This presentation does not contain any proprietary, confidential, or otherwise restricted information

The Future of Aerospace Manufacturing and Role of Composites and AI

Future Composites Symposium

November 13 - 14, 2024

Tim Gaur, Sr. Manager
Research and Technology

Airbus Americas
Herndon, VA

Co-Sponsors:

Our **purpose**

We pioneer sustainable aerospace for a safe and united world.

AIRBUS

impact

275,000+
American jobs supported by Airbus spending in U.S.

5,000+
Airbus employees

22+
Partnership universities in the U.S.

2,000+
U.S. suppliers located In 40+ U.S. states

$15+ BILLION
Spent annually in the U.S.

AIRBUS

U.S. operations

COMMERCIAL
- Atlanta, GA – Skywise HQ
- Aurora, CO – Training Center
- Herndon, VA – Headquarters
- Miami, FL – Training Center
- Miami, FL – Latin America HQ
- Mobile, AL – Design & Engineering Center
- Mobile, AL – Mobile Manufacturing Site
- Mobile, AL – Flight Works
- Newport Beach, CA – Engineering & Procurement
- Washington, DC – GR & Safety/Tech Affairs
- Wichita, KS – Design & Engineering Center
- Mukilteo, WA – Airbus Robotics

COMMERCIAL SUBSIDIARIES
- Atlanta, GA – Satair Atlanta
- Boca Raton, FL – VAS Aero Systems HQ
- Herndon, VA – Metron Aviation, Inc.
- Dulles, VA – Satair Spares Center
- Herndon, VA – Satair
- Kent, WA – VAS Aero Services
- Miami, FL – Satair USA
- Menlo Park, CA – Airbus Ventures
- Sunnyvale, CA – Acubed, Airbus Innovation Center
- Wilmington, DE – NAVBLUE US

HELICOPTERS
- Grand Prairie, TX – Headquarters
- Columbus, MS – Manufacturing Site
- Dallas, TX – Distribution Center
- Fort Novosel, AL – Programs & Support, Warehouse

SPACE AND DEFENSE
- Arlington, VA – Headquarters
- Fort Novosel, AL – Training Center/CLS
- Huntsville, AL – Stratospheric Center of Excellence
- Denver, CO – Space Systems
- Houston, TX – Space Exploration
- Merritt Island, FL – Manufacturing Site

DS Military Aircraft
- Mobile, AL – MRO

DS. Geo Inc
- Herndon, VA – Geospatial Intelligence
- Fort Collins, CO – Secure Communications & Imagery

DS Government Solutions, Inc.
- Plano, TX – Mission Critical Comms

AIRBUS

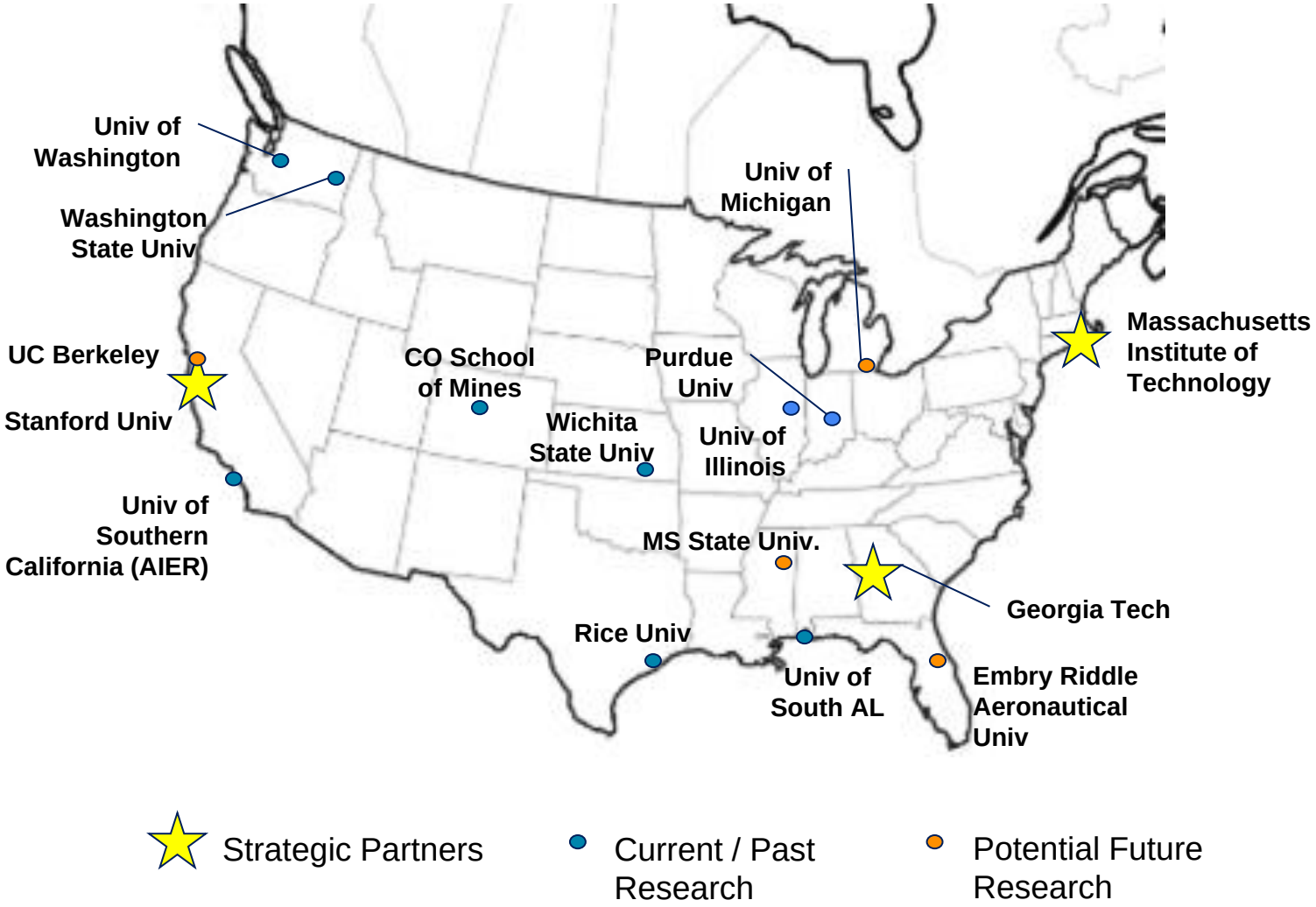
Airbus Research & Technology Footprint

- **Advancing what we make and how we make them by leveraging American innovation.**
  - Aligned with Airbus Technology Roadmaps, Central R&T, ZEROe, and engineering centers.
- **Airbus Americas R&T** is the point of operation for Airbus Technology in the Americas.
  - Research organization & U.S. Gov't research grant projects
  - University sponsorships
  - Cross-industry consortia
  - Global technology scouting
  - Professional memberships
- **Airbus Americas Research & Technology Nexus** focuses on communication and coordination.
  - Forum for research activities and innovation projects
  - Center for coordination on technology focus areas and organizations
  - Point of contact and coordination for R&T visits and contracts
  - Project approval process assistance
  - Provide opportunities for collaboration

R&T University Engagement

Research Topics

Aeroacoustics
Artificial Intelligence
Air Traffic
Cabin & structures design
Composites
Computing
Connectivity
Cyber Security
Electrification
Hydrogen and SAF
Industrial Systems
Integrated airframe
Manufacturing
Materials
Robotics
Safety
Sustainability
Vehicle configuration

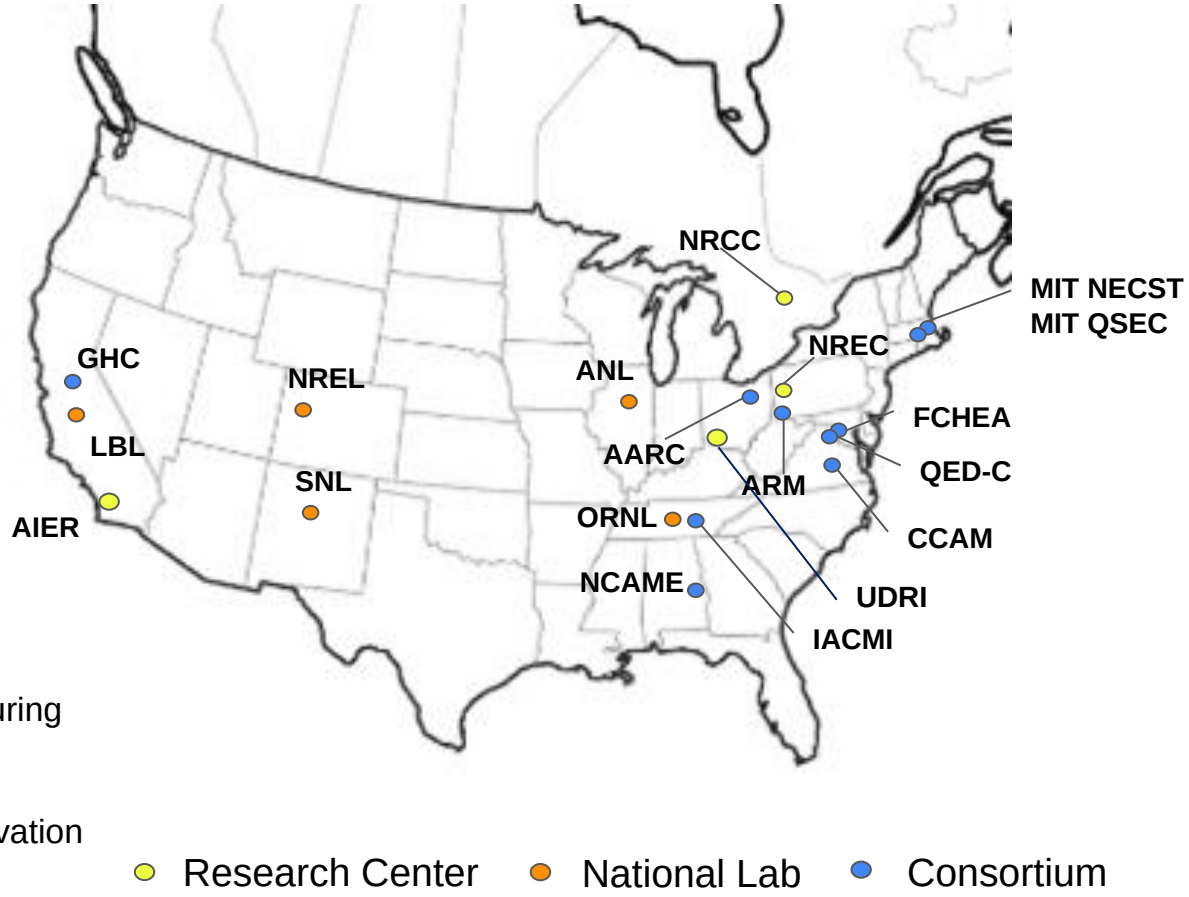


R&T Consortium and Research Center Engagement

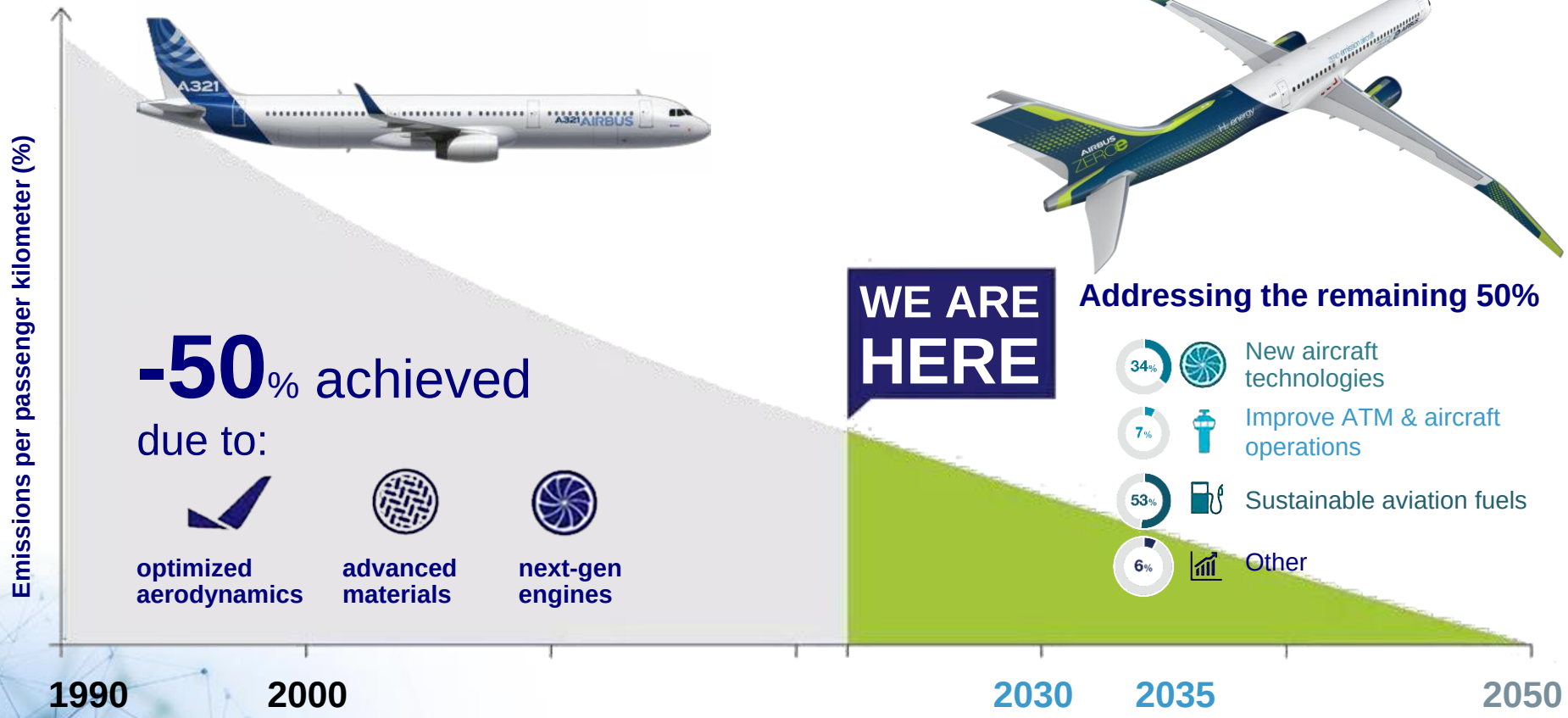
Research Center:
AIER – Airbus Institute for Engineering Research
NREC – National Robotics Engineering Center
NRCC – National Research Center of Canada
UDRI - University of Dayton Research Institute

National Labs Engagement:
NREL – National Renewable Energy Lab
LBL – Lawrence Berkeley National Lab
ORNL - Oak Ridge National Lab
ANL - Argonne National Lab
SNL - Sandia National Lab

Consortia Memberships:
AARC – AeroAcoustics Research Consortium
ARM – Advanced Robotics in Manufacturing
CCAM – Commonwealth Center for Advanced Manufacturing
GHC – Green Hydrogen Coalition
FCHEA – Fuel Cell & Hydrogen Energy Association
IACMI – Institute for Adv. Composite Manufacturing Innovation
MIT NECST – NanoEngineered Composite STructures
MIT QSEC – Quantum Systems Engineering Consortium
NCAME – National Center for Additive Manufacturing Excellence
QED-C - Quantum & Economic Dev. Consortium



Aviation Challenge



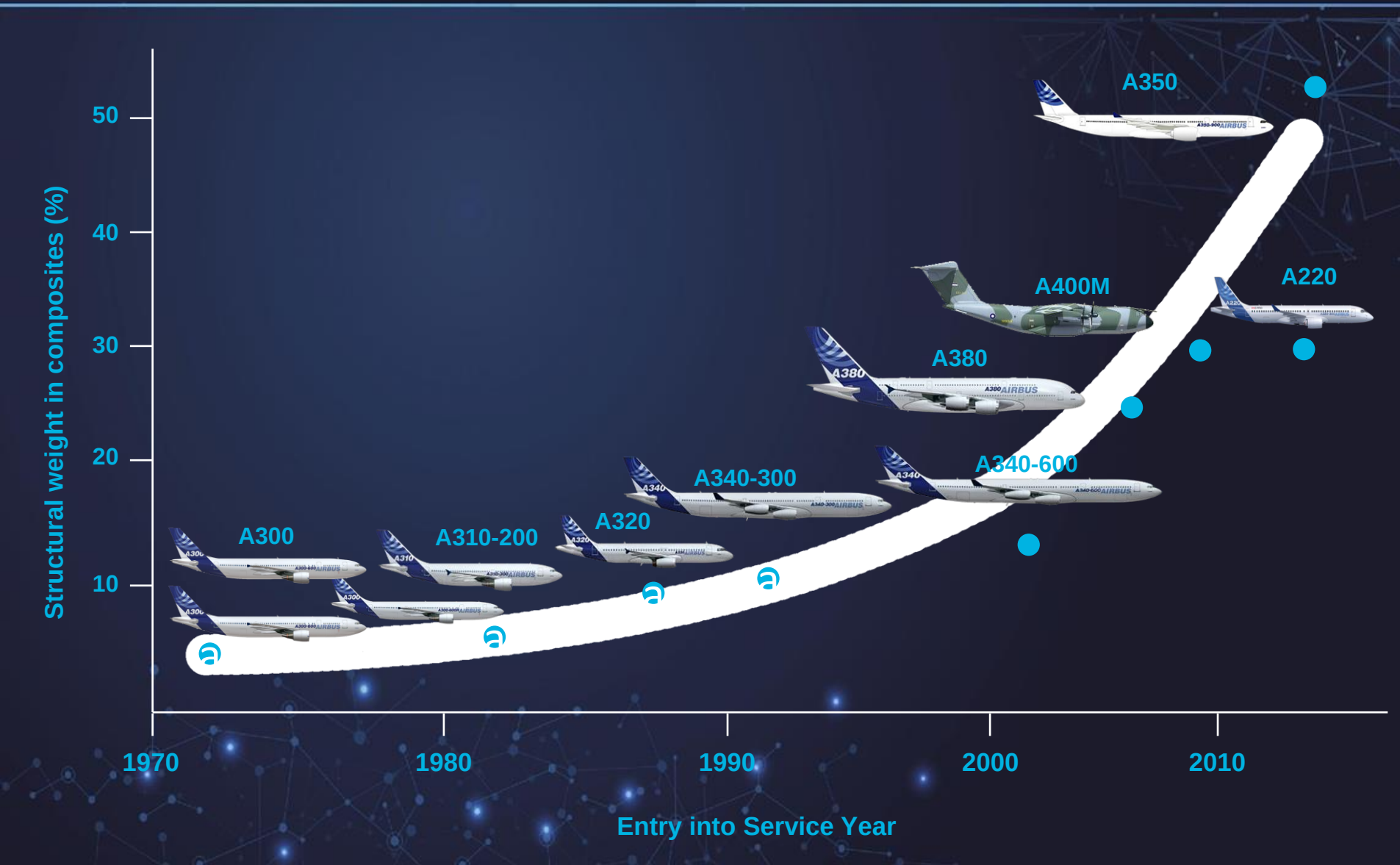
Addressing the remaining 50%

- 34% New aircraft technologies
- 7% Improve ATM & aircraft operations
- 53% Sustainable aviation fuels
- 6% Other

- Support the aerospace industry's decarbonization roadmap, set by ATAG and IATA, to reach NET ZERO Carbon emissions by 2050
- Airbus has the ambition to lead the pathway towards decarbonization

AIRBUS

The Relevance of Composites in Aeronautical Industry



Composite Evolution in Airbus

Advanced composite materials have played an important role to improve efficiency and decrease the environmental impact of our aircraft, like A350 with more than 50% of carbon fiber composites

AIRBUS

Challenges with Composites:

- **Production Rate**
- **Cost**
- **Sustainability**

AIRBUS

Efficiency Needs

- Increasing automation and robotics
- Next generation of cost efficient composite materials & formats
- Fast & robust forming & curing systems
- Agile and fast non-destructive inspections
- Reduction of auxiliary materials
- Minimize buy-to-fly ratio

AIRBUS

Composites

End-to-End **Sustainability**

Lightweight

Eco-efficient

Reduce waste

Repairability

Disassembly/ end-of-life

Recyclability/ circularity

Bio-based/ recycled content

Substance compliance

Material reduction

Mindful use of critical raw materials

AIRBUS

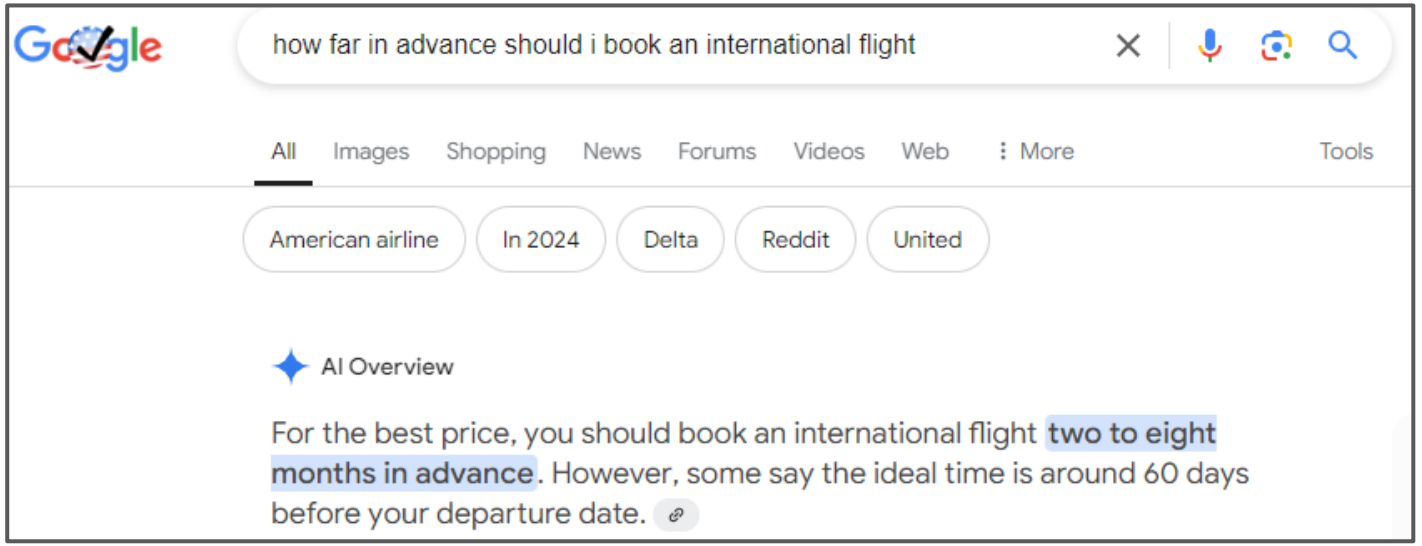
Enabling the Future of Aerospace Manufacturing

- **Technologies Needed for the Future:**
  - Materials with a reduced CO2 footprint from its production to its recovery.
  - Automation-enabling materials.
  - Decreasing time and energy demand across manufacturing (e.g. autoclaves, etc.)... at scale.
  - Advanced surface technologies for composites - bonding, painting, paint removal, repair, etc.
  - Thermoplastic welding / bonding: Technology maturation needed, especially on complex geometries (curved surfaces + thickness changes).
  - CFRP behavior under cryogenic conditions (microcracking, outgassing).
  - Aerospace-level testing for bio-based materials (fiber or resins) to correlate with equivalent oil-based material.
  - Materials and processes for improved maintenance and servicing.
  - Materials and processing capability for second life, and to manage end-of-life.

The Role of AI in Future Aerospace Manufacturing

- The role of artificial intelligence will vary by industry and application.
  - AI has already improved efficiency to improve our lives, and has the potential to unlock countless new pathways for efficiency.
  - Simplification of information, pattern detection, personal preferences, etc.

Example:



- For for the future of aerospace manufacturing, however, it's critical to recognize that AI is a **tool**.
  - **Like any tool: if used, calibrated, or handled incorrectly, results are not acceptable.**

With Every Opportunity Comes Challenges & Risks

- With appropriate use in Aerospace, AI will become a tool that is accepted and used more widely.

Opportunities for AI in Aerospace Manufacturing:

- Speed of information collection.
- Detecting patterns that people cannot see.
- Simplification of data.
- Reducing or elimination of manual tasks.
- Anomaly detection and alerting.
- Data processing.

Risks of AI in Aerospace Manufacturing:

- Data accuracy and confidentiality.
- Traceability and backtracking (no self-training)
- Process predictability.
- Certifiability.
- Security / Cyber.

AI will not replace human intelligence or decision making. Rather, it will give humans better information to make better decisions.

This presentation does not contain any proprietary, confidential, or otherwise restricted information

Thank You

Contact Info

Tim Gaur

Industrial Systems and Industry Partnerships

Timothy.Gaur@Airbus.com

706-599-6397