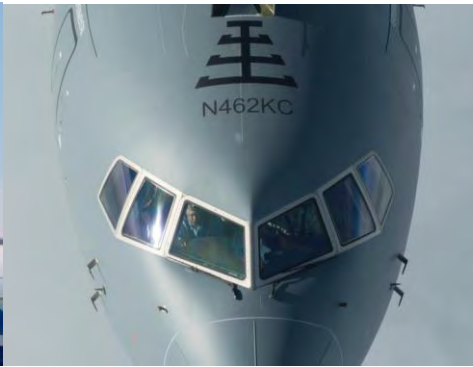




Reflections on CMI: collaborations, achievements and need for continual innovation for a sustainable aerospace industry for the future

CMIを振り返って：将来の持続可能な航空宇宙産業のための連携、成果、継続的なイノベーションの必要性について



Connect / Protect / Explore / Inspire

Glen M. Brown, Ph.D.

Chairman CMI

Manager, Boeing Research & Technology

October 2022

BOEING: What we do today

The Next 100 Years



COMMERCIAL AIRPLANES

Boeing 7-series family of airplanes leads the industry



DEFENSE, SPACE & SECURITY

World's largest manufacturer of military aircraft and satellites and major service provider to NASA

Large-scale systems integration, networking technology and solutions provider



GLOBAL SERVICES

A dedicated services business focused on the needs of global defense, space and commercial customers



BOEING CAPITAL CORPORATION

Financing solutions focused on customer requirements



CMI | The Beginning はじまり

- CMI established in 2013
2013年にCMI発足
- Builds on the strong, partnership
with Japan
日本との強力なパートナーシップを構築
- Focus on challenges in large
scale aerospace manufacturing
大規模な航空宇宙製造における課題に
焦点
- A stronger Boeing, and a stronger
Japanese aerospace industry
より強力なBoeingと日本の航空宇宙産
業を目指して



Engineering, Operations & Technology

Japan: A Key Partner in Building a Stronger Boeing

日本：強力なBoeingをつくるためのキーパートナー

Dr. John J. Tracy

Chief Technology Officer

Senior Vice President, Engineering, Operations & Technology

The Boeing Company

November 12, 2013 2013年11月12日

2013 CMI Symposium

CMI | Boeing & Industry Needs

Boeing と産業界のニーズ



- Efficient, advanced manufacturing processes and control
- Manufacturing and delivering the worlds best aerospace products, together with our partners
- Collaborating and working together to advance technology
- Achieving efficient, affordable and sustainable products through a environmentally responsible aerospace industry

Focusing Technology Investments on Future Needs

| | | |
|--|---|---|
|  | Extreme Affordability ... in development, production, operations, and support |  |
|  | Breakthrough Performance ...to meet the customer needs (range, payload, speed, mission effectiveness, availability, reliability, etc.) |  |
|  | Enduring Sustainability ... easy to modify, open system architecture, easy to upgrade |  |
|  | Environmentally Responsible ... non-polluting in production (no VOC, lead free solder, no carcinogens, no chromium), quiet, non-polluting, fuel efficient in operation, disposable/ recyclable at end of life | |

CMI | Construct 構成

- Consortium:
 - Japanese government (METI)
 - Japanese aerospace industry
 - The University of Tokyo
 - Boeing

- Address and solve “common pain” manufacturing challenges

- Leverage academic research with Japanese industrial capability to advance aerospace manufacturing in Japan

東京大学生産技術研究所
先進ものづくりシステム連携研究センター ← 

CMI (Consortium for Manufacturing Innovation)

Japanese English

Home Outline of CMI Event News Themes Members Link

Outline of CMI

Purpose

Through Industry, Academia, and Government Cooperation ※1, CMI will proceed progressive and innovative R&D of manufacturing and contribute to rapid and high value manufacturing, environmentally conscious manufacturing, and manufacturing with minimum natural resources and less amount of rare metals.

In order to resolve the common pain of aircraft manufacturing, we will carry out research and development of processing technology and etc. for carbon-fiber composite material which is one of the main materials of sustainable development of today’s society, but at this research center, we will not limit to aircraft manufacturing technology and promote **collaborative research** ※2 of manufacturing in a broad sense.



※1 Industry, Academia, and Government Cooperation

CMI | Technical Focus 技術的な焦点

Objectives:

- Rapid & High Value Manufacturing
 - ❑ High rank, high efficiency, high speed cutting technology, high accuracy measuring and high accuracy inspection technology of carbon-fiber composite material, titanium alloy, aluminum, and lithium alloys
- Environmentally Conscious Manufacturing
 - ❑ Cutting oils, semi-dry processing technology which has significantly less electricity consumption, High efficiency manufacturing processing system which has minimized emissions from the manufacturing process
- Manufacturing with Minimum Natural resources and reduced amount of rare metals
 - ❑ Minimizing titanium chip waste, and maximizing recycling capability; life extension techniques of cutting tools which contain large quantities of rare metals such as tungsten, titanium, cobalt

東京大学生産技術研究所
先進ものづくりシステム連携研究センター
 CMI (Consortium for Manufacturing Innovation)



日本語 English

ホーム 研究センター概要 イベント情報 中小企業メンバー募集 研究内容 メンバー リンク

研究センター概要

目的

先進ものづくりシステム連携研究センターは、産学官の連携※1により、ものづくりに関する先進的・革新的研究開発を進め、高付加価値生産(rapid and high value manufacturing)、環境対応型生産(environmentally conscious manufacturing)ならびに省資源型生産(manufacturing with the minimum natural resources and less amount of rare metals)に貢献します。

航空機製造に関する共通の課題(common pain)を解消するため、現代社会の持続的発展のための主要素材のひとつである炭素繊維複合材料の加工技術などの研究開発をおこないますが、本連携研究センターでは航空機製造技術に限ることなく、広くものづくり全般の共同研究※2を推進します。

政府 (経済産業省)

- 航空宇宙産業の発展、高効率・低コスト・消費削減技術による日本の競争力確保
- 新しい産学官連携、企業高度化システム構築
- 新たな研究開発政策のための情報収集

大学

- 生産技術基盤研究の体制強化
- 研究成果を実産業に転用

航空宇宙産業

- 課題の早期解決
- 新たなサービス
- 国際競争力の維持、向上

産学官連携による共同研究の推進

※1 産学官の連携

研究対象

| | |
|---------------------|--|
| 1. 高付加価値生産技術 | 炭素繊維複合材料・チタン合金、アルミ・リチウム合金の高品位、高効率、高速切削加工技術、高精度計測、高精度検査技術 |
| 2. 環境対応型生産技術 | 切削油剤 電力消費を大幅に減少させたセミドライ加工技術 製造工程からの排出物を最小化した高効率生産加工システム |
| 3. 省資源型生産技術 | チタン合金の切りくず除去量の最小化や切りくずのリサイクル タンングステン、チタン、コバルトなどのレアメタルを大量に含む切削工具の寿命延長技術等 |

CMI | Technical Focus 技術的な焦点



東京大学生産技術研究所
Institute of Industrial Science, The University of Tokyo



Manufacturing Innovation for Efficient and Sustainable Operations



Metal Deposition

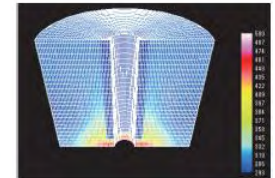


CFRP



CFRP

Ti6Al4V



Sustainability



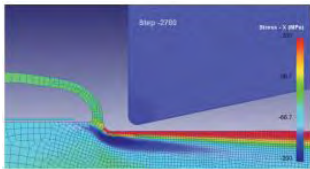
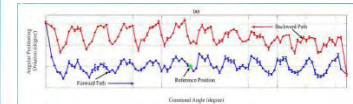
High value manufacturing

Efficiency and Economics

Intelligence and Flexibility



Robots



残留応力

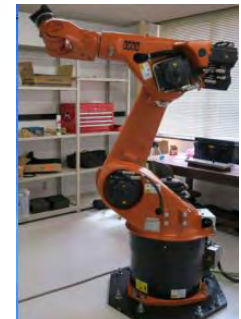


Machine tools



Cutting tools

Cutting & machining



CMI | Results and Achievements

成果と実績

| Achievement | Description |
|---------------------------------------|--|
| Technology | <ul style="list-style-type: none"> Establishment of cutting technology for difficult-to-machine materials (Ti and Al-Li) Practical application of robot sealing technology |
| Number of patents | 5 patents |
| Number of research papers | > 20 papers and presentations |
| Technologies transitioned to industry | 4 (including cutting technology, automation, and sealing technology) |
| Collaborations | University researcher development; university – industry engagement; industry – METI engagement |
| Strategic partnerships | Company to company, company to METI, |
| | |

The Future 未来

- Commercial Market Outlook (CMO) is healthy
- Sound fundamentals for the industry over next 20 years
- Airlines will need ~ 20, 000 airplanes over next 10 years
- Economical, affordable, reliable.....and sustainable

20-year forecast:
long-term fundamentals
remain intact

2.6%

World economy
(GDP)

3.8%

Passenger traffic
(RPK)

4.1%

Cargo traffic
(RTK)

2.8%

Fleet growth
(jets)

Forecast period: 2022-2041



Sustainability 持続可能性

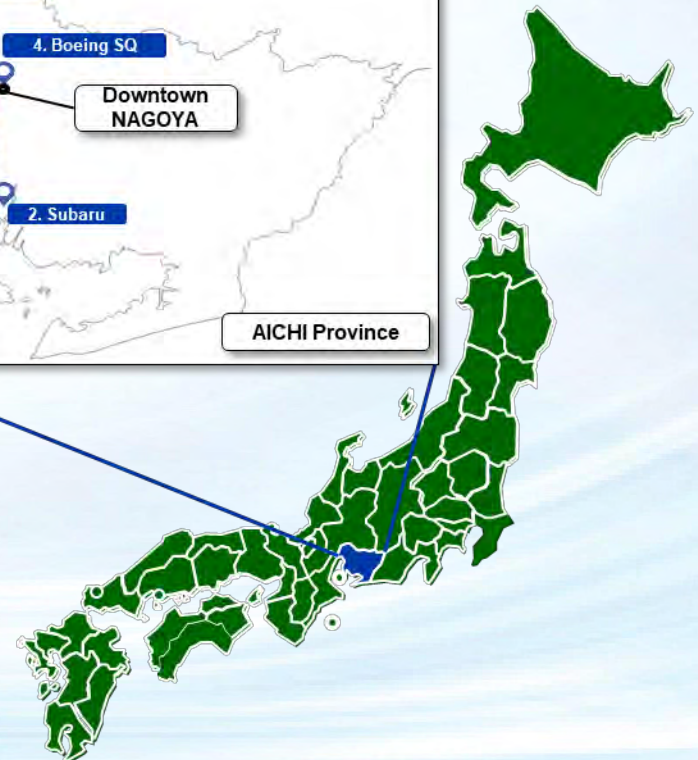
- Working to achieve a Sustainable Aerospace Industry Together
- Innovation is at the heart of aerospace
- We need to keep innovating to ensure a sustainable aerospace industry of the future
- Continued collaboration and cooperation across the aerospace industry is required to achieve sustainability goals of the future



BR&T Japan | Japan Research Center

日本 研究開発センター

- Strengthening our partnerships further
- A new chapter of Boeing in Japan
- Focus on working together to achieve a Sustainable Aerospace Industry
- Manufacturing technologies, SAF, renewable energy, electrification
- *A new vision.....In Japan, with Japan, for the world!*



CMI | The Future 未来

- We have demonstrated a successful working model comprising government, industry, academia collaboration
- A new vision is needed, building on a strong foundation, to face new challenges of our industry
- While CMI is coming to an end, we will explore new opportunities for collaboration
- Collaborations will continue to be an important part of our future
- Innovation must continue!



CMI | Thank you ありがとうございます

- Our successes are only due to our team, our stakeholders and supports
- On behalf of CMI I would like to extend my sincere gratitude and thanks to:
 - Ministry of Economy, Trade and Industry (METI)
 - The University of Tokyo, IIS
 - Professor Usuki (PI) and Professor Hashimoto (MO), Professor Yanagimoto, Professor Obikawa
 - University of Tokyo researchers
 - Office Administration staff
 - Japanese industry members, in particular KHI, MHI, Subaru, DMG Mori
 - Associated member companies
 - Boeing Japan KK office and Boeing team members
- Thank you all for your support and contributions to CMI!



Thank you!

