



MINI BEE

PERSONAL AIRCRAFT

Mini-Bee

2PAX VTOL Hybrid Octocopter



Agenda

- Mini-Bee description
 - Concept and technical description
 - SWOT analysis
- TRL1 project
 - Partners and project history
 - TRL1 Tasks
 - Aerodynamic studies
- TRL2 project launch
(TRL2 = Technology concept and application formulated)
- Annexes : State of the art, Other innovative projects

Mini-Bee : 2PAX VTOL Hybrid



TECHNOPLANE

MINIBEE

HAMZA FOUATIH © LESSER OPEN BEE LICENSE 1.3

Mini-Bee Project partners



Lesser Open Bee License 1-3

Coordinator :



Universities :



POLITECNICO
DI TORINO

Institution & financial partners :



Design:



MINI BEE

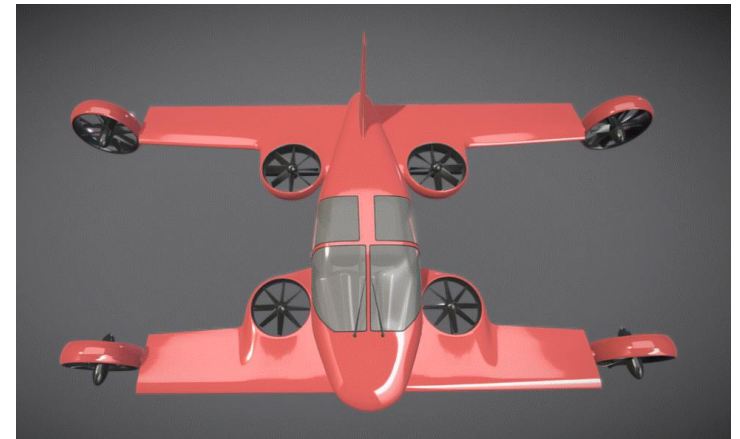
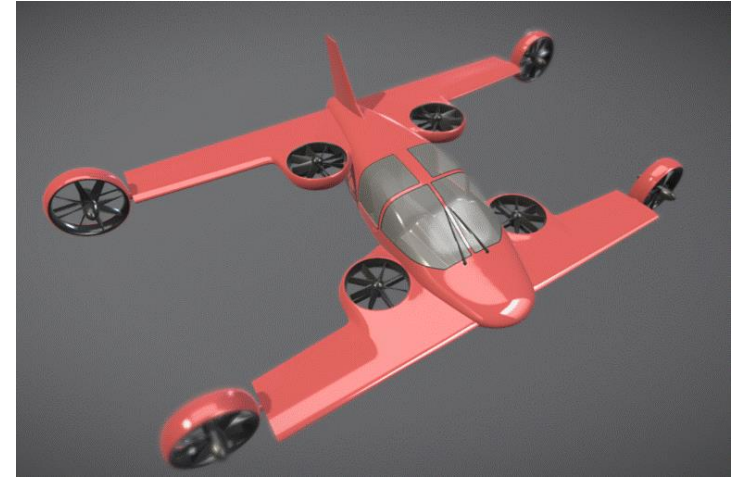
PERSONAL AIRCRAFT

www.mini-bee.com

v8.14 – 14 Dec. 2016
Copyrights Technoplane SAS

Mini-Bee description

- Project state : beginning of TRL2
 - Electric octocopter : 4 vertical + 4 tilt
 - Hybrid energy : fuel + batteries
 - 2 seats, VIP configuration
- Characteristics :
 - VTOL capacity, short wings, 1.2 ton
 - Range 600km, max speed 300km/h
 - Electric controls and engines
- Goals and market
 - VIP, Air Ambulance, individual aircraft
 - Estimated price 1m€ (for VIP)



Architecture

External tilt
quadcopter

Central vertical
quadcopter

Rear electric
generator

Gullwing
doors

Fuel
generators

Battery kits

Tailwheel-type
landing gear

Low noise nacelle

Retractable front
landing gear

3D printed
metallic
structure

Biplane

Electric flight
controls



Technical description

Aircraft characteristics

2 seats, VTOL, Short wing for cruise flight
MTOW 1200 kg, Range 800km , Cruise speed 220 km/h
Wing surface 15m², no control surface

Engines

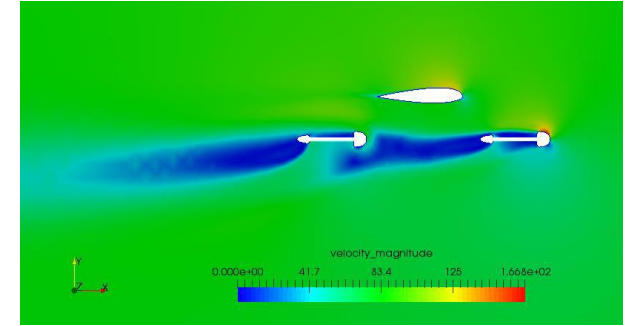
Central vertical quadcopter + External tilt quadcopter
4 hybrid fuel generator for central quad copter
4 electric engines for external tilt quadcopter
Electronic control of engines power and tilt angles

Cockpit interface

« Car like » pilot interface : Steering wheel, foot pedals, central screen

Take-off and flight transition

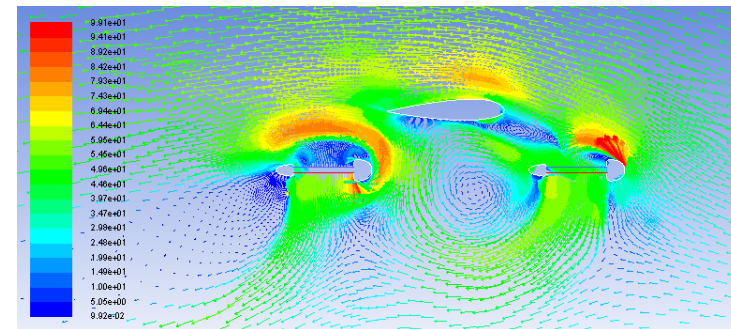
Cruise
flight



Tilt
transition

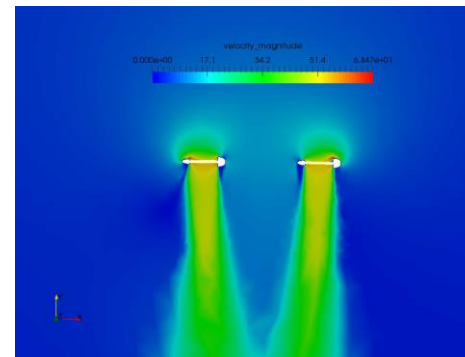


Estaca 2016

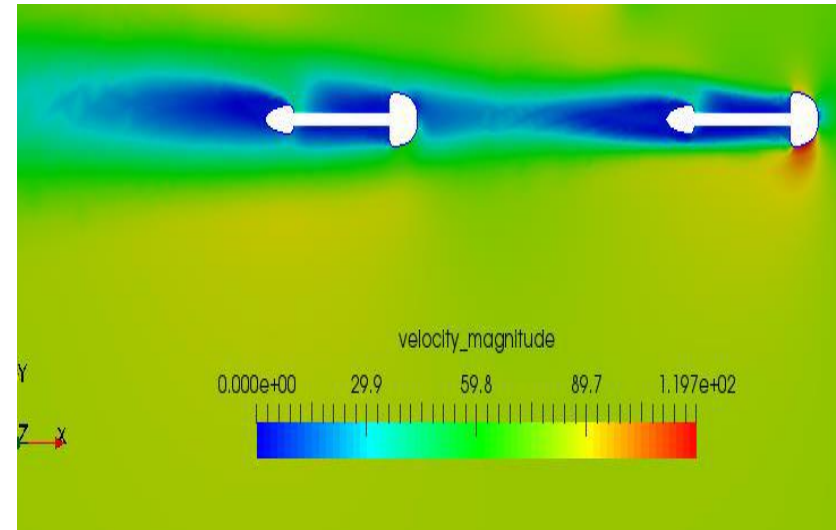


Supméca 2016

Vertical
take-off



Cruise flight

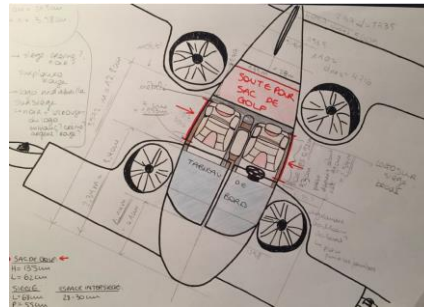


Main configurations

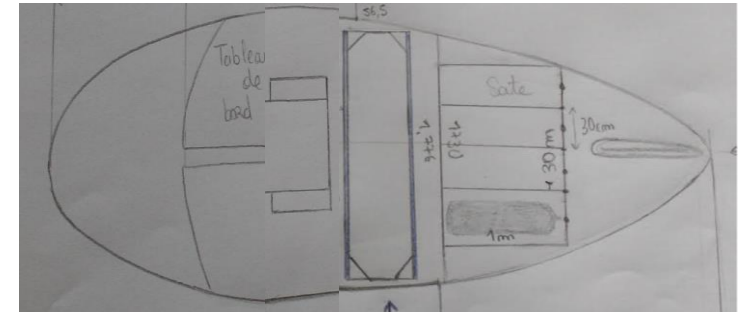
Sport



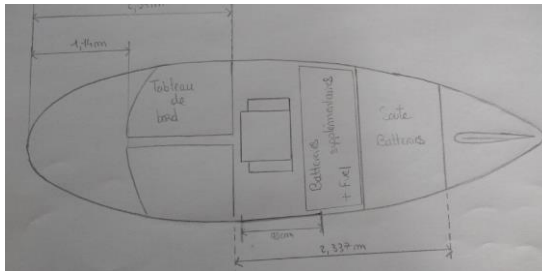
VIP



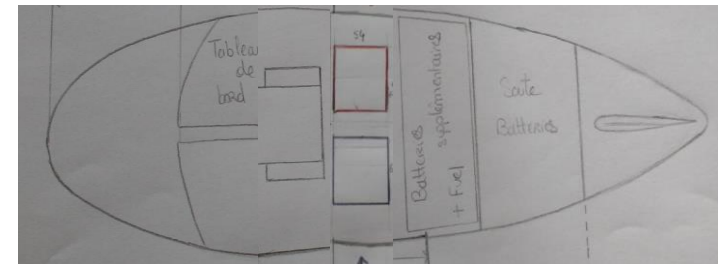
Ambulance



Utilitaire



Taxi

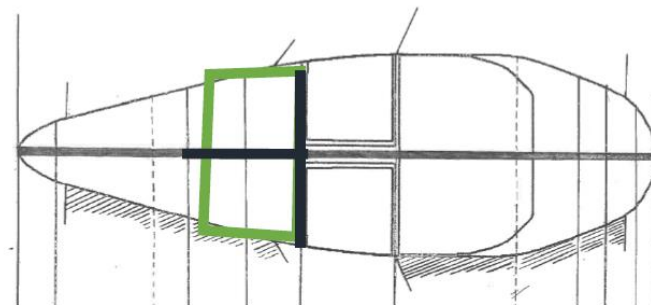
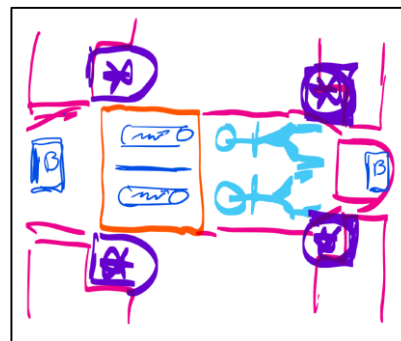
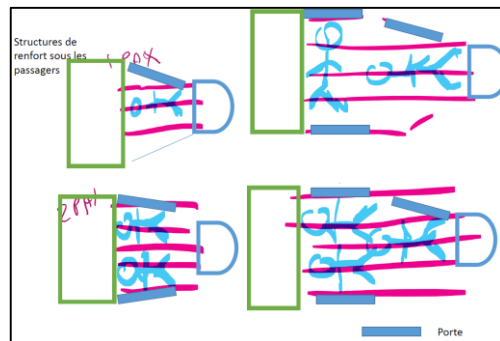
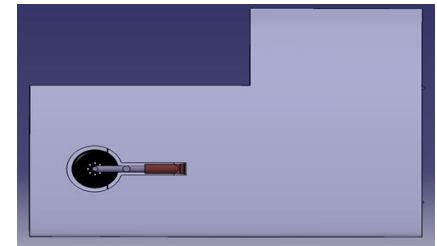
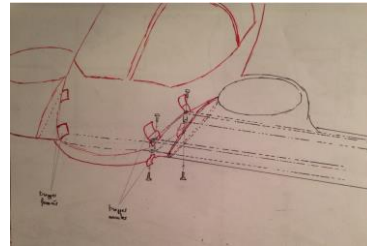
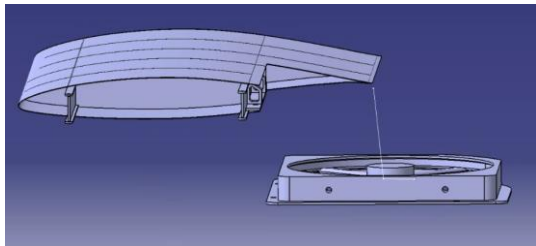
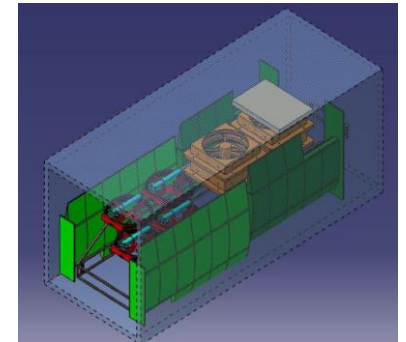
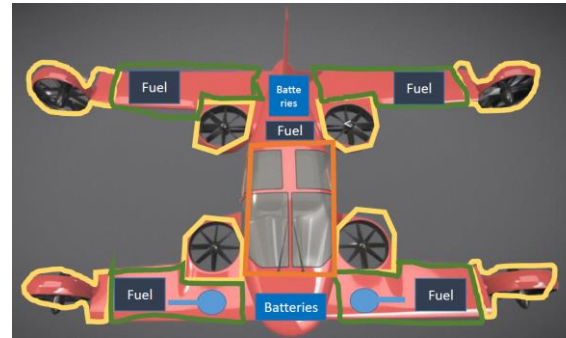
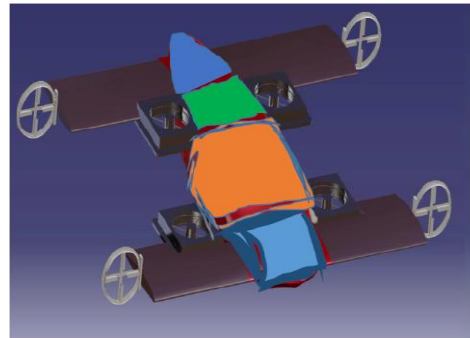
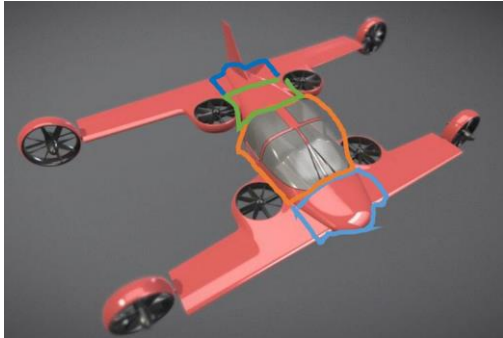


1 PAX

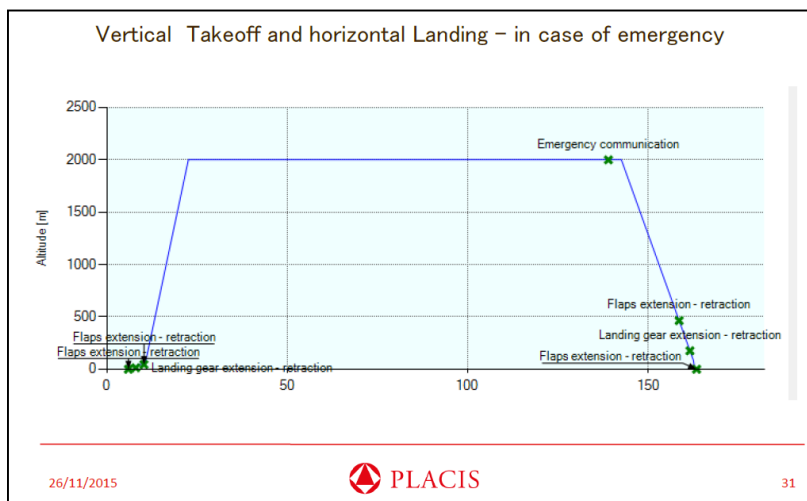
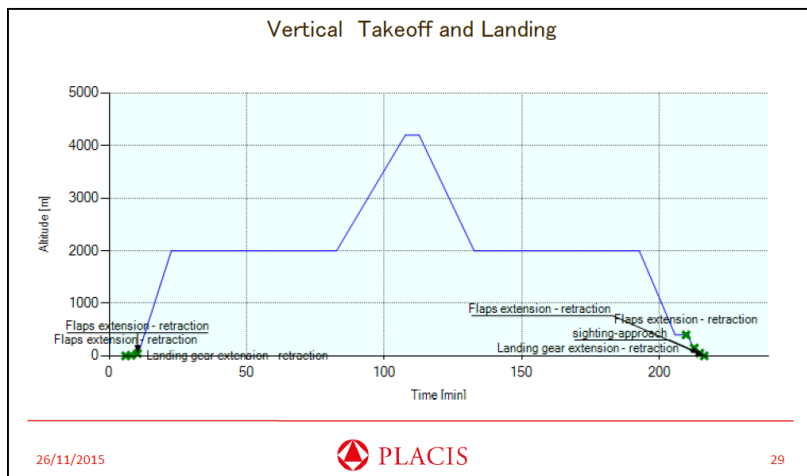
2 PAX

3 PAX

Modular structure



Mission profile



Phase	Duration		Altitude (start)	Altitude (end)	Speed	Climb rate	Specific Consumption
	hour	Min	m	m	km/h	m/s	lb/Hp/h
Engine start-up	0	0,3	0	0	0	0	0
Taxi out	0	4,5	0	0	60,0001	0	0,44
Flaps extension - retraction	Start time	60	-	-	-	-	-
Vertical Take off	0	0,8	0	45	0	0,9375	0,46
Landing gear extension - retraction	Start time	25	-	-	-	-	-
Rotors orientation	0	2	45	45	100,0001	0	0,45
Flaps extension - retraction	Start time	85	-	-	-	-	-
Climb	0	12	45	2000	200,0002	2,7153	0,45
1° cruise	1	0	2000	2000	299,9999	0	0,4299
obstacle deviation (climb)	0	25	2000	4200	249,9998	1,4667	0,45
Mini-cruise	0	5	4200	4200	249,9998	0	0,44
obstacle deviation (scent)	0	20	4200	2000	270	-1,8333	0,435
2° cruise	1	0	2000	2000	300	0	0,4299
Descent	0	13	2000	400	240	-2,0513	0,435
Holding	0	5	400	400	200	0	0,4331
Flaps extension - retraction	Start time	80	-	-	-	-	-
2° rotors orientation	0	1	400	200	100	-3,3333	0,45
Vertical Landing	0	4	200	0	20	-0,8333	0,447
Landing gear extension - retraction	Start time	25	-	-	-	-	-
sighting-approach	Start time	75	-	-	-	-	-
Taxi in	0	2	0	0	60	0	0,44
Flaps extension - retraction	Start time	30	-	-	-	-	-
Engine shutdown	0	0,2	0	0	0	0	0

26/11/2015

PLACIS

30

8 Electric Engines

Equipement proposed : 8 electric engines 55k (50kg)



55kW special designed engines (12kg/engine)
Or 8 engines Yuneec Power Drive 60kW

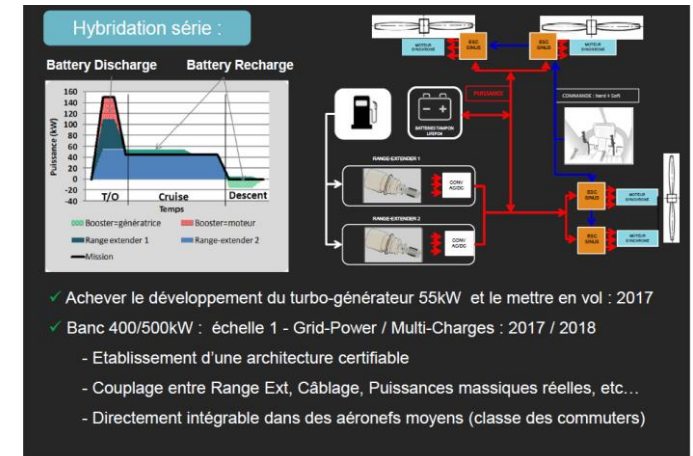
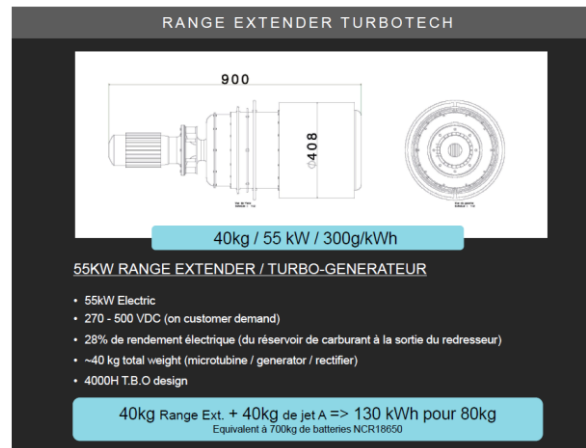
Power needed 220 kW
Installed power 440kW

provided by

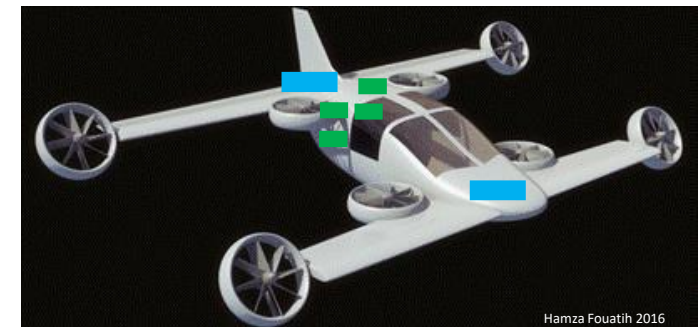
- 90kg of batteries during take-off and vertical flight
- 4 fuel generators during cruise flight

4 Electric fuel generator + Batteries

Equipement proposed : 4 Turbotech 55kW (160kg)



Batteries : 1800 NCR 180650 in 10C (90kg)



Data

MTOW : 1200 kg

- Structure : 310kg
- Fuselage : 80kg
- Payload : 220 kg (2 PAX)
- Systems : 125 kg
- Engines : 240 kg
- Batteries : 90kg
- Fuel : 140kg

Target for TRL3 : MTOW 1000 kg

Total costs : **700k€**

- System : 200k€
- Fuselage : 150k€
- Wing : 100k€
- Engines : 100k€
- Landing gear : 50k€
- Interior : 50k€
- Other : 50k€

Target for standard configuration :
Price = 700k€

SWOT analysis

Strengths

- VTOL capacities
- Speed of an aircraft
- Double quadcopter back-up in case of engine failure
- Fuel energy range
- Aircraft Design and configuration
- Lesser open source collaborative project

Weakness

- New configuration
- Project at low TRL
- Aerodynamic and light weight structure
- Propulsion and energy storage
- Project implementation
- Project funding

Opportunities

- Cost reduction :
 - Overall flight cost reduction compared to helicopter
 - Low purchasing & maintenance cost of engines
- New design space: tilt, octocopter
 - Weight / VTOL
- Project investment

Threats

- All electric helicopter
- All electric aircraft
- Tilt rotor (bi and quadri)
- Hybrid energy
- Others innovative projects

Partners for R&D

Project coordinator



Lesser Open Bee License 1-3

TRL2 Detailed Definition



POLITECNICO DI TORINO



In launch



TRL1 Basic Definition



POLITECNICO DI TORINO



Project history

TRL0 Project Launch (2015)



Studies 2015/2016



TRL1 Basic Definition (2016)



Lesser Open Bee
License 1-3

TRL2 Concept (2016) in Process

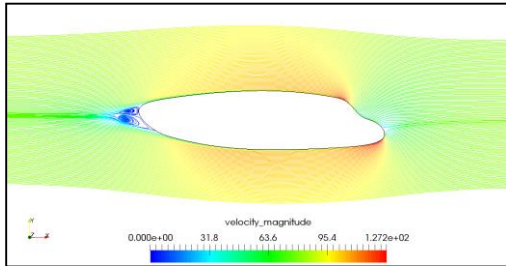


2016/2017

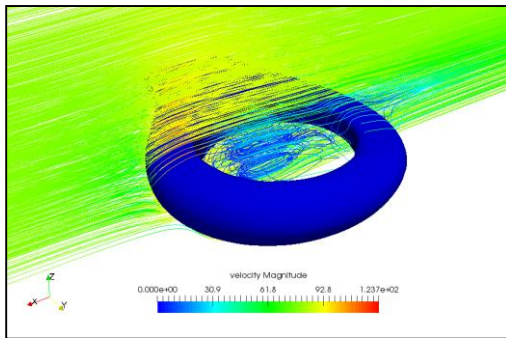


Meet us in
Le Bourget Air Show 2017 !

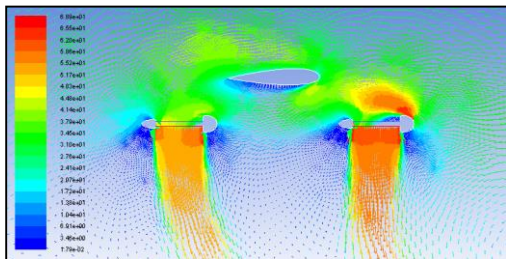
Aerodynamic studies



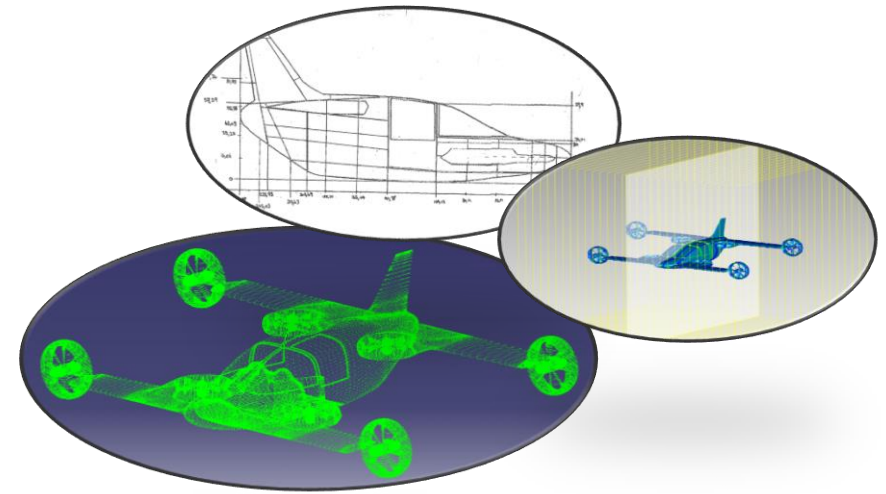
Cockpit shape optimization
Supmeca 2016



Rotor shape optimization
Supmeca 2016



Vertical rotor air flow studies
Supmeca 2016



Numerical studies
Supmeca, end of 2016

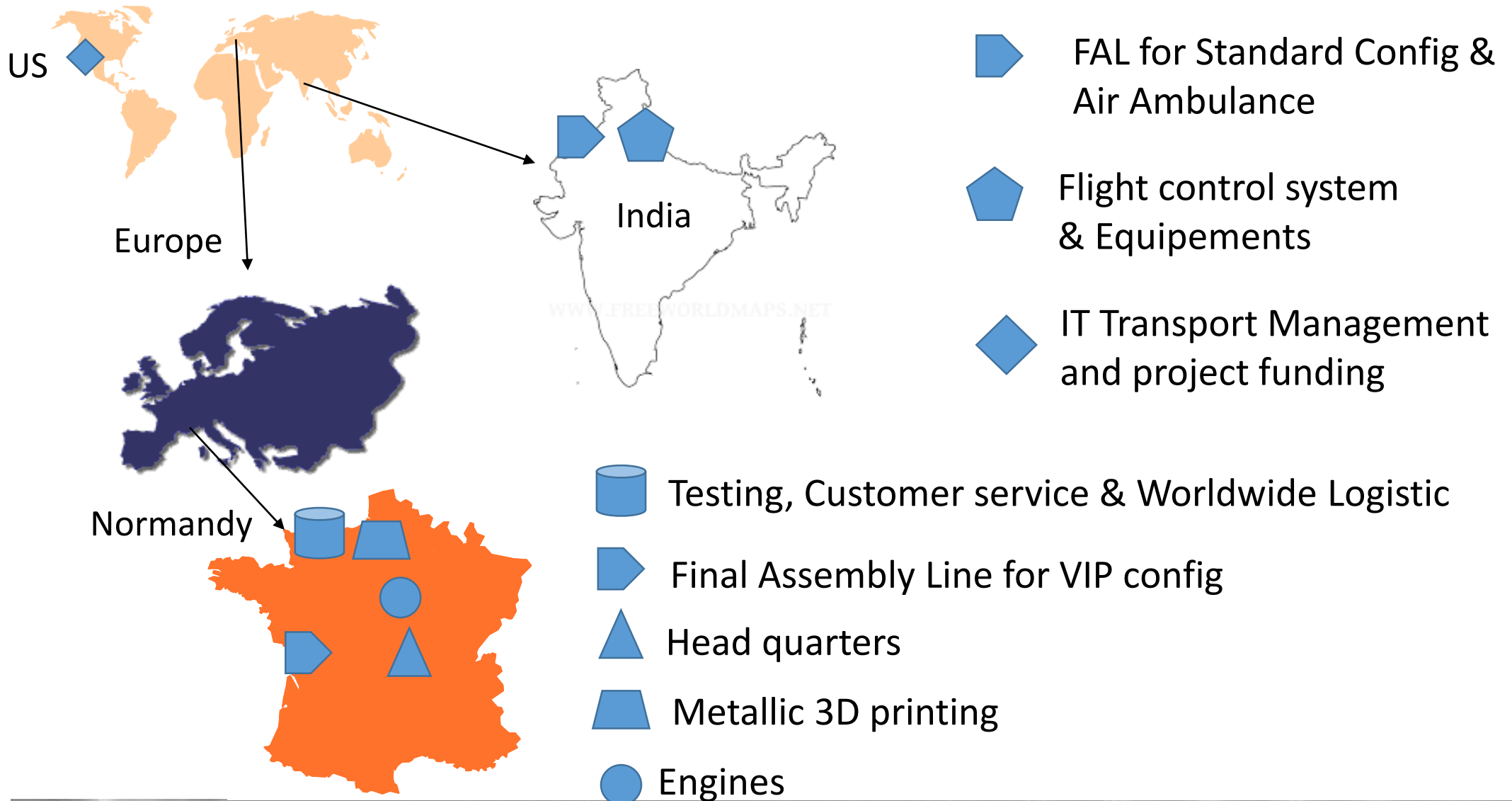
Actions for Mini-Bee TRL2 Project

- Launch Mini-Bee TRL2 project :
 - Refine detailed technical and equipment configuration
 - Evaluate market opportunities, production and flight costs
 - Define partnership for TRL2 and TRL3
 - Draw project financial path
 - Investigate for lovemoney phase

Partners to be defined

	World	France	Asia	US
Project sponsors & finance		★	☆	★
Electronics and equipment integration			☆	
Aircraft flight management control		★	☆	★
Cokpit interface and project integration		★		
Structure metallic 3D printer		★	☆	
Aircraft manufacturer		★	☆	
Luxury firm for VIP configuration		★		
VIP end users	★	★	☆	★
Air Ambulance end user	★		☆	

Targeted Industrial Schem



Financial project path

TRL	Statut	Début	Fin	Montant estimé (k€)
-----	--------	-------	-----	------------------------

0	Terminé	2014	2015	20
1	Terminé	2015	2016	50
2	En cours	2016	2017	200
3		2017	2019	2 000
4				5 000
5				10 000
6				15 000
7				20 000
8				25 000
9				25 000

Detailed numerical mock-up

First flight

Test flights

Final developments

Qualification

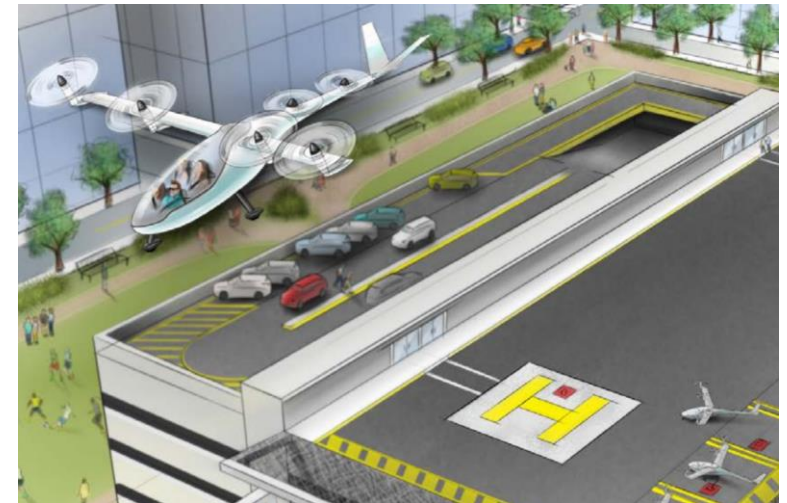
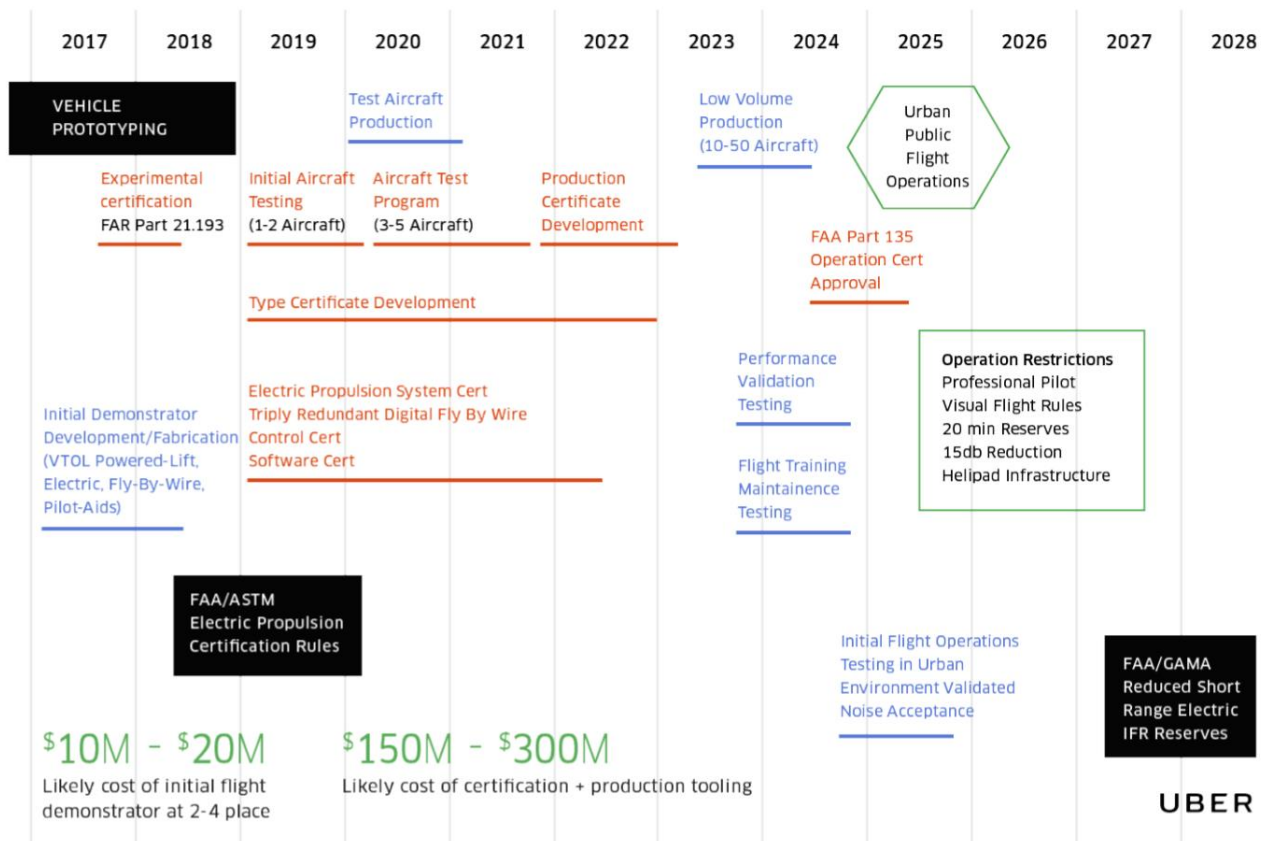
Commercialisation / Operations

Estimated overall project 100m€

Actual step : Lovemoney for 500k€ to 2m€

Uber elevate

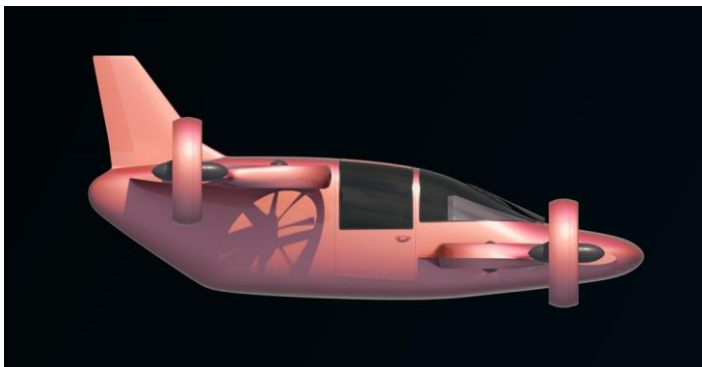
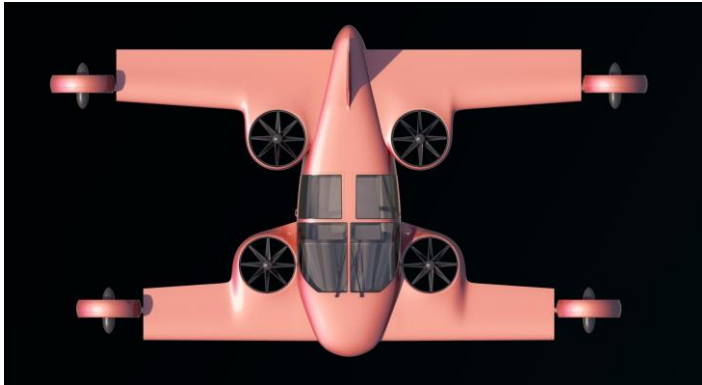
Certification



Annexes

Individual Air Vehicules

Mini-Bee project for TRL2



Lesser Open Bee License 1-3



Mini-Bee (at end of TRL1)

2 PAX VIP

Electric Octocopter

Tilt quadcopter & vertical quadcopter

Hybrid energy : batteries & fuel



Estaca Laval 2016

Take-off and tilt transition

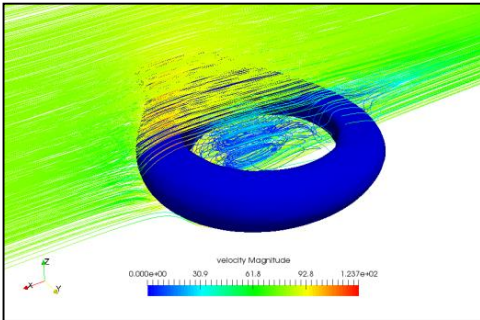


By Estaca 2016

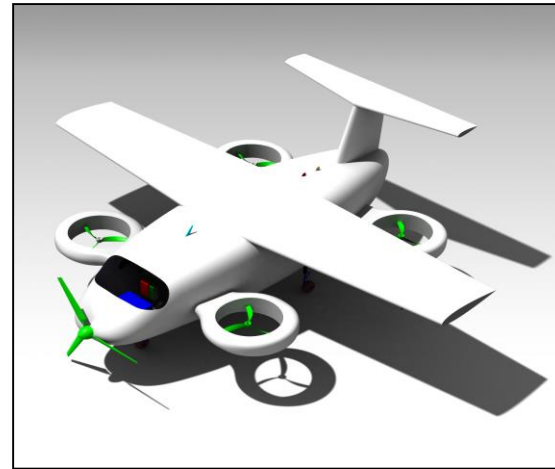
TRL1 project tasks



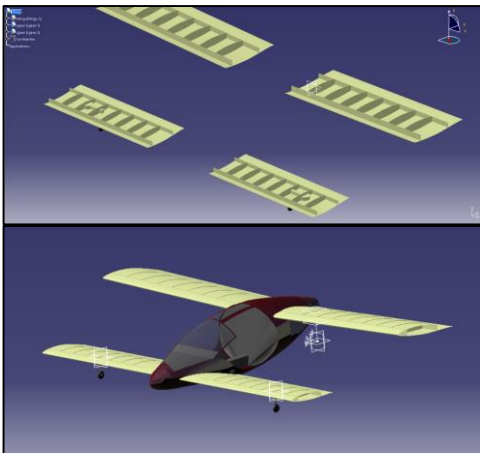
Polito 2015



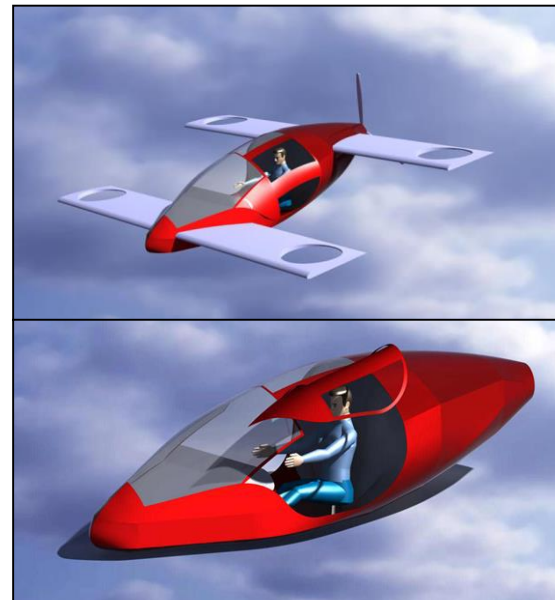
Supmeca
2016



Supmeca & Polito
2016 (Placis)



Estaca
2016 group1



Estaca
2016 group2

State of the art

Cessna Skylane



- Height: 2,84 m
- Wingspan: 10,97 m
- Length: 8,84 m
- Max Take-Off Weight: 1406 Kg
- Power: 230 hp
- Engine: lycoming IO-540-AB-1A5
- Maximum speed: 269 Km/h
- Range: 1695 Km
- Price: 277 300 \$

Robinson R44



- Height: 3,3 m
- Rotor diameter: 10,1 m
- Length: 11,7 m
- Max Take-Off Weight: 1089 Kg
- Power: 248 hp
- Engine: lycoming IO-540-AE1A5
- Maximum speed: 240 Km/h
- Range: 560 Km
- Price: 456 000 \$

X3 airbus



Osprey V22



Cessna TTX



- Height: 2,74 m
- Wingspan: 10,97 m
- Length: 7,68 m
- Max Take-Off Weight: 1633 Kg
- Power: 310 hp
- Engine: turbo TSIO-550-c
- Maximum Speed: 435 Km/h
- Range: 2315 Km
- Price: 733 950 \$

Agusta Westland AW609



- Height: 5,1-6,6 m
- Wingspan: 11,7 m
- Length: 13,3 m
- Max Take-Off Weight: 7200 Kg
- Power: 1900 hp
- Engine: Pratt & Whitney Canada PT6C-67A
- Maximum speed: 616 Km/h
- Range: 1390 Km
- Price: 10 000 000 \$

Airbus H160



Aeromobil 3.0



- Height: 1,50 m
- Wingspan: 8,32 m
- Length: 6 m
- Power: 81 hp
- Engine: rotax 912
- Maximum speed: 200 Km/h
- Range: 700 Km

Ecureuil



X2



Other innovative projects



Trifan 600 XTI (2015)



Helium (2016)



Agusta Westland
Zero (2015)



Airbus E-fan (2015)



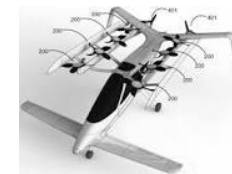
E-volo (<2014)



eHang (fin 2015)



Kitty Hawk (2016)



zee.aero (2016)



Joby (2016)



Moler skycar
(<2016)



Urban aeronautics
(<2016)



Xplorair (2016)



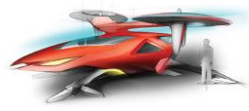
Lilium (2016)



SoloTrek Springtail



Airbus (2016)



Boeing (2016)



Macro industrie (2016)



Airbus Vahana (2016)



Trekaero.com



Mini-Bee (2016)

Mini-Bee

2 PAX VIP Hybrid Octocopter



TECHNOPLANE

MINIBEE

HAMZA FOUATIH © LESSER OPEN BEE LICENSE 1.3

Lesser Open Bee License 1-3

TECHNOPLANE

AERONAUTICAL INNOVATION



oséo

Prêt à la Création d'Entreprise



PLACIS



POLITECNICO DI TORINO



Le bon sens a de l'avenir.



CCI NORMANDIE



Ecole Internationale des Sciences du Traitement de l'Information



Ecole Nationale Supérieure de l'Electronique et de ses Applications



INSA

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES ROUEN



MINI BEE

PERSONAL AIRCRAFT

32

www.mini-bee.com

v8.14 – 14 Dec. 2016
Copyrights Technoplane SAS