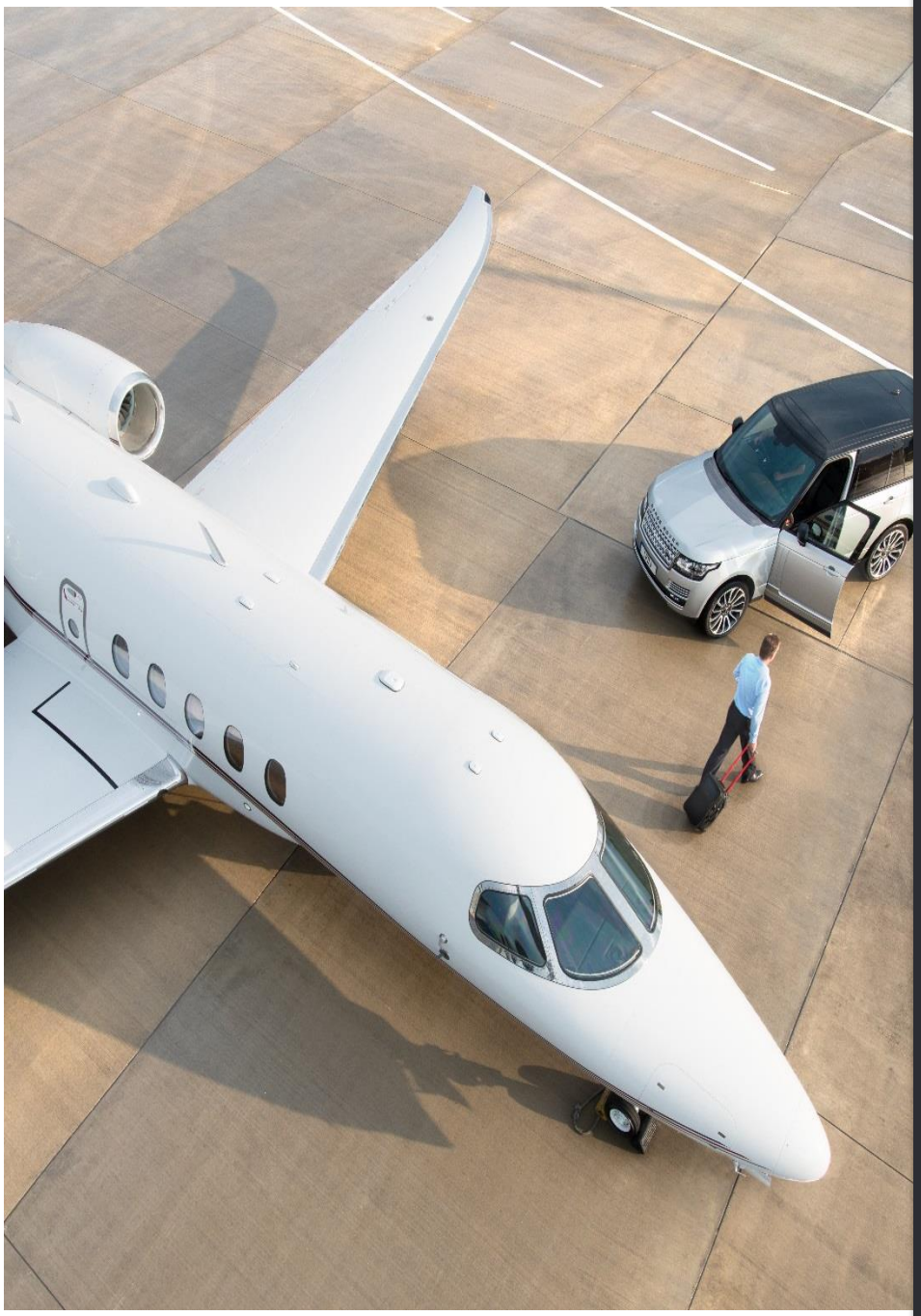


*EU SPACE WEEK*

# BENEFITS OF LPV APPROACHES FOR THE BUSINESS AVIATION

DECEMBER 5, 2018

NETJETS

# 1.1

## WHO WE ARE

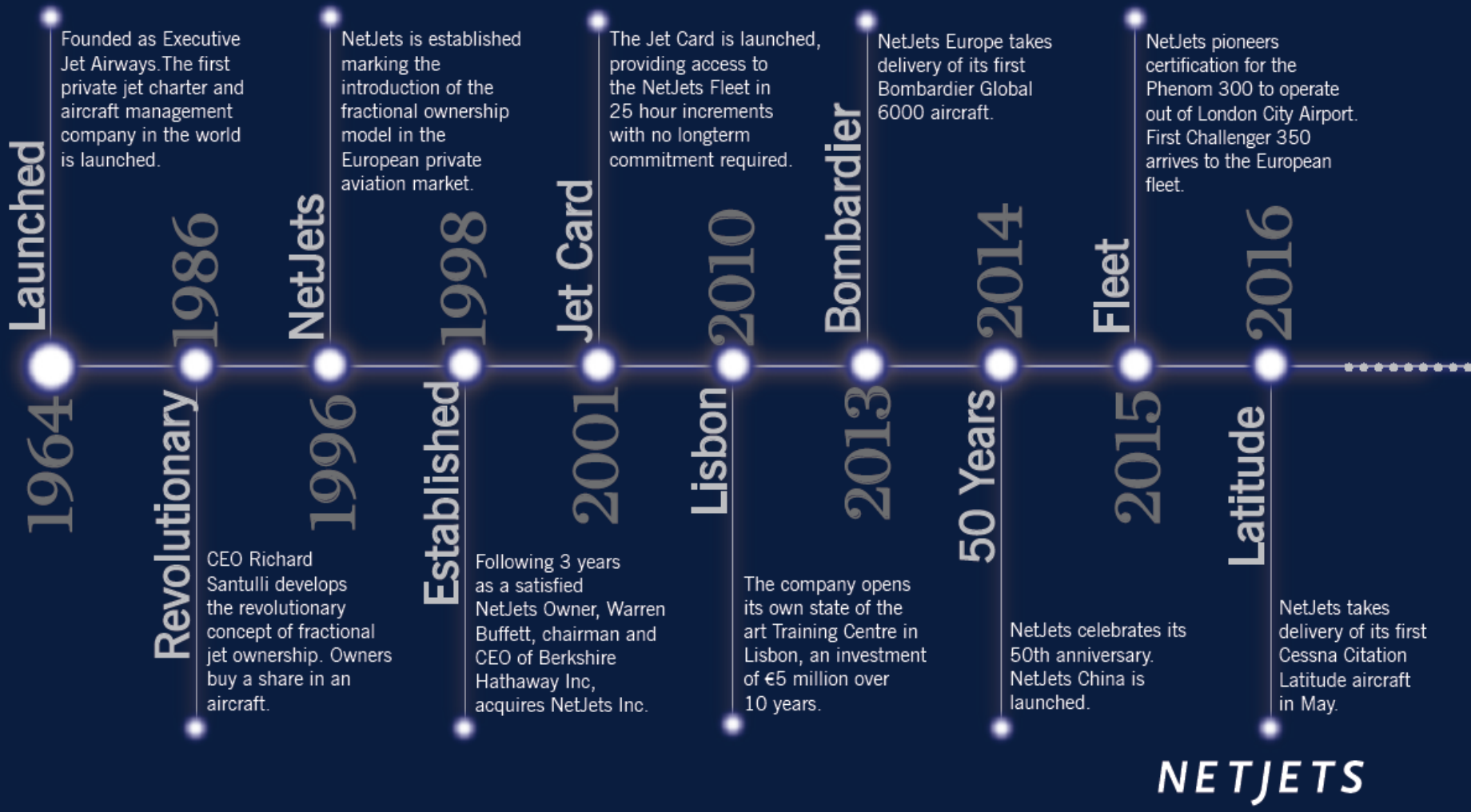
NETJETS

# WHO WE ARE

NetJets Europe is the world's leading business aviation company. Launched in Europe in 1996 and backed by Warren Buffett's Berkshire Hathaway, the Fractional Ownership Programme provides unmatched freedom and flexibility – all the advantages of owning a private jet, with none of the hassle.

In less than two decades, it has proven to be hugely popular with individuals and businesses looking to enhance productivity, work more efficiently, and relax more effectively.

# TIMELINE




NETJETS

# NETJETS BY NUMBERS

**700**
Aircraft worldwide
600 in the US
100 in Europe

**5,000**
Airports in 170 countries
with 900 in Europe alone

**7,600** NetJet Owners worldwide

**300,000**
Flights annually - equal to the world's fourth largest airline

**6,000** Aircraft professionals

**127,000,000**
Miles flown last year

**76,000** People in Europe flew on our jets last year


NETJETS


OUR BUSINESS
Whether around Europe or between continents, alone or with an entire management team, NetJets Europe has an aircraft and a programme to match the needs of every individual.
NETJETS

## EMBRAER PHENOM 300
Light Cabin

- Superlative range, reliability and runway performance
- Best in class for comfort, space and natural light
- The most fuel-efficient aircraft in the NetJets fleet
- 6 cabin seats and 1 belted lavatory seat
- Typical flight: Madrid to Berlin

## CESSNA CITATION XLS
Midsize Cabin

- The world's best selling jet
- Shortfield performance with midsize comfort
- Exceptional baggage capacity
- 7 cabin seats
- Range: 3.5hrs
- Typical flight: London to Dubrovnik

## HAWKER 750/800XP
Midsize Cabin

- NetJets Europe's most popular aircraft
- Combines comfort, cabin size and speed
- Considerable range with full payload
- 8 cabin seats
- Range 4.0 hrs
- Typical flight: Edinburgh to Casablanca

## CESSNA CITATION LATITUDE
Midsize Cabin

- A midsize jet with super - midsize comfort and the nimble performance of a light cabin
- Optimal cabin comfort with flat floor, large windows and generous height and width
- 7 cabin seats and 1 belted lavatory seat
- Range 5.5 hrs
- Typical flight: London to Tel Aviv

## BOMBARDIER CHALLENGER 350
Super-midsize Cabin

- Incomparable super-midsize jet with excellent performance
- Enhanced seat comfort
- Completely flat floor with in-flight baggage access
- 9 cabin seats and 1 belted lavatory
- Range 6.5 hrs
- Typical flight: London to Riyadh

## DASSAULT FALCON 2000EX
Large Cabin

- A premier large cabin jet with flight attendant service
- Stand up wide body cabin with full galley
- Excellent baggage capacity
- 10 cabin seats
- Range 7.0 hrs
- Typical flight: Dublin to New York

## GULFSTREAM G550
Large / Ultra long range

- The world's best-selling intercontinental business jet
- Spacious stand up cabin with oversized panoramic windows
- Full-service galley with flight attendant service
- 14 cabin seats
- Range: 13.0 hrs
- Typical flight: Manchester to Los Angeles

## BOMBARDIER GLOBAL 6000
Large / Ultra long range

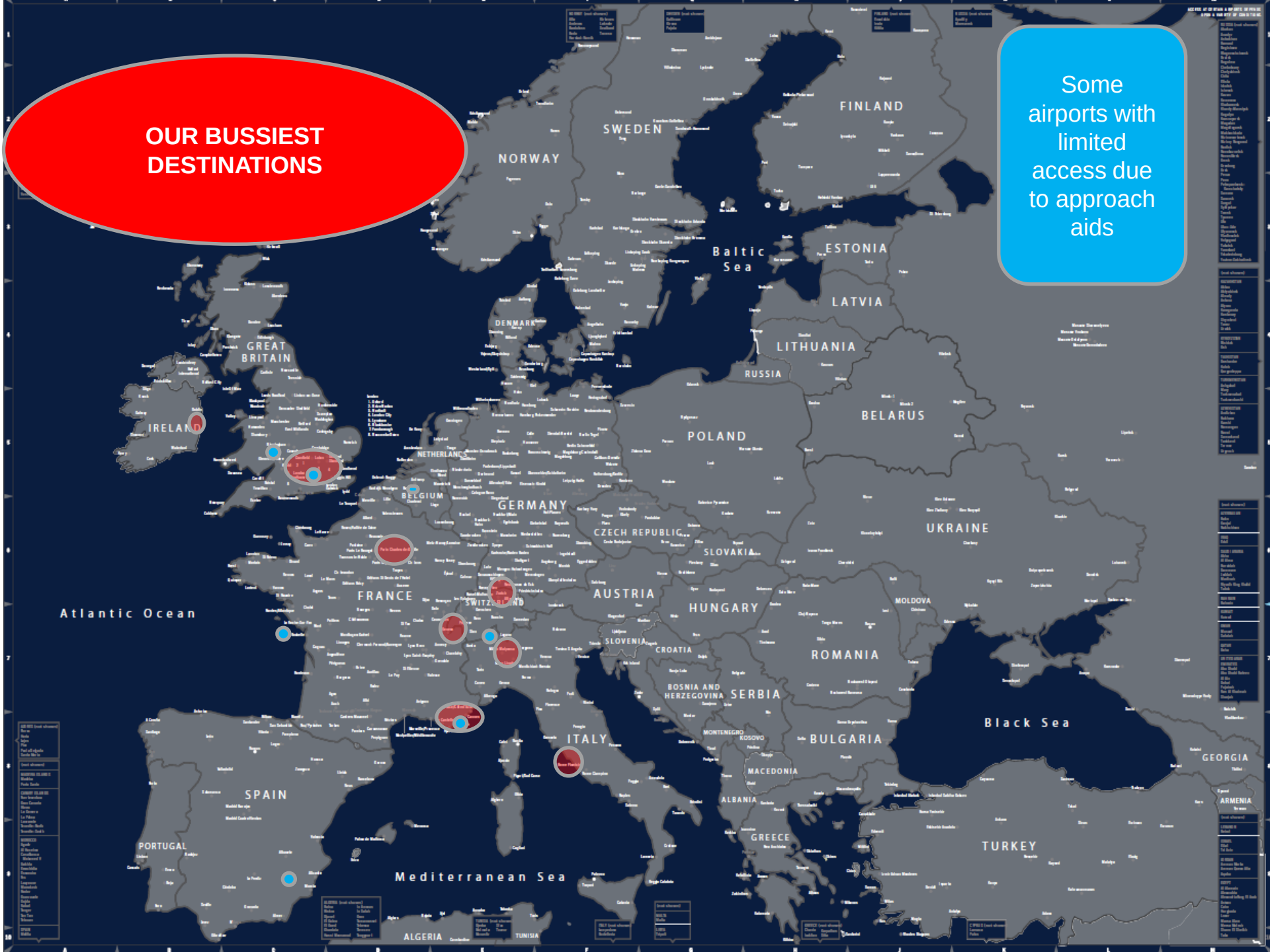
- The longest, largest seated compartment of any true business jet
- The quietest cabin in its class, with enhanced soundproofing specified by NetJets
- Full-service foward galley with flight attendant service, and a totally private aft stateroom

# OUR FLEET

NetJets Europe offers access to a diverse portfolio of 100 aircraft, spanning eight aircraft types, and partnering with aircraft manufacturers to offer Owners the most unique and diverse portfolio of jets in the world.

NETJETS

The range is based on the aircraft flying with four passengers at high speed cruise under standard atomospheric and wind conditions with standard NetJets fuel reserve


OUR BUSSIEST DESTINATIONS
Some airports with limited access due to approach aids
FINLAND
SWEDEN
NORWAY
Baltic Sea
ESTONIA
LATVIA
LITHUANIA
RUSSIA
BELARUS
DENMARK
GREAT BRITAIN
IRELAND
NETHERLANDS
BELGIUM
GERMANY
POLAND
CZECH REPUBLIC
SLOVAKIA
UKRAINE
FRANCE
AUSTRIA
HUNGARY
MOLDOVA
ROMANIA
Atlantic Ocean
SLOVENIA
CROATIA
BOSNIA AND HERZEGOVINA
SERBIA
MONTENEGRO
KOSOVO
BULGARIA
Black Sea
GEORGIA
ITALY
MACEDONIA
ALBANIA
ARMENIA
SPAIN
PORTUGAL
GREECE
TURKEY
Mediterranean Sea
ALGERIA
TUNISIA

# 1.2

## AIRPORT ACCESS

NETJETS

# EU AIRPORT CAPACITY : CHALLENGE FOR MOBILITY

## 1. COMMISSION'S AVIATION STRATEGY:

- "European airports will be unable to accommodate some 2 million flights due to capacity shortages" by 2035
- {making} "best use of existing capacity"

## 2. AIRLINES DRIVING THE AIRPORT DEMAND TO SPECIFIC AIRPORTS

## 3. BOOM OF THE LOW FARE MODEL

- Capacity at secondary airports more & more under pressure

# EU AIRPORT CAPACITY : CHALLENGE FOR MOBILITY

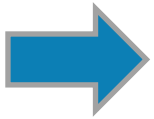
4. *INCREASING DIFFICULTY TO ACCESS PRIMARY AIRPORTS AND TO SOME SECONDARY AIRPORTS*

5. *A LOT OF AIRPORTS STILL VFR OR NO ACCESS TO CAT 1 MINIMA*

6. *BUSINESS AVIATION OPERATIONS AT RISK*

# EU AIRPORT CAPACITY : CHALLENGE FOR MOBILITY

*AT A TIME IN WHICH AIRPORT CAPACITY IS SEEN AS ONE OF THE MAIN CHALLENGES ACROSS THE EU*



*WE NEED TO* ***SECURE AIRPORT ACCESS***

*AND WE NEED TO SECURE THIS* ***IN ALL WEATHER SITUATIONS***

# WHAT CAN BE DONE TO OVERCOME THIS CHALLENGE?

## ONE OF THE MAIN SOLUTIONS

*Enhance use of satellite-based systems at airports*

NETJETS

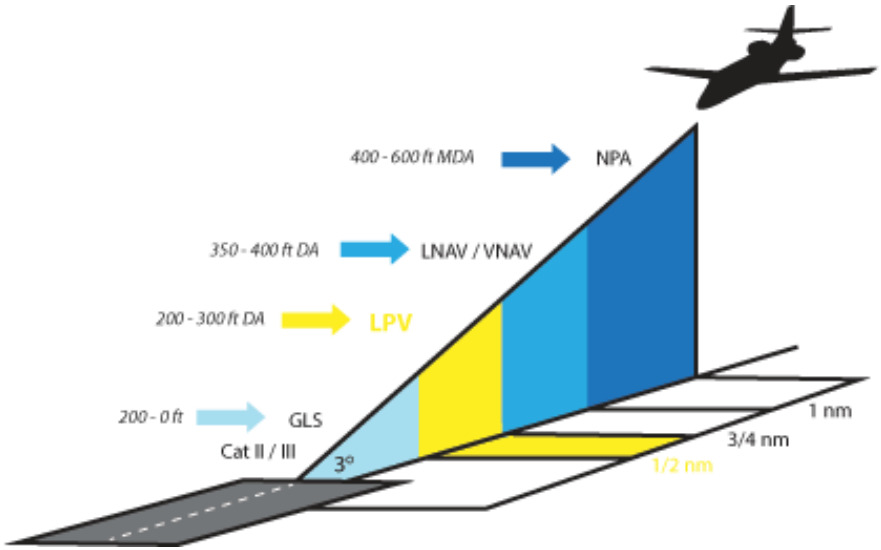
# 1.3

## TECHNICAL SOLUTION TO APPROACH AIDS

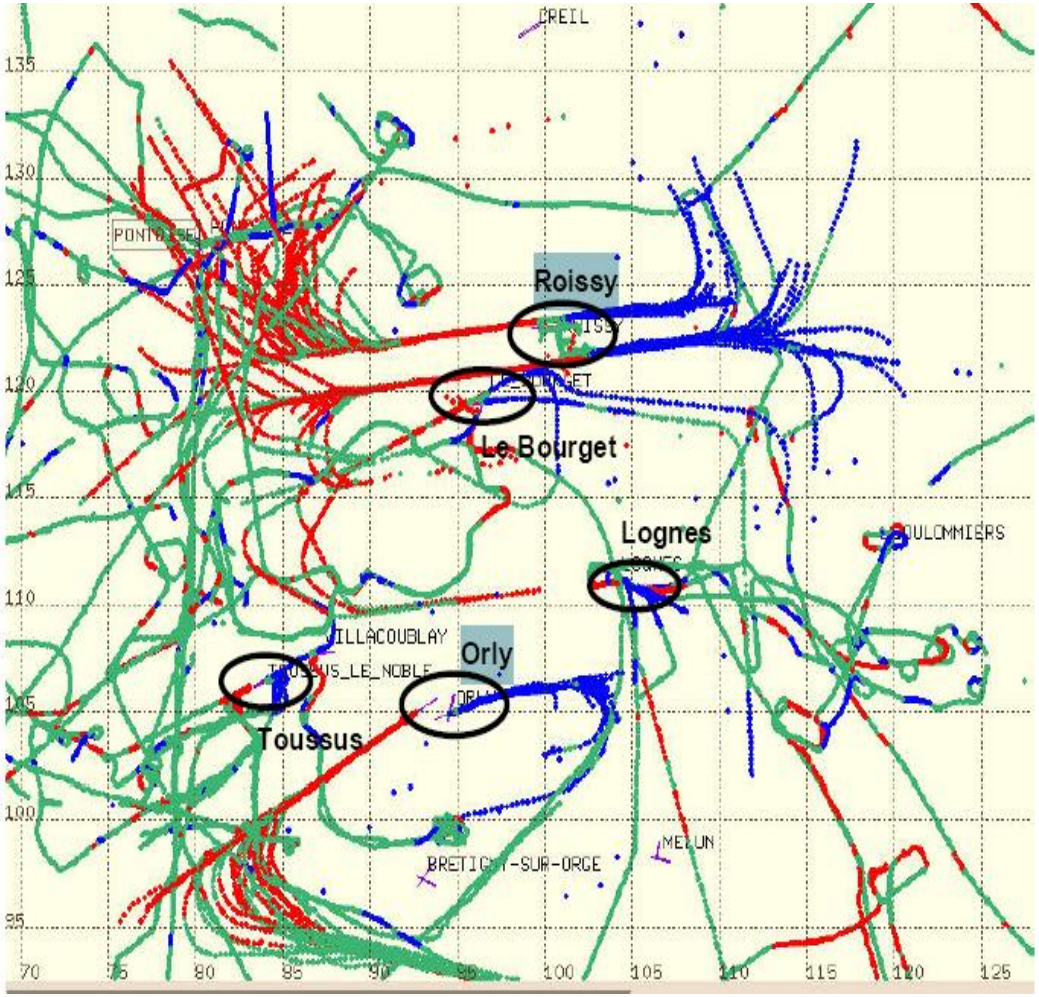
NETJETS

# TECHNICAL SOLUTION :
# DEPLOYMENT OF EUROPEAN GEOSTATINARY NAVIGATION OVERLAY SERVICES (EGNOS) BASED PROCEDURES
# LPV APPROACHES

- Equivalent to ILS Cat 1 > decision height down to 200ft
- Eliminates non-precision approaches
- Possible on all tracks without specific ground equipment



# TECHNICAL SOLUTION :
# RNP APPROACH ENABLING INDEPENDENT ARRIVAL/ DEPARTURE TO/FROM SATELLITE AIRPORTS




Better integration with primary airports

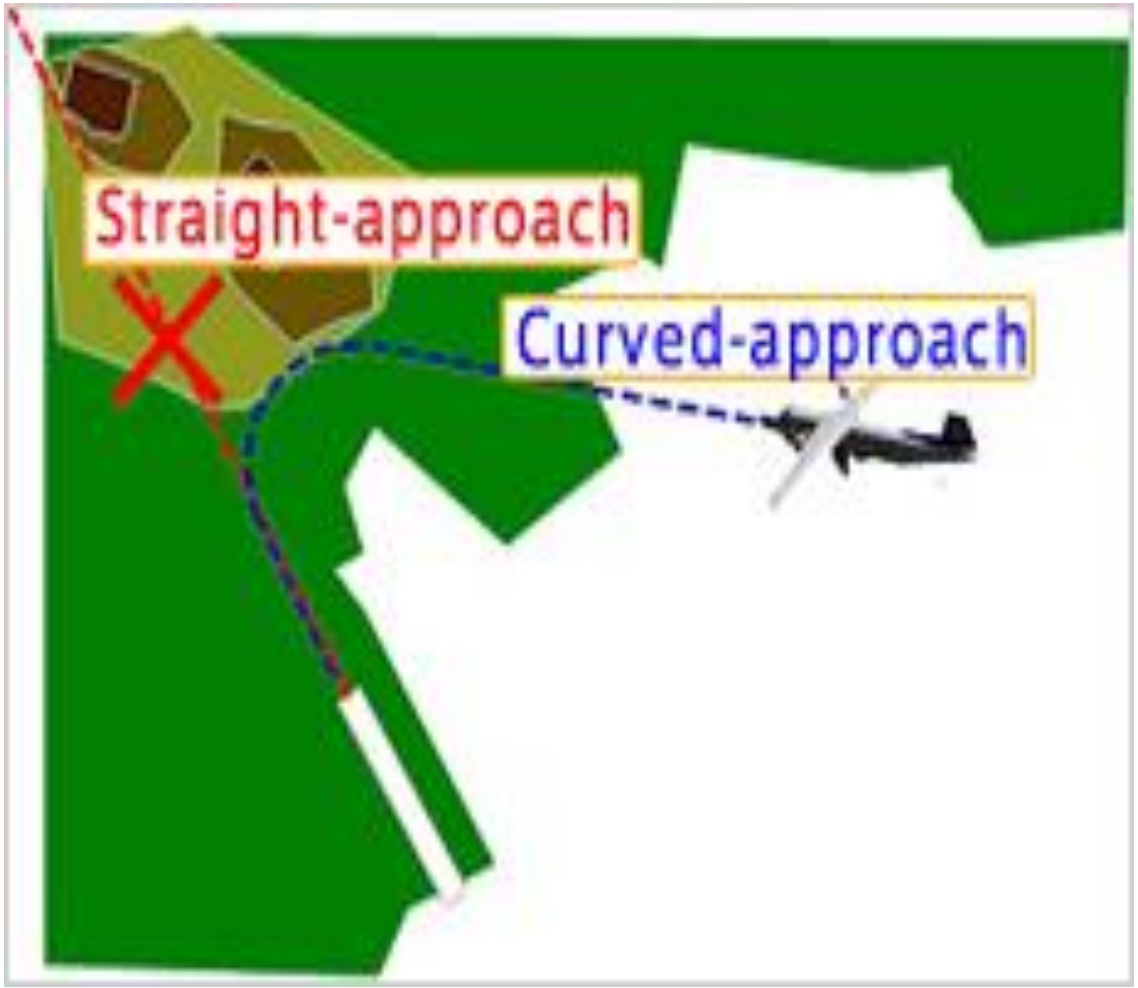
→ Minimizes impact on major airport traffic flows

→ Avoids early descend, which has a direct impact on fuel

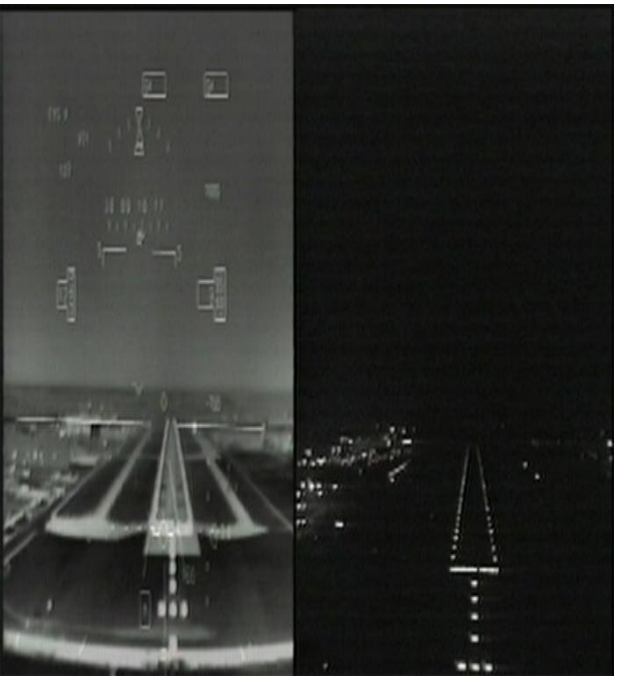
# TECHNICAL SOLUTION :
# SPECIAL APPROACH: CURVED APPROACH

- Access to restricted areas with a published approach where a straight in is not possible : *safety factor*

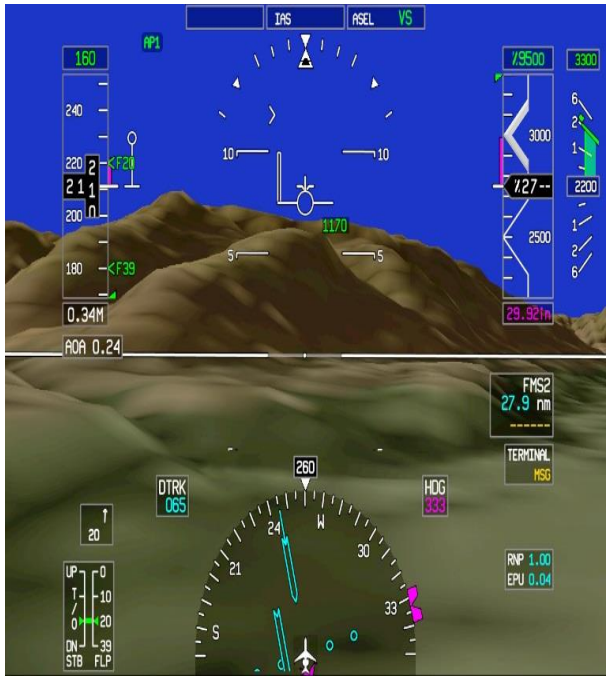
- Possible to avoid noise sensitive areas: *respect of the environment*



# TECHNICAL SOLUTION :
# LOW VISIBILITY CONDITIONS –IN CONJUNCTION WITH LPV APPROACHES, PROMOTE THE USE OF ONBOARD TECHNOLOGIES IMPROVING PILOT VISIBILITY



Enhanced Vision System




Synthetic Vision System


Combined Vision Systems (CVS)+ Head up Display (HUD)

# TECHNICAL SOLUTION :
# LOW VISIBILITY CONDITIONS –IN CONJUNCTION WITH LPV APPROACHES, PROMOTE THE USE OF ONBOARD TECHNOLOGIES IMPROVING PILOT VISIBILITY

- Increases pilot awareness in the cockpit ⟶ safety

- When combining LPV with CVS / HUD ⟶ possible to operate in equivalent conditions to Cat 2

# 1.4

## WHAT IS THE PRESENT STATUS ON

- AIRCRAFT EQUIPAGE
- REGULATION
- PROCEDURES
- OPERATIONAL ISSUES

NETJETS

# AIRCRAFT EQUIPAGE

## EMBRAER PHENOM 300
Light Cabin

- Sur[illegible]ge, reliability
- [illegible]y performance
- [illegible] in class for comfort, space and natural light
- The most fuel-efficient aircraft in the NetJets fleet
- 6 cabin seats and 1 belted lavatory seat
- Typical flight: Madrid to Berlin

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LPV

Syntetic vision

HUD/EVS

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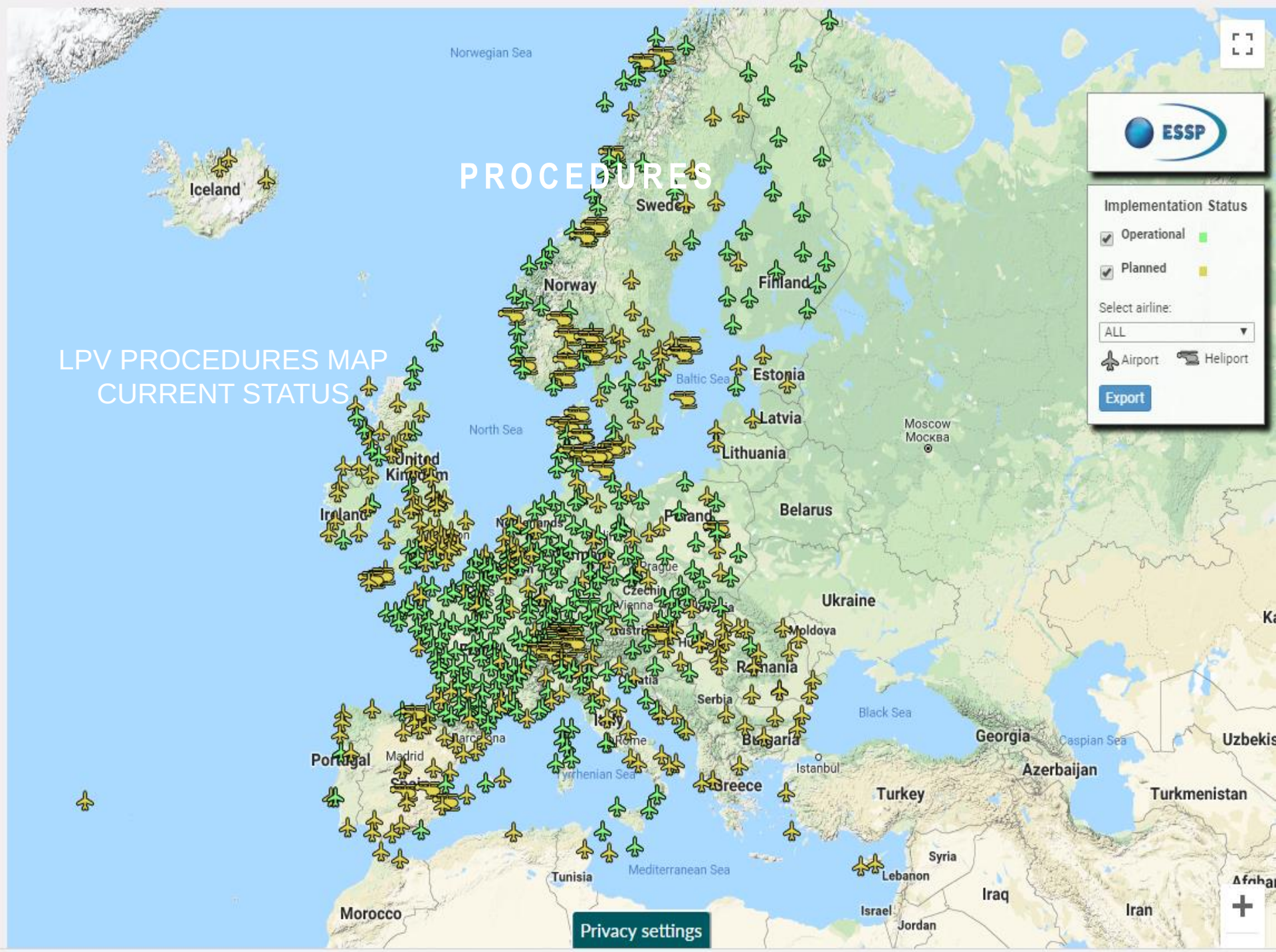
# REGULATION

## IMPLEMENTING REGULATION (EU) 2018/1048 PERFORMANCE BASED NAVIGATION

- ***MANDATE OF PBN IR 2018/1048 FROM JUL 2018 FOR AIR NAVIGATION SERVICE PROVIDERS:***
  - *LPV AND LNAV/VNAV ON ALL RUNWAYS WITHOUT PRECISION APPROACH BY DEC 2020*
  - *LPV AND LNAV/VNAV ON ALL RUNWAYS WITH PRECISION APPROACH BY DEC 2024*

- ***ALSO, THE CURRENT REGULATORY FRAMEWORK (PCP) IMPOSES:***
  - *SID/STAR: RNP1 IN THE TERMINAL MANOEUVRING AREA OF THE 24 LARGEST AIRPORTS BY JAN 2024;*
  - *RNP APPROACH W/ VERTICAL GUIDANCE LNAV/VNAV & LPV AT 24 LARGEST AIRPORTS BY JAN 2024*


PROCEDURES
LPV PROCEDURES MAP
CURRENT STATUS
ESSP
Implementation Status
Operational
Planned
Select airline:
ALL
Airport
Heliport
Export
Norwegian Sea
Iceland
Sweden
Norway
Finland
Baltic Sea
Estonia
Latvia
Lithuania
North Sea
Moscow
Москва
United Kingdom
Ireland
Belarus
Poland
Prague
Czechia
Vienna
Ukraine
Moldova
Romania
Serbia
Black Sea
Bulgaria
Georgia
Caspian Sea
Uzbekis
Portugal
Madrid
Rome
Istanbul
Azerbaijan
Greece
Turkey
Turkmenistan
Tunisia
Mediterranean Sea
Syria
Lebanon
Iraq
Iran
Israel
Jordan
Morocco
Privacy settings

# OPS ISSUES

*REGULATORY: OPERATIONAL APPROVALS FOR OPERATORS*

*DEVELOPMENT:*

- *IFR IN UNCONTROLLED*
- *SUPPORT TO LOCAL AND REGIONAL ENTITIES*

*OPERATIONAL: FEW*

- *MORE LINKED TO FINGER TROUBLE*
- *IN LAST 3 YEARS: 3 CASES OF LOSS OF SIGNAL*
- *SOME CASES OF VERTICAL GLIDE NOT CAPTURED*

*TRAINING: NONE*

# PROS

- SAFETY
  - More stable approach
  - No false glide slope
  - Reduced workload if have an IFR approach

- IMPROVED ACCESS \ COST SAVINGS
  - No need for outage due to ILS on maintenance
  - Reduced cost to implement as no ground equipment
  - Possible reduced fuel burn if avoid circle
  - No operational limits due to cold weather
  - More landings at less well-equipped airports
  - Increased capacity, benefiting both airport and airline operators
  - Curved approaches and more efficient routes
  - Possibility to phase-out some expensive ground based navaids infrastructure and to free valuable radio spectrum that can be exploited for new/other service

# CONS

- NO CAT III capability….yet
- Not every location is prone to develop a procedure
- Jamming; contingencies

- Others:

?

# MOVING FORWARD

**FULLY SUPPORT IMPLEMENTATION OF PBN-IR THAT PROMOTES DEVELOLPMENT of LPV APPROACHES**

- CONCRETE SOLUTION
- COST EFFICIENT AND EFFECTIVE SOLUTION

  THAT WILL INCREASE AIRPORT ACCESS
- BEST WAY TO ENSURE SAFER ACCESS TO AIRPORTS IN ALL WEATHER CONDITIONS

NETJETS

NETJETS

# THANK YOU

*Pascal Lhoest*
*Regulatory Affairs Executive*
*plhoest@netjets.com*