TECHNOPLANE

AERONAUTICAL INNOVATION

MINI BEE AIR AMBULANCE

TRL 3

Mini-Bee – Hybrid VTOL

Regional Institutions

Urban Air Mobility

Fondations and associations

Emergency and humanitarian missions

Financial partners

Public Fundings

Collaborative innovation

Drive your aircraft !

Industrial developpement

Crow Funding

Previous Incubators and institution

Institutional networks

Mini-Bee : Our Partners

Academics

CentraleSupélec · ESTACA ECOLE D'INGENIEURS · supméca · POLITECNICO DI TORINO · ENSTA Bretagne · ESITech ROUEN · centralelille · ENSEA Ecole Nationale Supérieure de l'Electronique et de ses Applications · iut ROUEN · Le Havre iut L'EXPERIENCE de la réussite · iut caen · INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES ROUEN · Lycée DIDEROT PARIS · ESIGELEC · ebs PARIS EUROPEAN BUSINESS SCHOOL · Lycées Marcel Sembat · académie Paris · EISTI · INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE · isae Institut Supérieur de l'Aéronautique et de l'Espace SUPAERO · ARTS ET METIERS ParisTech

Industrials

LOI

TECHNOMAP · Aviatube · CPM INDUSTRIES · Ingeliance · FEV · mecelec COMPOSITES · soben · FACTEM

France

India

GST Global Strategic Technologies

Coordinator

TECHNOPLANE

Design & Com

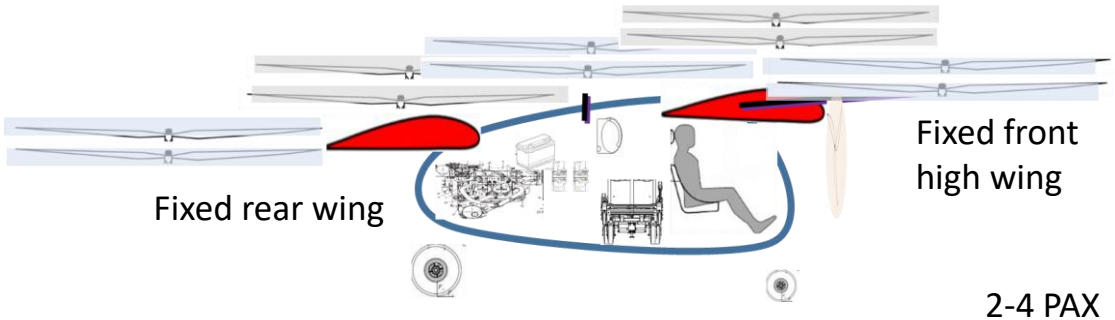
C-touCOM' · HAMZA FOUAHIH

Suppliers

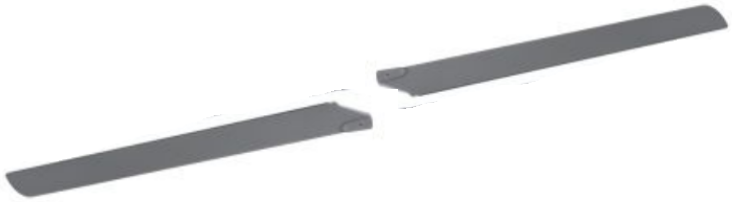
EPCI · WHELEN AVIATION LIGHTING · orolia · TE connectivity · EMRAX INNOVATIVE E-MOTORS · Moteur Aero Distribution · ROTAX AIRCRAFT ENGINES · BRP

- International access from Le Havre airport and sea port with a low cost and worldwide efficient **supply chain**
- Industrials engaged in R&D and **manufacturing**
- **Long term** relationship with highly qualified multi-field academics and industrial

Actual TRL3 configuration



2-4 PAX



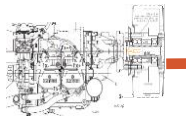
Fixe pitch blades

ROTAX AIRCRAFT ENGINES

Moteur Aero Distribution

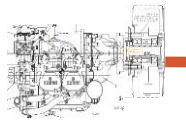
TECHNOPLANE

EMRAX INNOVATIVE E-MOTORS



EMRAX 188
Twin LV AC

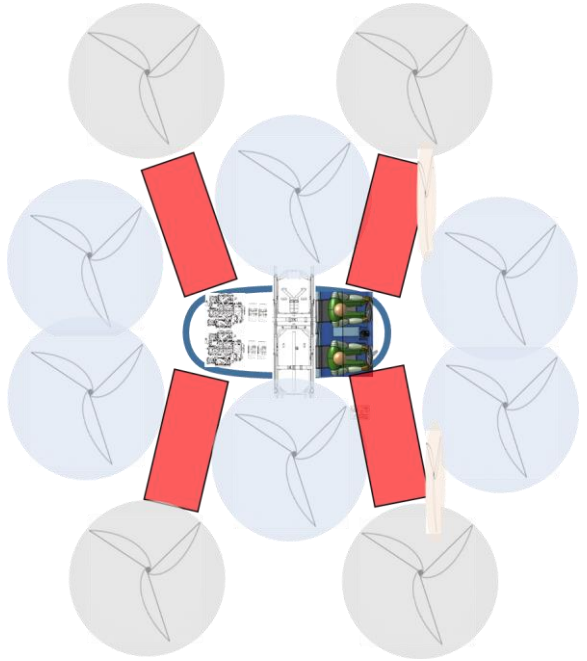
ROTAX 915IS
141 HP 105KW*



EMRAX 188
Twin LV AC

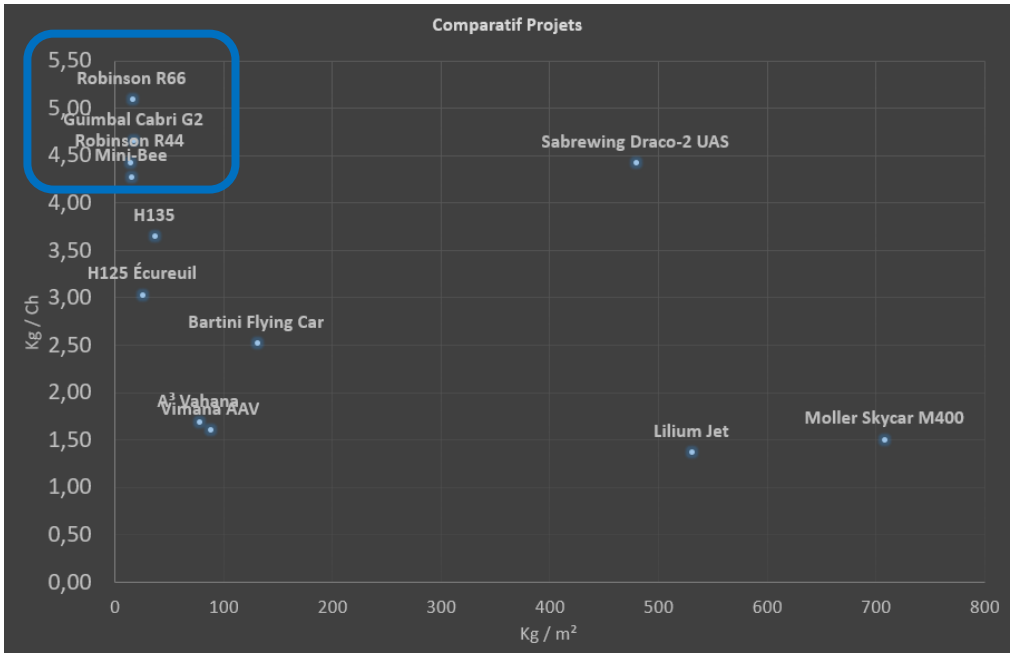
ROTAX 915IS
141HP 105KW

(*) max 5min



Technical state of the art

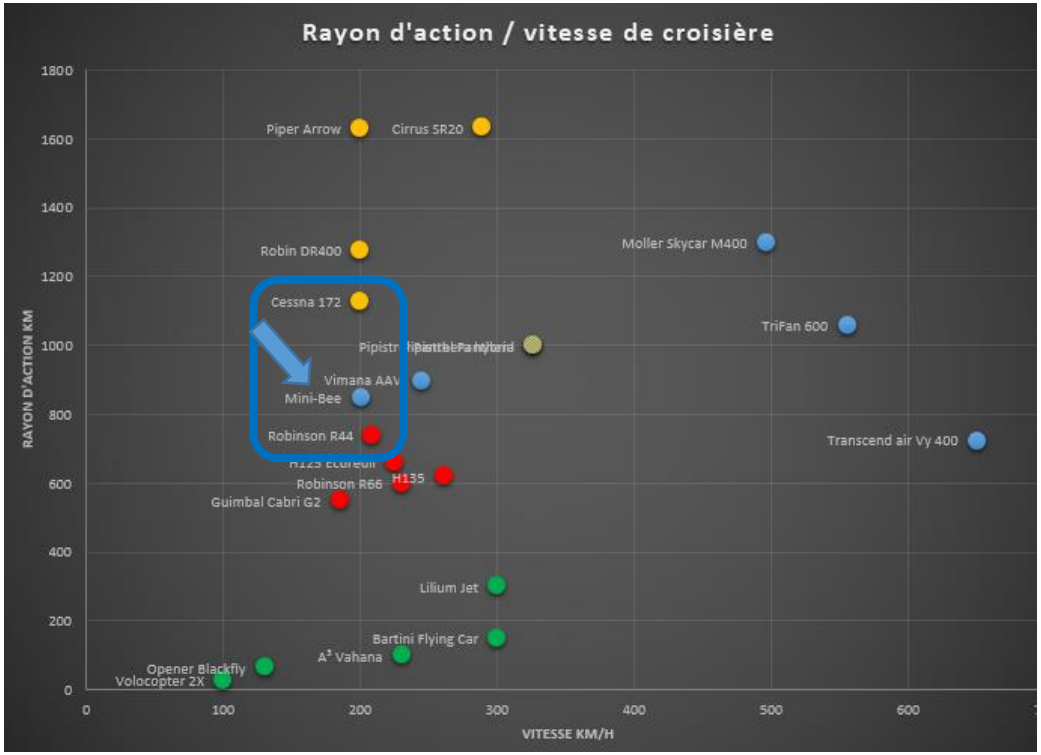
Projet VTOL	Masse maxi Projet (kg)	Masse à vide (kg)	Charge utile	ch	kg/m²	kg/ch	Surface Rotor (m²)	V.air m/s
Robinson R44	1087	653	40%	245	14	4,44	79,49	10
Robinson R66	1225	581	53%	240	15	5,10	79,49	11
H125 Écureuil	2250	1220	46%	740	25	3,04	89,75	14
Guimbal Cabri G2	700	420	40%	150	17	4,67	40,72	12
H135	2980	1485	50%	816	36	3,65	81,71	17
A³ Vahana	815	475	42%	480	77	1,70	10,62	25
Bartini Flying Car	1100	700	36%	435	130	2,53	8,45	32
Moller Skycar M400	1090	765	30%	720	708	1,51	1,54	75
Sabrewing Draco-2 UAS	1157	278	76%	261	479	4,43	2,42	62
Vimana AAV	1050	650	38%	652	88	1,61	11,97	27
Lilium Jet	600	400	33%	435	531	1,38	1,13	65
Mini-Bee	1200	750	38%	280	15	4,29	80,42	11

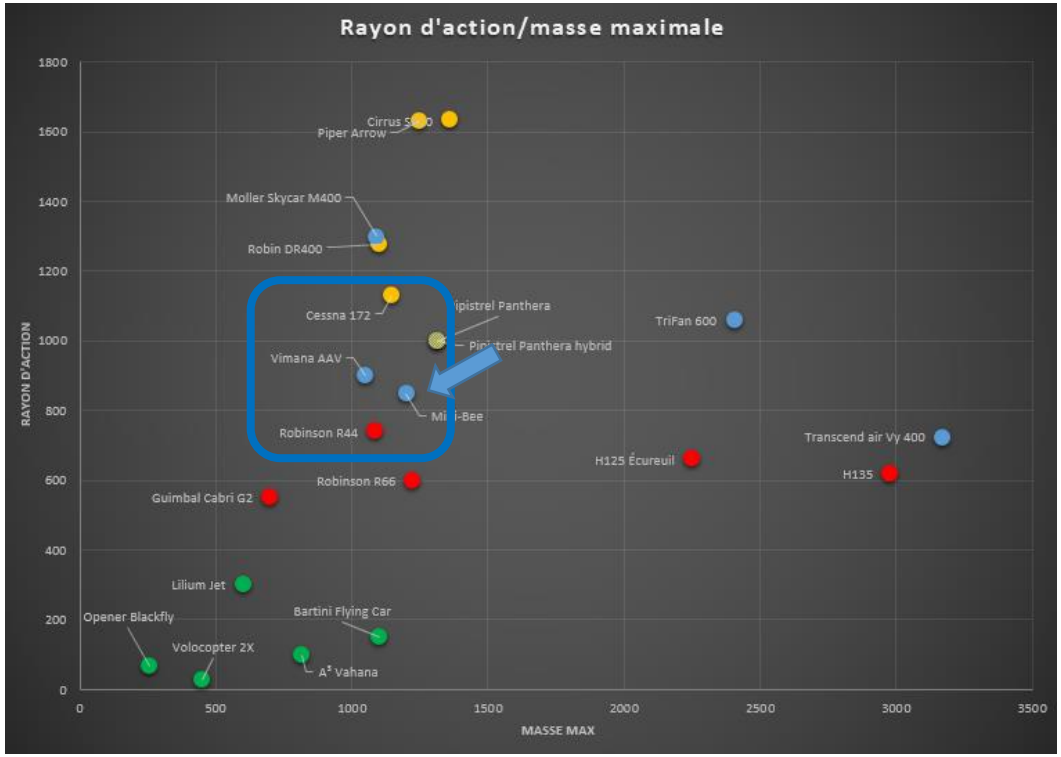


Main market drivers

- Electric VTOL
- Helicopters
- Hybrid VTOL
- General aviation

VTOL, MTOW 1200kg, 200km/h, 850km
Electric Multi-rotors





Mini-Bee R2H10P4 is between **Helicopter** R44 and **Aircraft** C172

½ cockpit Scale:1 Mock-Up – #PAS19

Displayed during Paris Air Show june 2019

Advanced IHM

Flight path

TECHNOPLANE

MCP-PRO

Autopilot

SAITEK Logitech G X-56 Rhino

AR Glasses

EPSON

FACTEM

Switch panels

Logitech G Saitek Pro Flight Radio Panel
Vendu par : Amazon EU S.a.r.L.
EUR 89,07

Logitech G Saitek Pro Flight Instrument Panel
Vendu par : Amazon EU S.a.r.L.
EUR 119,99

JullyeleFRgant Power Off Switch Panel Multifunction Quality Ignition Start Switch Red Push Button Aircraft Kit for Racing Car
Vendu par : JullyeleFRgant
EUR 24,99

KIMISS 6-in-1 Racing Car Auto Interrupteur D'allumage De Moteur Kit De Commande De Bouton De Démarrage 12 V
Vendu par : Kimiss 24k | Question produit ? Demander au vendeur
EUR 30,69

Rupse 5 Gang ON-OFF Panneau de Interrupteur à Bascule LED Bleu Chargeur Double USB Voltmètre Numérique 12V Allume-cigare avec Protection de Surchar
Vendu par : iTao_mall
EUR 49,99

Linux on board computer

12Volt

USB ADS-B and Radio

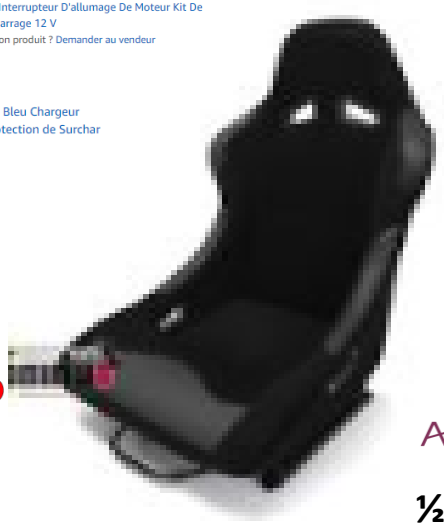
FlightAware Pro Stick Plus (Récepteur USB SDR ADS-B pour Raspberry Pi)
Vendu par : MODMYPI LTD
EUR 36,38

NooElec NESDR SMArTee XTR SDR - Premium RTL-SDR avec plage de réglage étendue, boîtier en aluminium, torsion, 0,5PPM TCXO, entrée SMA. RTL2832U &
Vendu par : Nooelec Inc | Question produit ? Demander au vendeur
EUR 39,95

Basic flight controls

Steering wheel

TECHNOMAP



Aviatube

½ Structure

TECHNOPLANE

Thermal imaging

GST
Global Strategic Technologies

Ground radar

TKOOFN Kit Radar De Recul Stationnement Numã©Rique
Vendu par : Hanko Electronic
EUR 19,99

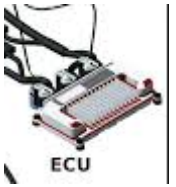
Lights

Emergency Location Beacons

orolia

Medical litter

ROTAX
AIRCRAFT ENGINES



ECU

Flight controls

Emergency beacon ON

Computers ON

ON

Computerized flight controls

Sport mode ON

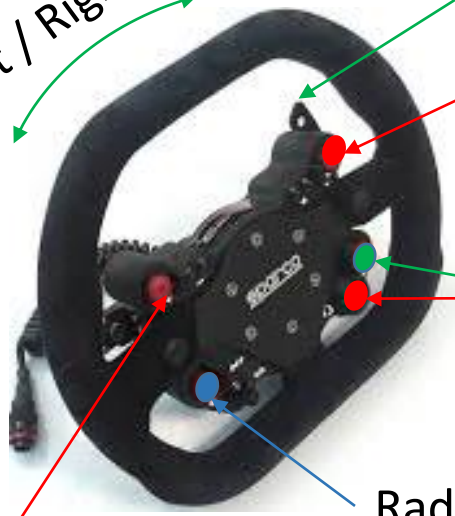
Engine Boost

Basic flight controls

Left / Right

Vertical speed +

Vertical speed -



Horizontal Speed **+/-**

Radio ON

Stop

Forward/Back

Left/Right

Pitch

Roll

Joystick activated

Market : HEMS

Helicopter **E**mergency **M**edical **S**ervices

Key strenghts of HEMS

- Gives a medical response to **crisis** and medical **emergencies**
- Provides **territorial grid** for medical interventions

Primary Missions

- Bring a medical support as **close** and **quick** as possible to the patient
- Transport a **stabilized** patient to the nearest specialized hospital

Secondary Missions

- **Urgent transfert** of a patient from a hospital to another

Limits and pain points of existing helicopters

Operations Management

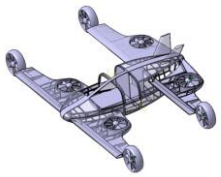
Pilot & Doctor's **Training**

Operational **Disponibility**

Operational and purchasing **Costs**

Other Markets accessible

Today



Ambulance & Utilities

3 PAX
Volum
VTOL mission

VIP

2 PAX (pilot included)
Weight and Confort

Taxi

4 PAX
Number of seats
All electric propulsion

Sport

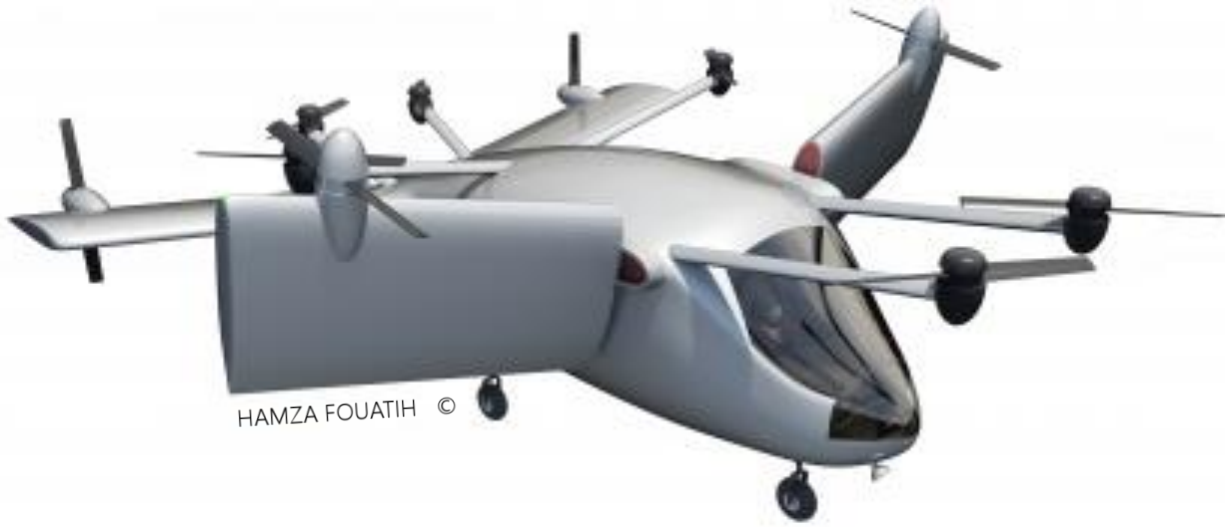
1 PAX
Power/weight ratio

Can be loaded into VIP or Corporate large civilian aircrafts cargo soute

Mini-Bee : Hybrid Powered solution

Basic flight path

- Cruise speed : **200km/h**
- Range : **850 km**
- MTOW : 1200kg
- Climbing angle: 10°
- Cruse altitude: 1500m
- Max power 280 kW
- Cruise flight : 90% of energy



Fuel tank

No Battery

2 Engines
Rotax 915is

Emrax

Three-phase
Generators

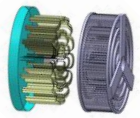
Emrax

Three-phase
Generators

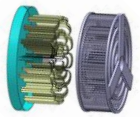
6 Internal **Vertical** three-phase
Asynchronous electric engines

4 external engines

Under Studies

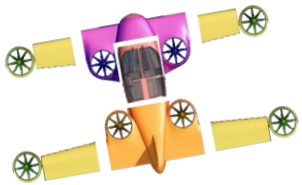


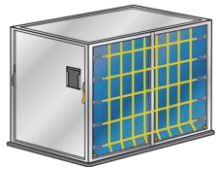
2 horizontal
engines

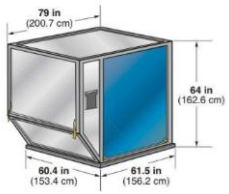


Product : Mini-Bee Hybrid VTOL

Hybrid power security







Modular & **ULD** conception

Low cost structure

Flight Path Management

Driving experience

Drive your aircraft !

VTOL Aircraft
(6 rotors + 4 tilt rotors)

Short Wings for longer **range**

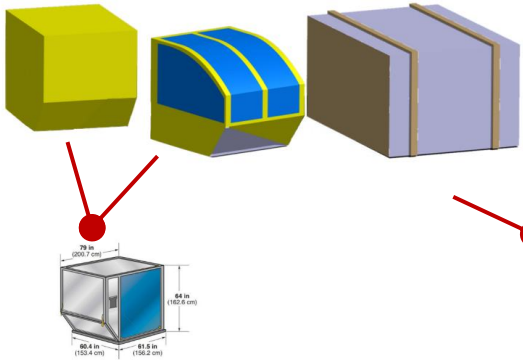
Specifications

Capacity:	2 crew 1 patient
MTOW	1200Kg
Payload:	350kg
Range:	850km
Cruise speed:	200km/h
Max. speed:	240km/h

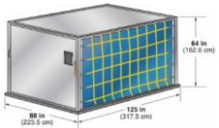
Mini-Bee : Modular deployment

Air **transportation** by civilian aircraft

Mini-Bee can be loaded onto civilian aircrafts **cargo soute**

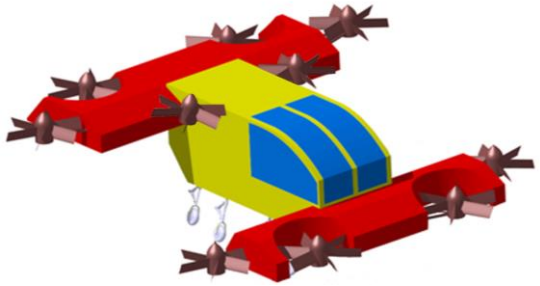


LD3: Cockpit/Generator



LD9: Wings/Rotors transportation

Mini-Bee can be **easily mounted** on tarmac



First air vehicule to be loaded into a civilian aircraft **cargo soute** without rotor assembly

Product : Mini-Bee Hybrid VTOL

Limits and pain points

Operations Management

Decision making and navigation support through flight path management solutions

- **Reduced preparation time.**
- **Find the flight path** to waypoints and consider actual air traffic
- **Increase flexibility** on the mission through new touchdown areas or rendezvous points

Pilot & Doctor's **Training**

Intuitive use through redesigned IHM and driving experience

- **Intuitive control**
- **User friendly interfaces** to shorten initial formation and increase medical time

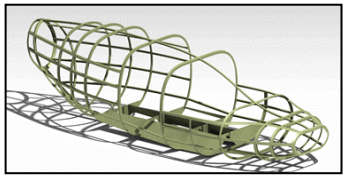
Operational **Disponibility**

MRO does not restrain the Mini-Bee to the ground thanks to evolutive and modular design

- Modules can **easily** be **supplied** by ULD or container to maintain disponibility
- Each module can be **monitored seperatly** from the aircraft

Operational and purchasing **Costs**

Low-Cost and light structure reduce the acquisition and operational costs



- **Low-Cost modules**
- **High autonomy** to decrease the training costs and operational costs

Benchmark

Exisiting solutions and competitors

Cessna 172

- Range > **500km**
- Total Variable cost/h: **175$**
- Purchase cost: **525k$**
- TakeOff/Landing distances: **530m/425m**

Robinson R44

EC130

- **Single-Engine**
- Cruise speed: **240km/h**
- Purchase cost: **3,1m$**
- Total Variable cost/h: **$646**
- **Autorotation** in case of emergency landing

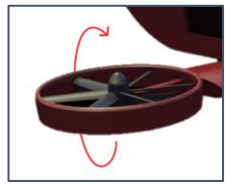
EC135

- Cruise speed: **261km/h**
- Purchase cost: **3,6m$**
- Total Variable cost/h: **$847**
- **Twin-Engine**

Purchase Cost: ~350k$

Cruise speed: 200km/h
Range: **850**km
Total Variable cost/h: ~$300

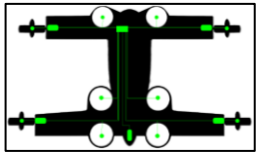
Mini-Bee solutions



VTOL & Wings

Security

Parachute

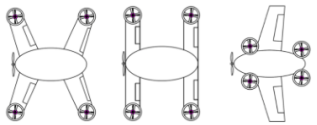


Cost

Double source power with 2 piston engines

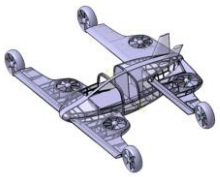
Mini-Bee – Project development steps

2015
Basic mock-up

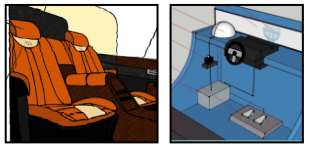


2016
Detailed Concept

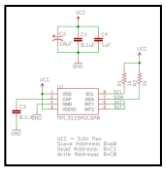
Structure



Usages and HMI



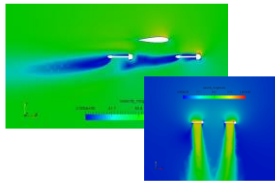
Electronics and sensors integration



2017
Scale Model

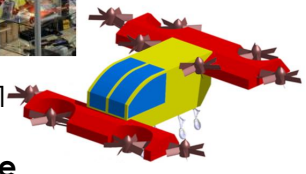
2018
Definition of scale 1 demonstrator

Dynamics of flight



Bourget 2017

½ Cockpit scale 1
Bourget **2019**
Rotax 915is choice



Today

2020
Rotax purchase

Shape **2PAX** optimization

Hybrid generator

Ground Demonstrator

Demonstrator

Prototype

Manned flight

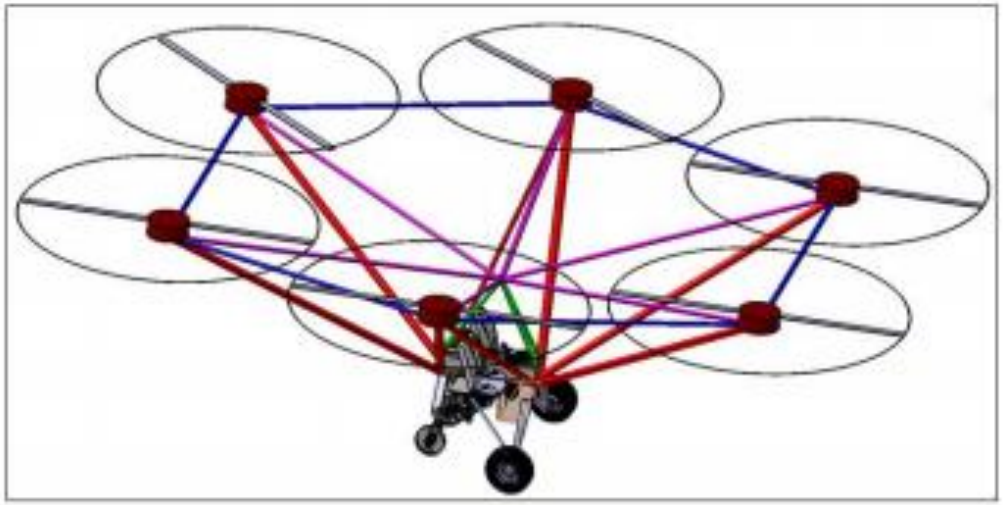
Test Flights

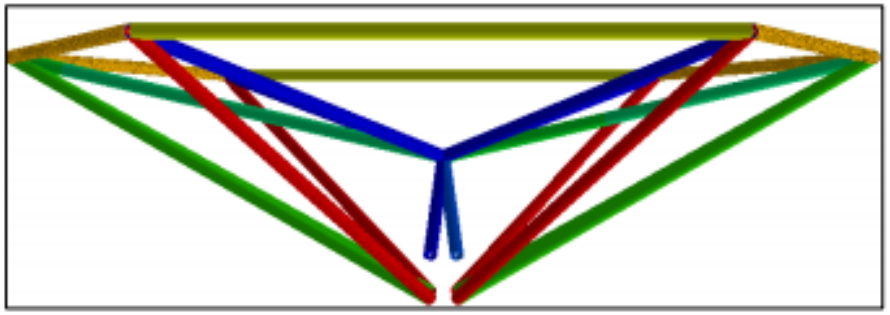
Final Developments

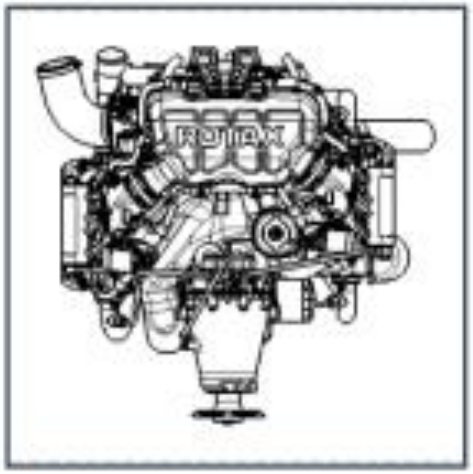
Qualification

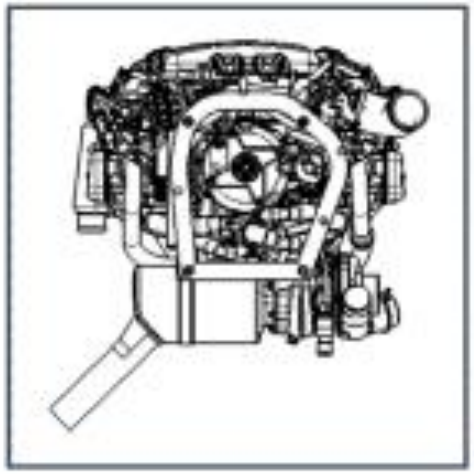
2030
Commissioning and sales

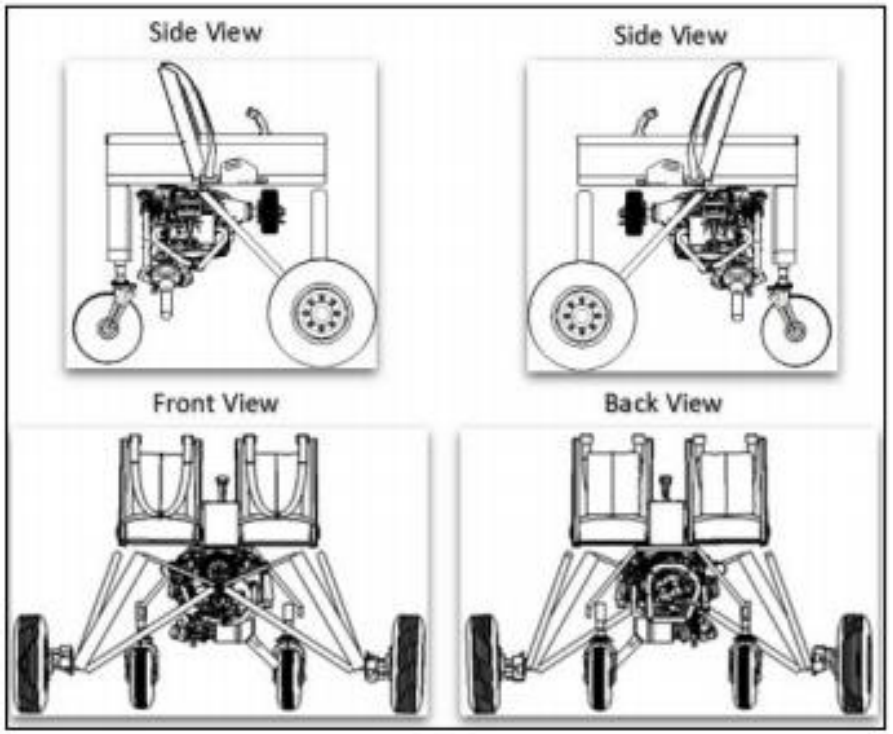
Actual 2PAX configuration for prototype



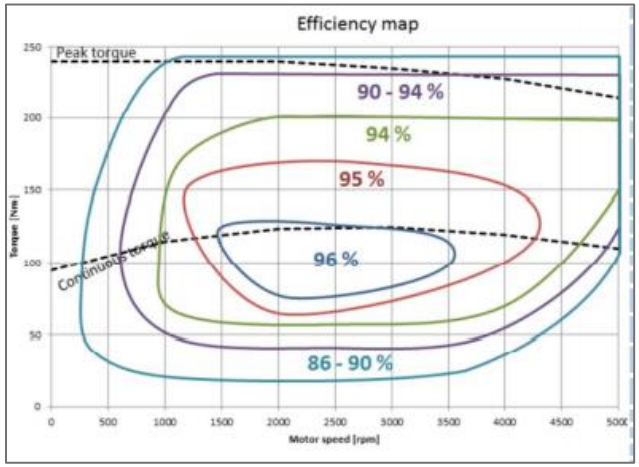


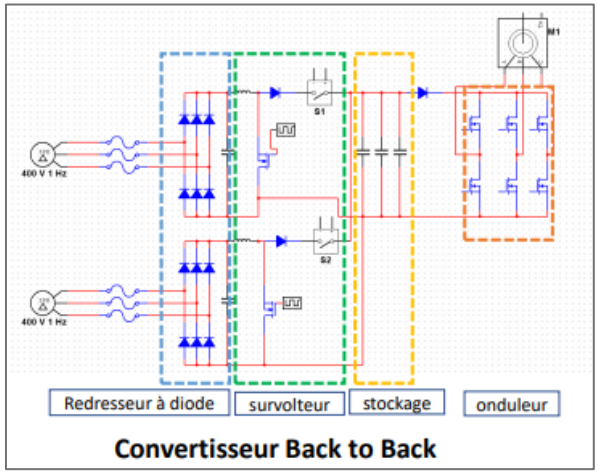


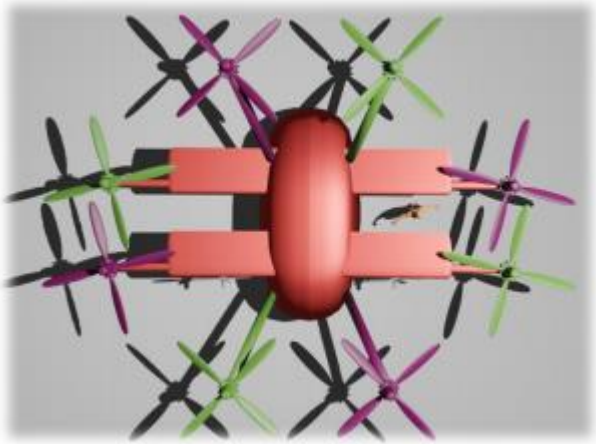




Synchrone standard configuration







TECHNOPLANE
AERONAUTICAL INNOVATION

ESIGELEC

Architecture du prototype

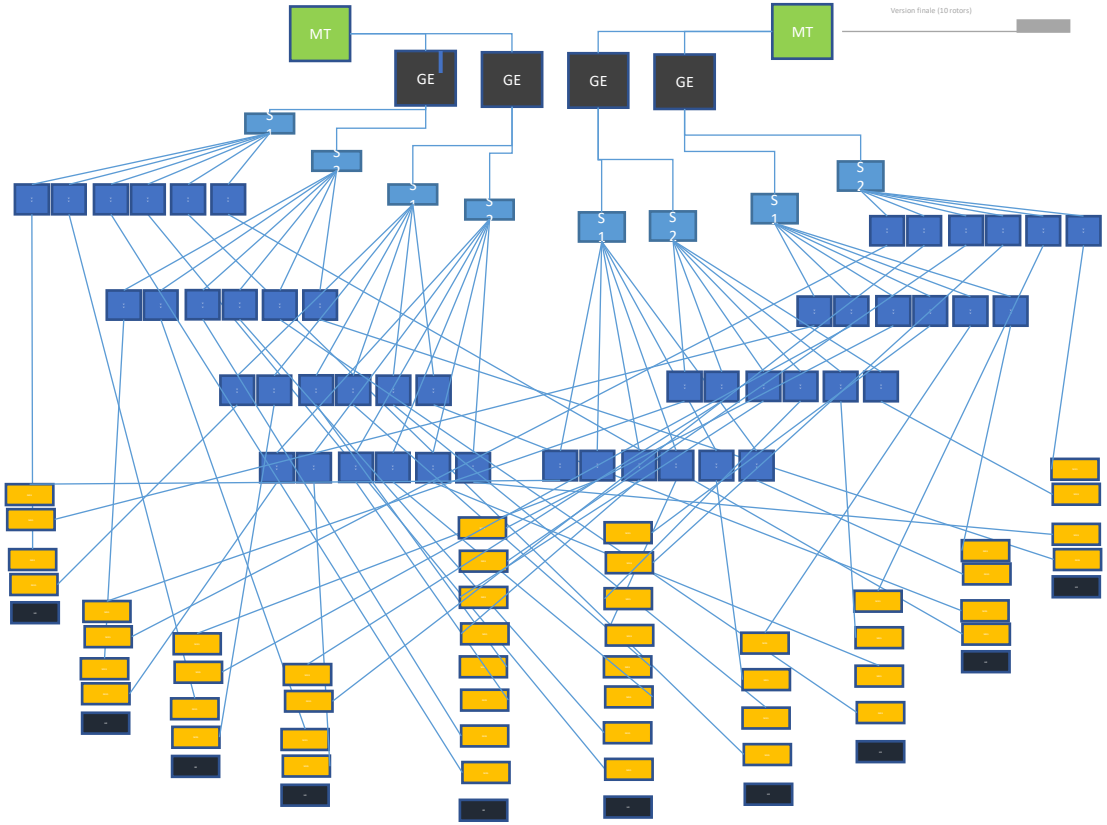
Moteur thermique	Génératrice électrique	Variateur de vitesse	Moteur électrique	Hélice
ROTAX 915 IS (1) 100 Kg*	**EMRAX 228H (2)** 24,8 Kg 4 980 €	**BACK TO BACK CONVERTER (6)** 30 Kg 12 000 €	**Rotex RET 30 (6)** 24,6 Kg 10 800 €	**Câbles** 1,5 mm² 11,88 Kg 4 500 €

Poids partie électrique: 191,3 kg
Prix: 32 280 € (sans le ROTAX)

Hybrid asynchronous power configuration

Key innovative solution :

- **No battery**
- **Asynchronous** multirotors configuration
- **Multi-stage** electric engine in each rotors
- **On/Off** control on each electrical engine



Based on:

- 2 Rotax 915is
- 4 Emrax 188 twin
- 10 vertical Rotors

Under Studies

Mini-Bee – Demonstrators

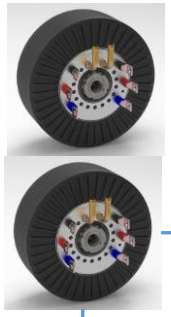
Engine	Three-phase **Generator**	**6** three-phase electric **Vertical engines**

Demonstrator 1 – 140HP

Rotax 915IS
141HP

In Process
TRL3

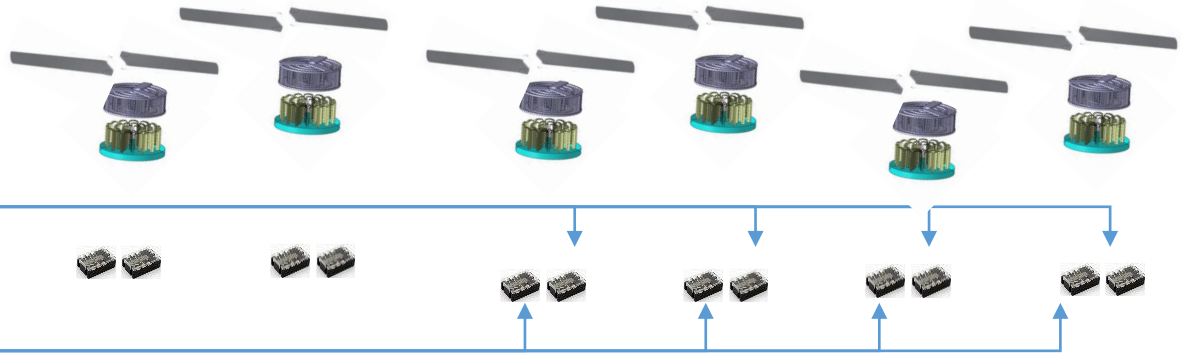
Emrax 188
Twin
470V
2x UVW connectors



Asynchronous
Configuration

TRL1

Continuous **20kw**, Max 40kw
= 2*10kw each; 21A

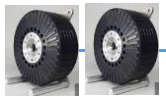


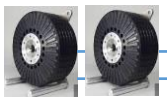
Configuration 2 – 280HP

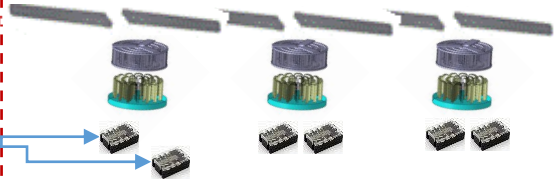
Emrax 188
twin

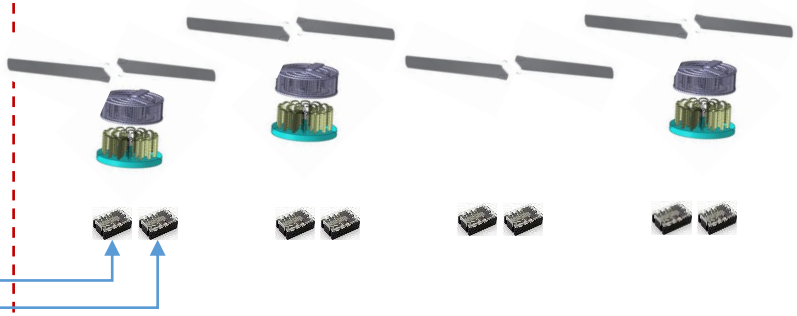
Rotax 915IS
141HP

Rotax 915IS
141HP









Industrial Property

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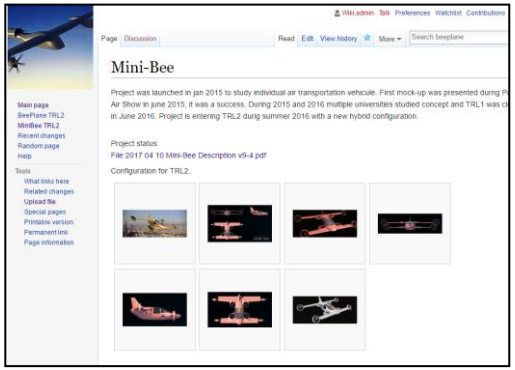
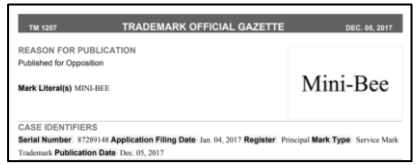
Lesser Open Bee License 1.3

- Mini-Bee project is achieved under dedicated **lesser open source** license
- It allows multiple actors (academic, industrial, individuals) to collaborate in an **open-innovation** workflow. Project works are mainly shared on a public wiki.
- Tasks are achieved with coordinator management
- **Private Tasks** (without public disclosure) or product covered by other licenses or other intellectual property rights can be included within the project. Only interface works will be covered by the open source paragraph of the Lesser Open Source License
- Any Participant may use works done on the Project for technical or commercial use. By default, standard royalties percent are defined

www.collaborativebee.com





Attorney Docket No. 69732.128.1
Design Patent Application