

Drive your Aircraft !



MINI BEE

PERSONAL AIRCRAFT

Agenda - Mini Bee Plane

- Problem
 - Solution
 - Market
 - Description
 - Project Tasks
 - Team / Partners
-
- Cabine 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)

Lake of
autonomy

Complex
interface

Existing vehicules



Needs

Speed over
200km/h

Vertical Take-Off
and Landing (VTOL)

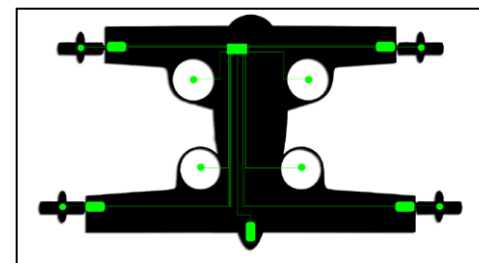
Low cost of
operation

Easy to drive
as a car

Solutions



VTOL aircraft



Hybrid
propulsion



« Car-Like »
interface

Mini-Bee Plane - 2PAX VTOL Hybrid



Mini-Bee – At a glance

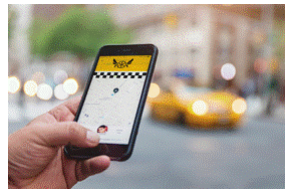
Range



Low costs



Security



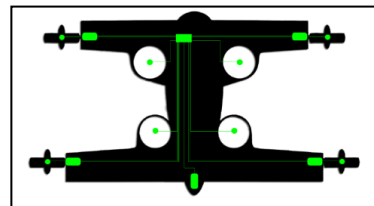
Flight path management



Collaborative project



Easy maintenance



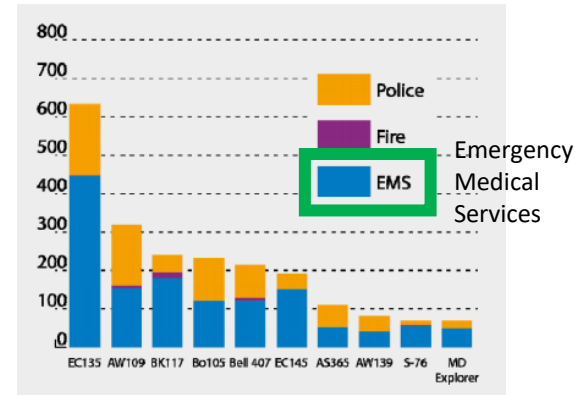
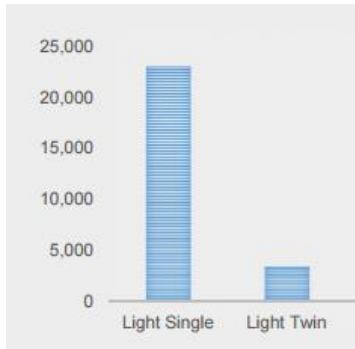
Autonomy



Driving experience

Helicopter Market

Helicopter deliveries : ~500 / year

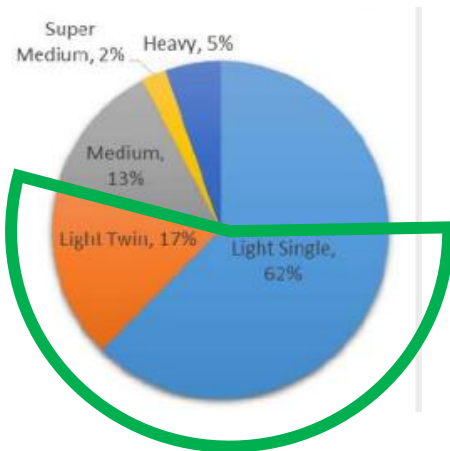


Annual Fleet Utilization

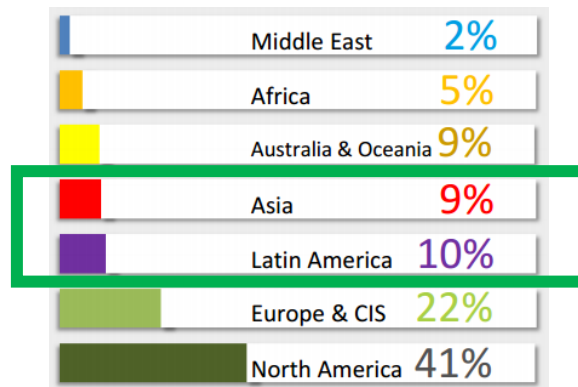
VEHICLE TYPES	VEHICLE HOURS (1,000)	VEHICLE MILES (MILLION)	PASSENGER MILES (MILLION)	AVERAGE ANNUAL FATALITIES
PASSENGER CARS	50,300,000	1,510,000	2,340,000	14,701
PART 121 AIRLINES	18,600	7,891	579,000	16
PART 135 AIR TAXI	2,100	375	1,500	18
MOTORCYCLE	600,000	18,000	19,800	4,809
GENERAL AVIATION	22,400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

* Data is US only

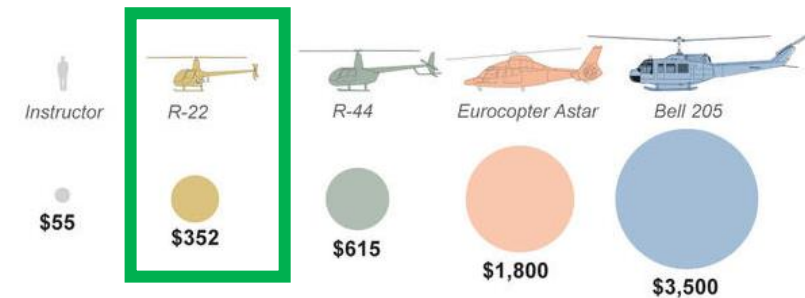
Deliveries per categories



Fleet per continent



Training cost per hour



First market target : EMS in Asia

Mini Bee Plane - Description

- Project state : TRL2
 - Electric octocopter : 4 vertical + 4 tilt
 - Hybrid energy : fuel + batteries
 - 2-4 seats
- Characteristics :
 - VTOL capacity, short wings, 1.2 ton
 - Range 600km, max speed 300km/h
 - Electric controls and engines
 - « Car like » interface
- Goals and market
 - VIP, Taxi, Air Ambulance
 - Estimated price 1m€ (0,7 to 2m€)



Mini Bee Plane - Team / Partners

Lesser Open Bee
License 1-3

Coordinator :



Universities :



POLITECNICO
DI TORINO



Institution & financial partners :

Industrials : **VOLUM-e**
3DComplexProduction



LOI Industrial :



Design:



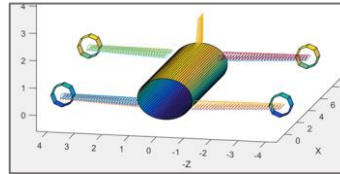
Mini Bee Plane - Project Tasks

Lesser Open Bee
License 1-3

Aircraft Design



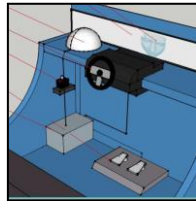
Aeronautical simulation



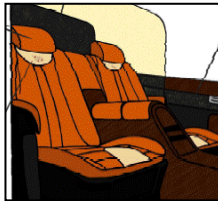
Scale Mock-up



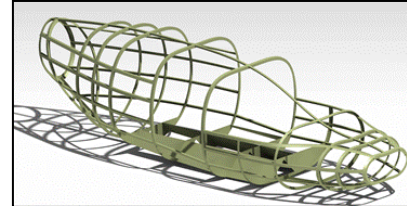
HM Interface



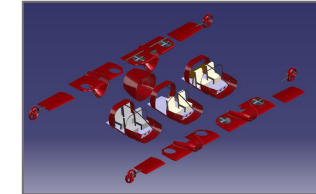
Usages



Structure



Modular conception



Landing gear



Rotors

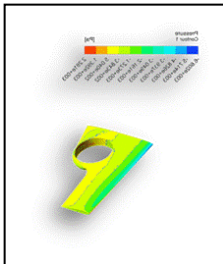


Tilt

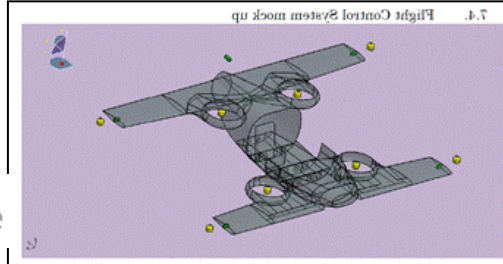


Seats

Simulation



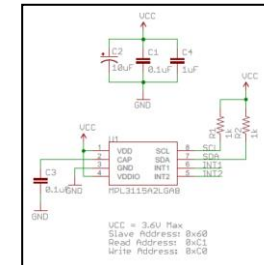
Equipements



POLITECNICO DI TORINO



Sensor Integration



Harness



3D Metal printing

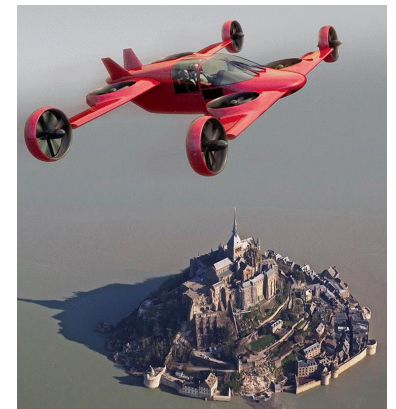


Electronics

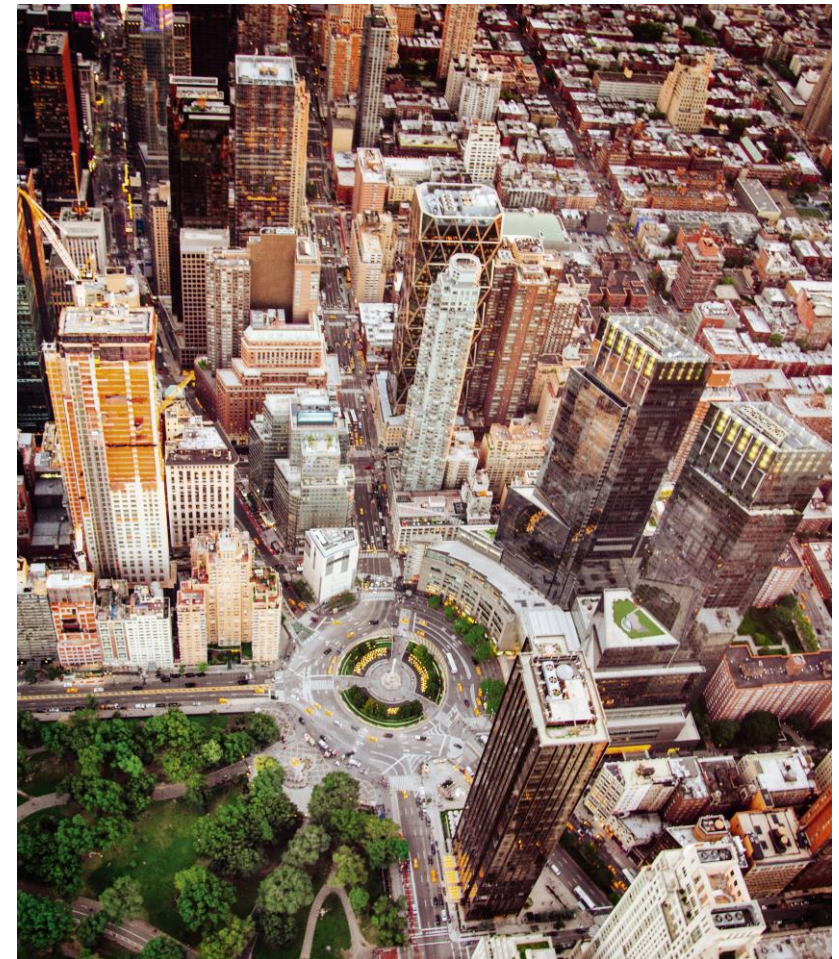


Why Mini-Bee Plane project ?

- 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**

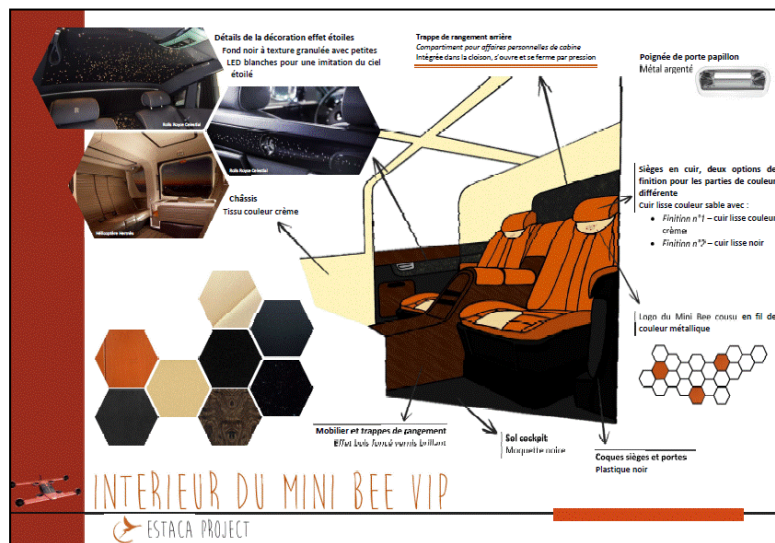
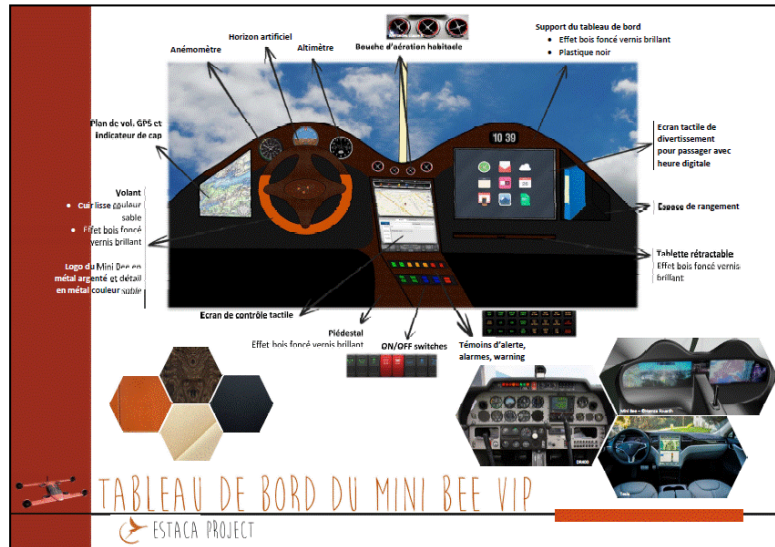


Mini Bee Plane - Taxi configuration



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

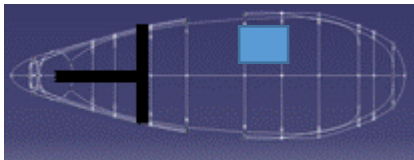
Mini Bee Plane - VIP Configuration



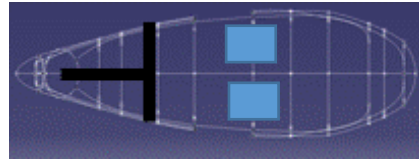
2 PAX (heavy)
Long wings
Retractable landing gear

Mini Bee Plane - Cabine configurations

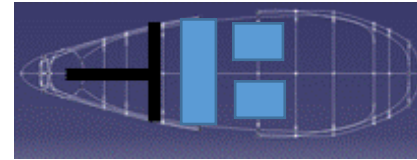
Sport



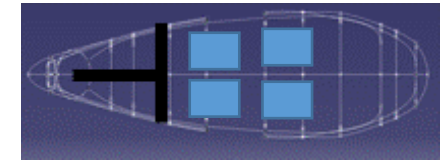
VIP



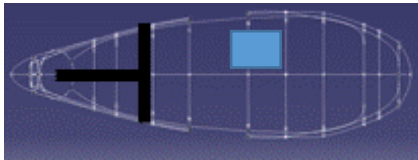
Ambulance



Taxi



Utilities



1 PAX



2 PAX

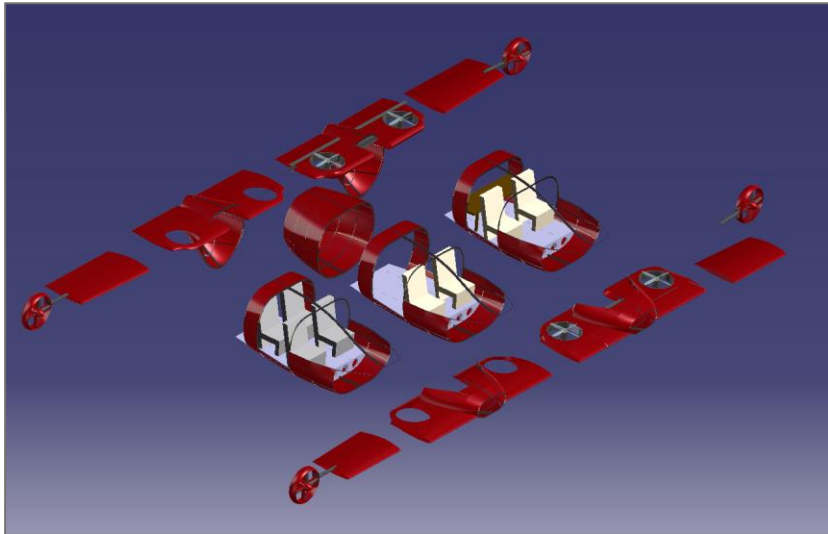


3 PAX



4 PAX (light)

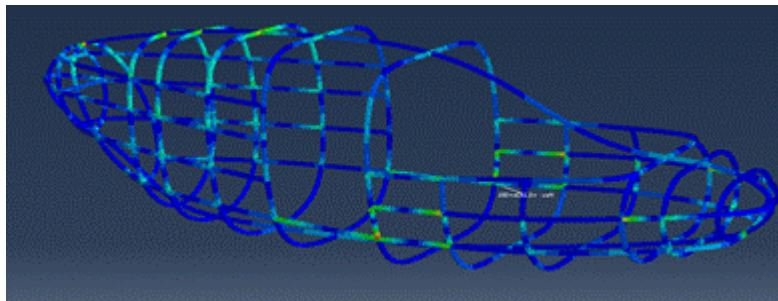
Mini Bee Plane - Structural architecture



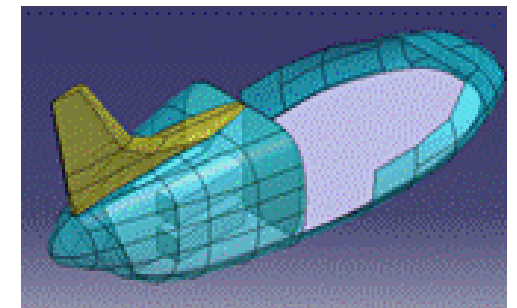
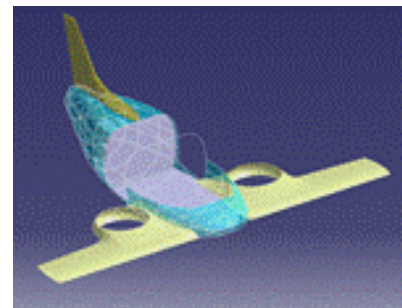
Estaca 2017



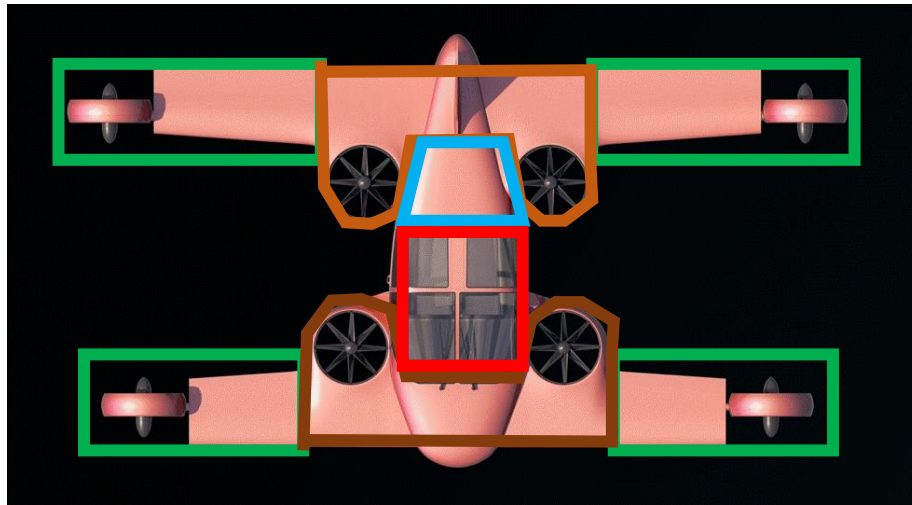
Ensta Bretagne 2017



Supmeca 2017

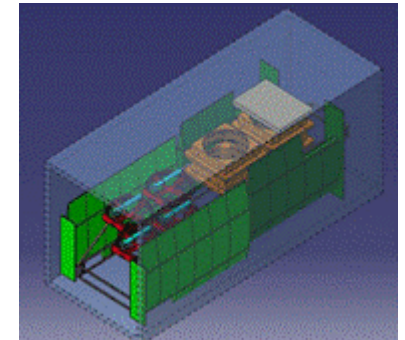


Mini Bee Plane - Modular structure



Production, delivery
and MRO optimization

Delivery in 20' Container



Estaca 2017

2 main flight
configurations

Taxi :

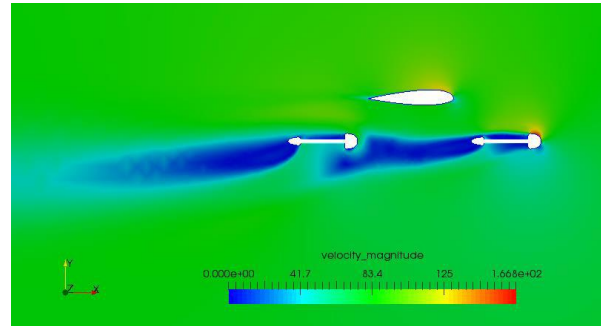
- VTOL Short intra city
- Short wings, high NACA
- Vertical central engines
- Fixed landing gear

VIP :

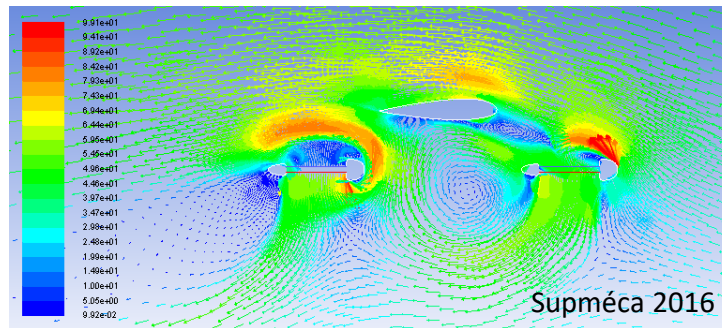
- VTOL + cruise
- Longuer wings
- Fuel capacities
- Retractable landing gear

Take-off and flight transition

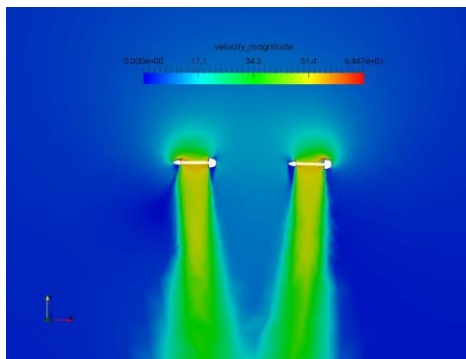
Cruise
flight



Tilt
transition



Vertical
take-off



Actions for Mini-Bee TRL2 Project

- Mini Bee Plane TRL2
 - Scale model with engine's configuration
 - Refine detailed technical and equipment configuration
 - Evaluate market opportunities, production and flight costs
 - Define partnership for TRL3
 - Draw project financial path
 - Investigate for seed funding
- Mini Bee Plane TRL3
 - Launch at Le Bourget Air Show in june 2017

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

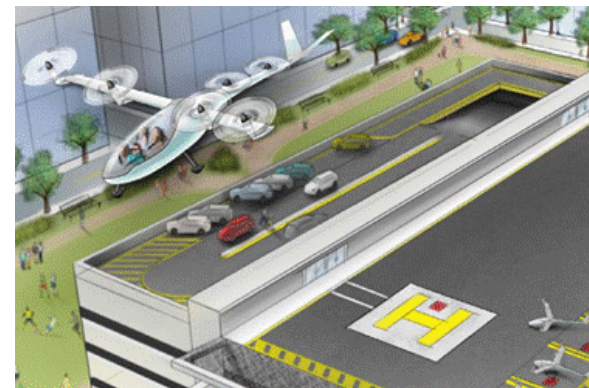
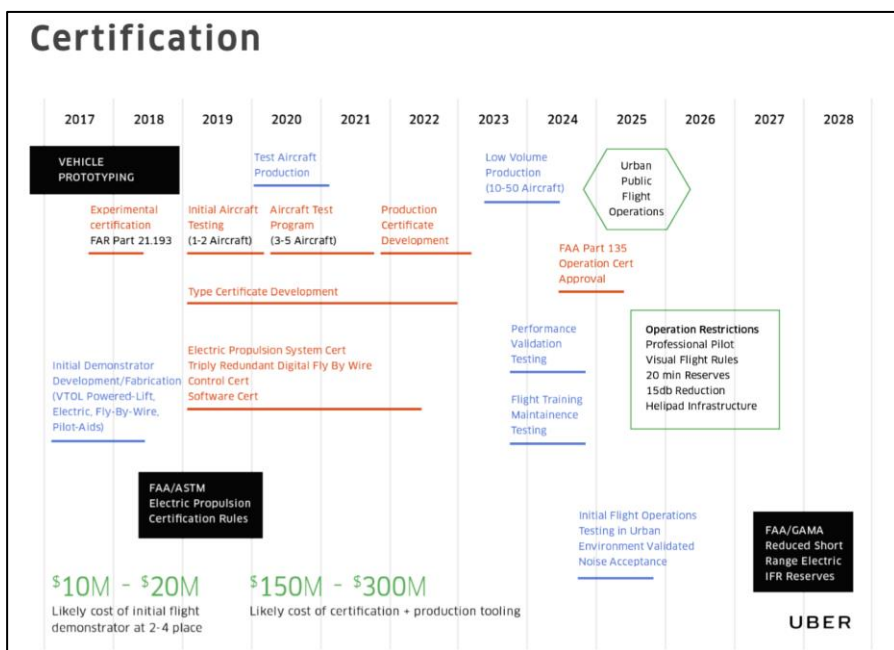
Estimated overall project 100m€

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 \$

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 \$

Hughes/MD 500 series



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

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 \$

Ecureuil



X2



Other innovative projects



Trifan 600 XT1 (2015)



Helium (2016)



Agusta Westland
Zero (2015)



Airbus (2017)



Pal-V (2015)



Airbus E-fan (2015)



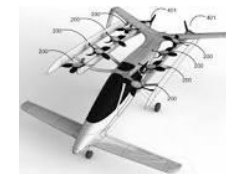
E-volo (<2014)



eHang (fin 2015)



Kitty Hawk (2016)



zee.aero (2016)



Joby (2016) ~ 100m€



Moler skycar
(<2016)



Urban aeronautics
(<2016)



Xplorair (2016)



Lilium (2016) ~10m€



SoloTrek Springtail



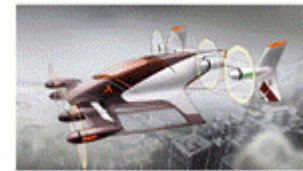
Airbus (2016)



Boeing (2016)



Macro industrie (2016)



Airbus Vahana (2016)



Trekaero.com



Olympus (2016)



Mini-Bee (2016)

Mini-Bee

Hybrid Octocopter

