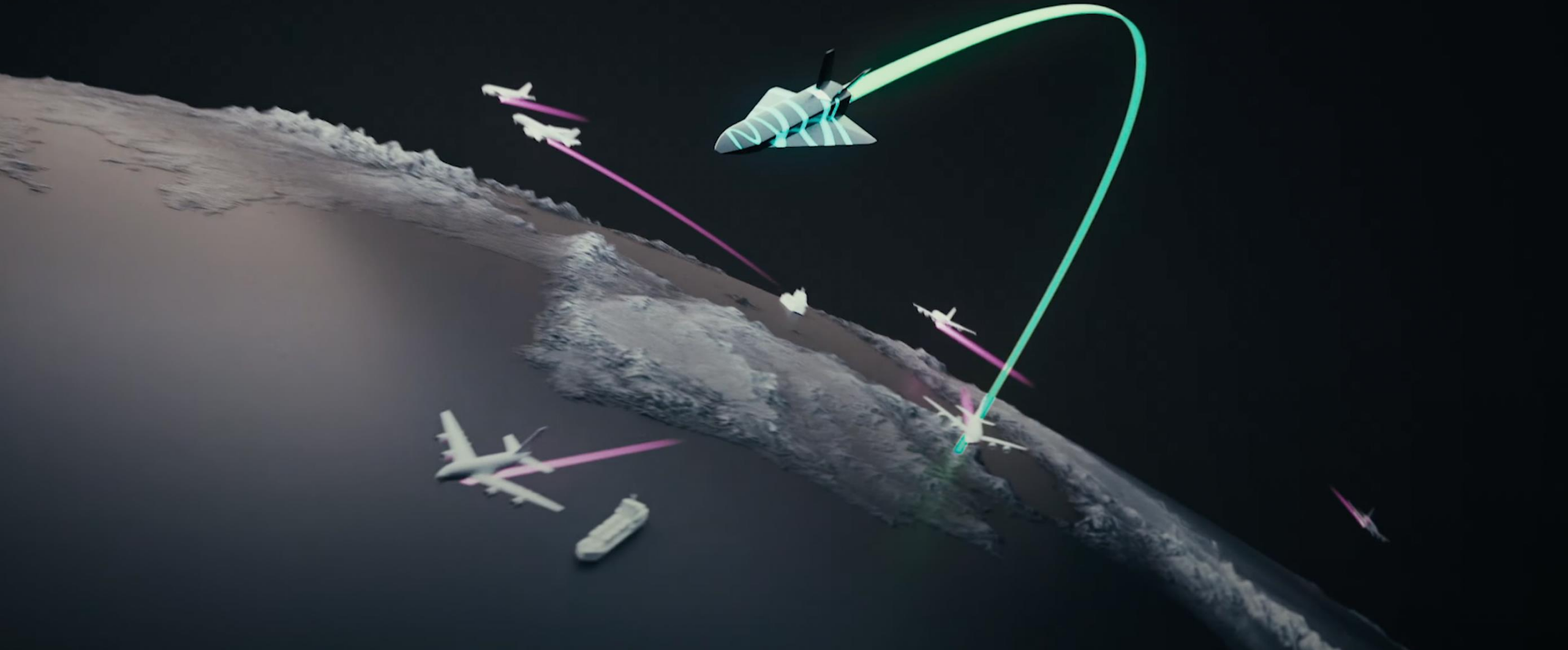


Reaching the future **faster**



Hydrogen is the enabler of ultra-long-range hypersonic flight



# Market Targets and System Design

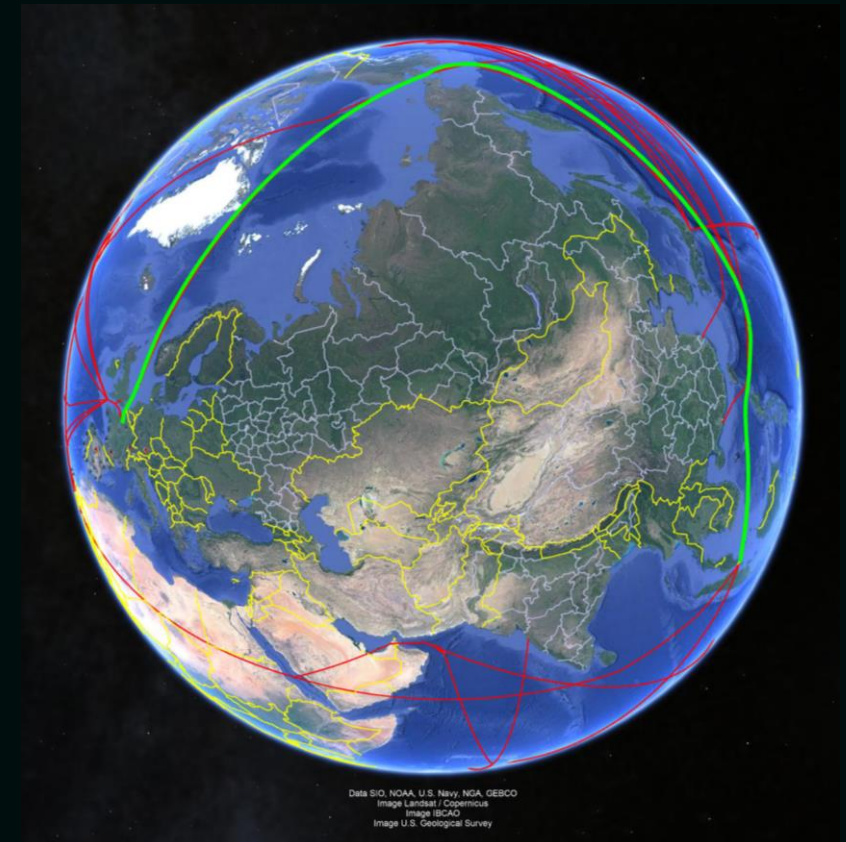
## Market Targets

- Long range beyond current commercial limits: **up to 20 000 km**
- Short travel time: multiple times faster than current aviation
- Cleaner than current aviation
- Connection between key hubs

## System Design

- Horizontal take-off and landing at commercial airports
- Hypersonic flight at high-altitude with ramjet propulsion
- Use of Jet-A and LH2
- Combination of several **key hypersonic technologies**

Example of long-haul route  
(Paris to Singapore)  
**18000 km, 3.5 h**



# Development Plan

## Technology challenges

Progressive development and combination of key technologies

TRL raising with ground and flight testing

**Design → Build → Test → Improve**

### Ground testing

- Structures
- Thermal
- Cryogenics
- Propulsion
- Avionics

### Flight Demonstrators

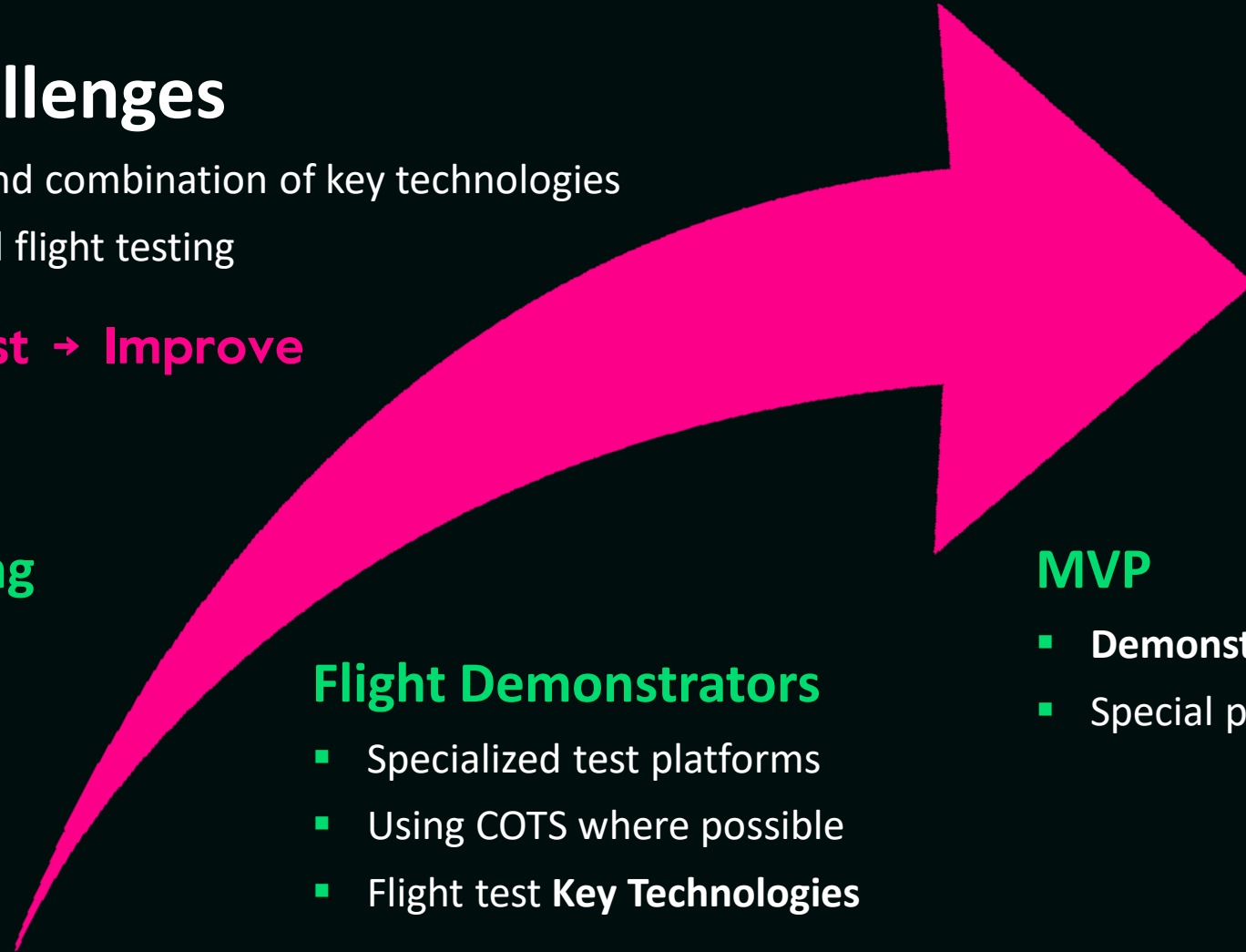
- Specialized test platforms
- Using COTS where possible
- Flight test **Key Technologies**

### MVP

- **Demonstrator spin-off**
- Special products

### Commercial

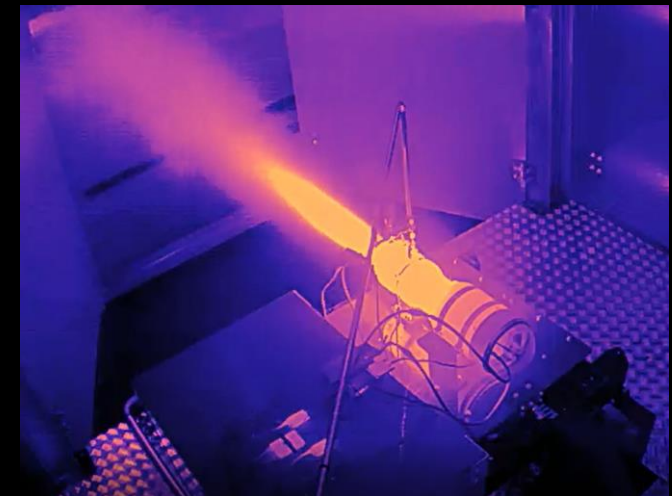
- Cargo
- Passengers
- Airport integrated



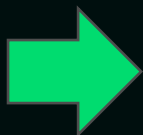
# Destinus highlights



- Company founded in March 2021
- Raised EUR 35m so far
- 80+ aerospace experts
- Offices in Switzerland, Spain, Germany and France. Truly and proudly European
- Built and tested two subsonic flying demonstrators
- Hydrogen test facilities for testing engine technologies in operation and expanding

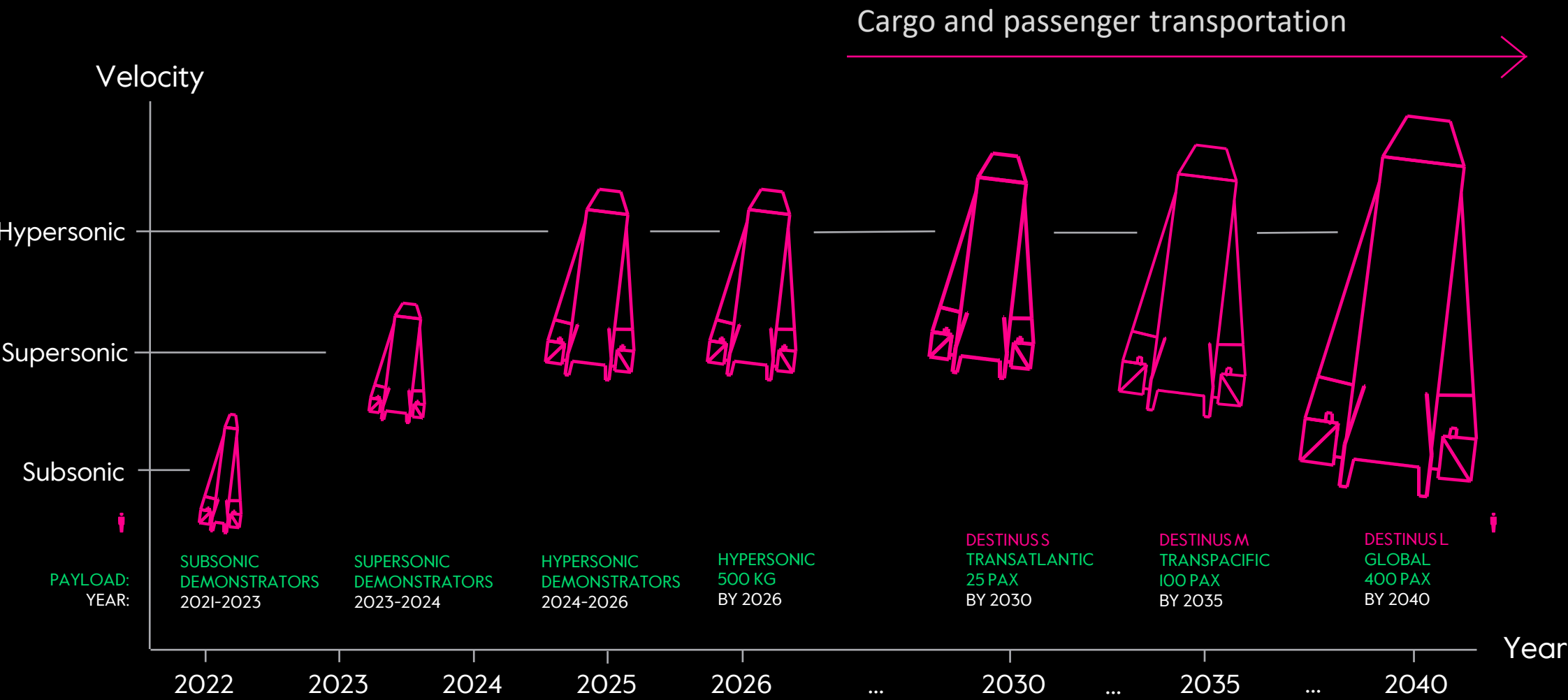


# VIDEO of EIGER FLIGHT



VIDEO (October 2022) [https://www.linkedin.com/posts/destinus1\\_successful-flight-of-destinus-eiger-prototype-activity-6996038642330656768-kJf8/?utm\\_source=share&utm\\_medium=member\\_desktop](https://www.linkedin.com/posts/destinus1_successful-flight-of-destinus-eiger-prototype-activity-6996038642330656768-kJf8/?utm_source=share&utm_medium=member_desktop)

# Flight Roadmap



# Products: our vision



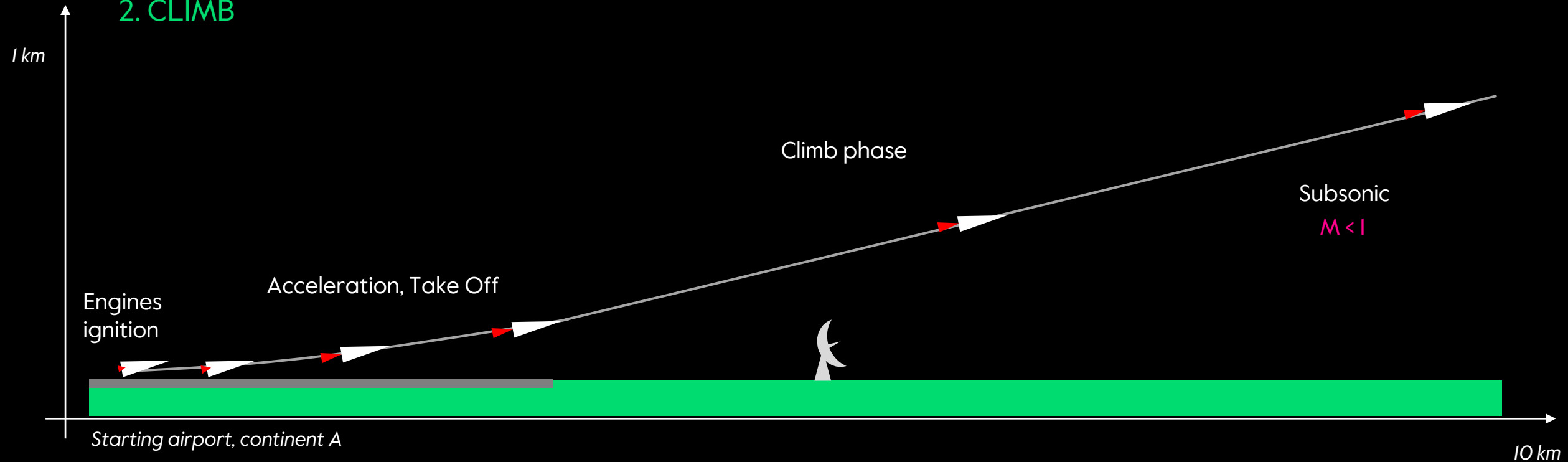
## General operations foreseen:

Piloted on board (cargo version could be remotely piloted), aided by automatic operations, progressively including autonomous elements, if possible.

Mission Control Centre is always in the loop to monitor flights from ground, to update or take over operation mode, if needed.

# CONOPS

1. TAKE-OFF
2. CLIMB



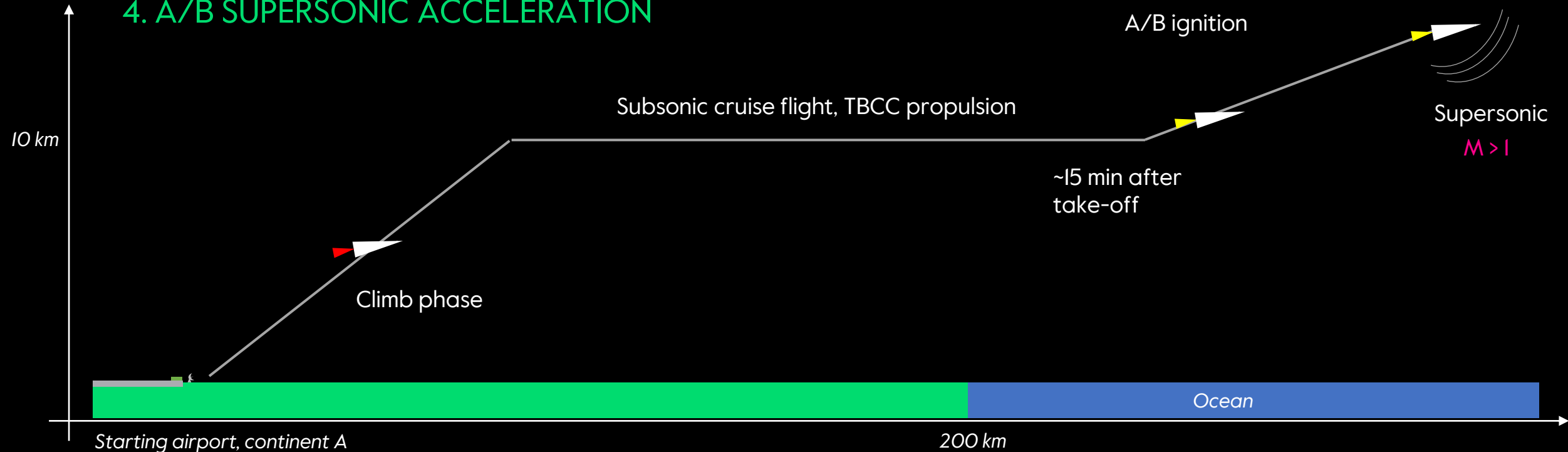
Initial considerations:

- Take-off from existing airport. Runway 3-4 km.
- Vehicle ignites air-breathing engines (Turbine-Based Combustion Cycle), accelerates and takes-off
- All flight phases are subsonic, engine throttle limited. Objective is to keep noise comparable with current aviation
- Return to airport in case of emergency.

# CONOPS

## 3. SUBSONIC CRUISE

## 4. A/B SUPERSONIC ACCELERATION

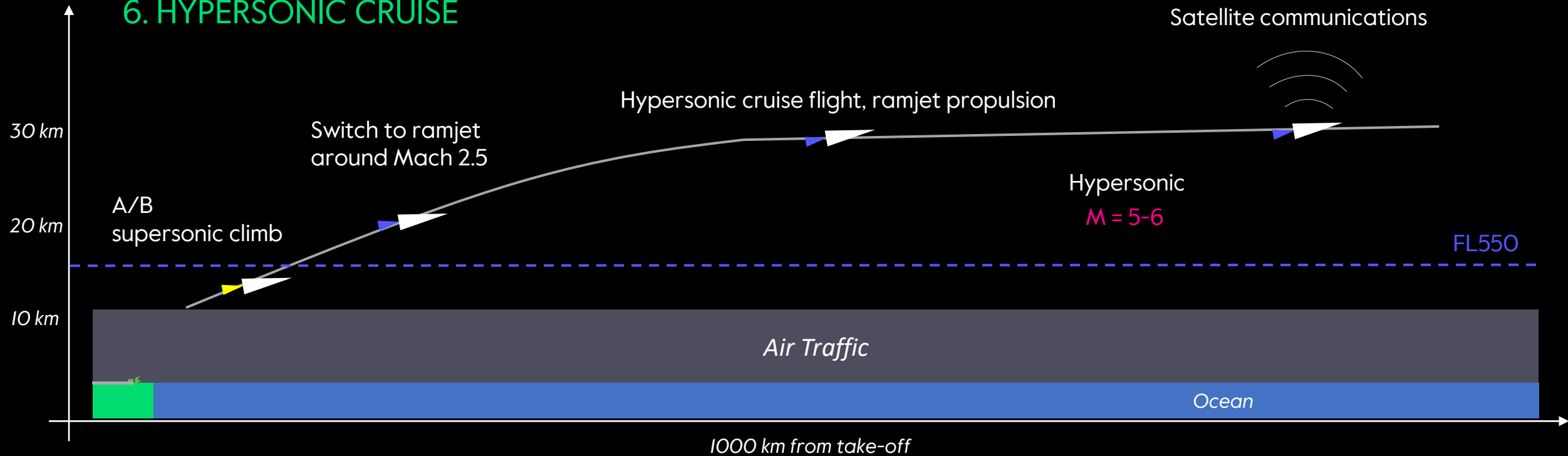


### Initial considerations:

- Vehicle climbs up to subsonic ( $M$  0.9) cruise conditions, respecting altitude-speed limits
- Cruise flight with TBCC, heading towards open water
- Noise comparable to current aviation
- Vehicle integrated in current air traffic, ideally in a pre-defined 4D corridor to minimise fuel consumption
- Afterburner ignition far from coastline, at about 10 km altitude: vehicle climbs and accelerates further
- Vehicle reaches supersonic speed far from the coastline, with minimal impact of engines and sonic boom noise

# CONOPS

## 5. RAMJET SUPERSONIC ACCELERATION 6. HYPERSONIC CRUISE

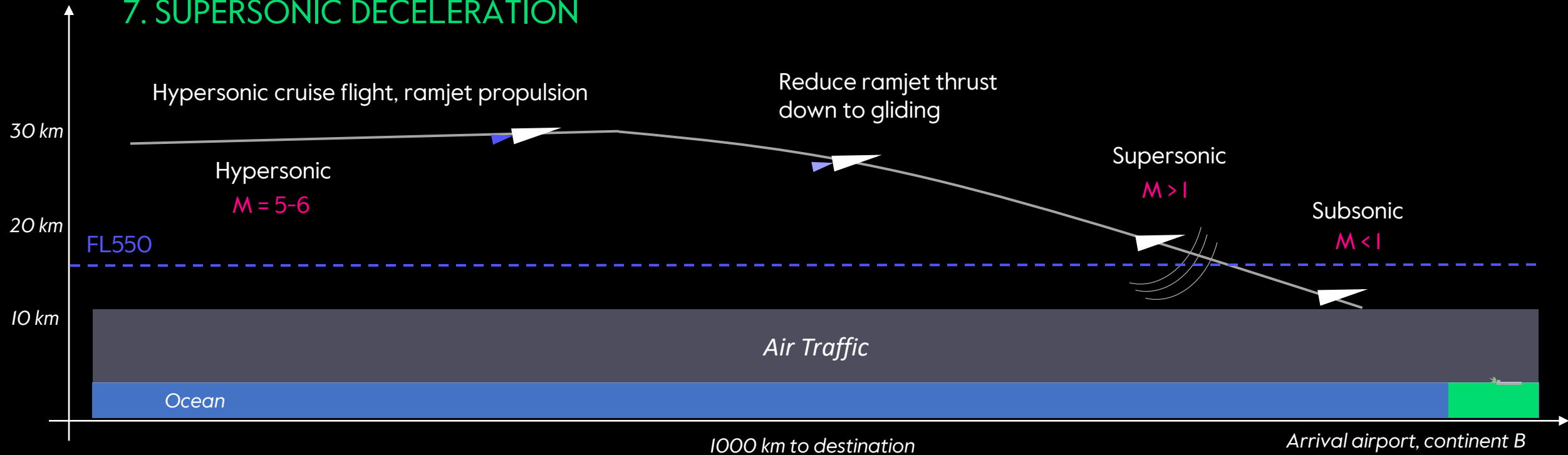


### Initial considerations:

- Vehicle climbs through supersonic conditions and switches to ramjet engine mode (M 2.5)
- Vehicle climbs up to hypersonic (M 5-6) conditions, at about 30 km altitude (well above FL550)
- Hypersonic cruise starts about 1000 km from take-off airport, over open oceans, with minimal impact of engines and sonic boom noise
- In all the mission phases the vehicle uses satellite communications

# CONOPS

## 6. HYPERSONIC CRUISE 7. SUPERSONIC DECELERATION



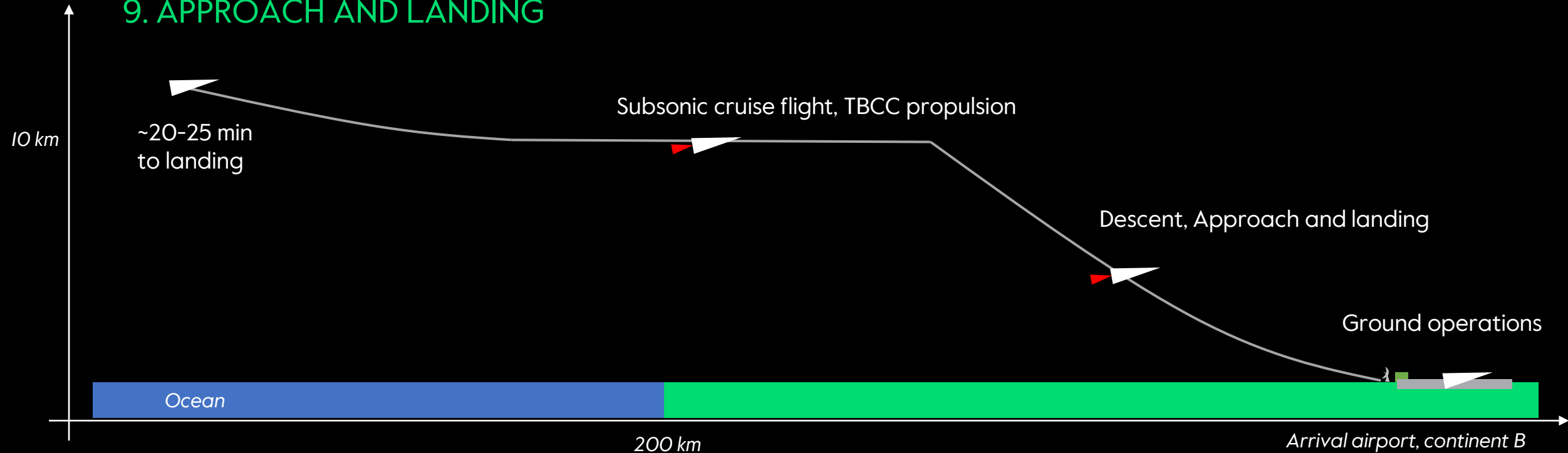
### Initial considerations:

- Vehicle completes hypersonic cruise phase
- Gentle reduction of ramjet thrust: vehicle reduces altitude and speed down to supersonic
- Vehicle glides down to subsonic, still at several hundreds of km from the target airport, with minimal impact of engines and sonic boom noise
- Enters into the the air traffic from above, in a 4D corridor planned and booked in advance

# CONOPS

## 8. SUBSONIC CRUISE

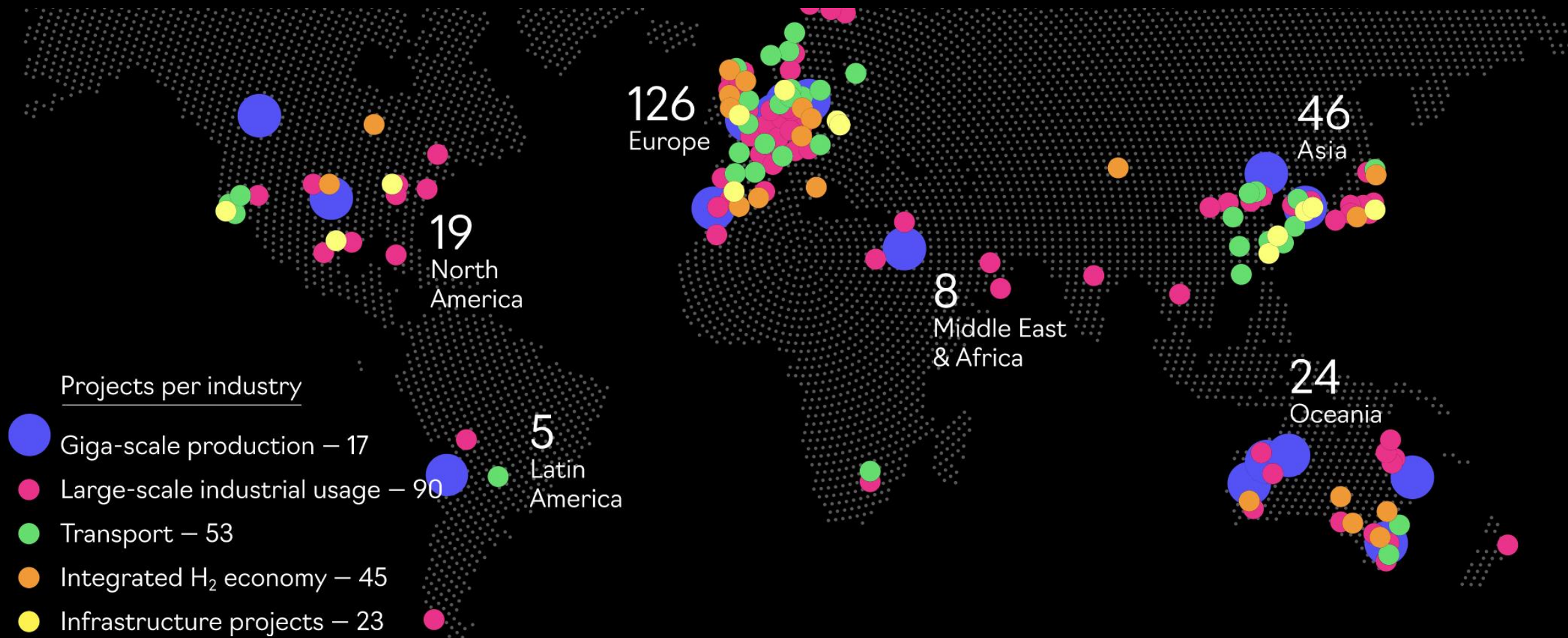
## 9. APPROACH AND LANDING



### Initial considerations:

- Vehicle reaches subsonic ( $M 0.9$ ) cruise conditions
- Cruise flight with TBCC, heading towards arrival airport; descent, approach and landing.
- All flight phases are subsonic, engine throttle limited. Objective is to keep noise comparable with current aviation
- Automatic operations where possible; TM/TC stations to facilitate landing targeting; D-GPS if needed beyond ILS
- Mission Control Centre in the loop to take over operation, if needed.
- Runway 3-4 km. Hyperplane lands and performs ground operations.

# Hydrogen: the fuel of the future



# Routes: possible connections



# Conclusions



- Destinus is one of the key actors: European private company with commercial needs
- Current ECHO CONOPS offers the option to contribute to the foundation of future HAO (High Altitude Operations)
- Support from ATM is needed to continue developments
- Design compatible with evolving requirements, aligned with real demand
- Europe as the cradle of initial operations, the world as the target

# Thank you!



[www.destinus.com](http://www.destinus.com)

Davide Bonetti

[davide.bonetti@destinus.com](mailto:davide.bonetti@destinus.com)

CEO Destinus Spain SL

Chief Engineer, Mission Design

C/Comercio, 4B, 28760, Tres Cantos

