HIGH INNOVATIVE GYROPLANE

e-mail: vukoja75@gmail.com / web: www.coroflot.com/zvukoja6

PROJECT: PAV (PERSONAL AIR VEHICLE)

Design: Zdenko Vukoja

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INTRODUCTION

The Autogyro has come a long way since its first successful flight in 1923. Encompassing a lot of the designs of both a conventional airplane and a helicopter, The Autogyro has its own unique flight characteristics. Using the phenomenon of autorotation, an Autogyro is able to produce lift by simply flying in a forward Direction. Even in the event of engine failure, the aircraft will still be producing Enough lift to keep it from having a crash landing. But one of the main reasons why the Autogyro was kept from being mass produced and used in commercial An application was its inability to hover. This ability to hover proved to be a winning Formula for the helicopter, especially in the event of rescue missions. However Autogyros are still used by hobbyists all over the world, making still a favourite for Aviation enthusiasts.

Goal of this concept is done Gyroplane competitive light sport aircraft and helicopters to 2 tons:

- reduce CO2 emissions, fuel consumption (SUS – 8l/hour / Vcruise 260km/h, Hybrid – 3l/hour / Vcruise 300km/h)
- increase the range (SUS – 2000 km, Hybrid - 5000 km)
- increase the top speed 400 km/h
- increase the capacity and stability

1. CONCEPT GP 4200 1+1 persone

CONCEPTUAL DESIGN - TEHNICAL DATA AND BASIC PARTS

- TECHNICAL DATA
- BASIC DIMENSION
- EXTERIOR DESIGN
- BASIC EQUIPMENT
- INNOVATIVE ROTOR HEAD DESIGN *

2. CONCEPT GP 6200 4+1 persone

CONCEPTUAL DESIGN - TEHNICAL DATA AND BASIC PARTS

- BASIC DIMENSION *
- BASIC PARTS *
- INTERIOR SPACE *
- FOSSIL FUEL GYROPLANE *
- HYBRID FOSSIL FUEL GYROPLANE *
- HYBRID HYDROGEN FUEL GYROPLANE *
- POSSIBILLITY CONFIGURATION AND FLIGHT CONTROL *
- POSSIBLE MISION *

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* This is the short version and the excluded pages are confidential and displayed a complete presentation

CONCEPTUAL DESIGN - TEHNICAL DATA AND BASIC PARTS

- TECHNICAL DATA
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ROTAX ENGINE – FOSSIL FUEL

Seats	2	/1+1
MOTORISATION		
Rotax 914 UL		
Power	80	kW
Volume	73.91	cu.ft.
Mass	70	kg
PERFOMANCES		
Gross Weight	610	Kg
Empty Weight	270	Kg
Useful Load	240	Kg
Maximum Speed	300	Km/h
Cruise Speed	260	Km/h
Fuel Capacity	100	Lit.
RANGE	2000	km

HYBRID - HYDROGEN

Seats	2	/1+1
FUEL CELL		
PEM – fuel cell system	100	kW
Weight	55	kg
MOTORISATION		
Brushless electric motors		
Power	100	kW
Dimension Ø290x230mm		
Mass	50	kg
BATERRY		
Technology Lithium	1.5	kW/h
Weight	5	kg
PERFOMANCES		
Gross Weight	610	Kg
Empty Weight	310	Kg
Useful Load	200	kg
Maximum Speed	360	Km/h
Cruise Speed	300	Km/h
Fuel Capacity H2 Tank 2x40l	80	l
RANGE	800	km

HYBRID – FOSSIL FUEL

Seats	2	/1+1
ROTARY ENGINE & LINEAR GENERATOR MODUL		
150cc RotaPower engine & 25kW Generator (ROTAPAC)		
Weight	55	kg
MOTORISATION		
Brushless electric motors		
Power	100	kW
Dimension Ø290x300mm		
Mass	50	kg
BATERRY		
Technology Lithium	6	Kw/h
Weight	20	kg
PERFOMANCES		
Gross Weight	610	Kg
Empty Weight	330	Kg
Useful Load	220	kg
Maximum Speed	360	Km/h
Cruise Speed	300	Km/h
Fuel Capacity	60	l
RANGE	5000	km

C O N C E P T

AUTOGYRO GP4200

EXTERIER DESIGN
basic dimension

INOVATIVE ROTOR DESIGN
(VARIABLE ROTOR DIAMETER)

SIMPLICITY CONSTRUCTION
(AUTOMATIC REGULATION ROTOR DIAMETER)

HIGH SPEED 360 Km/h
(GREAT RATIO PUSH POWER AND SPEED)

Canard - automatic correction of Flight

VARIABLE ROTOR DIAMETER
45%

B E N E F I T S

Variable rotor diameter an increase of :

- speed
- agility
- payload 30%
- range 40%
- acoustic detection range 50%
- reduction in vibration 90%

E-mail: vukoja@po.t-com.hr / web: www.coroflot.com/zvukoja6

CONCEPT
AUTOGYRO GP4200

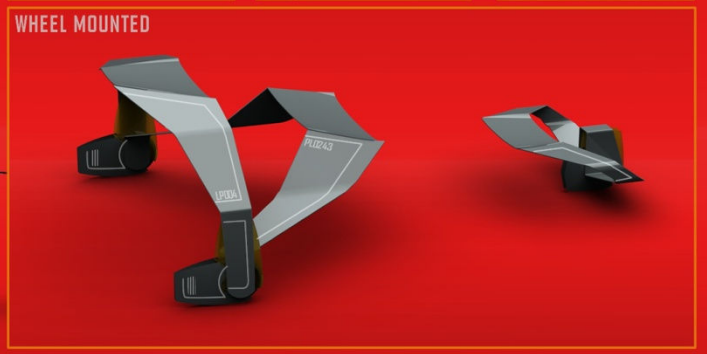
EXTERIER DESIGN
wheel mounted and inovative wheel fairing design

INOVATIVE ROTOR DESIGN
(VARIABLE ROTOR DIAMETER)

SIMPLICITY CONSTRUCTION
(AUTOMATIC REGULATION ROTOR DIAMETER)

HIGH SPEED 360 Km/h
(GREAT RATIO PUSH POWER AND SPEED)

STRUCTURALLY DERIVED SIMPLY CONNECTING WHEEL MOUNTED DIRECTLY ON THE MONOCOQUE AND MAKE A SOLID, AND RELIABLE MACHINE WITH EXELLENT AERODINAMIC QUALITIES, GIVE THE AIRCRAFT STABILITY AND ASTHETICALLY INTEGRATED INTO THE OVERALL DESIGN



E-mail: vukoja@po.t-com.hr / web: www.coroflot.com/zvukoja6

C O N C E P T

AUTOGYRO GP4200

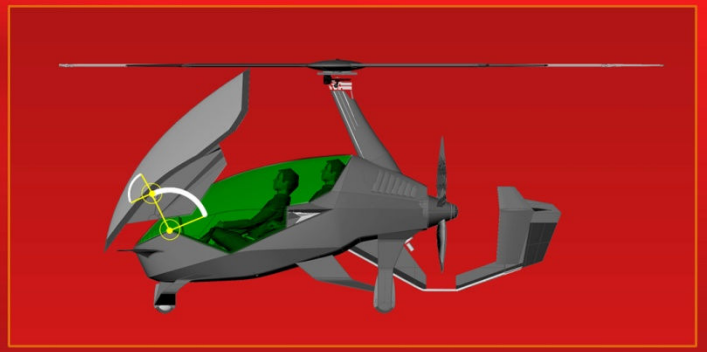
EXTERIER DESIGN

conceptual solution to opening vehicle

INOVATIVE ROTOR DESIGN
(VARIABLE ROTOR DIAMETER)

SIMPLICITY CONSTRUCTION
(AUTOMATIC REGULATION ROTOR DIAMETER)

HIGH SPEED 360 Km/h
(GREAT RATIO PUSH POWER AND SPEED)



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ZDENKO VUKOJA

Basic equipment autogyro GP 4200 with Rotax 912 ULS

Closed, two seat autogyro in tandem configuration

Monocoque cell with closed canopy (fitted with emergency vision vent and 2 side vents)

Mast and tail boom electropolished

Aluminum rotor system Naca 8H12 8,4m

Rotax 912 ULS with 100 HP

Gearbox with integrated slipper clutch

Exhaust system high-grade steel

Carburetor anti icing preheat

Propeller HTC 3B CW172,5

Instrument panel

Trip and altimeter

Engine and rotor speed

Oil and cylinder head temperature

Oil pressure

Compass

Hour (Hobbs) meter

Pneumatic pitch trim and rotor brake

Pneumatic or electric PreRotator with safety interlock

Hydraulic man wheel brake with lock

Polypropylene tank, capacity 60 litre

POSSIBLE MISION

Agriculture & Forest

Law Enforcement

Military

Environment Protection

Geo Hazard Management

Aerial Sensing

Film & Foto

Sightseeing

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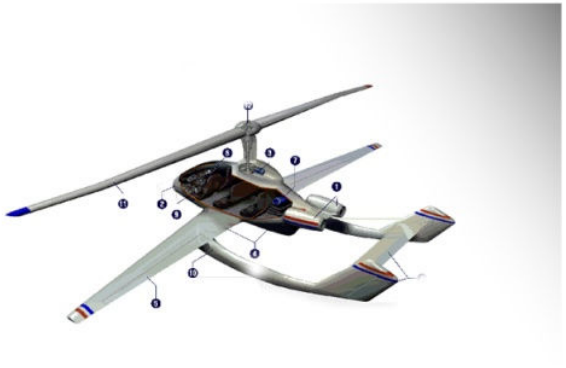
Juan de la Cierva's
C-4 AUTOGIRO
History's first controlled gyroplane flight.




16-MW
Slobodan Trifunović - airserbia.com

The ideas of a personal aerial vehicle (PAV), by which ordinary people can travel to distant places easily and safely, has been around for at least 60 years .With the increasing problem of ground traffic in many cities and the need to make air travel more effective and efficient, the ideas of PAV have been revisited by many research institutes. The fact that in the intervening time the PAV has yet to be adopted for broader market indicates that there exist critical barriers (economically and technologically) that need to be addressed. A report published at NASA in 1994 presented an overview of status and issues of personal aircraft. The suggested personal aviation vehicle discussed in this report was an automatic VTOL-capable affordable converticar which meets, for both the air and ground sides, all applicable safety, environmental and nuisance regulations in terms of collision avoidance/ survivability, noise, emissions, ground-vicinity operations and reliability as well as providing reasonable ride quality, all weather operation (in the same sense as current automobile operations) and minimal maintenance requirements/cost [2]. It was envisaged that requisite technologies exist which includes composite materials, advanced Wankel IC engines, the electronics revolution in terms of size/cost/capability of sensors/control systems/computing, the GPS system, the emerging global satellite-based personal Communications systems, computational fluid mechanics and flow control.
PAV as the viable future solution for a rural/regional and intra-urban transportation system. The bottom line for PAV technologies was that there is

the opportunity to make small aircraft much better than they are today, and to develop an on-demand transportation system that would be much faster and provide more throughput than what exist today. This capability to travel faster, further, anytime, anywhere is a dream that is achievable, and one that could lead people into a new age of mobility.

PAV was viewed as one of the fundamental new business opportunities in the automotive market: the tailored car (driven by production technology enablers, cars will be custom-made, not only by mixing and matching standard components, but by actually customizing the shape and style of components), brand worlds (car manufacturers extend their brands to other consumer product categories, attempting to ''immerse'' consumers in a ''total brand experience'' that includes, among others, financial, lifestyle, entertainment, and communication product) and multiple transportation modes (cars will extend other modes Of individual transportation, such as water (boat-car), air (flying car), etc.)

OVERVIEW GYROCOPTER MARKET

Matrix of actual available gyrocopter models designed in accordance with German UL – certification rules (empty weight 265kg / MTOW 450kg)* which are produced in series.

	ZEN I	MAGNI M24	MAGNI M16	AUTOGYRO CALIDUS	AUTOGYRO CAVALON	AUTOGYRO MT03	XENON II	ARROWCOPTER AC30	TRIXI G 4-2 R	ROTORTEC CLOUD DANCER II
TYPE	side-by-side closed	side-by-side closed	tandem open	tandem open	side-by-side closed	tandem open	side-by-side closed	tandem closed/open	tandem closed	side-by-side closed
DOORS	2	2	open	canopy	2	open	2	canopy	canopy	2
CHASSIS MATERIAL	CFK / Aramid	CFK / GFK	GFK	GFK	GFK	GFK	GFK	CFK / Kevlar / GFK	CKK / GFK	CFK / GFK
ENGINE STAND. AVAILIBLE DOUBLE Y / N	Rotax RST 122 PS	Rotax 914 Turbo	Rotax 912 Turbo	Rotax 912ULS	Rotax 912ULS	Rotax 912ULS	Rotax 912ULS, RST	Rotax 914 Turbu	Rotax 912 ULS	Weber, Watercooled
FUEL CAPACITY										
FUEL BURN AT 75%										
ROTOR BLADES	2	2	2	2	2	2	2	2	2	4
ROTOR DIAMETER	8,4m / 8,6m	8,4m	8,4m	8,4m	8,4m	8,4m	8,4m		8,4m	7,2m
ROTOR MATERIAL	Aloy	GFK	GFK	Aloy	Aloy	Aloy	Aloy	GFK	GFK	Aloy / CFK
PRE ROTATION	flex shaft	flex shaft	flex shaft	propeller shaft	propeller shaft	propeller shaft	flex shaft	propeller shaft	propeller shaft	hydraulic system
PROPELLER	Duc	Arplast	Arplast	HTC	HTC	HTC	Duc	FD-composites	Duc	Duc
PROP CONFIGS	3 Blade, Duc	3 blade 1,75m	3 blade, 1,72m	3 blade, 1,72m	3 blade HTC	3 blade HTC	Kaspar K2	3 blade 1,72m	3 blade 1,72m	3 blade 1,72m
MAX MTOW CALC KG	450kg	450kg	450kg	450kg	450kg (560kg)	450kg	450kg	450kg	450kg	450kg
VNE IN KM/H	175			185	160	185	167	195	167	162
PRICE AVERAGE BASIC CONFIGURATION IN €	**68.900,–**	**82.000,–**					**65.000,–**	**116.900,–**		**68.800,–**

GYROCOPTER OPERATIONAL COSTS

Be positively surprised at the operational costs of our gyrocopters. The most interesting thing: **A gyrocopter or autorotation aircraft accomplishes 80% of the tasks of a helicopter at max. 12% of the costs.** (Identified and researched by the DLR – German Aerospace Centre)

	single engine low fuel consumption **BMW R1,2**	single engine aviation certified **Rotax 912iSc**	double engine **Taurus**
average fuel consumption / operation at 75% power setting	9,5	15	22
Factual fuel costs per litre / MOGAS in €/ltr.	1,75	1,75	1,75
average maintenance costs / 100 hrs (high level) in €	950	950	950
annual check by examiner class 5 in €	200	200	200
CSL – Insurance / year (Germany) in €	450	450	450
engine TBO 2000hrs / per h in €	0	3,5	0

	single engine low fuel consumption **BMW R1,2**	single engine aviation certified **Rotax 912iSc**	double engine **Taurus**
rotor blade TBO 1000hrs / per h in €	3,7	3,7	3,7
operation costs at 43,5 hrs/ year in € / h	57,61	68,81	80,19
operation costs at 100hrs / year in € / h	38,13	49,33	60,7
operation costs at 500hrs / year in € / h	29,13	37,33	48,7
operation costs at 1000hrs / year in € / h	24,63	35,83	47,2

- crew: 1 x pilot + 1 x operator
- sensor payload up to: 180kg
- standard endurance up to: 15 hrs
- cargo compartment: 1,6m³
- rotor: 8,40 m / alloy / rotary mass 35kg

Here you will see the runing costs to the flight personnel / pilot costs (example based on german aviation regulations)

flight hours required compliance to aviation regulations	12 hrs / 2 years
running costs – aircraft / hour (see e.g. calculation above)	€ 49,33 / hrs (at 100 hours / year)
minimum annual flight hours for pilots	6 hrs / year

CONCLUSION

At a time when the gyroplane is created production technology and materials have not been able to exploit the advantages offered by this vehicle. Today´s technology and materials allow us to take advantage and fill the gap between the helicopters on the aircraft. Afford the cheaper and safer transport, would be cheaper and more profitable than some vehicles (suv, business class - limousine). Idea solution morphing rotor system for a notional future rotorcraft providing an increase of 30% in payload, 40% in specific range, 50% in acoustic detection range and a 90% reduction in vibration. Other desirable attributes are increased speed, agility, a simple and more cost-effective way of already existing solutions, slowed rotor technology (Carter Copters).

Rotor blades should be retracted parallel to accelerating, increases the rotation speed increase we get lift drag, a shortening of rotor blades neutralize unnecessary lift drag. To control the length of the rotor blades, we exploit the rotation of the rotor and the centrifugal force! In combination with hybrid technology to achieve high energy efficiency, which would drastically reduce fuel consumption and co2 emissions.

ZDENKO VUKOJA

Personal:
born. 24.07.1968g. Maribor, SLOVENIA

Profile:
Designer enthusiast Always is looking for a new and bigger challenge.

Education:
High gradient – Electrotechnic school
self educated in CAD and 3D design, eager to learn everything new in technology and designing process

Skills:
Sketching, Rhinoceros 3D, V-ray HyperShot, Adobe Photoshop, Illustrator, Fireworks, Flash, Freehand, Corel

Awards:
Winner - 2010g. Auto (r) contest
Winner - 2012g.Auto (r) Volvo Workshop

Languages:
Croatian (mother tongue) , English (basic)

Interests:
Sport: streatball & swimming
Creative field: I like to observe to find better ways to use all things that we can find around us.

Contact:
Ul. M Božića 18/a / 34551 Lipik / CROATIA
tel/ (+385) 98 92 80 442
E-mail: vukoja@po.t-com.hr
vukoja75@gmail.com
Web: www.coroflot.com/zvukoja6

E-mail: vukoja@po.t-com.hr / web: www.coroflot.com/zvukoja6