



CORUS-XUAM — MARCH 2022 STAKEHOLDER WORKSHOP



CONFIDENTIAL



AGENDA

- 1/ ADP's global UAM strategy**
- 2/ WP11's presentation**
- 3/ WP11's objective and link with 2024 and + operations**
- 4/ Target scenarios**
- 5/ Initial flight tests**
- 6/ Focus on vertiport operations**



ADP'S GLOBAL UAM STRATEGY

／ A ROADMAP ALIGNING WITH MARKET PROJECTIONS AND ADOPTING AN INCREMENTAL APPROACH TO OPERATIONAL SCALE-UP .

2030 +

PARIS REGION

2020 2024 2028

Strategic positioning in terms of partnerships and exploitation of assets to ensure the group's readiness for commercial deployment starting 2030.

THE SANDBOX

Set a test vertiport on Pontoise Airfield 35 km from Paris

THE 'SHOWCASE' SCALE-UP

Launch the first commercial air route between the airport and the city, and prepare for scaling-up

Respond to the expected market growth

A REGULATORY FRAMEWORK UNDER ACCELERATED CO-CONSTRUCTION EASA . DGAC



VEHICLES TESTS

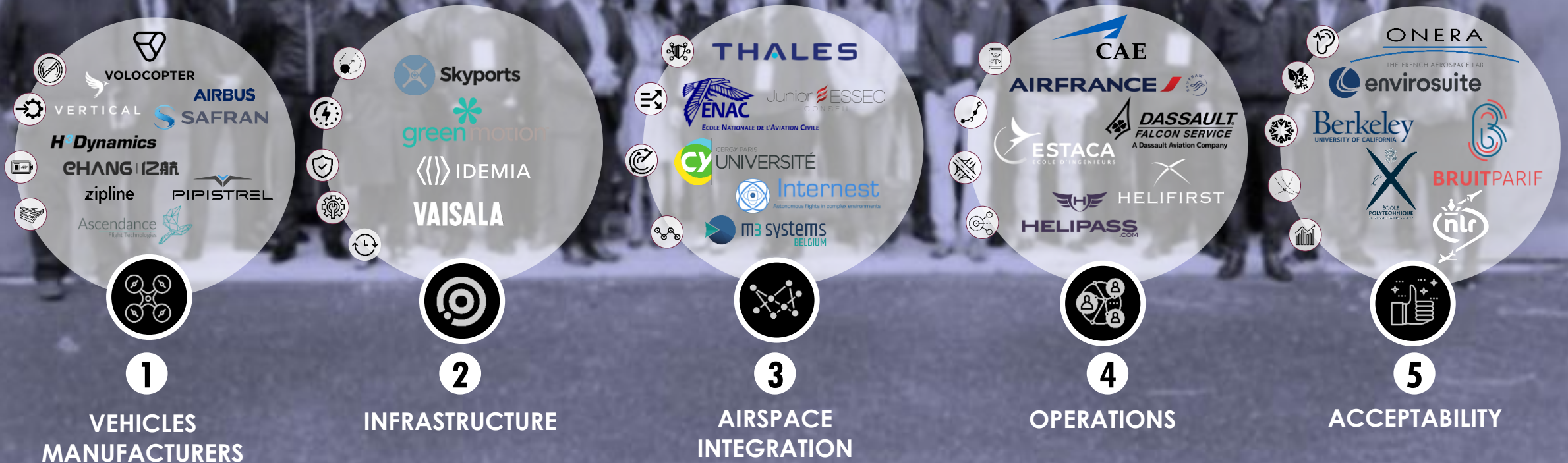


GROUND INFRASTRUCTURE INTEGRATION TESTS



AIRSPACE INTEGRATION TESTS

WE BROUGHT TOGETHER LEADING INDUSTRIALS AND INTERNATIONAL START-UPS ALONGSIDE MAJOR ACADEMIC AND RESEARCH INSTITUTIONS COVERING THE UAM VALUE CHAIN, IN COLLABORATION WITH THE FRENCH CIVIL AVIATION AUTHORITY DGAC



／ **AROUND A SANDBOX IN A CONCRETE AERONAUTICAL SETTING TO TEST THIS TECHNOLOGY, THE WORK-IN-PROGRESS REGULATIONS, THE SERVICE AND ITS ACCEPTABILITY AS OF SEPTEMBER 2021 .**



VEHICLE TESTS

Analyze and model the VTOL effects on its environment in terms of noise and blast.



GROUND INFRASTRUCTURE INTEGRATION TESTS

Conduct ground tests (movement, recharging, maintenance) and testing passenger processes.



AIRSPACE INTEGRATION TESTS

Conduct the first flight tests and the first suburban links to aeronautical platforms.

———— June 2021

PHASE 1 AIRSIDE

- ① FATO
- ② Hangar/ Maintenance
- ③ Taxiway

———— Summer 2022

PHASE 2 VERTIPORT LANDSIDE

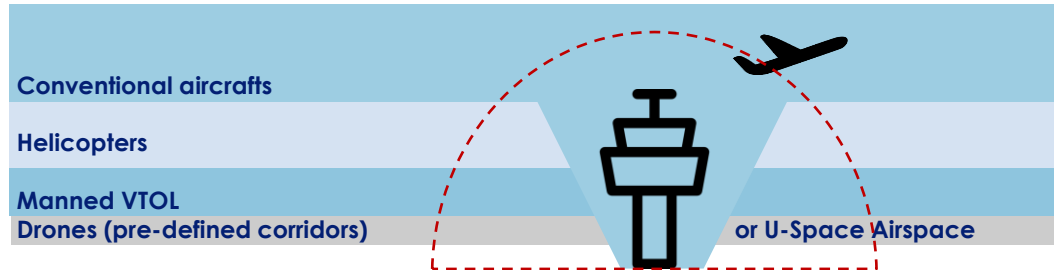
- ④ Taxi Stands
- ⑤ Electric Recharge
- ⑥ Modular Reusable Vertiport Skyports



／ AIRSPACE INTEGRATION: ADP'S APPROACH

HORIZON A.

piloted VTOL - 2024



Key principles

- **Manned VTOL:** VFR, VMC during the day, radio communication
- **Segregation between** manned VTOL and helicopters / conventional aircrafts
- USSP's role: providing a tool allowing to track and **plan the manned VTOL traffic but also drones (flight geography visibility) in an airport's CTR**

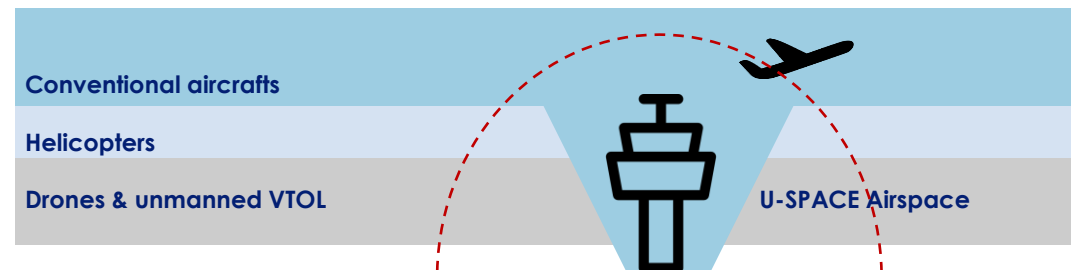
How do we prepare for this horizon?

- **Tests in Pontoise**
 - VTOL operators' presence (flight testing+ workshops)
 - **CORUS-XUAM**
- **GT3 : routes, trajectories and operations**

In order to build a specific conops for a given traffic and a given route, with dedicated robust procedures (to be built)

HORIZON B.

2030+ / Long term – unmanned VTOL



Key principles

- Unmanned VTOL
- USSP's role: **VTOL and drones traffic management**

How de we prepare for this horizon?

- 2024 horizon
- **CORUS-XUAM**
- Further call for proposals
- Technology development
- Regulation evolution



WP11 – FRENCH EXERCISE PRESENTATION

／ CORUS-XUAM - WP11 PRESENTATION

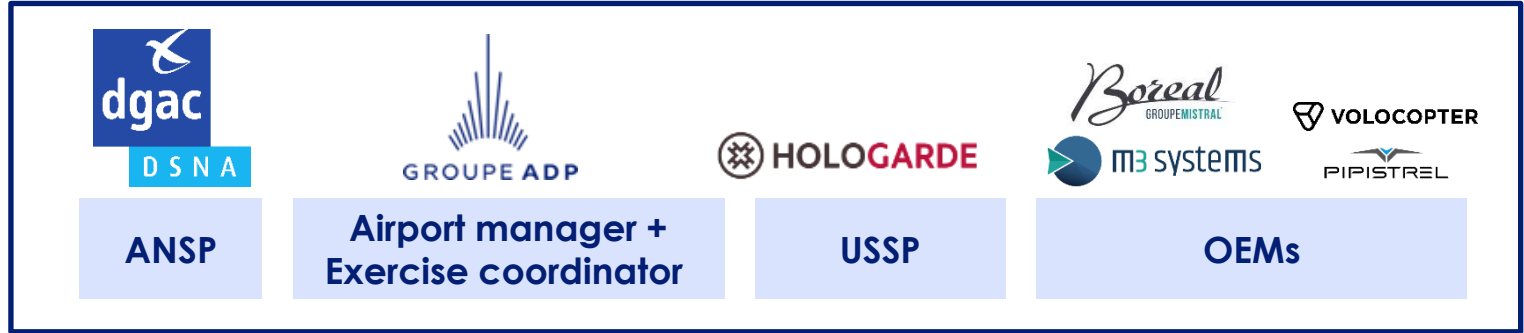
CX Global lead



Financed by



French Exercise Stakeholders



Objectives

Test in a real environment interactions between USSP, VTOL /Drone and the ATC to guarantee safe operations around vertiports

◆
Ways of **collecting and transmitting information** between stakeholders

◆
USSP's ability to **propose deconfliction actions** to the operators concerned

◆
The process' degree of automation

◆
The impact of these interactions on

- VTOL operations
- conventional aircraft operations
- **ATC agents (workload, procedures, etc)**

◆
Optimize vertiport operations

WP11'S APPROACH AND METHODOLOGY

INITIAL SCENARIOS

INITIAL SCENARIO A
M3 Systems flight

INITIAL SCENARIO B
Volocopter flight

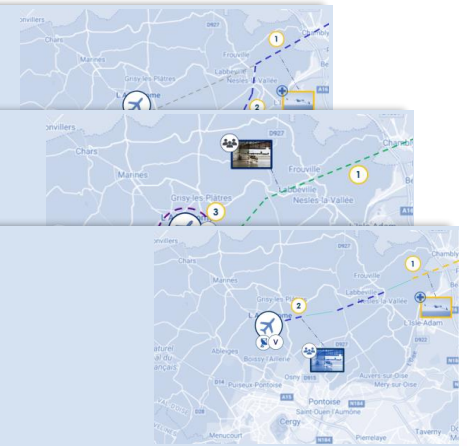
INITIAL SCENARIO C
Pipistrel

DECONFLICTION SCENARIOS

DECONFLICTION SCENARIO 1 – DOUBLE DIVERSION

DECONFLICTION SCENARIO 2 – MANAGEMENT OF AN OCCUPIED FATO SITUATION

DECONFLICTION SCENARIO 3 – DYNAMIC CAPACITY MANAGEMENT





TARGET SCENARIOS



TARGET DECONFLICTION SCENARIO: DOUBLE DIVERSION

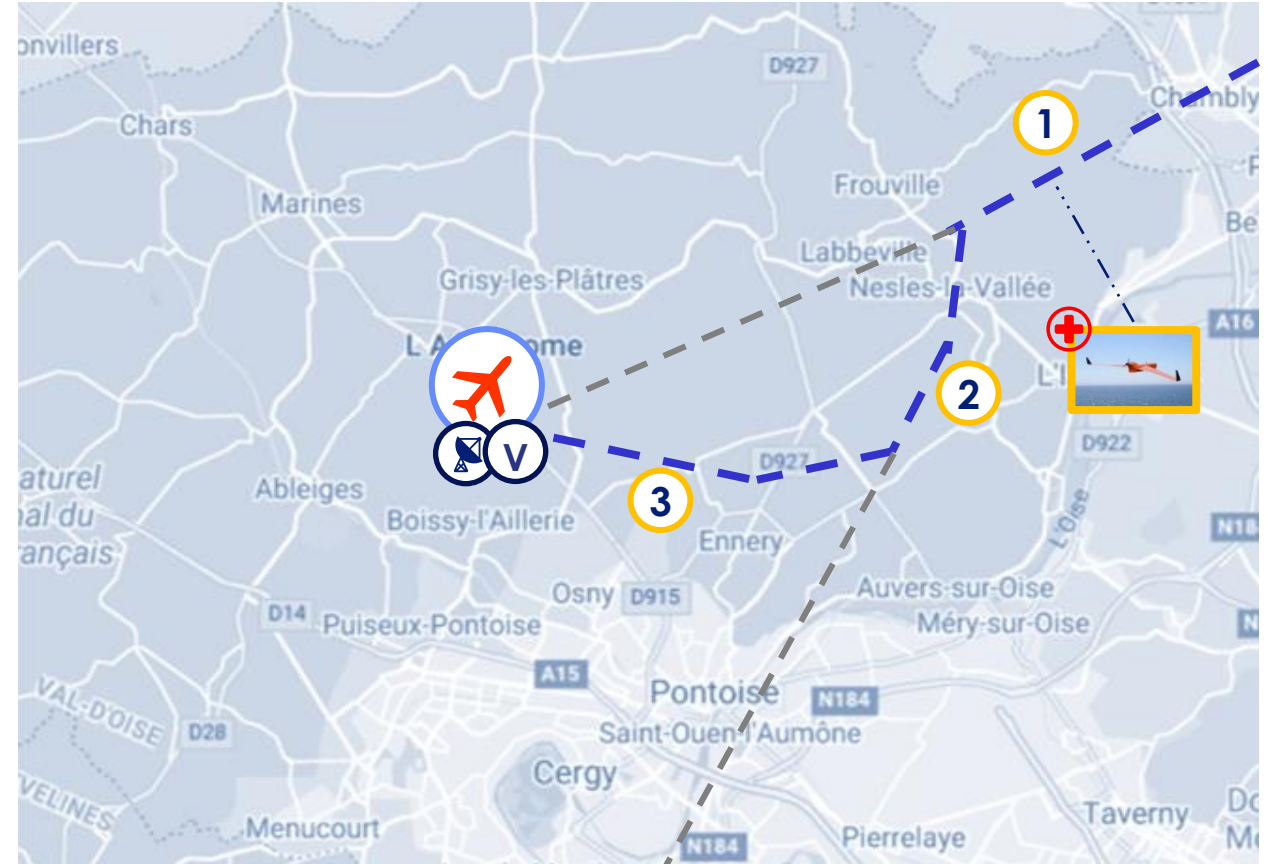
◆ **Objective:** Demonstrate that the unforeseen closure of a vertiport does not engage safety, given the ability to tactically divert the drone traffic towards alternate suitable vertiports.

◆ **Key element:**

- Real-time update of destination's availability
- Communication to operator of the options and action taken

Diversion

Re-routing when first destination is available



TARGET DECONFLICTION SCENARIO: MANAGEMENT OF AN OCCUPIED FATO SITUATION

◆ **Objective:** Demonstrate that UAV flights can be safely performed, even in case of non-foreseen unavailability of the destination vertiport.

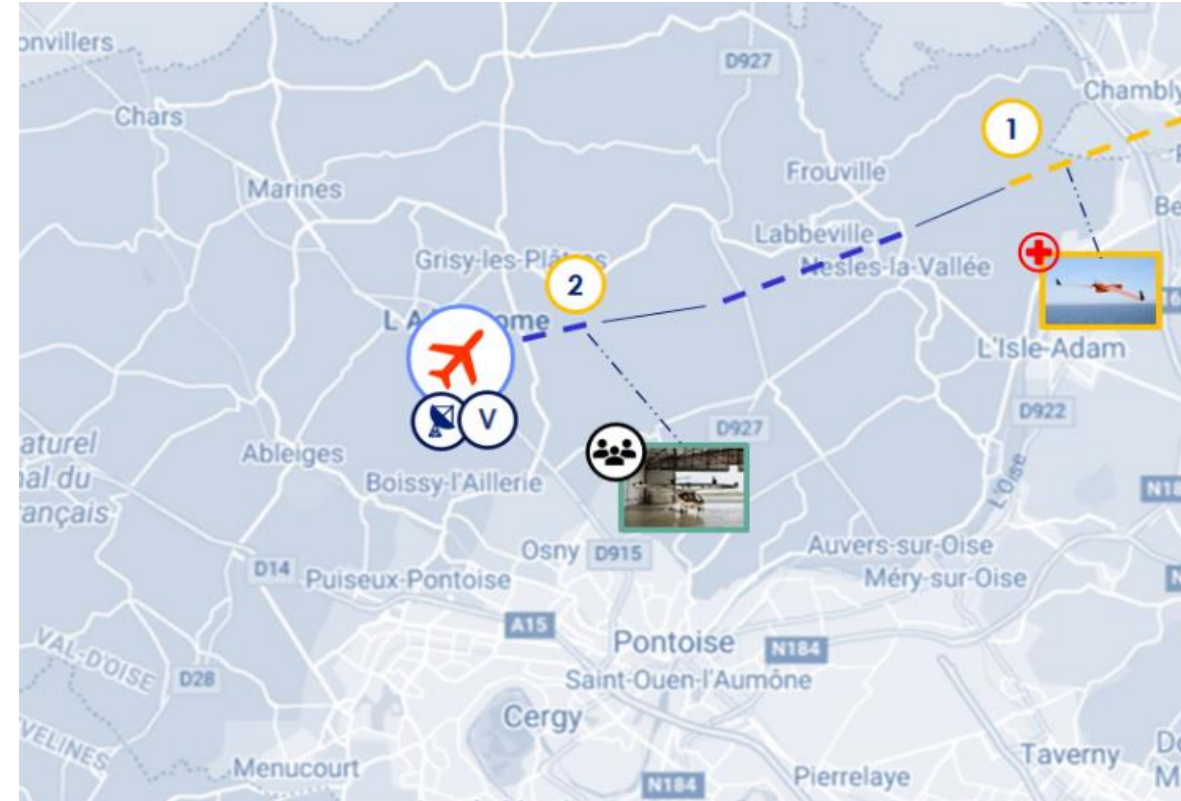
◆ **Key element:**

- Information of occupied FATO and
- transmission to the operator
- Real-time update of options
 - Holding pattern
 - Emergency landing due to low battery
- Communication to operator of the options and action taken



TARGET DECONFLICTION SCENARIO: DYNAMIC CAPACITY MANAGEMENT

- ◆ **Objective:** Demonstrate that a safe and sufficient distance can be assured between two different unmanned vehicles flying the same route.
- ◆ **Key element:**
 - **4D FPLN**
 - Corridor
 - Time check points
 - Departure and arrival time
 - **Precise and live tracking of both drones**
 - **Management of separation**
 - Keeping minimum separation distance at all time





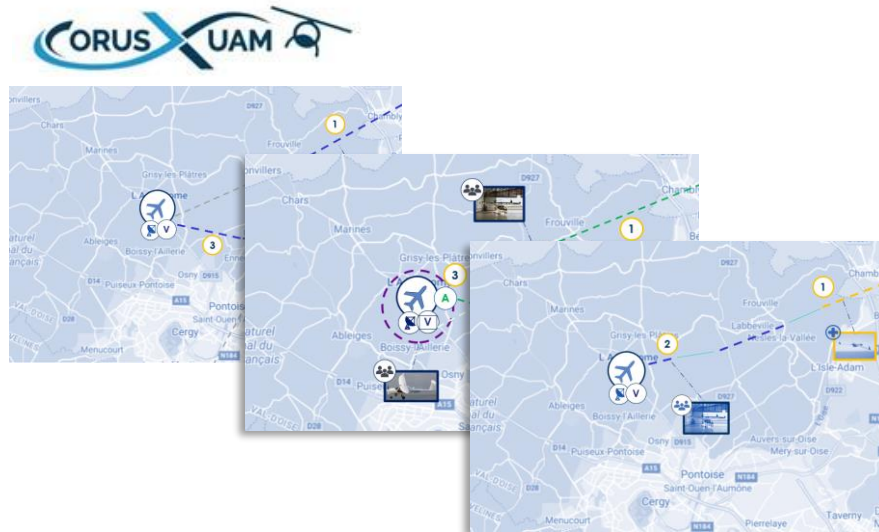
INITIAL FLIGHT TESTS



FEBRUARY INITIAL FLIGHT TESTS: LESSONS LEARNED (1/3)

Why did we carry out these tests?

- **Launch CORUS-XUAM demos:** Update of the U-space concept of operations addressing the integration of UAM/UAS operations into the airspace
- **Prepare for deconfliction scenarios later this year:** Preparation of these flights with a first trial with stakeholders
- **Carry out « initial flights »:** Getting familiar with regulatory constraints and the airfield's environment



Test description

- **Regulatory tools:** NOTAM publication, information to airport users. Protocol between ADP, ANSP and the drone operator
- **2 flight trials:**
 - Monday 14/02: flight over Pontoise. Flight time: 40 minutes
 - Tuesday 15/02: Up to 3km away from the airfield. Flight time: 40 minutes
- **Equipment used:**
 - ISR Boreal drone and its Ground Control Station
 - 2 Hologarde's remote ID antennas, ADS-B antenna, Control Station
- **15 people team on site:** Hologarde, Boréal, ADP, Eurocontrol and Unifly
- **Total flight distance:** ~150KM, ~1h20 of flight



FEBRUARY INITIAL FLIGHT TESTS: LESSONS LEARNED (2/3)

Results

Verification of tracking, monitoring and surveillance data exchange services:

/ The 3 services worked as planned

ATC's feedback on Hologarde's interface :

/ UX : Clarity of Informations displayed,

- Black background preferred
- Aeronautical areas to display
- ...

/ Used interface: seems relevant to have a dedicated interface during transitory phase

- Interest to have precise **drones' flights areas** with altitude information as a floor for manned aviation

/ Drone flight planification : Could be facilitated thanks to Hologarde's interface

/ Next steps :

- Take into account ATC feedbacks
- Possibility of having information transmitted by Hologarde, toward ATC and operators

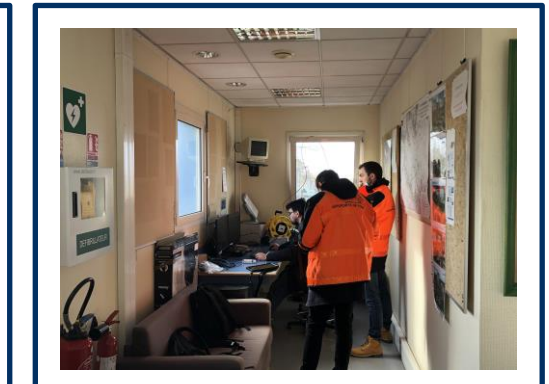
Flight Plan vs. Real trajectory



Hologarde's interface

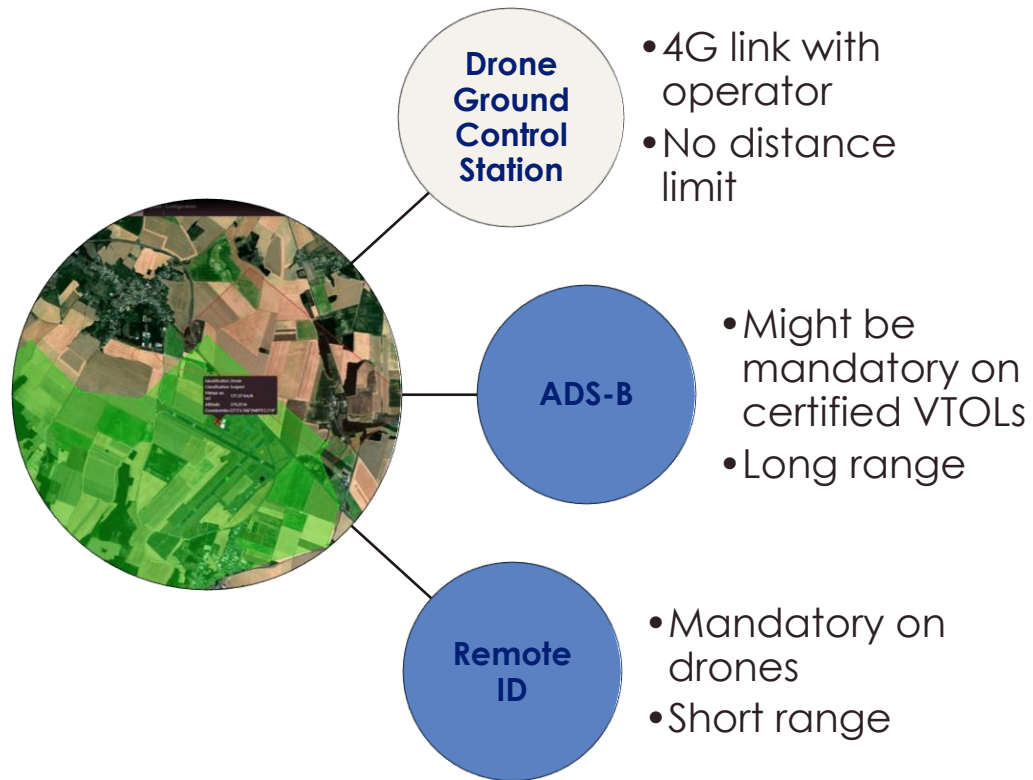


Hologarde's control station



FEbruary INITIAL FLIGHT TESTS: LESSONS LEARNED (3/3)

3 different tracking methods



Monitoring

- **Flight Plan**
 - Alert if leaving the FPLN (In 3 dimensions)
- **No Fly zone**
 - Alert if entering No fly Zone





FOCUS ON VERTIPOINT OPERATIONS

A CONCRETE AERONAUTICAL SETTING TO TEST VERTIPORT OPERATIONS



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June 2021

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- 1 FATO
- 2 Hangar/ Maintenance
- 3 Taxiway

April 2022

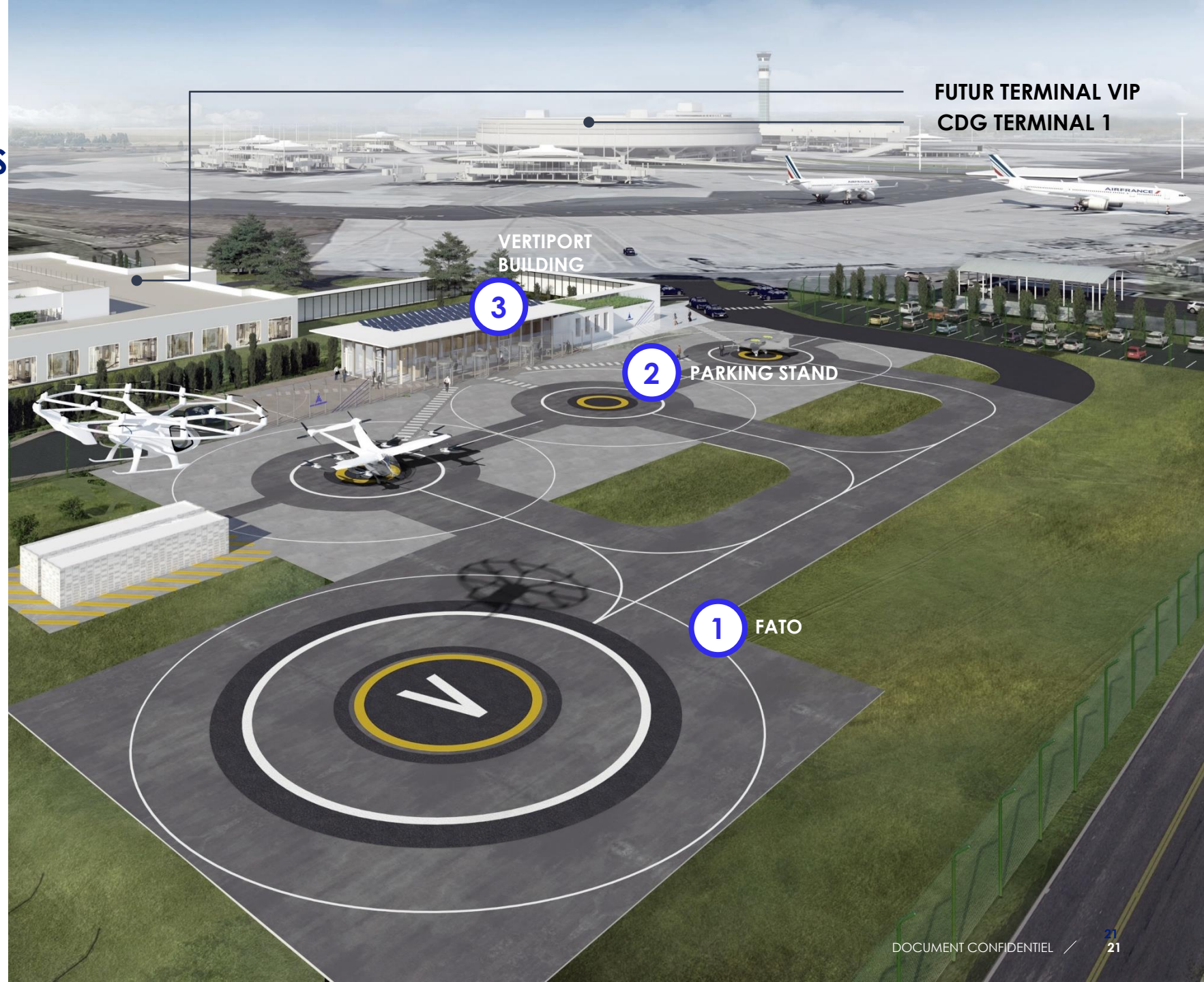
PHASE 2 VERTIPORT LANDSIDE

- 4 Taxi Stands
- 5 Electric Recharge
- 6 Modular Reusable Vertiport Skyports



OUR APPROACH TO VERTIPTS' PROGRAMING AND DESIGN IS ONE THAT IS MODULAR, SUSTAINABLE AND ADAPTABLE TO THE SITE'S SPECIFICITIES AND CONSTRAINTS .

Selected site for the CDG Vertiport based on a multi-criteria analysis of more than ten potential sites across the platform.



JOIN US IN MAKING URBAN AIR MOBILITY HAPPEN



APPENDICES



CORUS-XUAM – FRANCE VLD OBJECTIVES

	Manned aircrafts	Unmanned aircrafts
Key principles	<ul style="list-style-type: none"> - VFR flights - VTOL managed by ATC the same way as helicopters - DSNA's expects USSP to provide a tool allowing a better operations monitoring. - ATC, according to regulations, will have a responsibility to interact w/ USSP : information service has to be provided to USSP 	<ul style="list-style-type: none"> - IFR fights - USSP as a central role in UTM - USSP capable of: <ul style="list-style-type: none"> - Centralizing information for ATC via an interface - Dealing with emergency scenarios (e.g., holding patterns) - Monitoring trajectories and distance between aircrafts. - Opening, closing and sizing air corridors dynamically.

Unknown fields, remaining questions from DSNA - 2024

VTOL visibility on ATC existing radars	Traffic monitoring method/interface and degree of integration within ATC systems	VTOL capacity of maneuverability and following specific itineraries, <u>given its autonomy</u>	ATC additional workload related to VTOL traffic	Capacity of TWR to control VTOL traffic <u>in airports</u>	Separation principles with helicopters for instance	Dealing with VTOL breakdown
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Some answers will be provided with CORUS-XUAM scenarios

VTOL tracking	Trajectory compliance	Emergency management	Interface w/ ATC and live feedbacks from TWR	Dynamic capacity management
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OBJECTIVES (DEMO PLAN)

Overall objective : Demonstrate that ATC and drone operators can communicate efficiently using dedicated interfaces to manage the interaction between manned and unmanned aviation.

SCR1: the HMI provided to ATC is suitable and efficient to manage the interaction between manned and unmanned aviation.

SCR2: the HMI provided to drone operators is suitable and efficient to manage the interaction between manned and unmanned aviation

EX6-OBJ-VLD-CX-001: Demonstrate that a U-Space service can ensure coordination between ATM and UTM in airport/vertiport surroundings without any additional safety events to deal with

EX6-OBJ-VLD-CX-002:

•002: Demonstrate that a U-Space service facilitates flight preparation by the drone operator, allowing a better traffic anticipation

•002 bis: Demonstrate that a U-Space service facilitates flight management by the drone operator, allowing better traffic visibility

EX6-OBJ-VLD-CX-003: Demonstrate that a U-space service is a good means to avoid safety event due to MET conditions for drone operator and to get all the required MET information

EX6-OBJ-VLD-CX-004: Demonstrate that a safe and sufficient distance can be assured between two different unmanned vehicles flying the same route.

EX6-OBJ-VLD-CX-005: Demonstrate that a U-space service can be a good means (safe, efficient, time-saving) to coordinate interactions with ATC

EX6-OBJ-VLD-CX-006: Demonstrate that UAV flights can be safely performed, even in case of non-foreseen unavailability of the destination vertiport.

EX6-OBJ-VLD-CX-007: Demonstrate that the unforeseen closure of a vertiport does not engage safety, given the ability to tactically divert the drone traffic towards alternate suitable vertiports.

FEBRUARY INITIAL FLIGHT TESTS WITH M3 SYSTEMS

◆ Tracking

- Remote ID
- ADS-B

◆ Monitoring

- Deviation from FPLN (geographically)
- Entering NFZ

◆ Data exchange from operator's GCS

- Live cross checking of telemetry

+ Interface with Pontoise ATC

- real-time feedback on the tools and the information displayed

