XWING

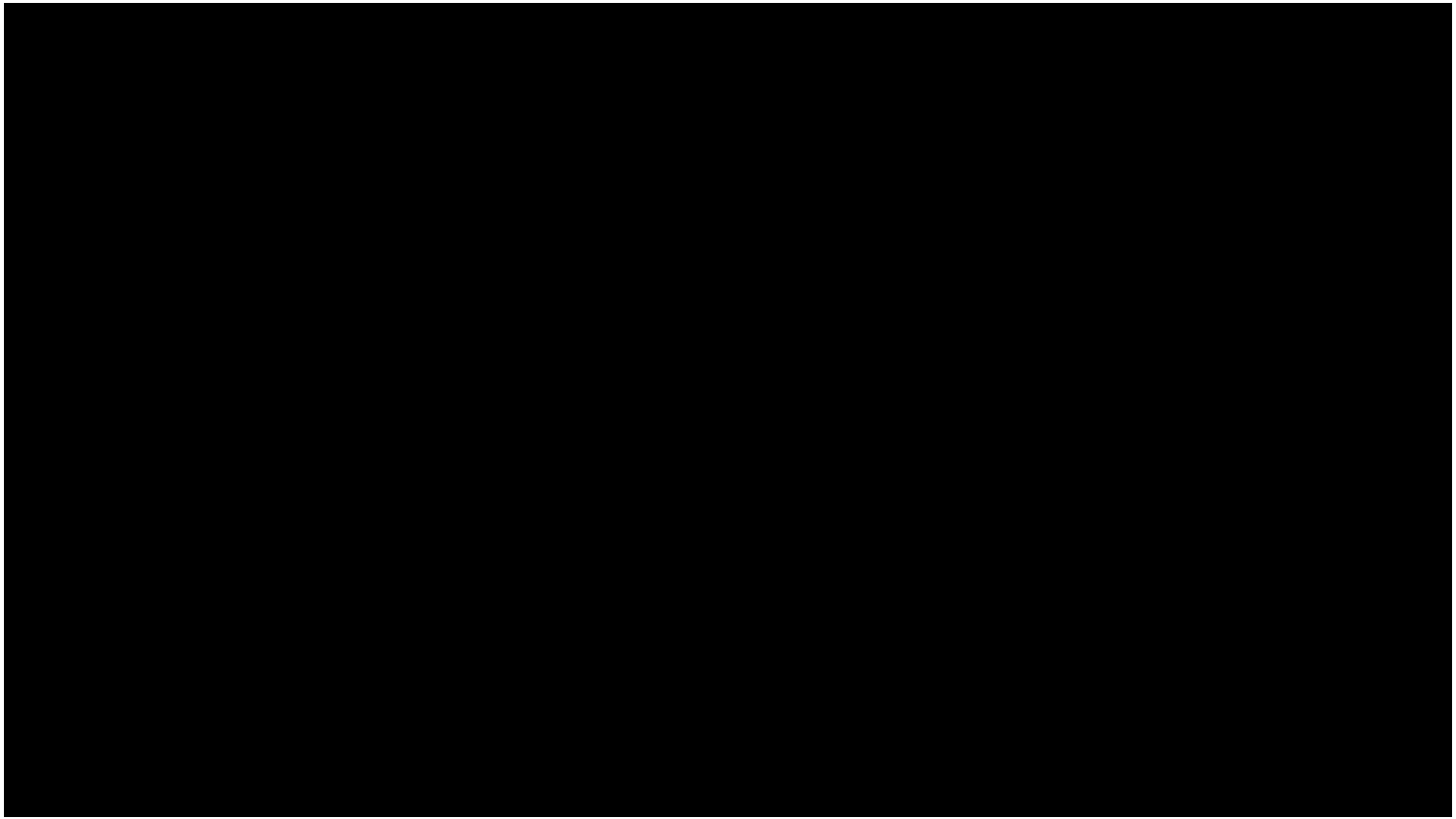
The Leader in Autonomous Aviation

Kevin Antcliff, Head of Product

2023 AUVSI Advanced Air Mobility Exposition

For more about Xwing, visit us at www.xwing.com

Xwing **Introduction**



Xwing Introduction

What is autonomy?

Change to the pilot's role and location

The **aircraft is self-sufficient**, capable of safely conducting all phases of flight, including taxi and detect and avoid of cooperative/non-cooperative traffic

The **pilot supervises the flight** from a mission control center, similar to an air traffic controller

All of the Xwing tech is applicable to and will **improve safety in both piloted and autonomous aircraft**.

Building on 100 years of aviation automation

We leverage **recent advancements in sensor technology and processing methods** to solve the few remaining problems to allow for full autonomy

We use **deterministic and certified AI** where traditional methods cannot be used

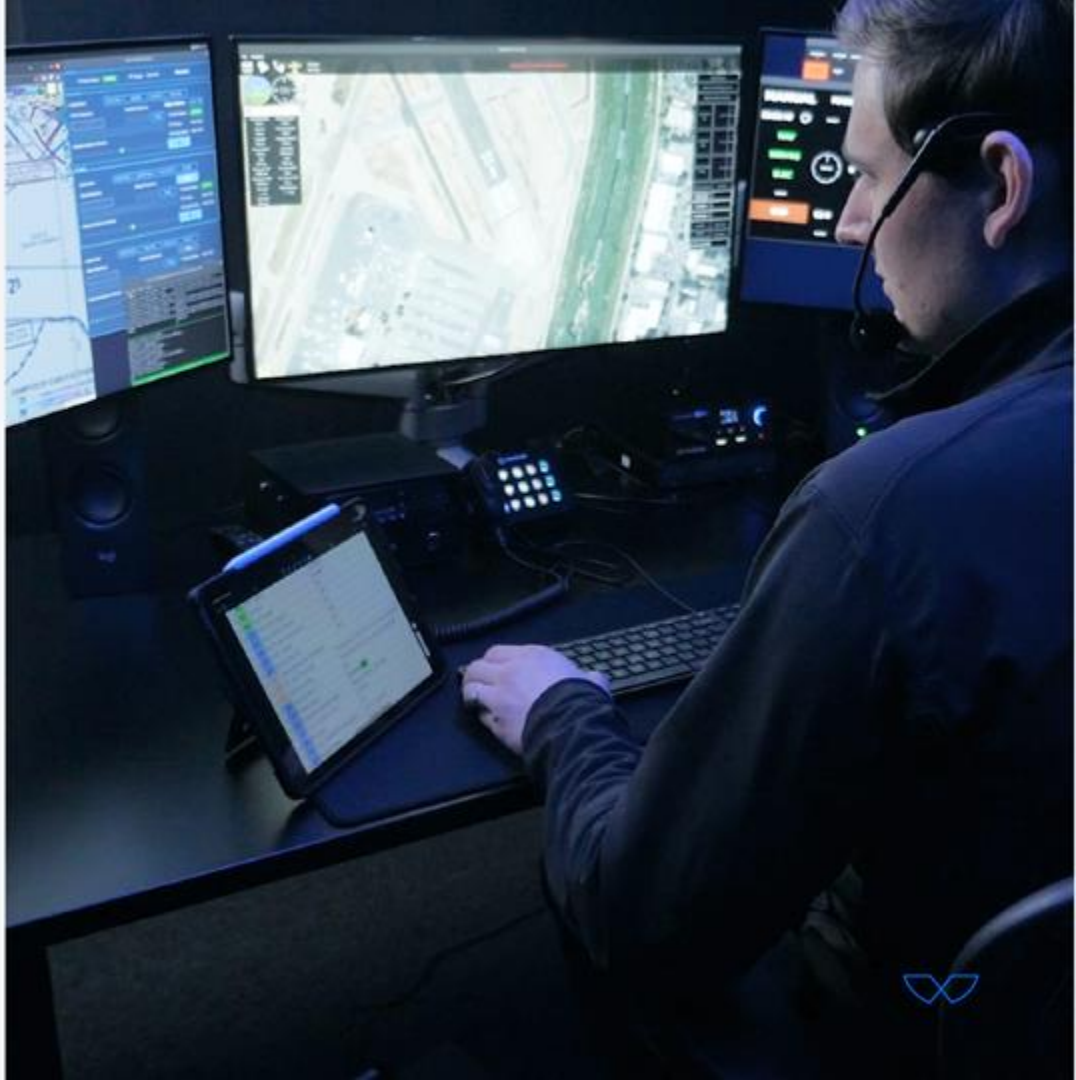
We **build on decades of safety knowledge and processes** and apply them to new technologies

Keeping humans involved to supervise and monitor

From the Mission Control Center, remote supervisors:

- Communicate with air traffic control and other aircraft
- Approve/modify the aircraft's proposed flight plan
- Allow the aircraft to progress through critical phases of flight
- Will have ability to supervise many aircraft at once

Keyboard Mouse Headset



Xwing leads the industry in developing certifiable autonomy technology

Relieve Pilot Shortage

One-to-many ops (like air traffic control), faster training, more diverse workforce, flexible schedule

Improve Safety & Security

Removes common pilot errors; decisions made 50 times per second

Lower Operational Costs

Removes dominant cost factor

Increases network flexibility; increase asset utilization

"Fly the Battery"

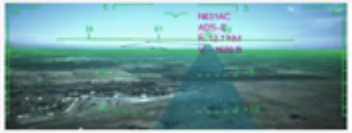
Increase vehicle range; increase battery and cycle life

OUR SHORT TERM GOALS :

Certifying our autonomy stack with the FAA for commercial use

Advancing DoD deployment to fulfill military needs

Xwing's tech stack makes **any** aircraft autonomous through all stages of flight operations



Mission management system
Decision making engine

Detect and avoid
Hazard avoidance in air/on ground

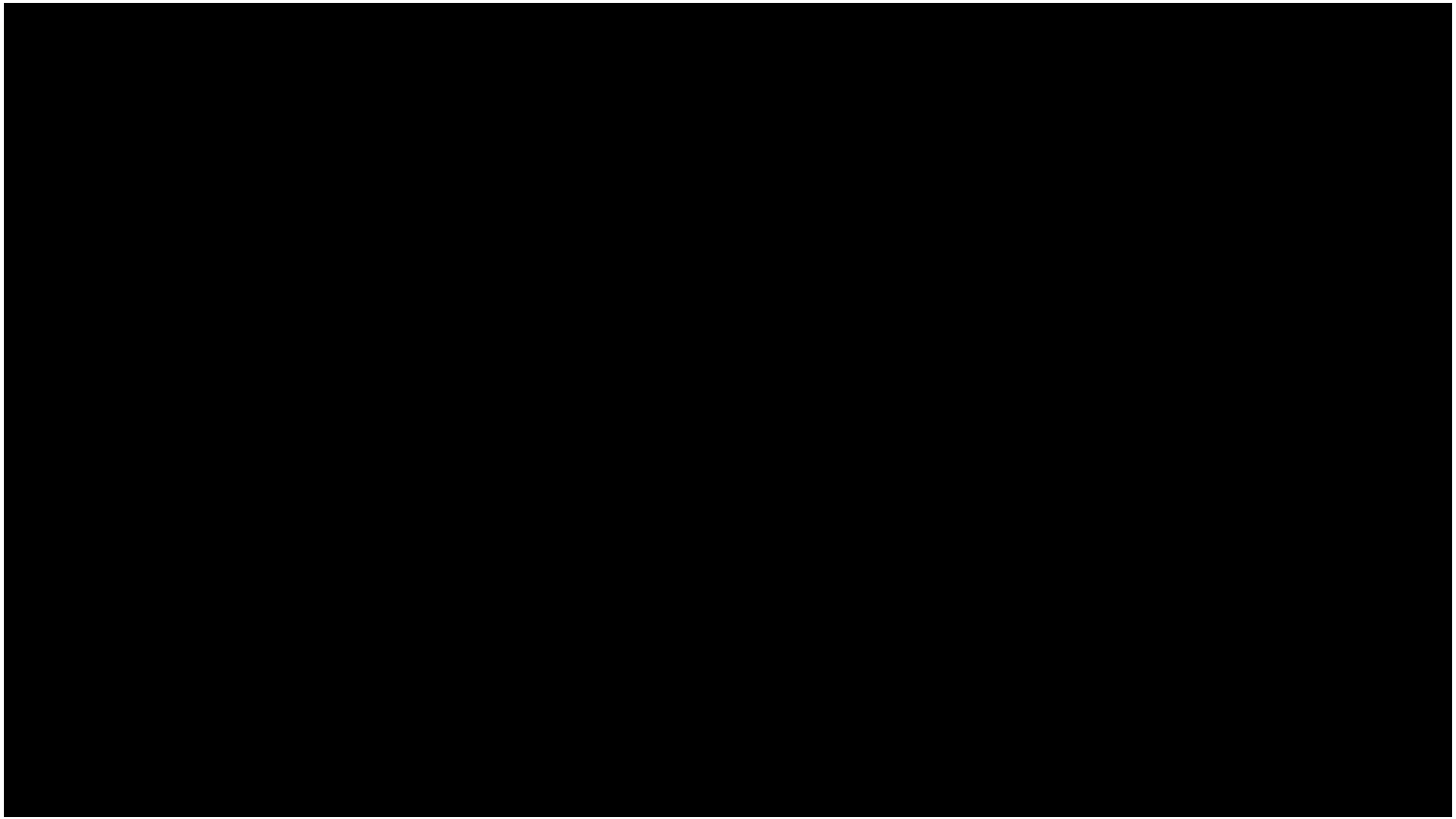
Precision navigation
Landing without ground infrastructure

Communication
Secure and redundant

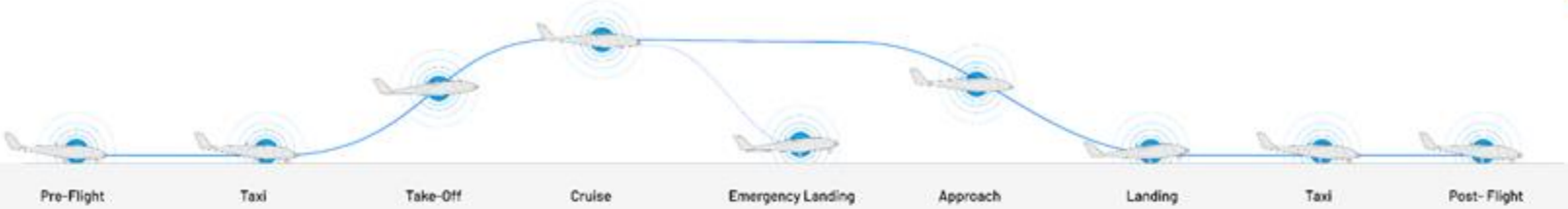
Mission Control Center
Ground-based flight supervision

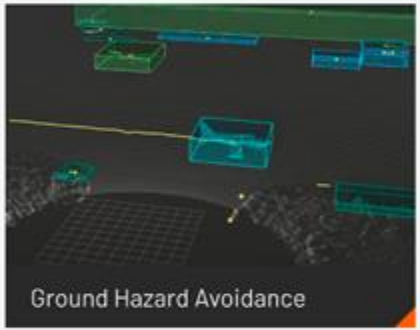
2023	Xwing enters FAA certification program for uncrewed autonomous system
2022	Dual-use SBIR projects begin
2021	Joint development partnership with Textron
2021	Completes first fully autonomous gate-to-gate flight
2020	Start of UPS Partnership, piloted commercial cargo operations begin
2019	Xwing acquires first aircraft: Cessna Grand Caravan 208B
2018	Xwing and Bell partner to complete NASA UAS demo
2016	Xwing founded

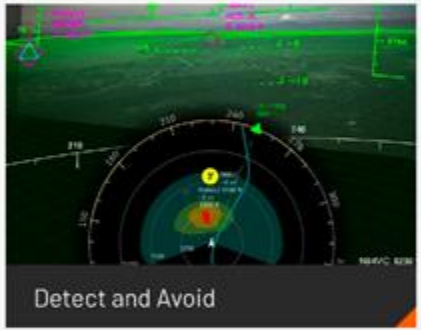
Gate-to-Gate Flight: February 2021



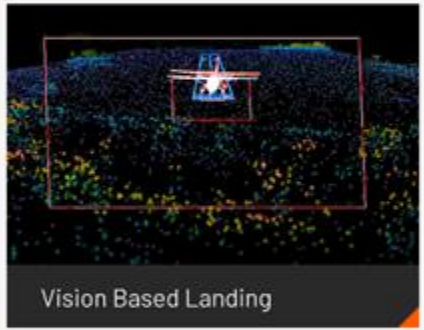
Xwing Gate to Gate - Short Version - Feb 2021




Ground Hazard Avoidance

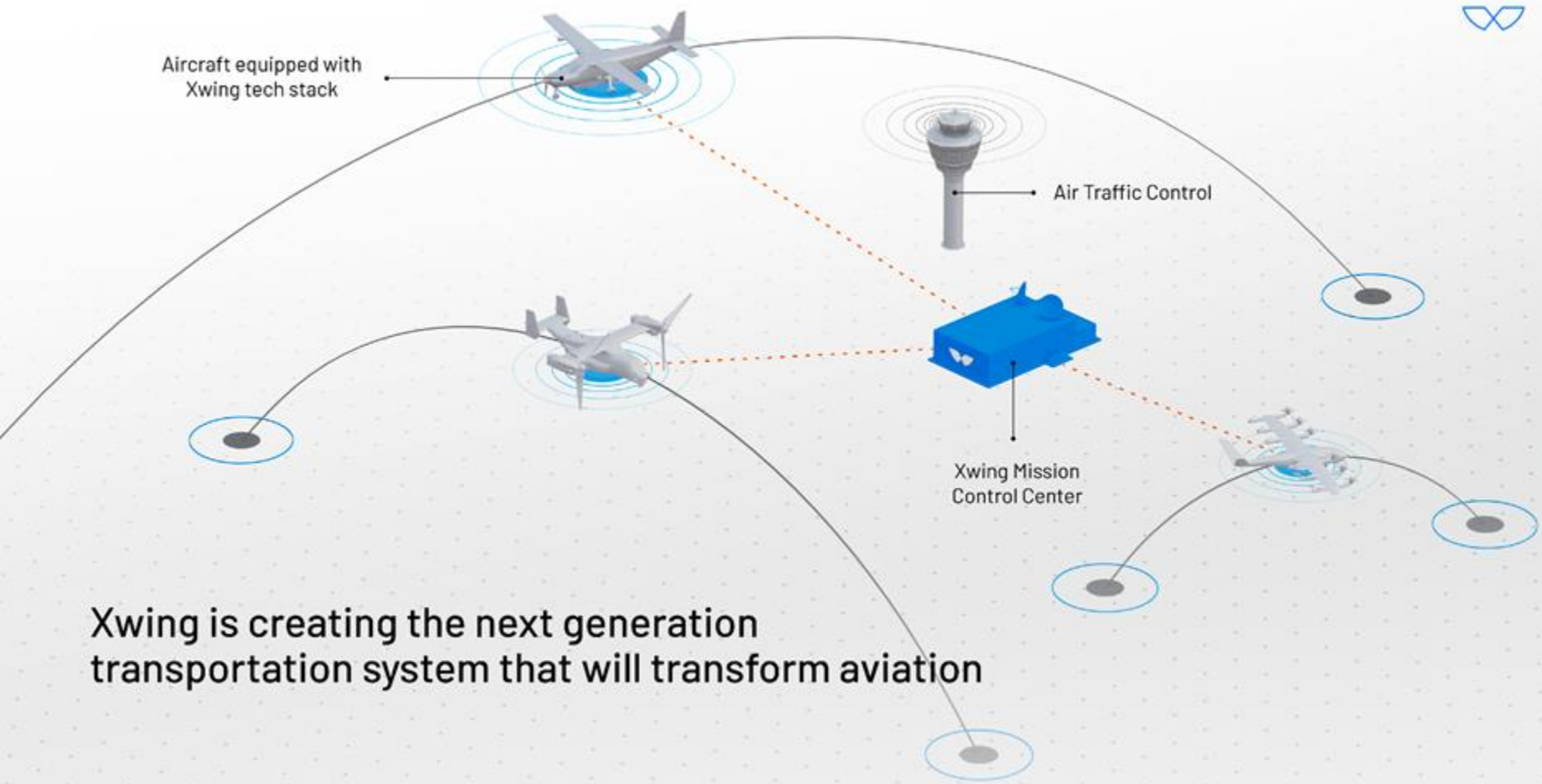

Detect and Avoid


Emergency Landing


Vision Based Landing

Xwing's Cessna Caravan has flown autonomously since 2021

525	400	40000	240
Auto-Landings	Flight Hours	Miles Flown	Autonomous Flights

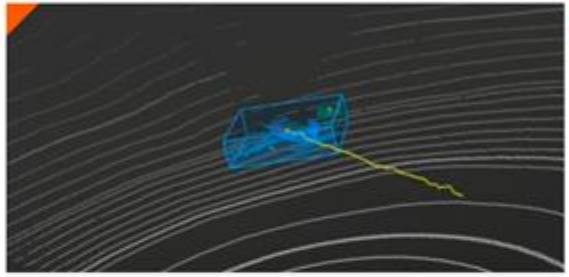


Xwing is creating the next generation transportation system that will transform aviation

Xwing leads the industry in the responsible deployment of AI in aviation

Unique and proprietary data, gathered from real world and simulations

- Onboard sensor pods collect a wealth of varied condition and location perception data
- Real-world flight operations from our Part 135 airline
- Advanced simulated data environment to efficiently train on repeated exposure



Innovative, market-leading AI for aviation

- Machine learning & deep neural networks to auto-detect runways, enable auto-taxi, enhance detect-and-avoid capabilities
- AI enhances safety with added redundancy & performance
- AI enhances security with guards against GPS and ILS fails due to jamming, spoofing or radio interference

Active FAA certification program, the first with AI

- Published multiple peer-reviewed and award-winning papers and industry-leading AI certification frameworks
- Working directly with FAA's Chief Scientist on frameworks to certify AI
- Entered certification program in April 2023, on track for Certification Basis (G-1)

Cargo and Defense are first, leading the way for broader adoption of autonomy

The Cessna Caravan is our first application

Fastest way to FAA Certification
Modifying an existing, well-known aircraft is the best way to derisk certification

Lowest risk for regulatory approval
Working within the existing rules and minimizing alternate means of compliance

An FAA certified autonomous aircraft requires an FAA certified airline to operate it
Xwing owns and operates a cargo feeder airline in the UPS network

Proven product-market fit
There is a high demand in both cargo industry and DoD

"It was the quality of the technology, pragmatic approach to compliance, and commitment to safety that drew me to Xwing."

Earl Lawrence
Chief Compliance and Quality Officer
Former FAA Executive Director
Aircraft Certification

Market demand for autonomy is strong today and will exponentially increase tomorrow

In progress and inevitable transition

Reasonably high probability over time

Now

Later

$81B + $290B

$730B

DEMAND DRIVERS

Defense

US technical superiority
Agility - IndoPac theatre
Contested logistcs

Commercial Cargo

Need for low-cost delivery
Customer service (faster, ubiquitous)
Ability to meet climate goals

Air Taxis

Enabled by electric propulsion
High number of vehicles
2-6 passengers

Introducing the Xwing executive team

Fred Cromer

Chief Executive Officer

Former President, Bombardier
Sold the C-Series aircraft program (now A220) to Airbus

Former President, ILFC
Managed $40B of assets during the financial crisis

Former CFO, Continental Express
Took the airline public through IPO

BOMBARDIER ILFC

Maxime Gariel, PhD

Co-founder, President and Chief Technology Officer

Former Chief Engineer, Collins Aerospace
Led the conversion of a full-size, piloted helicopter to fully autonomous

Post-Doc, MIT:
Aircraft collision detection and avoidance

PhD, Georgia Tech:
"Graceful Degradation of Air Traffic Management Systems"

Thales
Design of autopilots for airliners

THALES Collins Aerospace

Earl Lawrence

Chief Compliance and Quality Officer

Former FAA Executive Director of Certification
Led revamp of small aircraft certification (Part 23) regulations to support technical innovation

Former FAA Director
Unmanned Aircraft System (UAS) Integration Office
Launched UAS integration office responsible for initial UAS regulation certification and policies.

Former VP Industry & Regulatory Affairs, EAA
Drove creation of Sport Pilot and Light Sport Pilot certification categories.

EAA

Right team, right time: Xwing's world-class engineering and certification team includes industry-leading experts, advisors, and innovators.

Joby

Led eVTOL vehicle design at Joby and Kittyhawk from concept to realization

MS in Aerospace Engineering, Stanford

TERRAFUGIA

Led computer systems, instrument panels design and certification of Eclipse Jet

FAA Certification advisor Bombardier, Mitsubishi

AIRBUS prime air

Developed vision-based applications for Acubed and Amazon Prime Air drone delivery program

PhD, Aerospace Engineering, Georgia Tech

NASA

6 years as a NASA research engineer researching provably safe decision making algorithms

PhD in Aerospace Engineering, University of Michigan

Collins Aerospace

15 years designing UAS autonomy systems across many military platforms (Rockwell Collins)

MS in Aerospace Engineering, Stanford

NASA

Industry thought leader who authored NASA white paper to define regional air mobility

MS Aerospace Engineering, Virginia Tech

TERRAFUGIA

Regulatory advisor and thought leader UAS, eVTOL and Co-founder COO Terrafugia

MS, Aerospace Engineering, MIT

SAFRAN

Certification expert who led many STC certification projects end-to-end through the FAA, EASA and other regulators

MS Engineering Management, Duke University

LOCKHEED MARTIN

F-35 Program Flight Test Engineer (Skunk Works - Lockheed Martin)

National Test Pilot School graduate

MITRE

8 years leading military SATCOM and tactical datalink for airborne system

MS, System Engineering, Worcester

XWING

Questions?

- kevin@xwing.com

For more about Xwing, visit us at www.xwing.com