

Drive your Aircraft !



MINI BEE

PERSONAL AIRCRAFT

Mini-Bee Plane - Agenda

- Problem
 - Solution
 - Market
 - Description
 - Team / Partners
 - Key Success drivers
-
- Configurations
 - Modular structure
 - Project state and actions
- Annexes :
- State of the art
 - Other innovative projects



Problem of air transportation

Problems

Length of
runways

High **cost** per
hour (>300\$/h)

Lack of
autonomy

Complex
interface

Existing vehicules



Needs

Speed over
200km/h

Vertical Take-Off
and Landing (VTOL)

Low cost of
operation

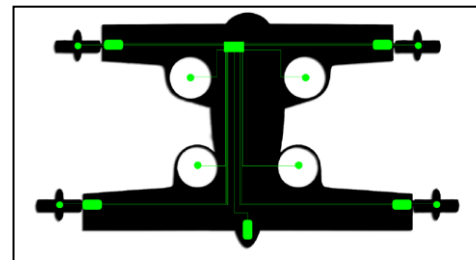
Easy to drive
as a car

Solutions

VTOL aircraft



Hybrid
propulsion



« Car-Like »
interface



Mini-Bee Plane – Hybrid VTOL



Mini-Bee Plane – At a glance

Range



Low costs



Security & Noise



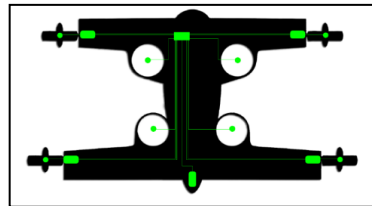
Flight path management



Collaborative project



Easy maintenance



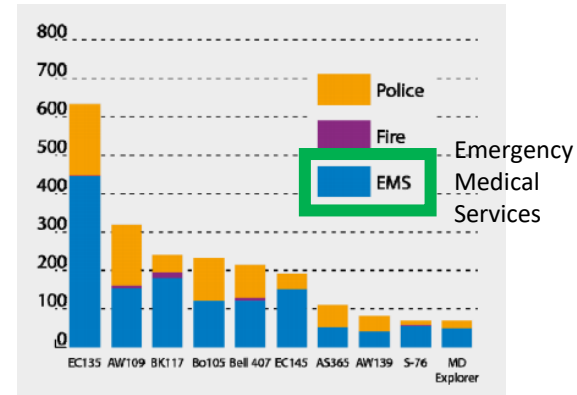
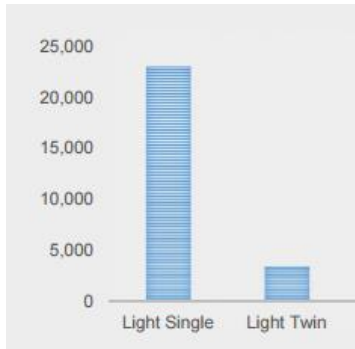
Autonomy



Driving experience

Helicopter Market

Helicopter deliveries : ~500 / year

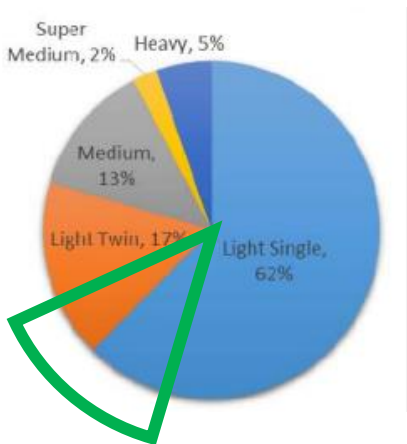


Annual Fleet Utilization

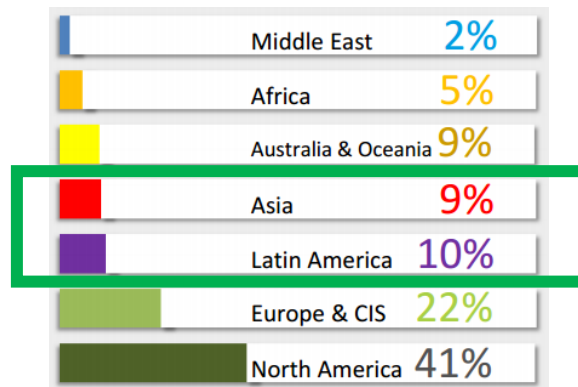
VEHICLE TYPES	VEHICLE HOURS (1,000)	VEHICLE MILES (MILLION)	PASSENGER MILES (MILLION)	AVERAGE ANNUAL FATALITIES
PASSENGER CARS	50,300,000	1,510,000	2,340,000	14,701
PART 121 AIRLINES	18,600	7,891	579,000	16
PART 135 AIR TAXI	2,100	375	1,500	18
MOTORCYCLE	600,000	18,000	19,800	4,809
GENERAL AVIATION	22,400	3,370	6,740	511

* Data is US only

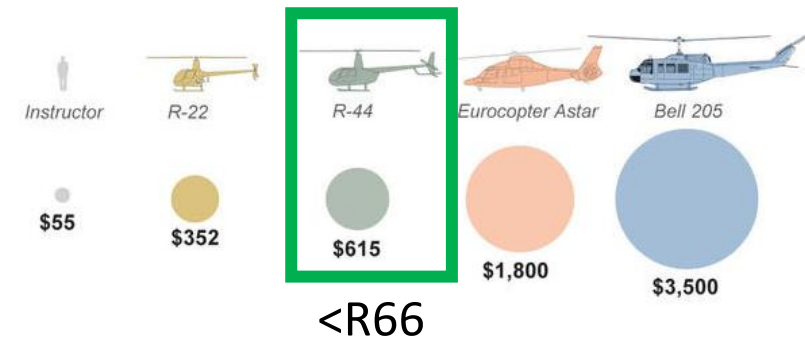
Deliveries per categories



Fleet per continent



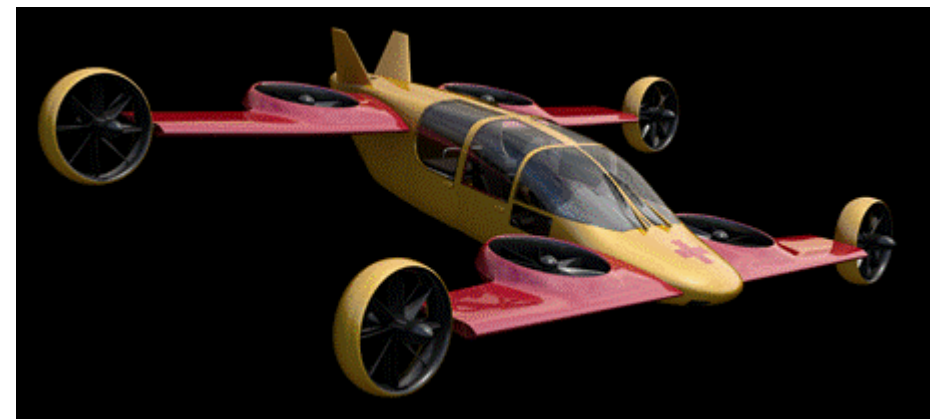
Training cost per hour



First market target : EMS in Asia

Mini Bee Plane - Description

- Project state : TRL3
 - Electric octocopter : 4 vertical + 4 tilt
 - Hybrid energy : fuel + batteries
 - 2 to 4 seats (driver included)
 - CS 27 multi-rotors certification
- Characteristics :
 - VTOL, short wings, 1.2 ton
 - Range 500km, cruise speed 250 km/h
 - Electric controls and engines
 - « Car like » interface
- Goals and market
 - Air Ambulance ; then VIP, Taxi, Sport
 - Estimated price 1m€ (0,7 to 2m€)



Mini Bee Plane - Team / Partners

Lesser Open Bee
License 1-3

Coordinator :



Academic partners :



POLITECNICO
DI TORINO



Project started in 2015
with 4 universities



Institution & financial partners :



Le bon sens a de l'avenir.



Industrials : **VOLUM-e**
3DComplexProduction



LOI Industrial : **Ingeliance**



Design:



Mini-Bee Plane - Project Tasks

Lesser Open Bee
License 1-3

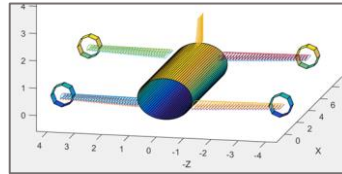
Aircraft Design



TECHNOPLANE
AERONAUTICAL INNOVATION



Aeronautical simulation



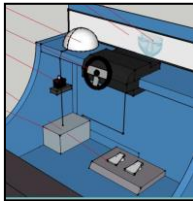
Scale Mock-up



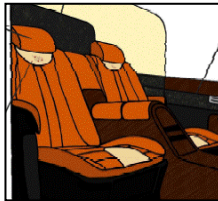
Marketing



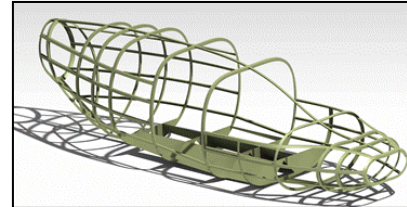
HM Interface



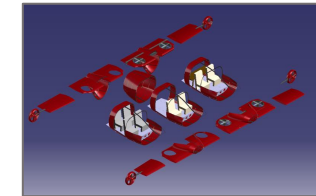
Usages



Structure



Modular conception



Landing gear
soben



Rotors

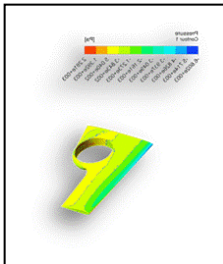


Tilt

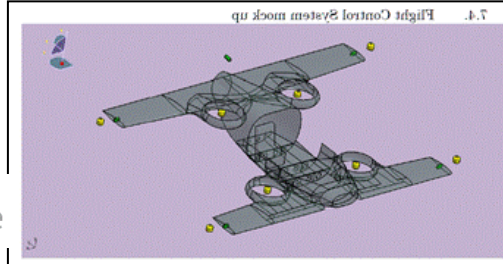


Seats

Simulation



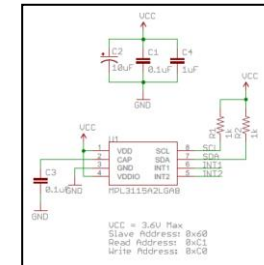
Equipements



POLITECNICO DI TORINO



Sensor Integration



Harness



3D Metal printing

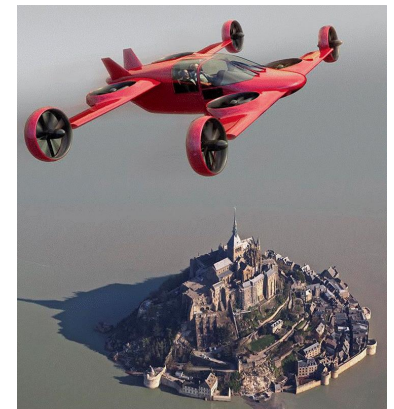


Electronics



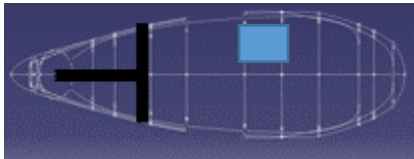
Mini-Bee Plane – Key success drivers

- **Lesser open source** license is key to :
 - A **low cost** structure that will drive project and product cost down
 - An **agile** project methodology that will achieve disruptive innovation and **quick** project implementation
- Highly **collaborative project** allows :
 - **Long term relationship** between SME, academics and large industrial groups that is necessary for a new air transportation design and network
 - **Disruption** of air transportation with existing players
 - To build the **first** hybrid VTOL multicopter project in France
- Project based **in Normandy** will benefit from :
 - A large industrial aeronautical network with all core **competences** for the project
 - The developpement of regional **air traffic** (professionnal and tourist) with a high number of private landing fields
 - Airports close to an international maritime port with a low cost and worldwide efficient **supply chain**

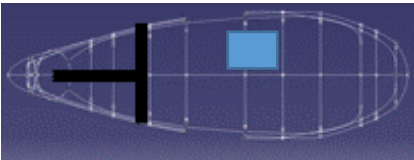


Mini-Bee Plane - Configurations

Sport

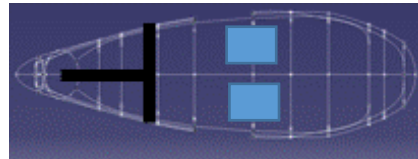


Utilities



1 PAX
Power

VIP



* Driver included



2 PAX*
Weight

Ambulance

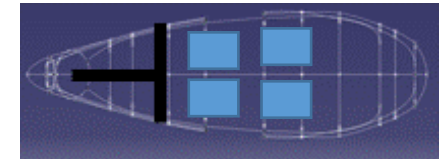


1srt market



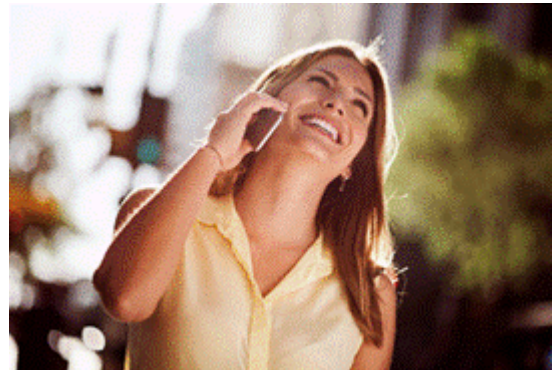
3 PAX
Volum

Taxi



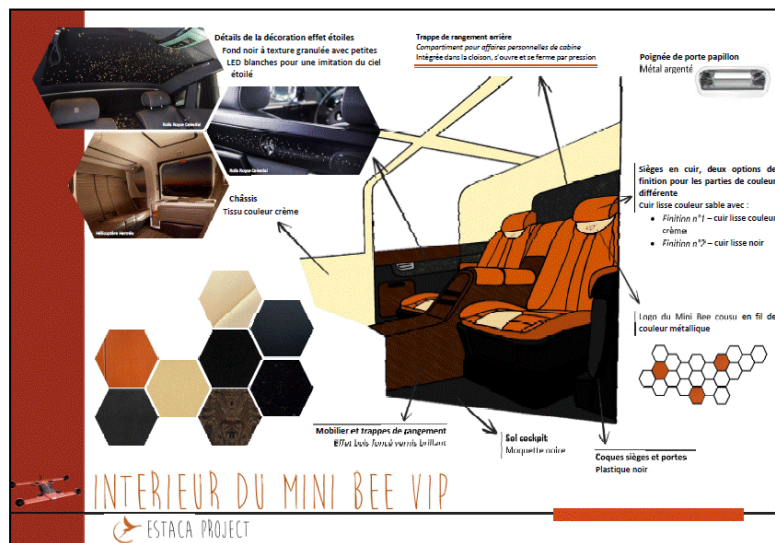
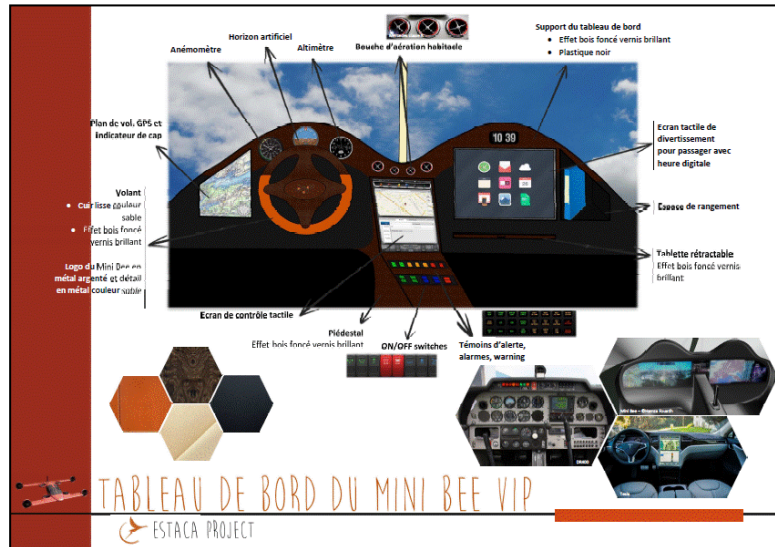
4 PAX
Seats

Mini Bee Plane - Taxi configuration



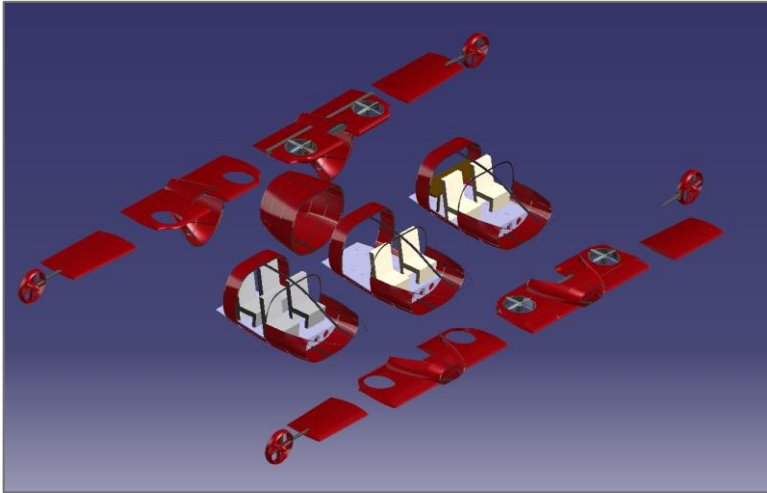
4 PAX (light), shorts wings, fixed landing gear

Mini Bee Plane - VIP Configuration

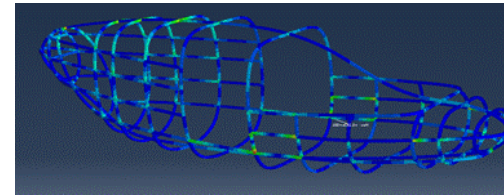


2 PAX (heavy)
Long wings
Retractable landing gear

Mini Bee Plane - Structural architecture



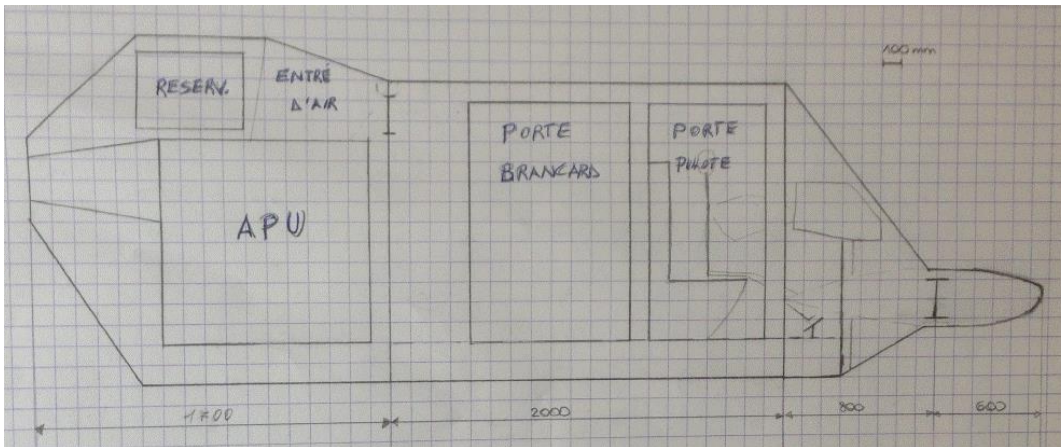
Estaca 2017



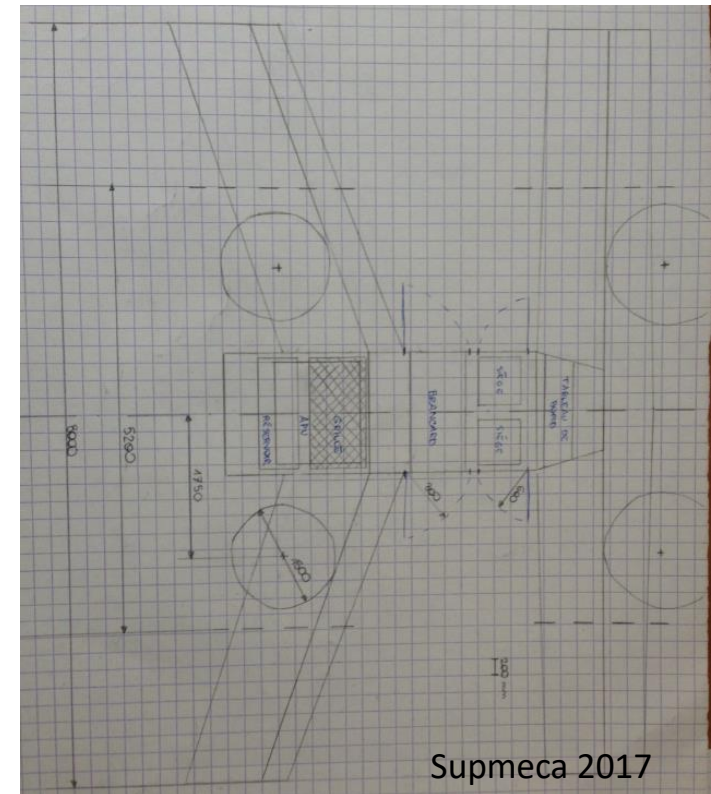
Supmeca 2017



Ensta Bretagne 2017

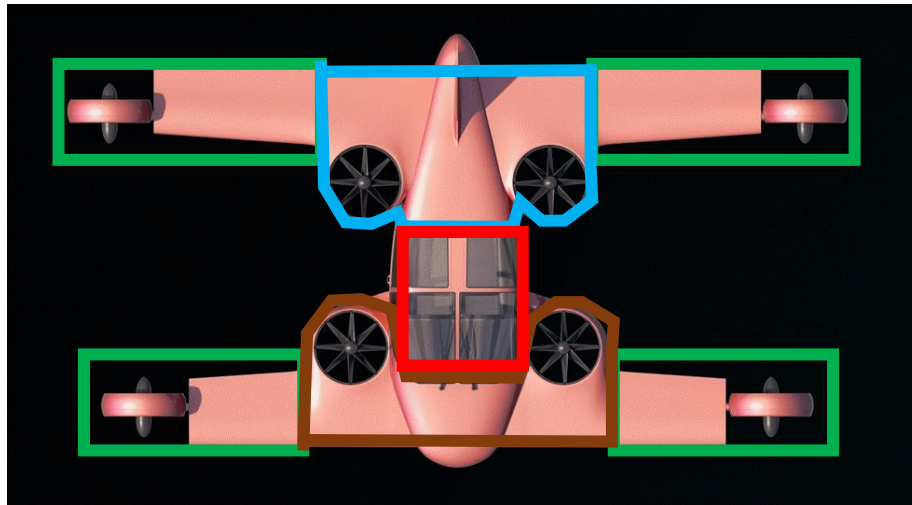


Supmeca 2017



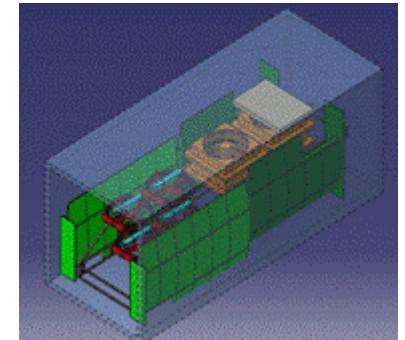
Supmeca 2017

Mini Bee Plane - Modular structure



Production, delivery
and MRO optimization

Delivery in 20' Container



Estaca 2017

Flight
configurations

Taxi :

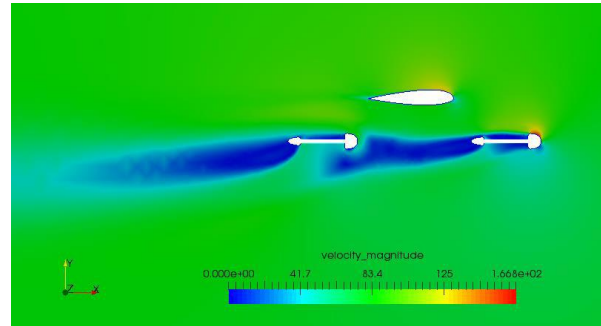
- VTOL Short intra city
- Short wings, high NACA
- Vertical central engines
- Fixed landing gear

VIP :

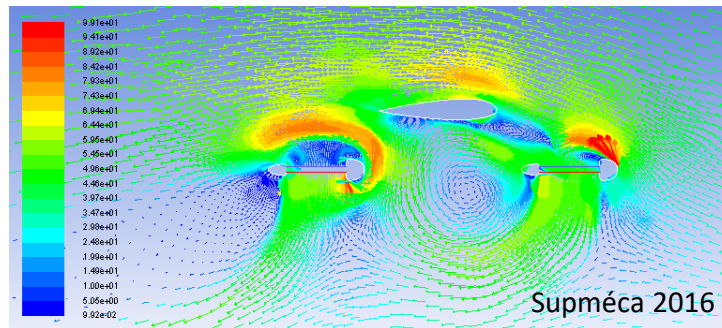
- VTOL + cruise
- Longuer wings
- Fuel capacities
- Retractable landing gear

Take-off and flight transition

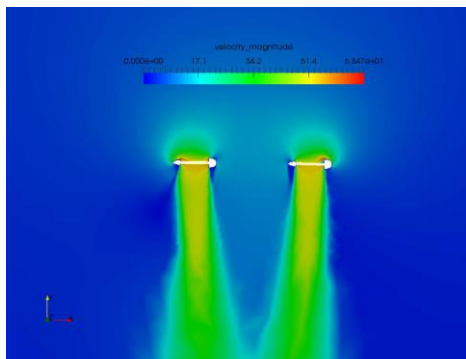
Cruise
flight



Tilt
transition



Vertical
take-off



Actions for Mini-Bee TRL3 Project

- Mini Bee Plane TRL3
 - Fly a scale model with engine's configuration (tilt in flight)
 - Achieve a scale 1:1 prototype for Le Bourget Air Show 2019
 - Refine detailed technical and equipment configuration
 - Evaluate market opportunities, production and flight costs
 - Define partnership for TRL4
 - Draw project financial path
 - Investigate for VC funding
- Mini Bee Plane TRL4
 - Launch at Le Bourget Air Show in June 2019

Financial project path

TRL	Status	Start	End	Amount (K€)	Universities	Industrials	Steps
0	Finished	2014	2015	20	3	0	Basic mock-up
1	Finished	2015	2016	50	6	0	Detailed concept
2	Finished	2016	2017	200	12	4	Scale Model
3	In Process	2017	2019	2 000			Proto
4				5 000			
5				10 000			First flight
6				15 000			Test flights
7				20 000			Final devs
8				25 000			Qualification
9				25 000			Sales / Operations
MRO				-			Support

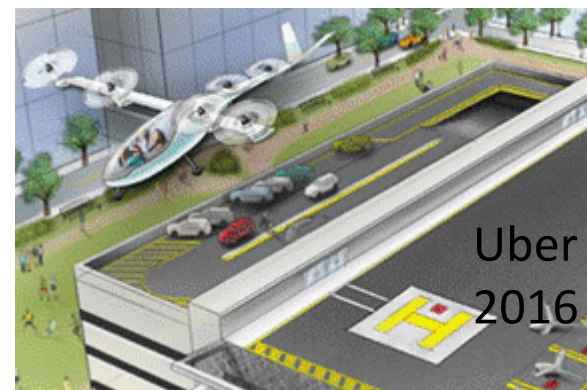
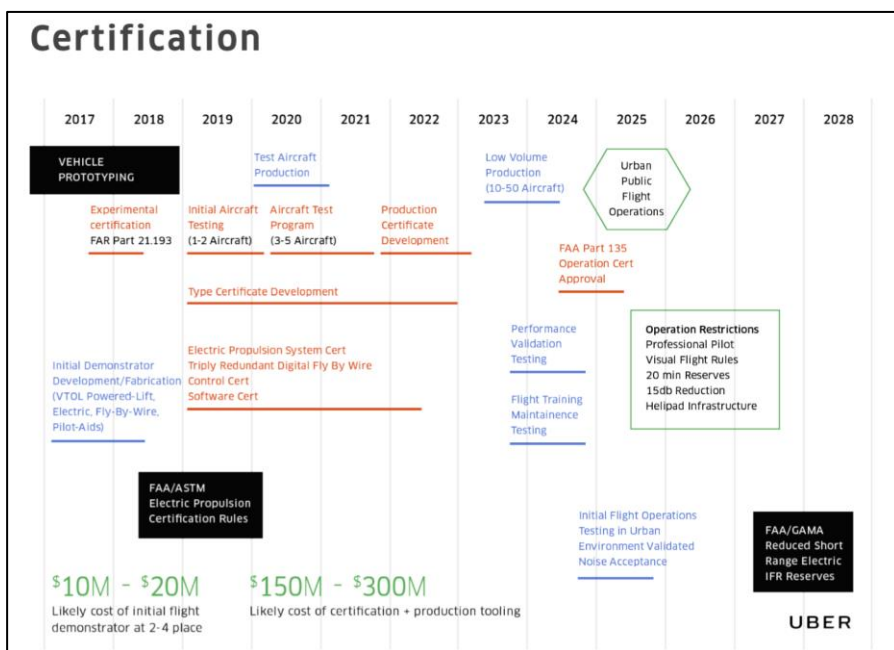
Estimated overall project 100m€

Actual funding step : **Seed Capital** 2m€ to 4 m€

Annexes

Individual Air Vehicules

Uber Elevate planning



VTOL Assumptions	PILOTING COSTS	VEHICLE PRICE (4-person, without battery)	BATTERY COST (140kWh, 2000 cycles)
INITIAL Existing helicopter production (100 vehicles/yr)	\$75K/yr Professional helicopter pilot @ \$50k/year with 1.5 pilots per vehicle	\$1.2M Lamborghini-like produc- tion rate (100/year)	\$56K @ \$400/kWh Current high-performance battery costs
NEAR-TERM Best current manufacturing near-term case	\$75K/yr Professional helicopter pilot @ \$50k/year with 1.5 pilots per vehicle	\$600K Best recent helicopter production rate (500/year)	\$28K @ \$200/kWh DOE near-term high-perfor- mance battery costs
LONG-TERM Aggressive, long-term case	\$60K/vehicle Autonomous avionics kit to replace pilot	\$200K Specialty car-like produc- tion rate (5000/year with production tooling)	\$14K @ \$100/kWh DOE longer-term high-per- formance battery costs

UBER

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 \$

Ecureuil



Airbus H160



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 \$

Hughes/MD 500 series



Advanced Tactics (2016)



Osprey V22



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

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 \$

X3 airbus



Pipistrel



Mooney



Elytron



X2



Other innovative projects



Trifan 600 XT1 (2015)



Helium (2016)



Agusta Westland Zero (2015)



Airbus (2017)



Terrafugia (<2015)



Pal-V (2015)



Airbus E-fan (2015)



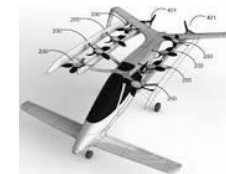
E-volo (<2014)



eHang (fin 2015)



Kitty Hawk (2016)



zee.aero (2016)



Joby (2016) ~ 100m€



Moler skycar (<2016)



Urban aeronautics (<2016)



Xplorair (2016)



Lilium (2016) ~100m€



SoloTrek Springtail



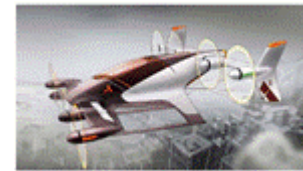
Airbus (2016)



Boeing (2016)



Macro industrie (2016)



Airbus Vahana (2016)



Trekaero.com



Olympus (2016)



Mini-Bee (2016)

Mini-Bee

Hybrid Octocopter

