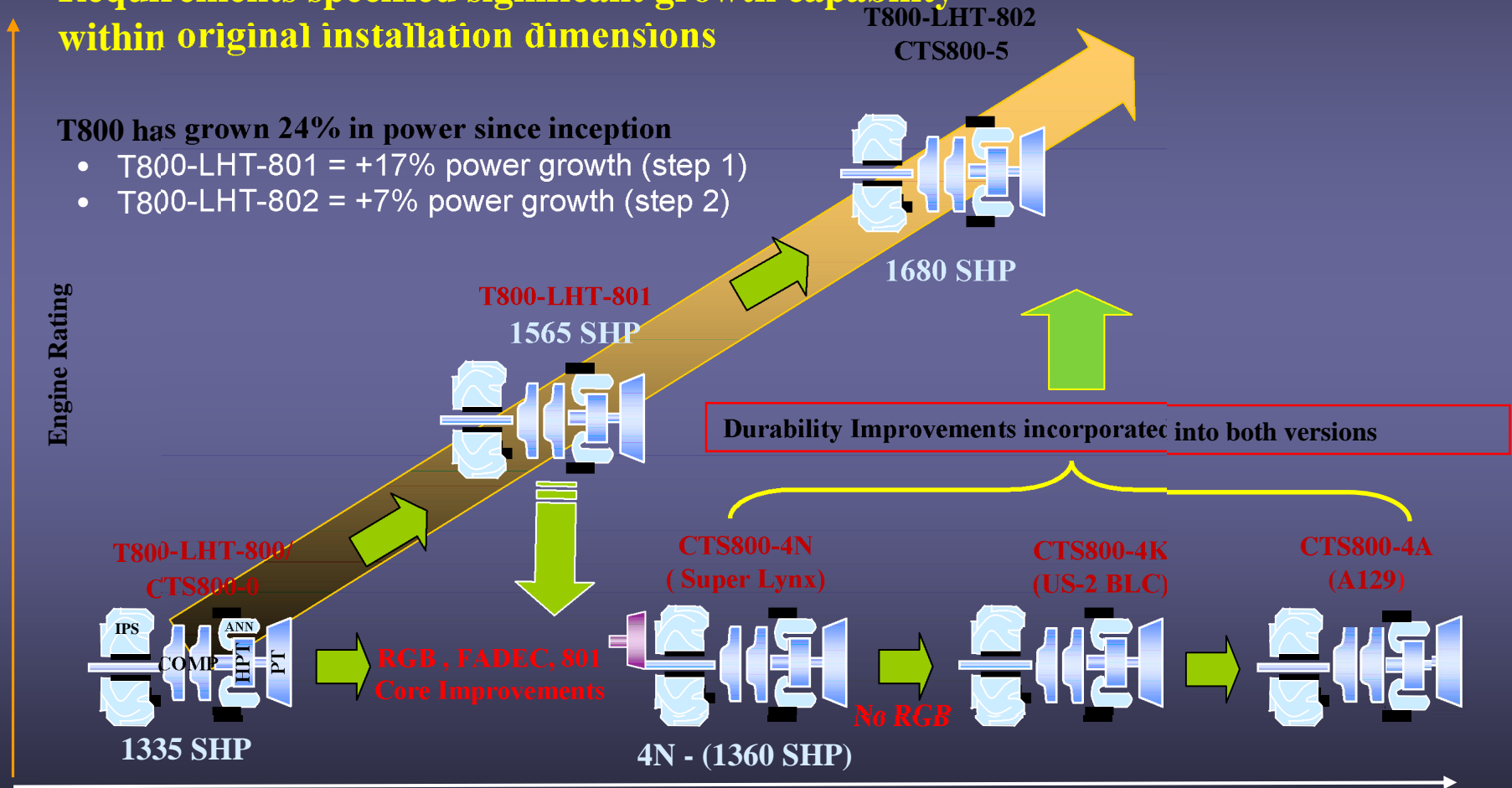


T800 Engine Family: Growth Built In

Requirements specified significant growth capability within original installation dimensions

T800 has grown 24% in power since inception

- T800-LHT-801 = +17% power growth (step 1)
- T800-LHT-802 = +7% power growth (step 2)





T800 – FEATURES

- Design according to military requirements (MIL -8593)
- 1300-1700 shp class modern technology engine
- Inherent growth capability
- Low parts count for low cost of operation
- Low SFC and high specific power from latest turbomachinery concepts
- Maintainability considerations equal to performance
- Exploit operational capability provided by FADEC
- Marinisation in the basic design
- All weather capability
- Provide operational flexibility through integrated inlet particle separator
- Incorporate experience to give high reliability /maintainability



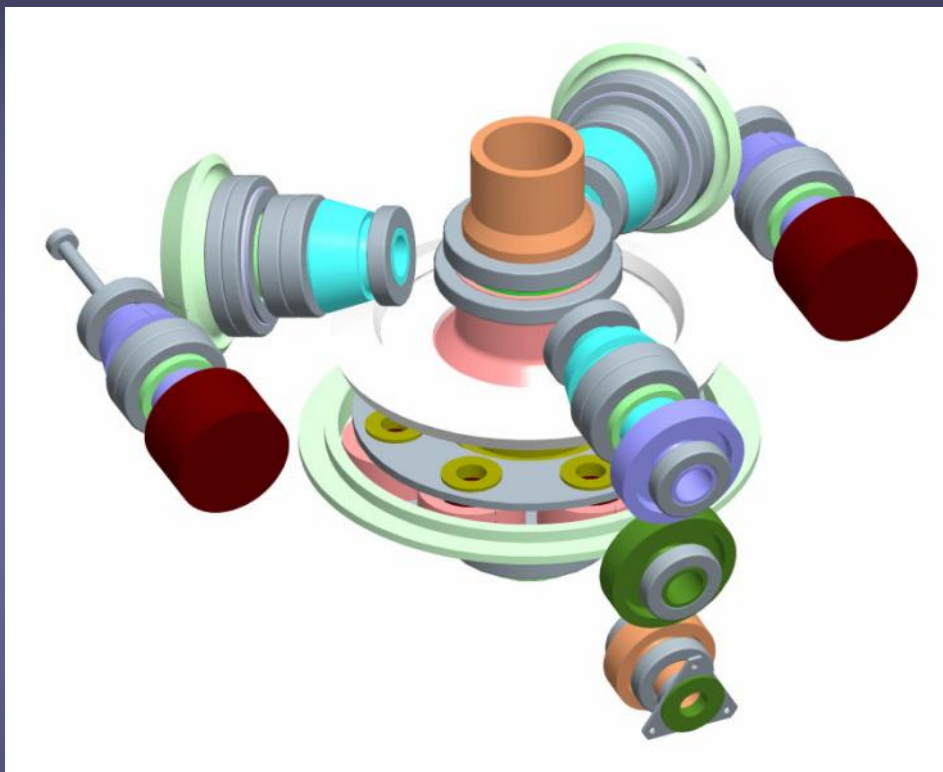
T800 - FEATURES

- **Modern Technology Satisfies Military Requirements**
 - Long design life (6000 Hours ~ 20 yrs. operation)
 - Highest power-to-weight ratio
 - Lightest weight/least installation penalties
 - Lowest SFC in power class
- **Efficient Installation**
 - Front drive/rear exhaust
 - Integral Inlet Particle Separator
 - Self-contained lubrication system
 - FADEC controlled since design inception
 - Engine Health Monitoring
- **Simplified Maintenance**
 - 14 minute LRU removal & replacement with just 6 common hand tools
 - No safety wire / self-retaining bolts
 - No rigging required for engine installation or maintenance
 - On-Condition Maintenance facilitated by FADEC
 - Overhaul Interval Eliminated - Maximizes system availability

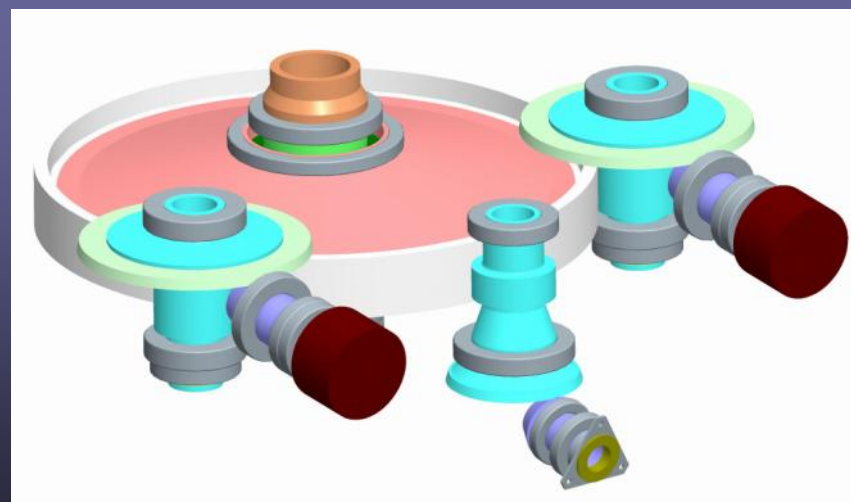
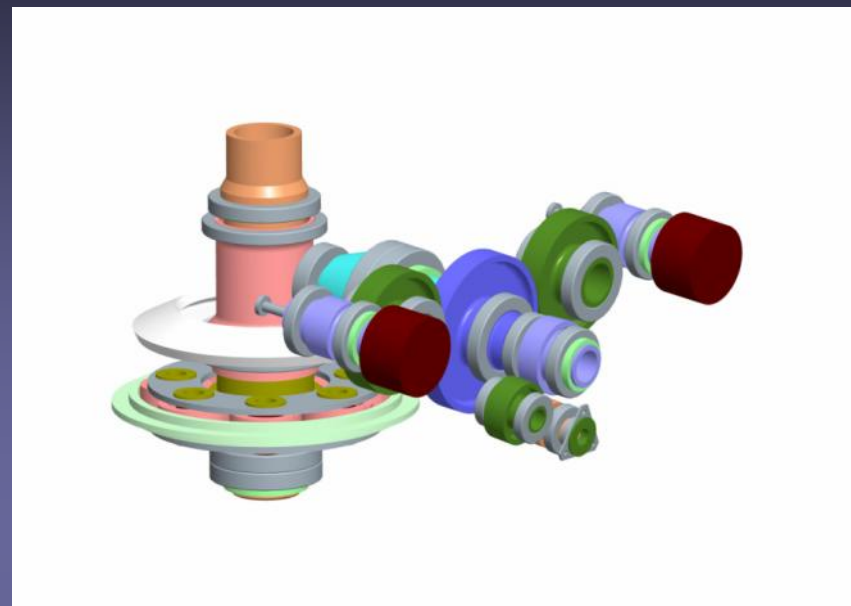


NEW ENGINES - OPTION

- T-800 Family**
- MTR 390 Family**
- PT6 – 67C**



Main gear conception design





Innovative programs

- 1. Active main gear mounting (PZL, IL, ZFL, DLR)**
- 2. Active landing gear (PZL, IL)**
- 3. Monitoring of high-loaded composite structures (PZL, PW, PL)**
- 4. Method of determining fatigue strength with failure tolerance (PZL, IL, PW, PL)**
- 5. Smart MR blades deicing installation**



Comparison of PZL helicopters basic data

Helicopter	Engine	Payload	Max range in Mm	Max power	Max Constant power	Max T-O weight [kg]	V max	Cruising Speed	HOGE [m]	HIGE [m]
W-3A Sokół	PZL-10W	2400	411	1800	1620	6400	260	235	1000	2020
W-3A Sokół PLUS	CTS800-4N	2700	470	2658	2468	7000	300	280	2000	3000
SW-5	CTS800-4N T800-5	3200	500	2900	2700	7500	320	305	2500	3500



Data Medium - Heavy Helicopter

Application	Engine	Usefull weight [kg]	Max Range [nm]	Max Power [shp]	Max Continous Power [shp]	MTOW [kg]
W3A Sokol	PZL-10W	2400	411	1800	1620	6400
W3A Sokol 2	CTS800-4N	2700	420	2658	2468	7000
SW-5	CTS800-4N T800-5	3200	500	2900	2700	7500
Bell 412 EP	PT6T-3D	1460	354	1910	1910	5397
AW139	PT6C-67C	2500	400	3358	2504	6414
AW149		2900	420	4000	3600	7000
Lynx	CTS800	1680	370	2688	2480	5125
S76	Arriel 2S2	2129	411	1844	1650	5306
S70	CT7-2C/D	3300	330	3446	3250	9980
S92	CT7-8A	3850	476	4400	4086	12020
EC155	Arriel 2C2	1150	427	1906	1706	4920
EC175	PT6C-67	2700	400	3358	2504	6700
Mi-54	VK-800V	1500	378	1578	1420	4500
Ka-60/62	VK-1500	2000	378	3000	2700	6500
EC725	Makila 2A	3712	448	4194	3784	11000
NH90	RTM322-01/9	2750	432	4795	4457	10600
Ka32	TV3-117V	3700	443	4800	4380	12700
ALH Dhruv	Ardiden 1H	1500	356	2334	2100	5500



Sokół - 2





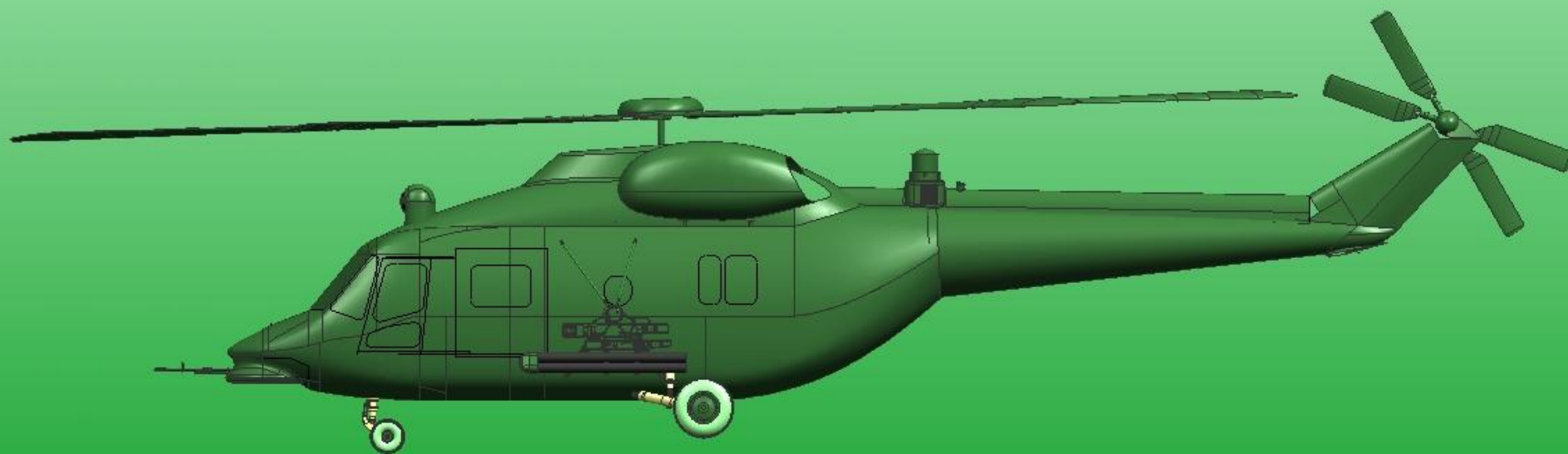
Sokół - 2



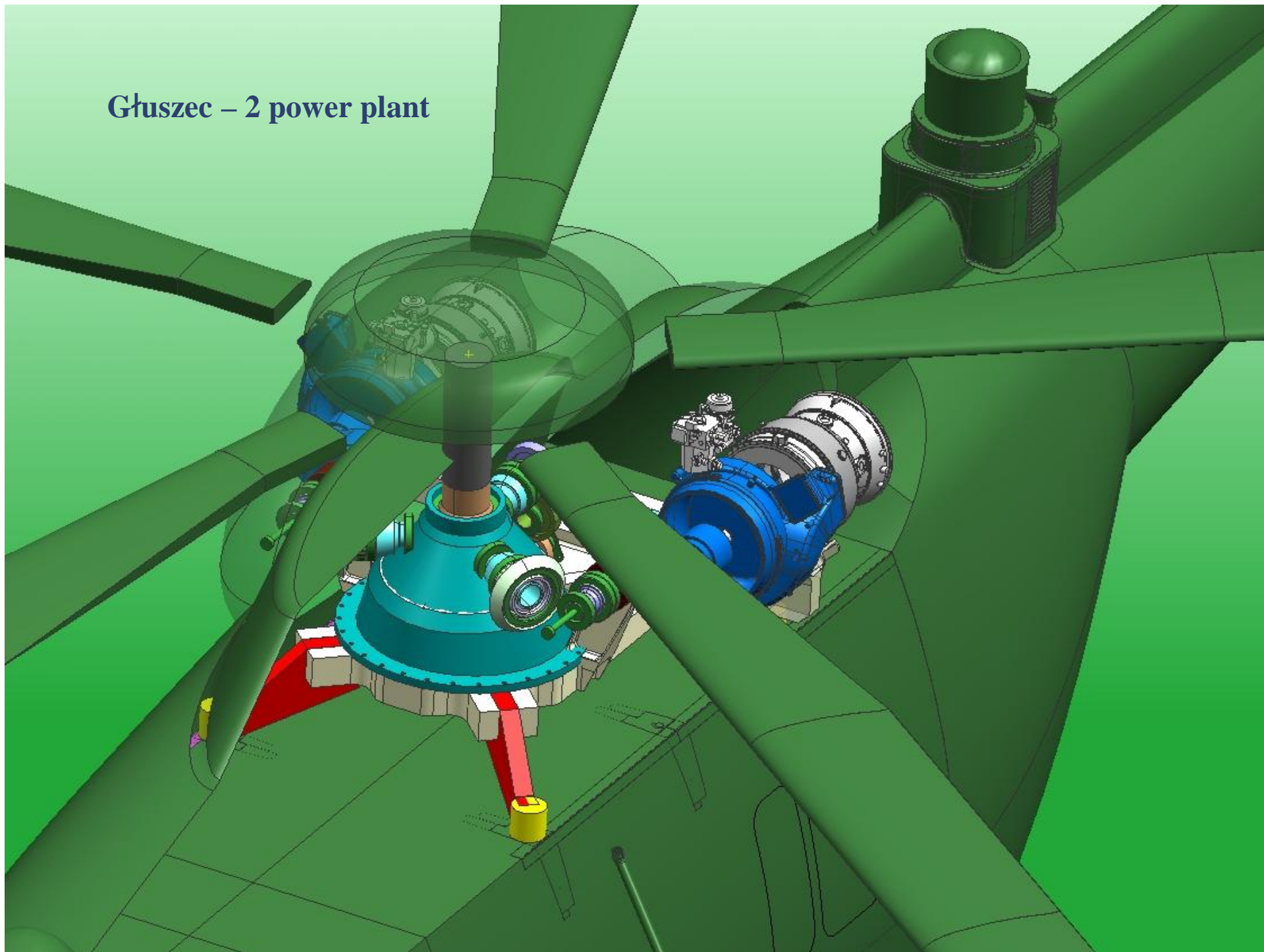
Głuszec – 2



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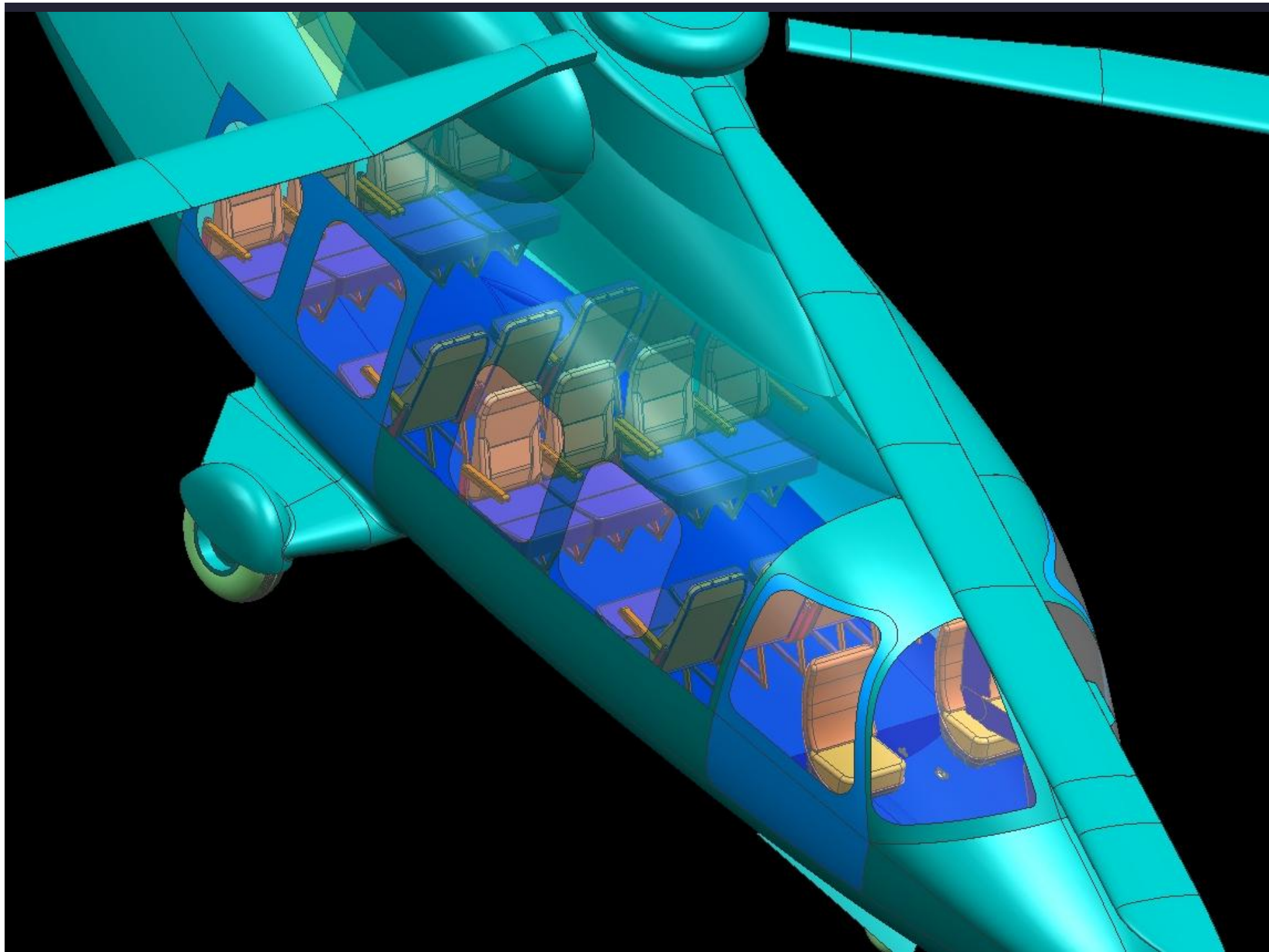


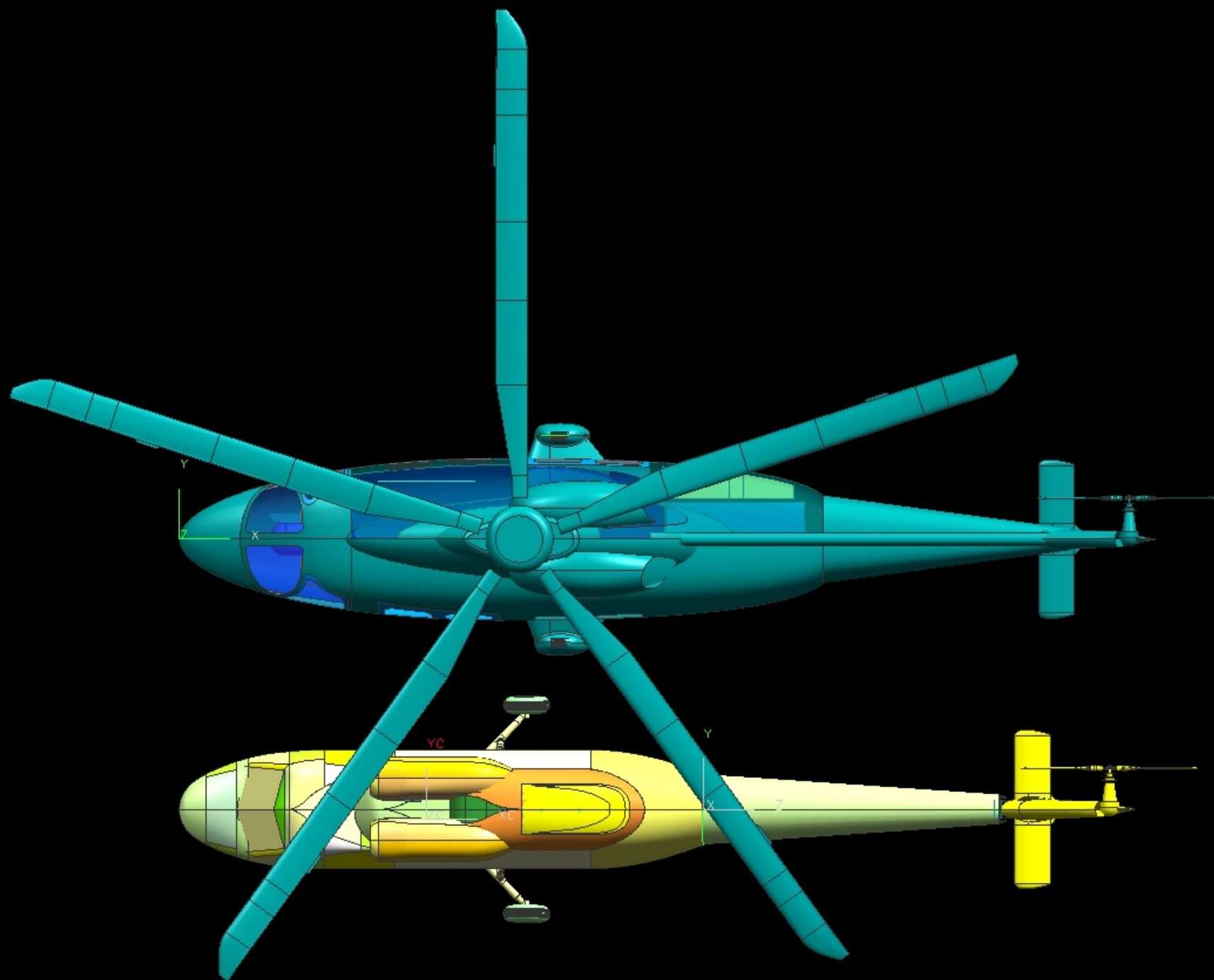
Głuszec – 2 power plant





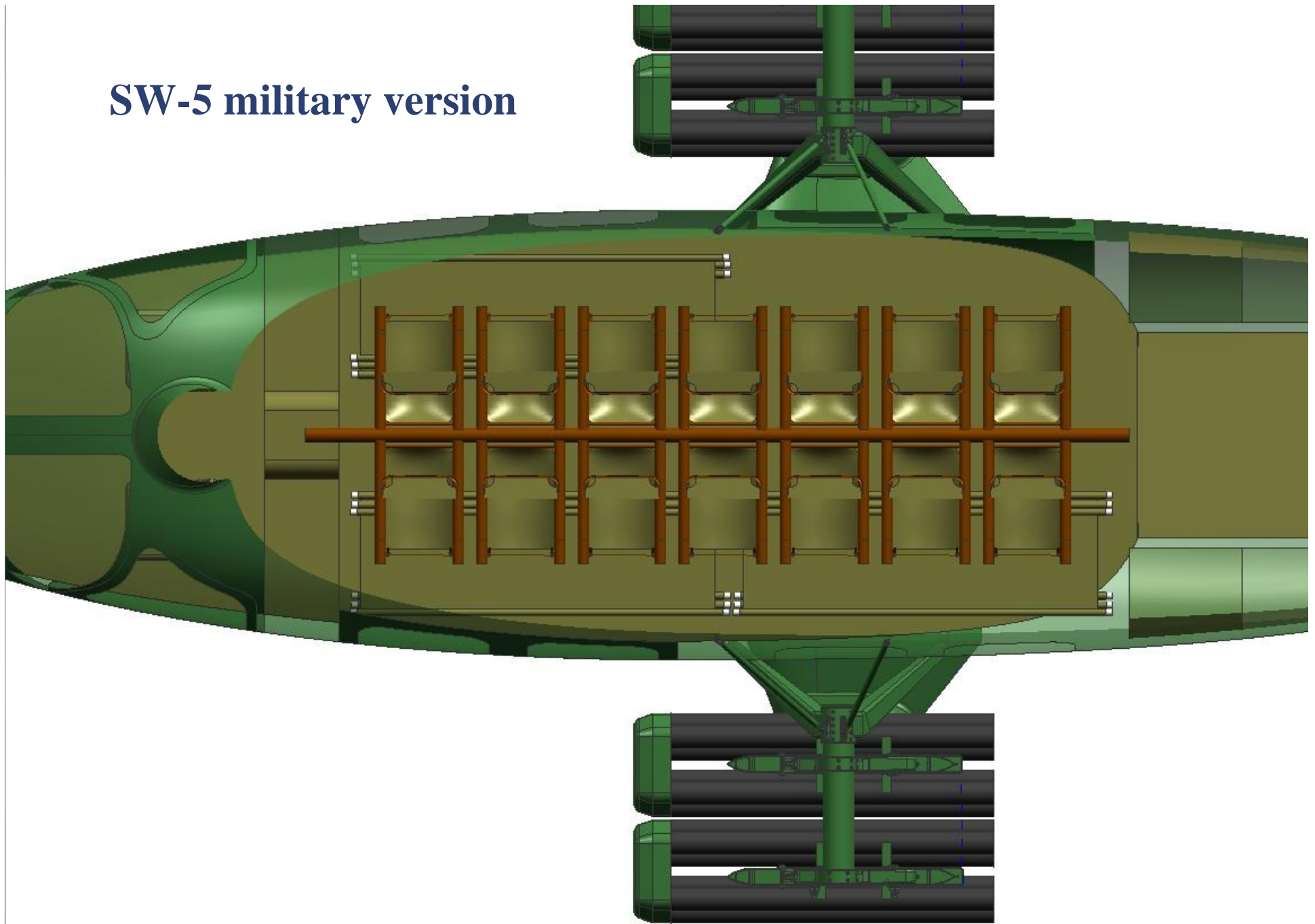




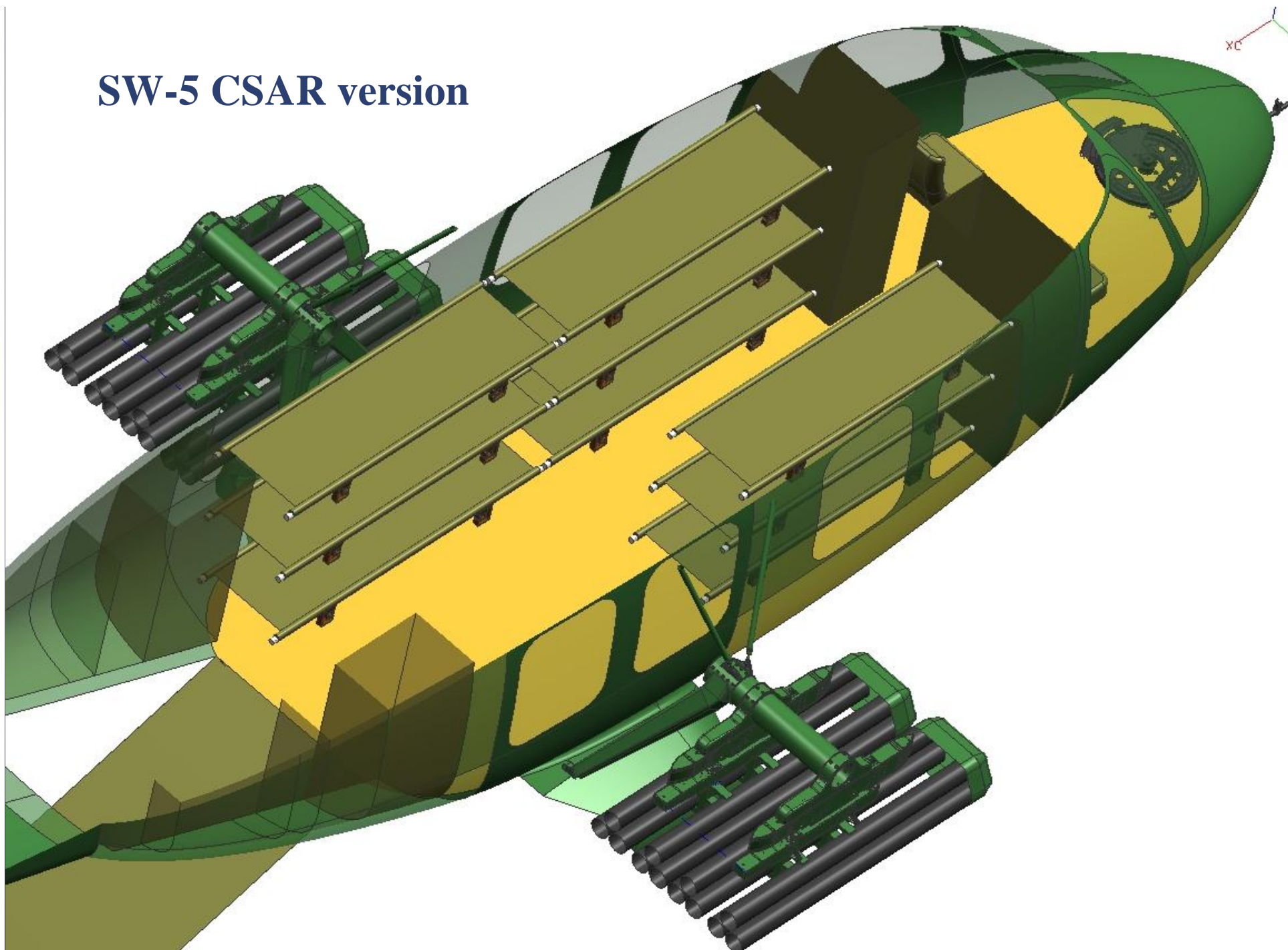




SW-5 military version



SW-5 CSAR version









Thank You for Your Attention



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