

Drive your Aircraft !



MINI BEE

PERSONAL AIRCRAFT

Agenda Mini-Bee

- 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

Needs

Speed over
200km/h

Vertical Take-Off
and Landing (VTOL)

Low cost of
operation

Easy to drive
as a car

Existing vehicules



Problems

Length of
runways

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

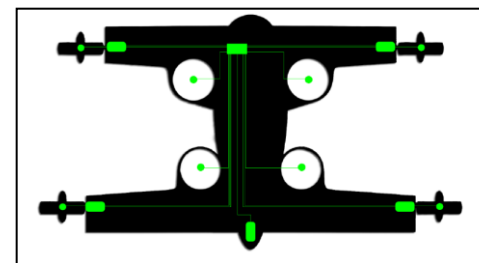
Lack of
autonomy

Complex
interface

Solutions



VTOL aircraft



Hybrid
propulsion



« Car-Like »
interface

Mini-Bee 2PAX VTOL Hybrid



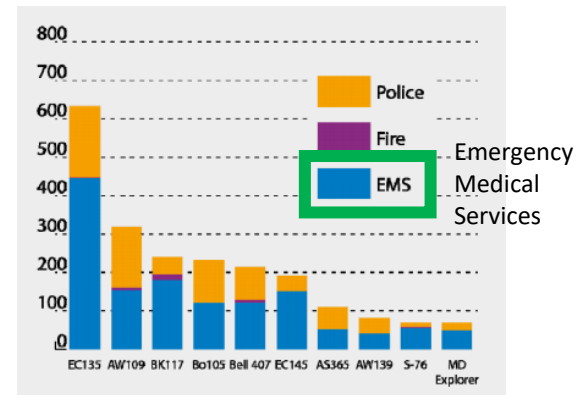
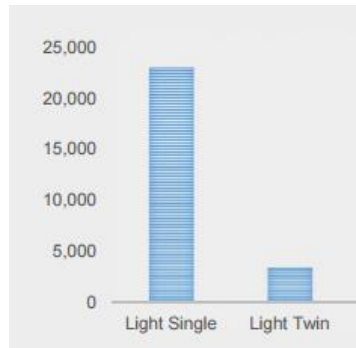
TECHNOPLANE

MINIBEE

HAMZA FOUATIH © LESSER OPEN BEE LICENSE 1.3

Helicopter Market

Helicopter deliveries : ~500 / year



Annual Fleet Utilization

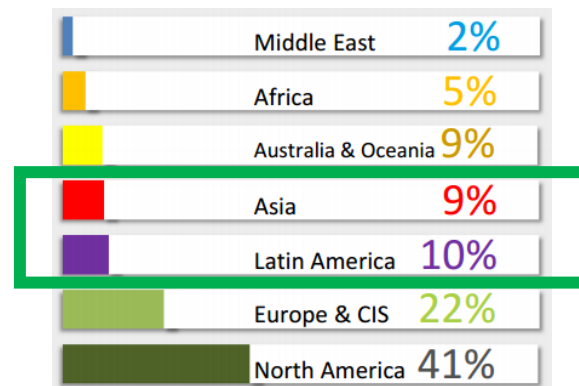
VEHICLE TYPES	VEHICLE HOURS (1,000)	VEHICLE MILES (MILLION)	PASSENGER MILES (MILLION)	AVERAGE ANNUAL FATALITIES
PASSENGER CARS	50,300,000	1,510,000	2,340,000	14,701
PART 121 AIRLINES	18,600	7,891	579,000	16
PART 135 AIR TAXI	2,100	375	1,500	18
MOTORCYCLE	600,000	18,000	19,800	4,809
GENERAL AVIATION	22,400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

* Data is US only

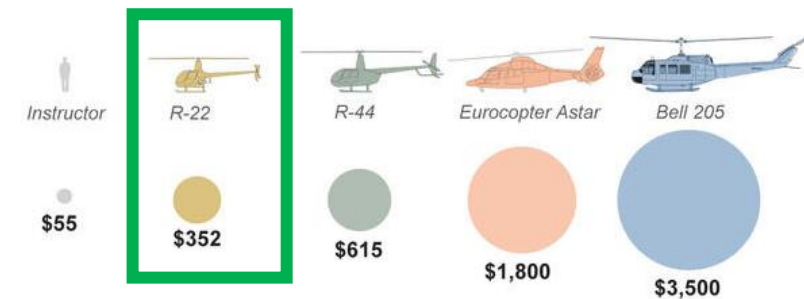
Deliveries per categories



Fleet per continent

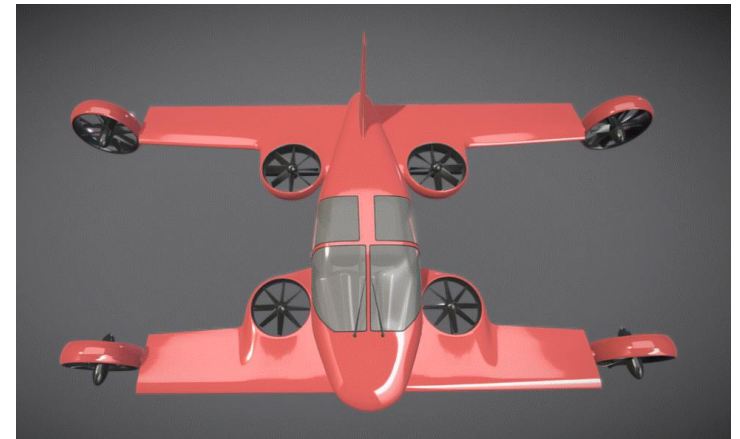
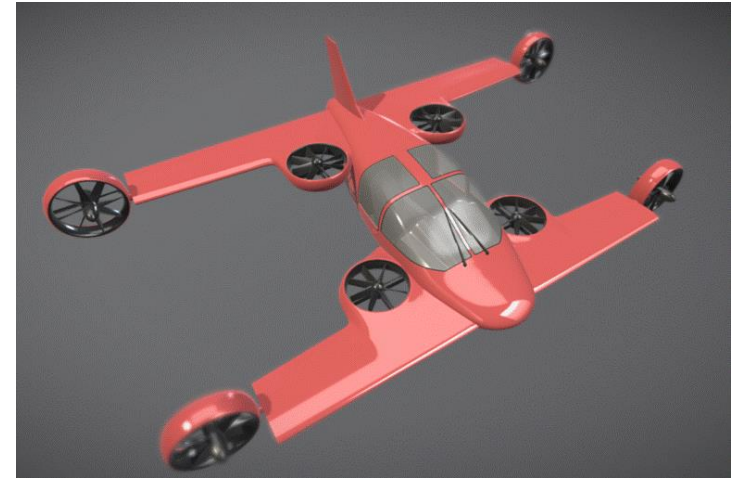


Training cost per hour



Mini-Bee 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€)



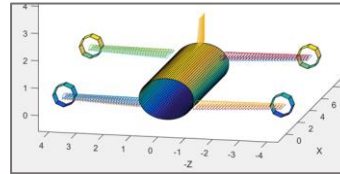
Project Tasks

Aircraft Design



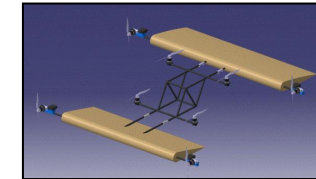
TECHNOPLANE
AERONAUTICAL INNOVATION

Aeronautical simulation



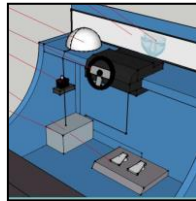
CentraleSupélec

Scale Mock-up



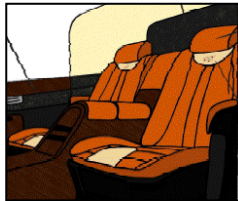
ENSTA
Bretagne

HM Interface



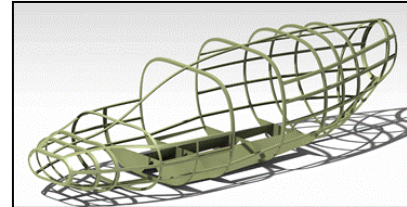
ENSEA
Ecole Nationale Supérieure de l'Electronique et de ses Applications

Usages



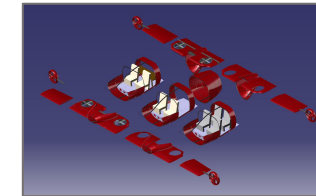
ESTACA
ÉCOLE D'INGÉNIEURS
Groupe ISAE

Structure



supméca
CPM
INDUSTRIES

Modular conception



ESTACA
ÉCOLE D'INGÉNIEURS
Groupe ISAE



Landing gear



Rotors

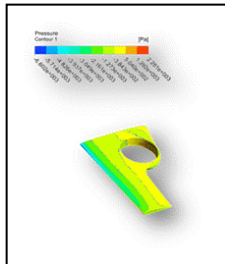


Tilt

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES ROUEN

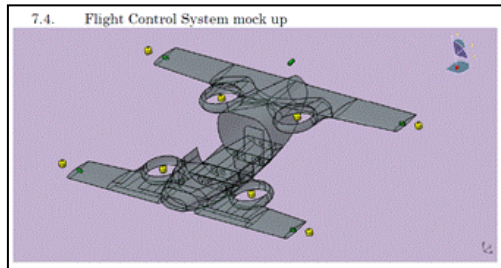
Seats

Simulation



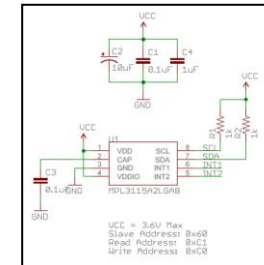
supméca

Equipements



POLITECNICO DI TORINO

Sensor Integration



Harness

TECHNO MAP

Team / Partners

Lesser Open Bee
License 1-3

Coordinator :



Universities :



POLITECNICO
DI TORINO



Institution & financial partners :

LOI Industrial :



Design:

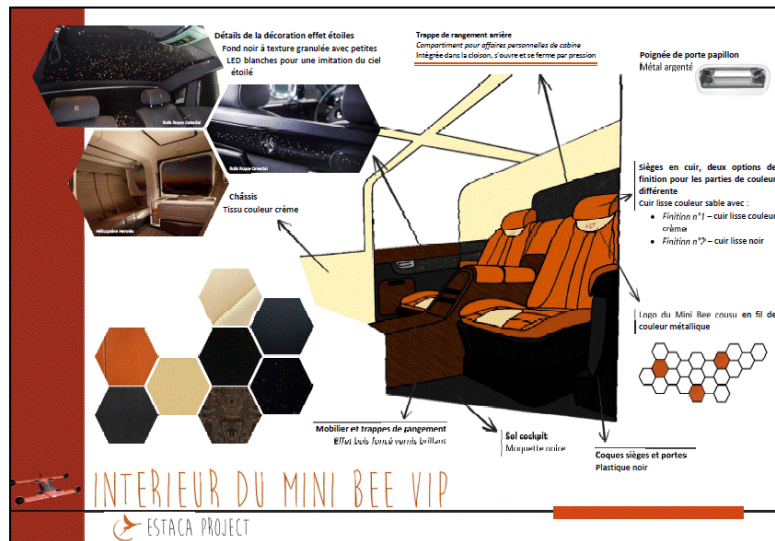
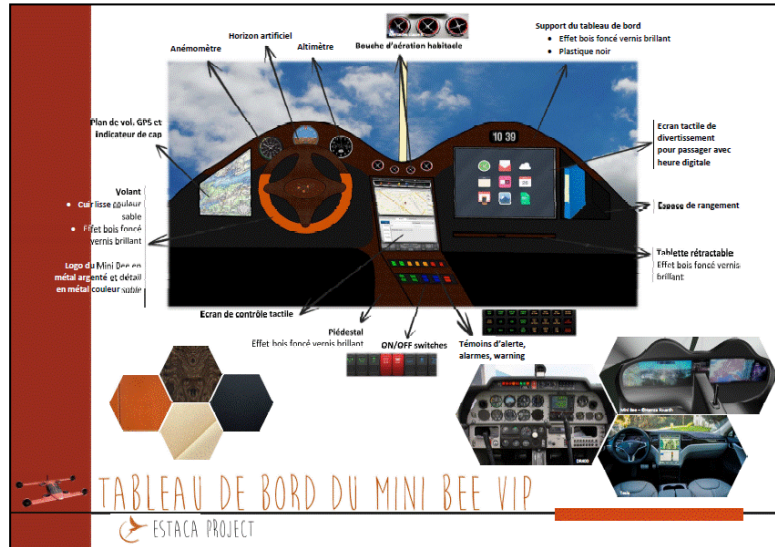


Taxi configuration



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

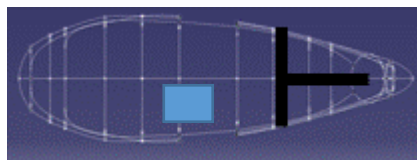
VIP Configuration



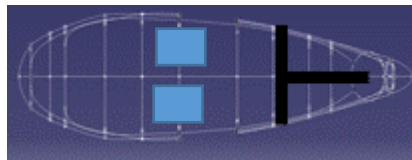
2 PAX (heavy)
Long wings
Retractable landing gear

Cabine configurations

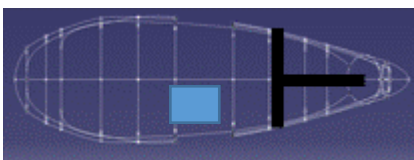
Sport



VIP



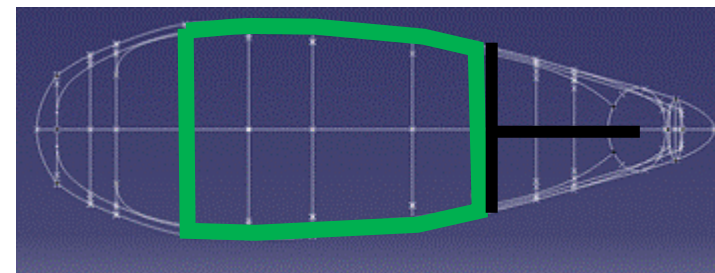
Utilities



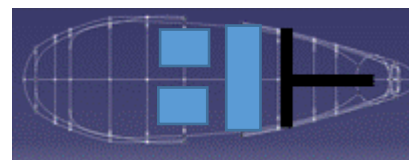
1 PAX



2 PAX

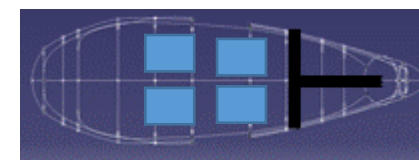


Ambulance



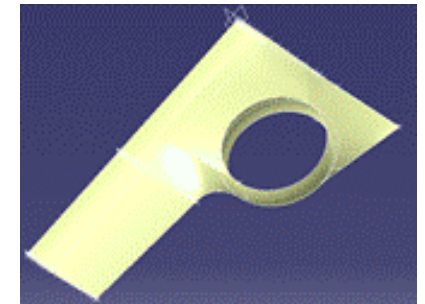
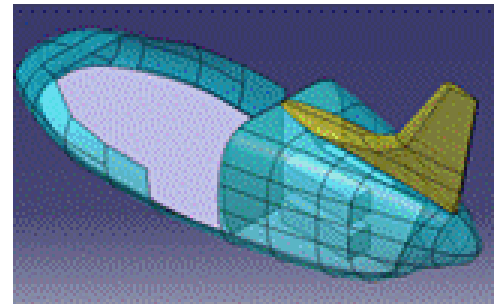
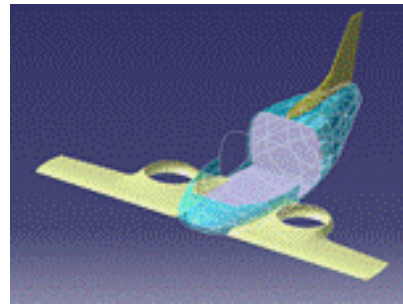
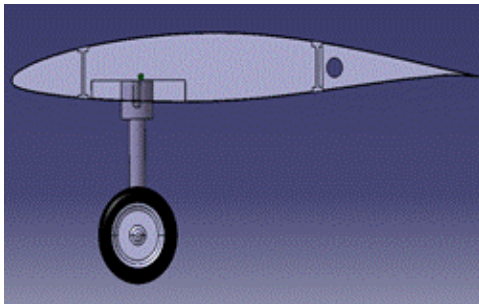
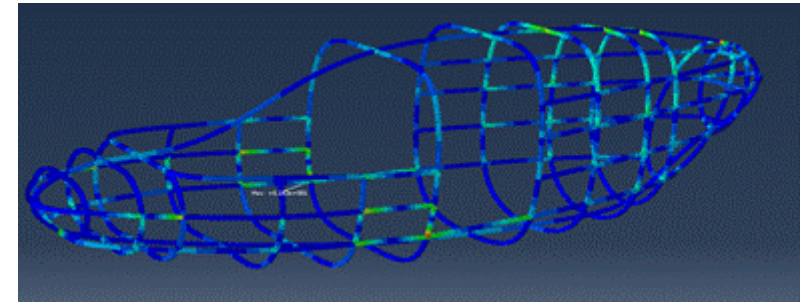
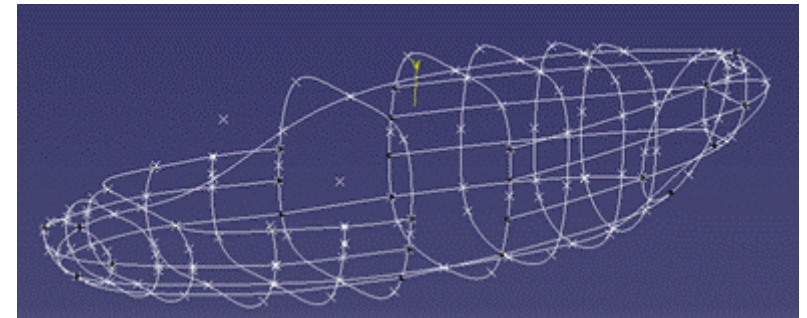
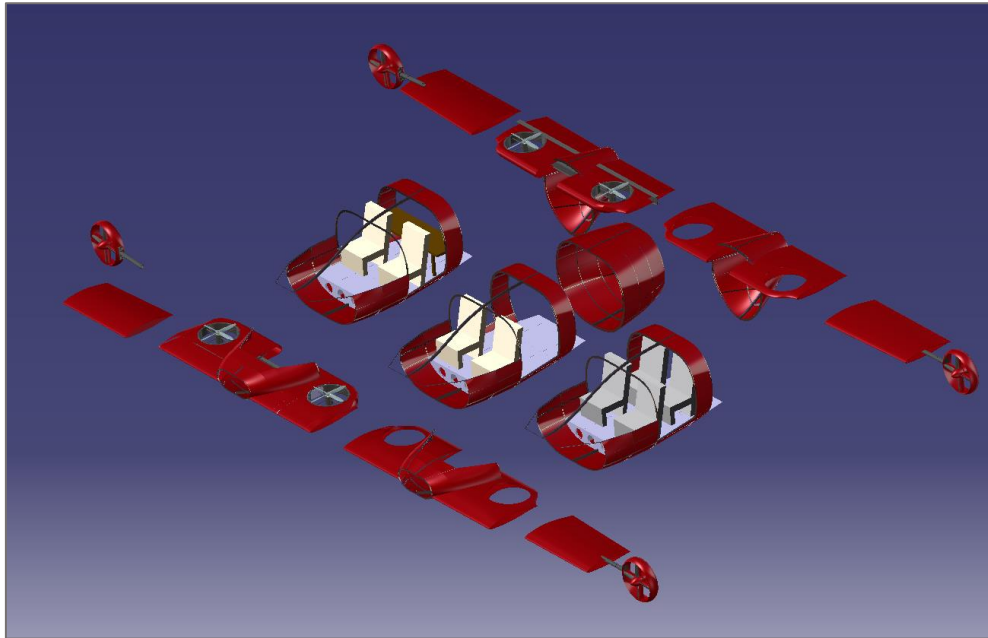
3 PAX

Taxi

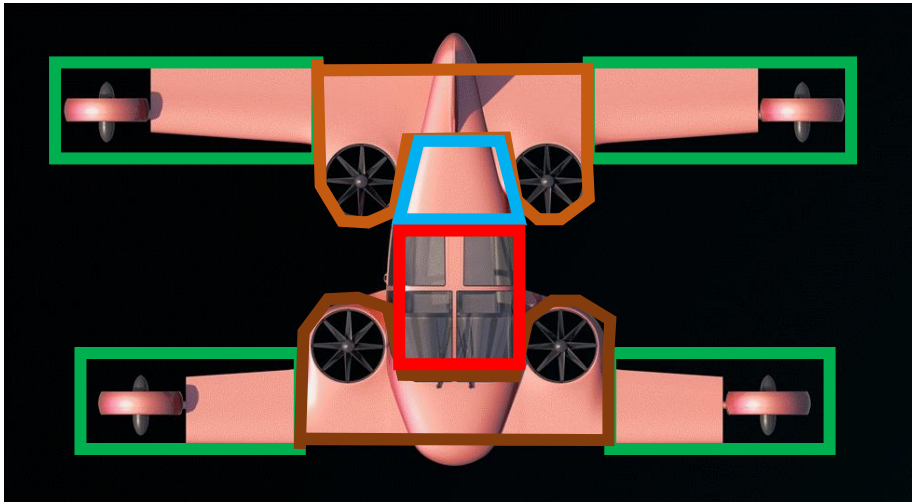


4 PAX (light)

Structural architecture

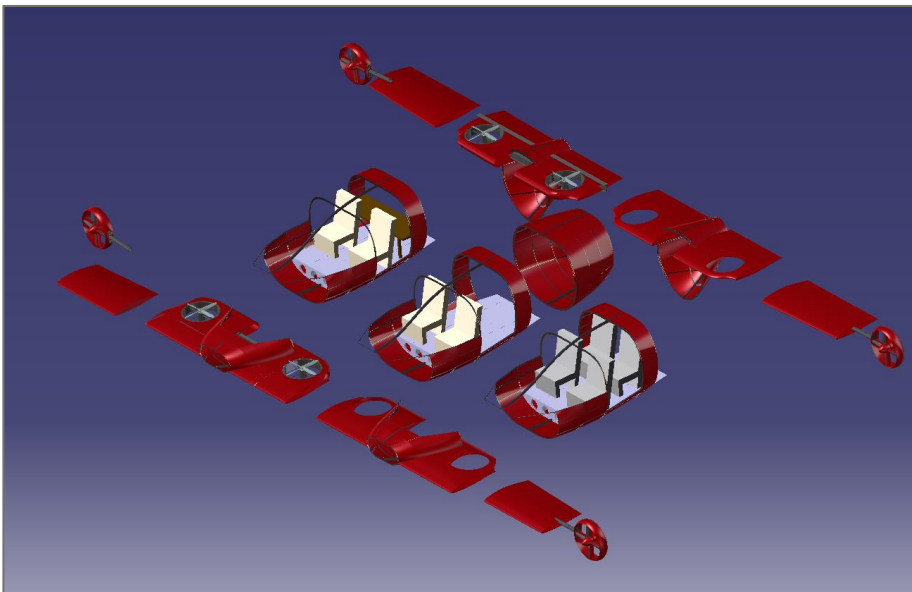
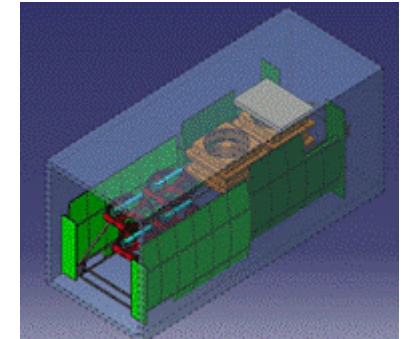


Modular structure



Production, delivery
and MRO optimization

Delivery in 20' Container



2 main flight
configurations

Taxi :

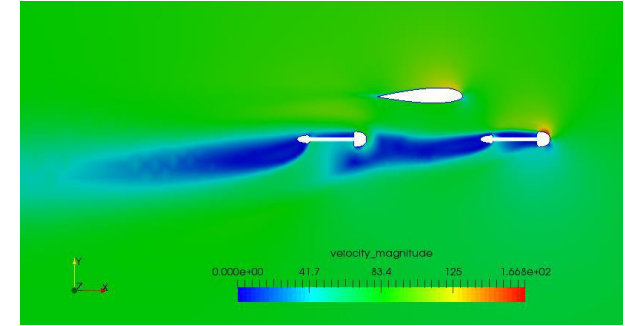
- VTOL Short intra city
- Short wings, high NACA
- Vertical central engines
- Fixed landing gear

VIP :

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

Take-off and flight transition

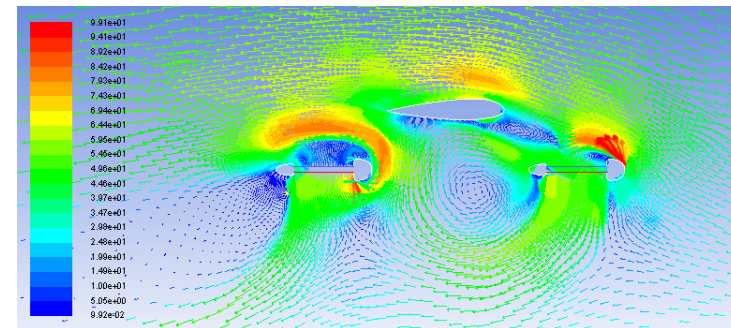
Cruise
flight



Tilt
transition

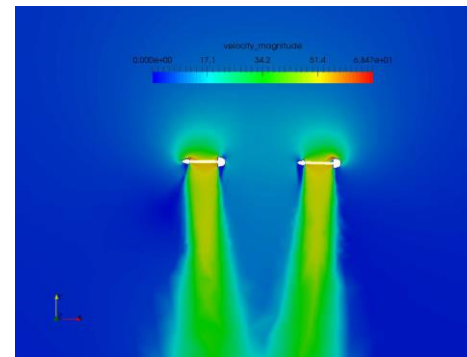


Estaca 2016



Supméca 2016

Vertical
take-off



Actions for Mini-Bee TRL2 Project

- Mini-Bee TRL2 tasks :
 - 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

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

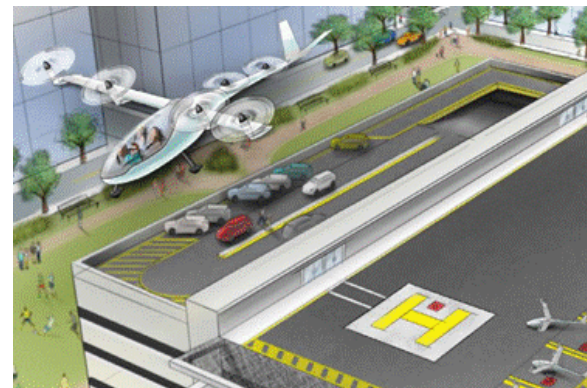
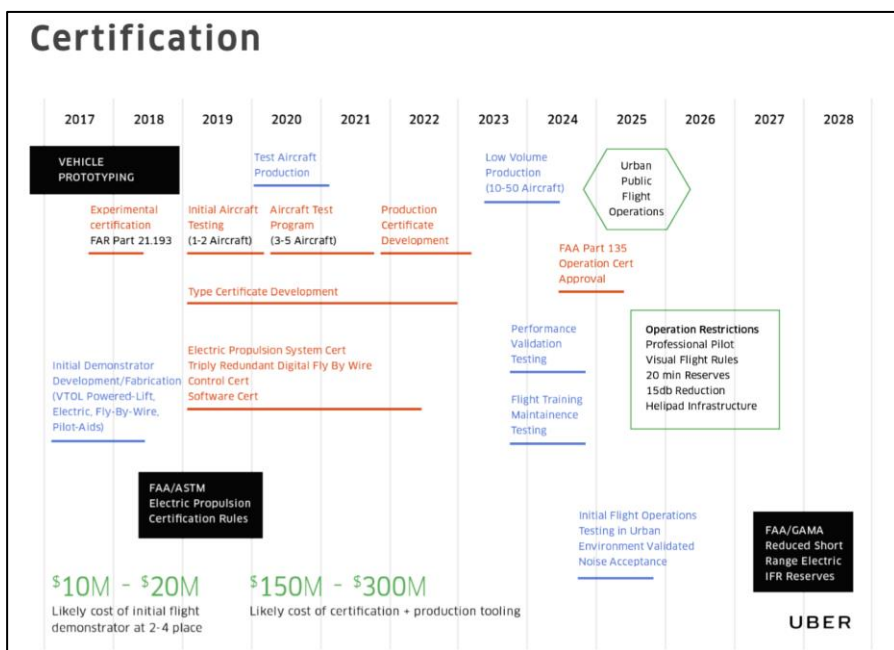
Qualification

Commercialisation / Operations

Estimated overall project 100m€

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

Uber Elevate 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

Annexes

Individual Air Vehicules

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)



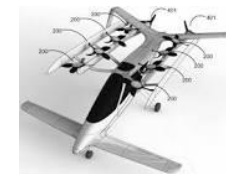
E-volo (<2014)



eHang (fin 2015)



Kitty Hawk (2016)



zee.aero (2016)



Joby (2016) ~ 100m€



Moler skycar
(<2016)



Urban aeronautics
(<2016)



Xplorair (2016)



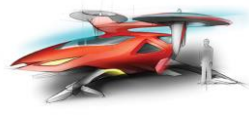
Lilium (2016) ~10m€



SoloTrek Springtail



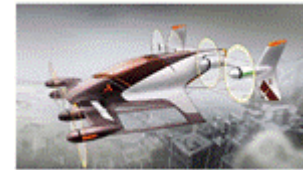
Airbus (2016)



Boeing (2016)



Macro industrie (2016)



Airbus Vahana (2016)



Trekaero.com



Olympus (2016)



Mini-Bee (2016)

Mini-Bee

Hybrid Octocopter

Drive your Aircraft !



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TECHNOPLANE
AERONAUTICAL INNOVATION

CPM
INDUSTRIES

TECHNO MAP



oséo

Création d'Entreprise

PLACIS



CentraleSupélec



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DI TORINO



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