



航空機製造技術の現状と将来

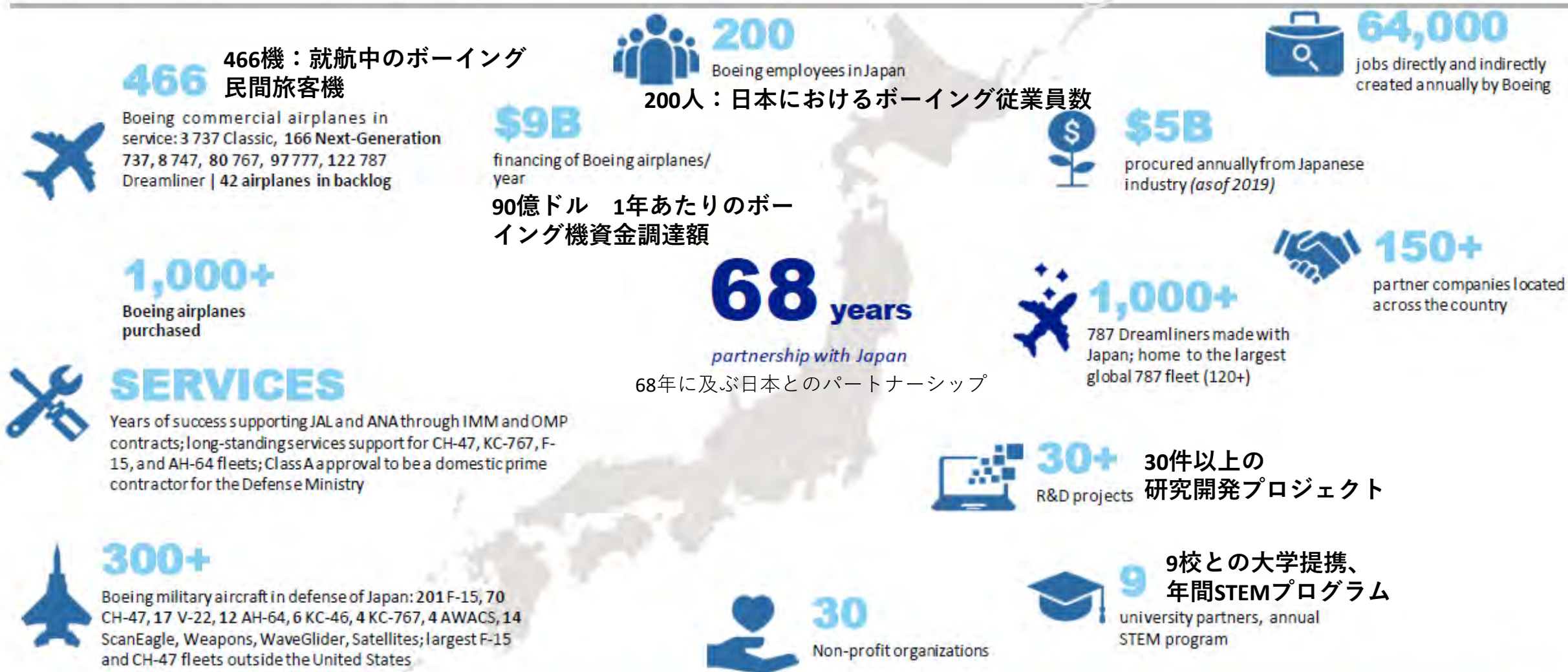
Current and Future Manufacturing for Aerospace

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Boeing Commercial Airplanes

October 22, 2021
The Ninth CMI Symposium

Boeing Presence in Japan

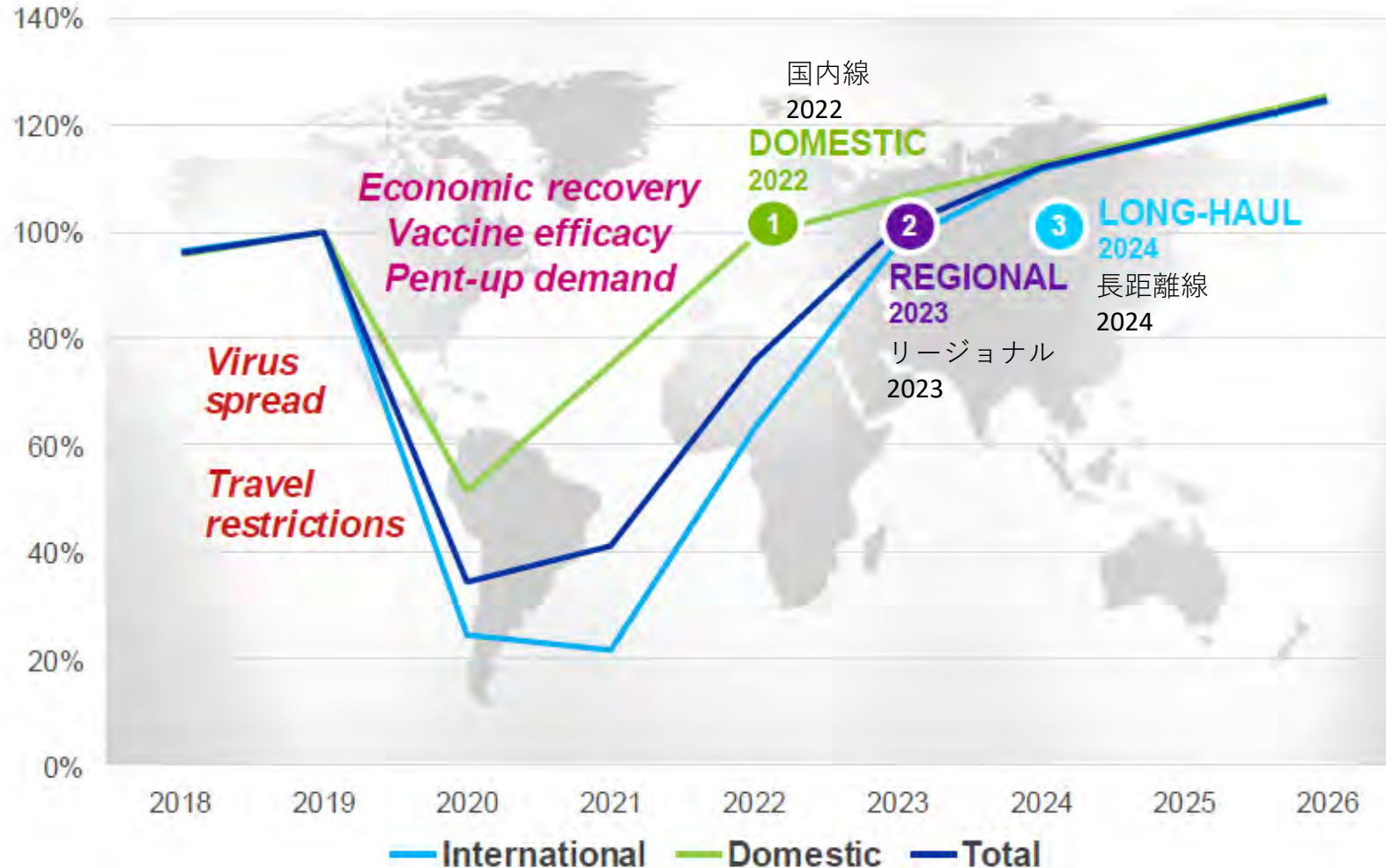


プレゼンスは、パートナーシップ、大きなプラットフォームと小規模なローカルチームによって、築かれている

Presence founded on partnerships and large platform base; small local team

Multi-speed recovery assumptions largely unchanged from CMO 2020

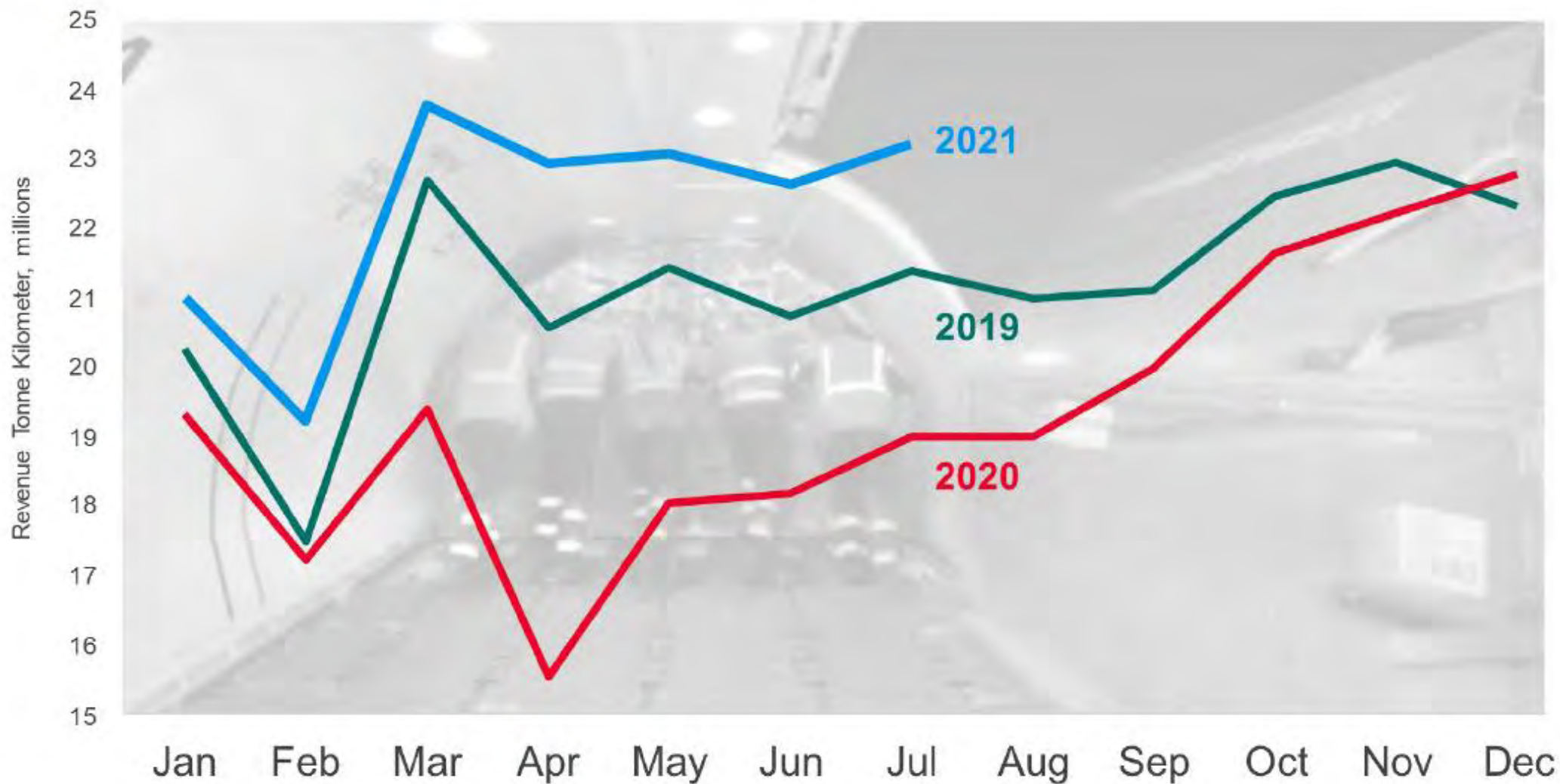
マルチスピード回復仮定は、
CMO 2020からほとんど変更なし



国内線市場がリードする
Domestic markets lead
LCCの回復が一番早い
LCCs recover fastest
小型機（単通路型）の回復力
Single-aisle resilience
ハブが長距離線の回復をサポート
Hubs support long-haul recovery
2023-2024年には2019年の水準に戻る
2023-24 return to 2019 traffic

World air cargo traffic above pre-pandemic levels despite capacity loss

容量の減少にもかかわらず、パンデミック前のレベルを超える世界の航空貨物取引



A large industrial robot arm, primarily orange and black, is positioned on the left side of the frame. It is working on the fuselage of a large aircraft, which is the central focus of the image. The fuselage is a long, curved, metallic structure with a ribbed texture. The background shows the interior of a large industrial facility with a high ceiling and various structural elements. The lighting is bright, highlighting the metallic surfaces and the robot arm. The text "Automation in fabrication" is overlaid on the image in a large, white, sans-serif font. Below it, in a smaller font, is the Japanese text "製造における自動化". In the bottom right corner, there is more text in both Japanese and English.

製造における自動化

Automation in fabrication

787 胴体製造

787 fuselage fabrication North
Charleston, South Carolina



製造における自動化

Automation in fabrication

777X 主翼外板製造

777X wing skin fabrication

Composite Wing Center, Everett, Washington

Family of materials and manufacturing processes

材料の種類と製造プロセス

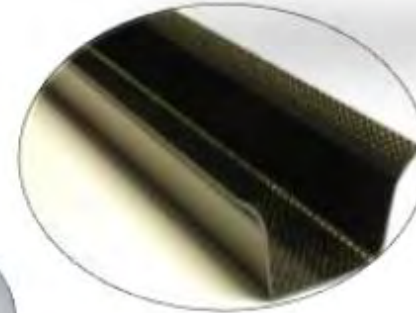
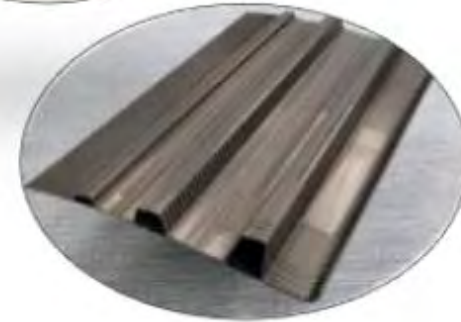
Thermosets, thermoplastics, resin infusion

熱硬化性樹脂、
熱可塑性樹脂、
樹脂注入



Exploit material,
process for net shape
manufacturing

材料を活用、
net shape製造のプロセス



Early technology development with academia

アカデミアとの早期技術開発

- Invested in early feasibility
- Demonstrated technology



Pete George et al.,
CAMX 2015



Carbon fiber recycling for sustainable factories

持続可能な工場のための炭素繊維リサイクル

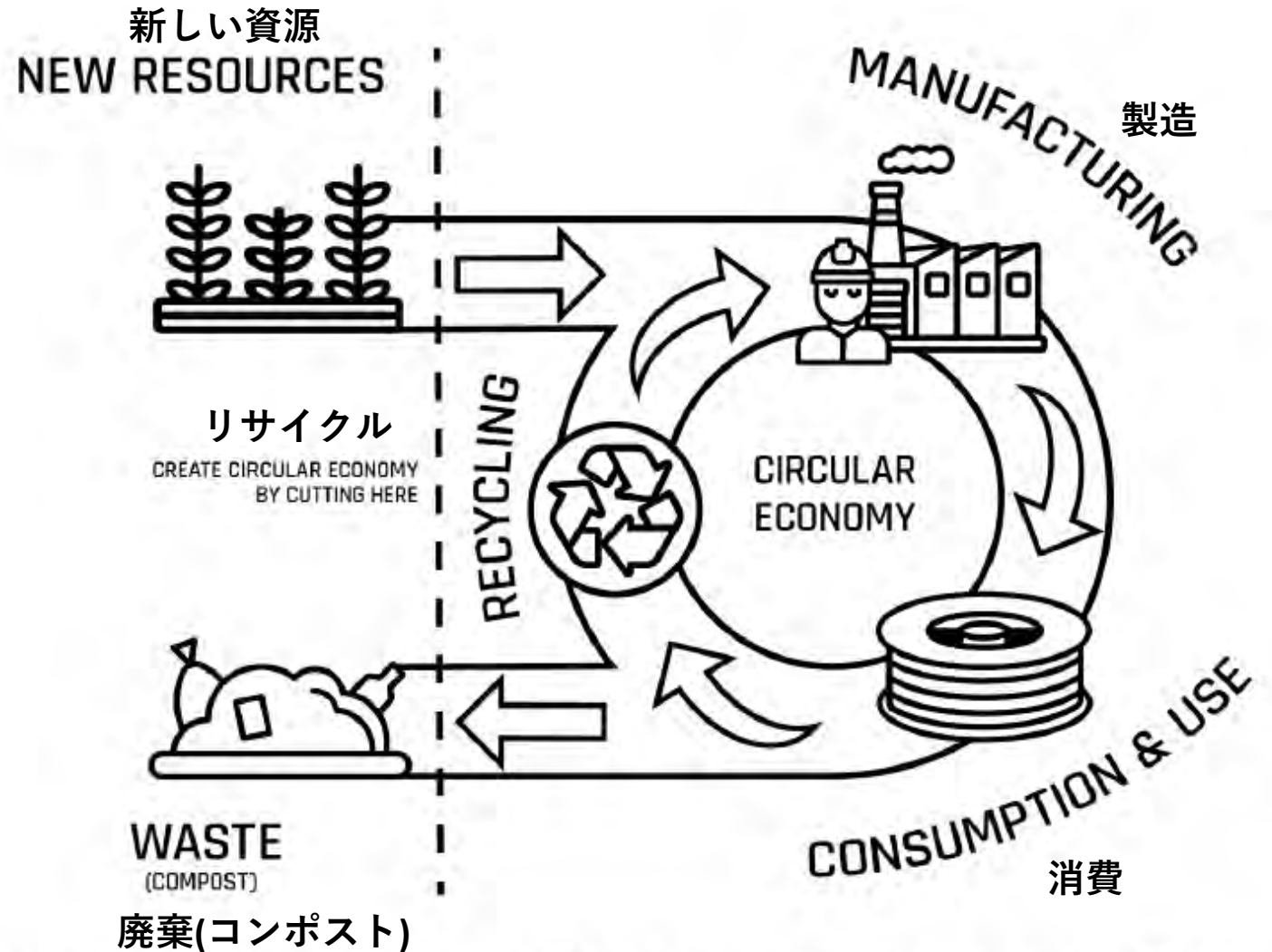
- Mature a commercially viable recycling industry
- Enabled zero-waste-to-landfill
Composite Wing Center,
Everett, Washington
- Manufacturing Leadership Council's
High Achiever Award in Sustainability
(October 2020)



Circularity

循環性

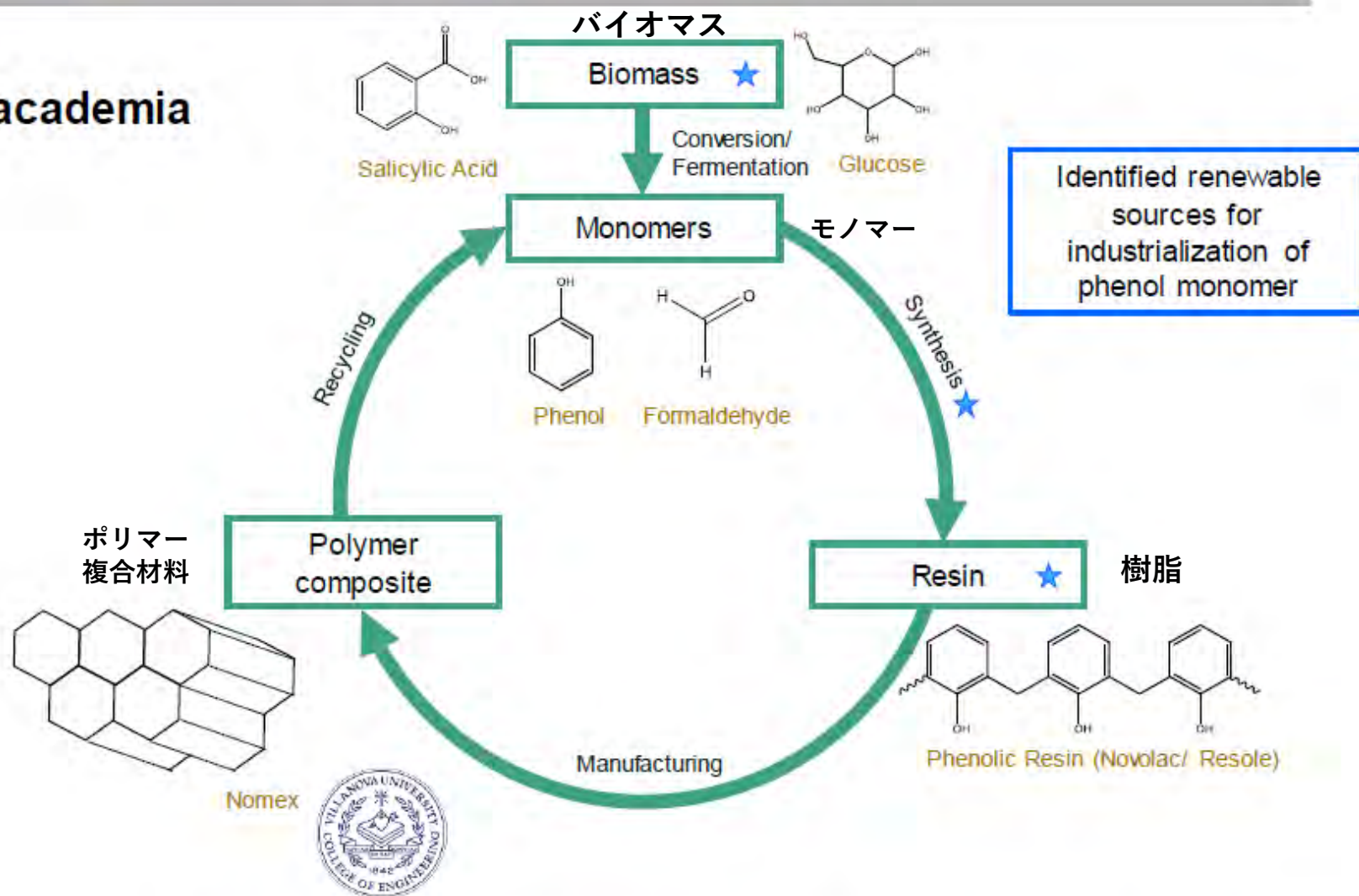
- Optimum use of resources
- Avoid waste (do less 'bad')
- Value-add second use



Renewable constituents for aerospace materials

航空宇宙材料の再生可能な構成要素

- Early feasibility with leaders in academia
- Do more 'good'





2021 SUSTAINABILITY REPORT



航空機の各世代は、
前の世代よりも
20～25%効率的

Each
generation
of airplanes
is **20-25%**
more
efficient
than the
previous
one





フリートのリニューアルにより、大幅なコスト削減と環境面でのメリットあり。3000機以上が近々入れ替え予定

Fleet renewal provides significant cost savings and environmental benefits; 3,000+ airplanes ready for near-term replacement

燃料節減

Fuel savings

\$9B

per year

コスト削減

Cost savings

\$16B

per year

CO₂削減

CO₂ reduction

36M tonnes

per year

Big goals and opportunities in manufacturing processes and materials

製造プロセスと材料に関する大きな目標とチャンス

Performance Area

2030 Goals 2030 目標



Greenhouse Gas Emissions

- Net-zero emissions
- 55% GHG reduction from 2017
- 100% renewable electricity

- 実質ゼロ排出
- 2017年比 55%の温室効果ガス削減
- 100%再生可能電力



Energy

10% energy-intensity reduction from 2025

2025年比 10%のエネルギー削減



Water

5% reduction from 2025

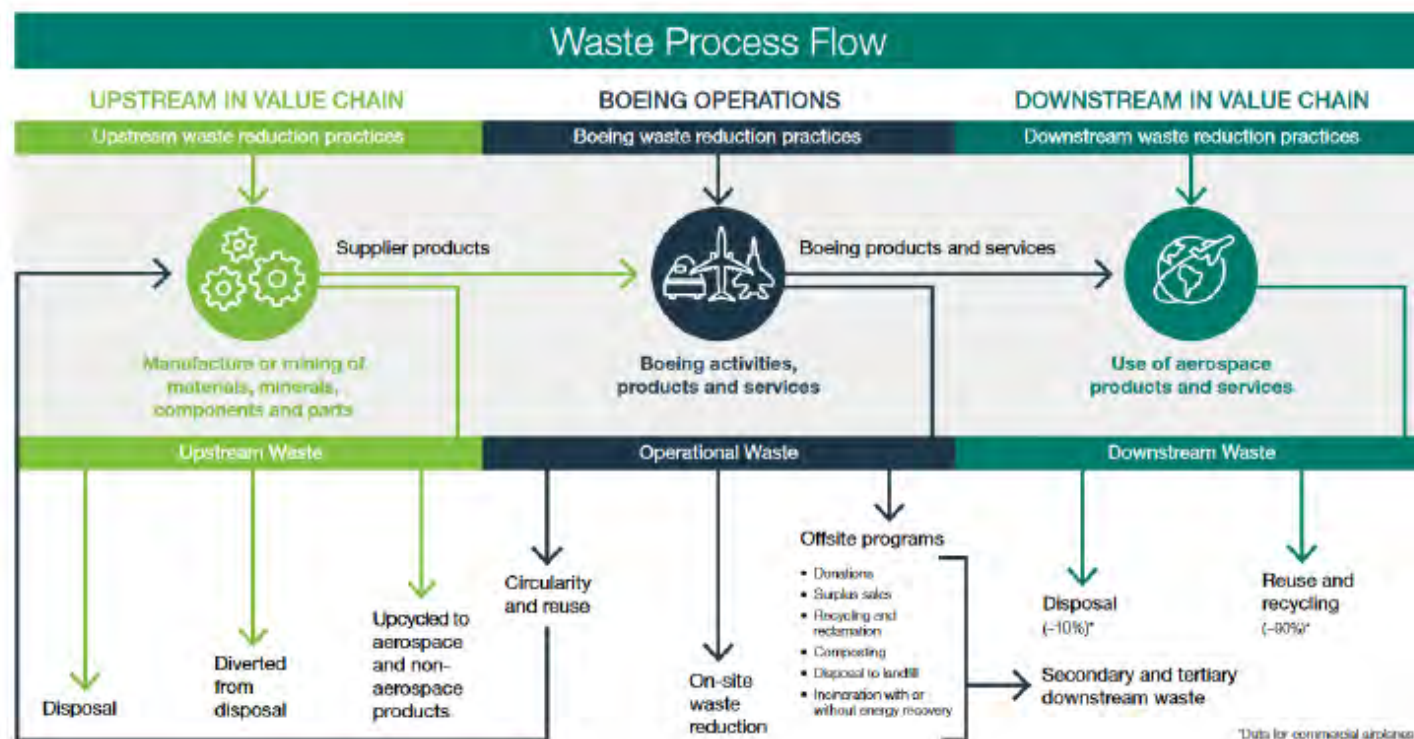
2025年比 5%削減



Waste

- 30% reduction in waste produced from 2025
- Over 90% diversion from landfill or incineration
- Zero waste where applicable at major sites
- 5% hazardous waste reduction from 2025

- 2025年比 30%廃棄物削減
- 90%以上の埋め立てまたは焼却から転換
- 主要な現場で可能な場合はゼロ廃棄
- 2025年比 5%有害廃棄物削減



Materials and manufacturing opportunities

材料と製造の機会



- Design and analysis
- Constituents
- Fabrication approaches
- Data
- Chemistry
- Engagement

Current and future manufacturing for aerospace

航空機製造技術の現状と将来

- **Aircraft industry and manufacturing is in recovery**
航空機産業及び製造業は回復中
- **High-rate, high-efficiency manufacturing enables aviation**
高速かつ高効率製造が航空機製造を可能にする
- **Sustainability and environmentally conscious manufacturing is our future**
サステナビリティと環境に配慮した製造は我々の未来に欠かせない
- **Collaboration and cooperation continues to be the key to unlock our future**
コラボレーションと協調が我々の未来を解き放つ鍵であり続ける



Thank you!