# AerosPACE

## Aerospace Partners for the Advancement of Collaborative Engineering

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# 2013 Global Engineering Deans Council Conference

*Distributive Engineering Cognition Transforming Industry, Faculty and Students Roles*

**2013-2014 AerosPACE Distributed Capstone**

***"Online Digital Education and Transformed Faculty Roles"***

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GLOBAL ENGINEERING DEANS COUNCIL

# 2020 Workplace: Three Forces Shaping the Future of Work

Boeing – Learning, Training, and Development **2013**


*Traditional Undergraduate programs are not equipping graduates with the skills needed for the complex challenges of the 21st century (Graham, 2012)*

**Globalization:** Through this multidisciplinary – distributed framework the students developed strong outcomes in critical thinking, creativity and innovation.
**Challenge: test a distributive industry-university design experience for the students.**

**Demographics:** Through this translational framework the undergraduate and graduate students (Millennia's working with Boomers) developed strong leadership skills.
**Challenge: research student leadership, teaming, accountability and peer motivation**

**Social Web:** Social Media, Mobile and Cloud based collaboration:
**Challenge: Research students transfer within a social network, (Corp-U, Multi-user MMORPG platform)**

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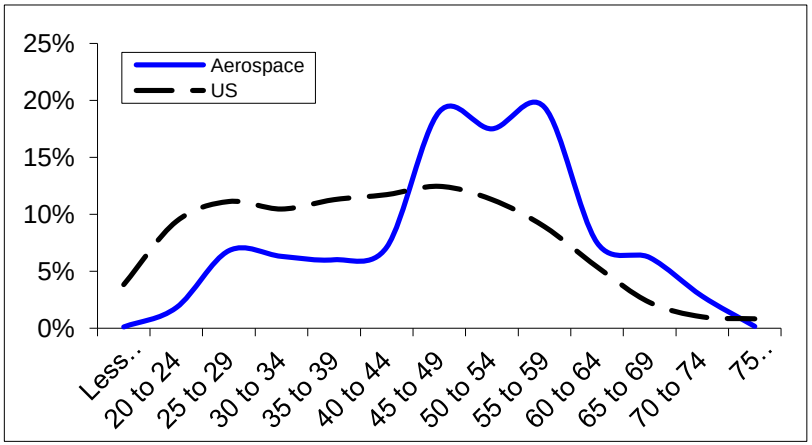
# Aerospace and US Workforce Age Distribution

Boeing – Learning, Training, and Development **2013**




**The projected STEM Shortage will impact U.S. Security and Prosperity**

- 18% of employees are currently eligible to retire
- The current annual retirement is approximately 2%
- The percentage of employees eligible for retirement is projected to reach 25% in the next 5 years
- The annual retirement to increase by 50% over the next 5-6 years
- Over the next 15 years resignations and retirements will exceed current headcount – 150,000+
- Roughly a quarter of the nation's 637,000 aerospace workers could be eligible for retirement this year

(Source: http://seattletimes.nwsource.com/html/boeingaerospace/2004174511_jobsage10.html)

**Boeing's workforce age distribution, including its STEM workforce, is similar to that of the national aerospace workforce, leading to questions…..**

1) Is the STEM education pipeline & labor market adequate to replace retirees?

2) Can we reduce retirement & resignation rates giving more time to increase the STEM education pipeline & labor market supply?

3) In the STEM education pipeline & labor market, where are the high- leverage points for investment?

4) How can we increase the quantity/quality **and knowledge transfer** of the current STEM workforce, education pipeline & labor supply?

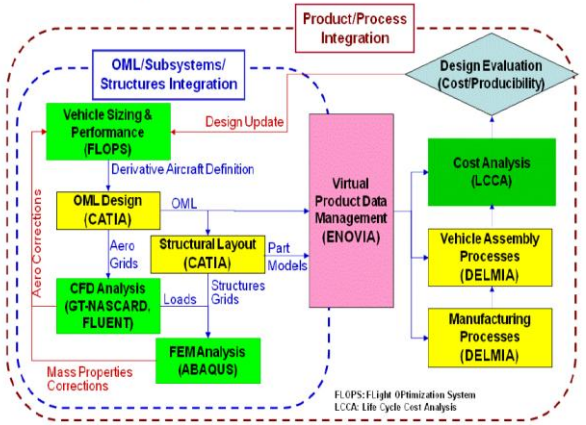
# AerosPACE Design-Build-Fly Capstone Grand Challenge

Boeing – Learning, Training, and Development **2013**

## The Basic Idea

- Select a Grand Challenge
  - How will we feed 9 billion people by 2035?
- Challenge:
  - Build and Fly a low cost, affordable and easy to operate agricultural UAV

**System Integration of Product/Process for Multidisciplinary Design Optimization (MDO)**




## How to engage?

- Present students with RFP of aerospace mission requirements
  - Assign students into multi-university teams with strong faculty core
- Mixed graduate & undergraduate teams
  - Mentored, multi-disciplinary teams perform to PLM-MDO lifecycle
- Assemble an industry-academia advisory board
  - Guide student research, curriculum and design projects

# AerosPACE: An elegant multi-disciplinary, cross-cultural collaboration between industry, faculty and students

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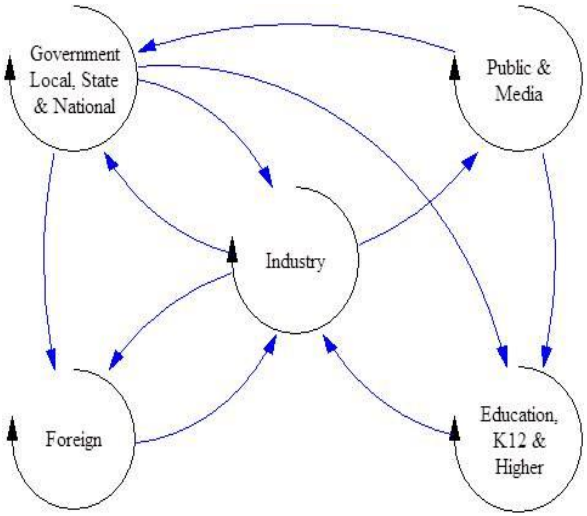
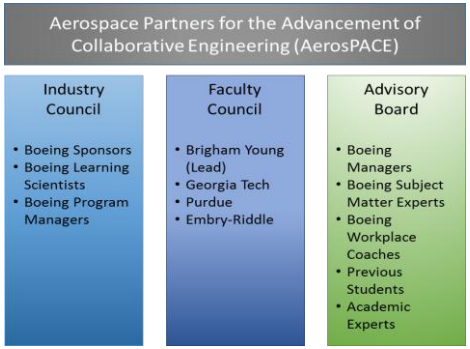
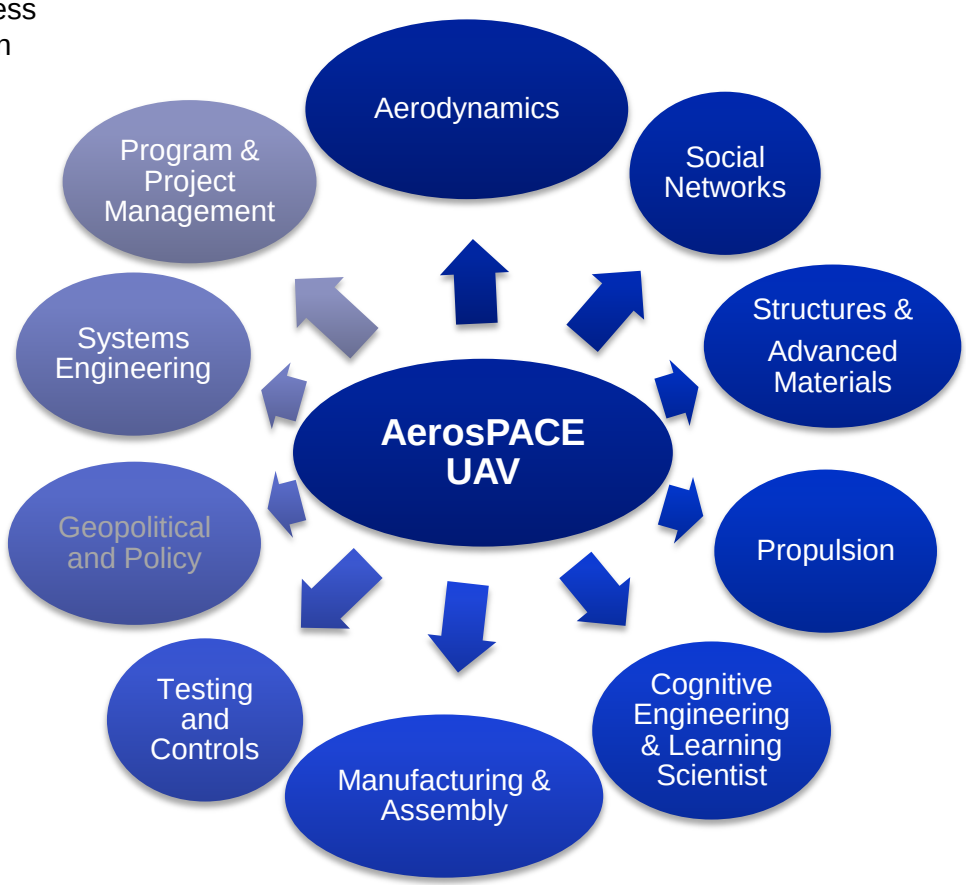
**A Sociotechnical System:** Where knowledge is an emergent process across a distributive sociotechnical system through interaction between students, faculty and industry




*NSF-IUCRC multi-disciplinary collaborative approach where basic research is linked through intermediate processes (Callon,1998)*

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# AerosPACE: A socio-technical distributive system focused on large scale systems integration

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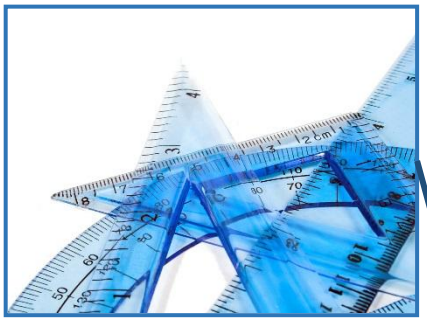
## Learning Science

- STEM Pipeline
- Distributed Learning
- Teamwork
- Mentor/Mentee Relationships

Engineering Education Research



Educational Improvements
"Learning to Learn"

## Distributive Stakeholders

Industry-Academia Collaboration
"Knowing what to learn"

Stakeholders

- The Boeing Company
- Universities
  - Brigham Young University
  - Georgia Institute of Technology
  - Purdue University
  - Embry-Riddle, Prescott AZ
- Partners
  - CD-Adapco
  - Stratasys
  - NASA

# AerosPACE

Novel Manufacturing Processes
"Learning by Doing"

- Additive Manufacturing
- Distributed Manufacturing
- Hands-on experience

Advanced Manufacturing

Advanced Manufacturing

Novel Collaborative Tools
"Learning to work together "

Social Networking

Collaboration

- NX Connect
- CorpU
- Multidisciplinary Students
- Crowdsourcing

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# AerosPACE is Multi-University and Multi-disciplinary Capstone*:*

***University – Industry partnerships are fundamental to global innovation***

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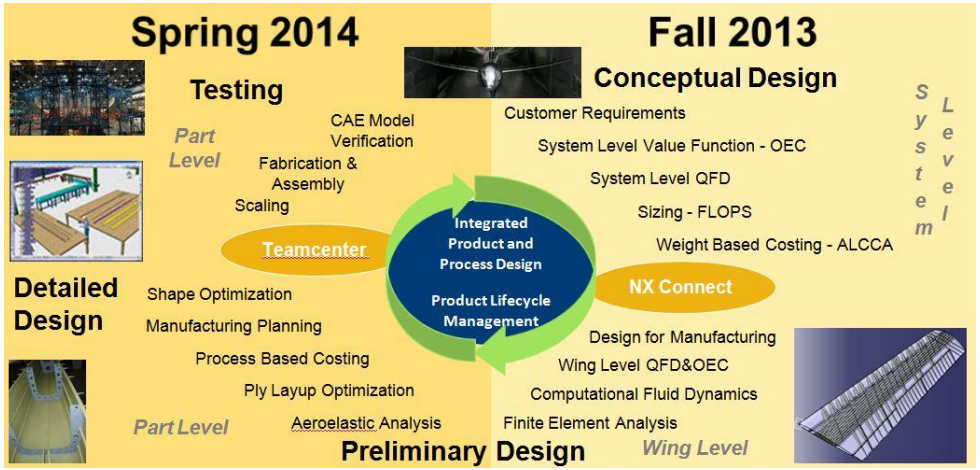
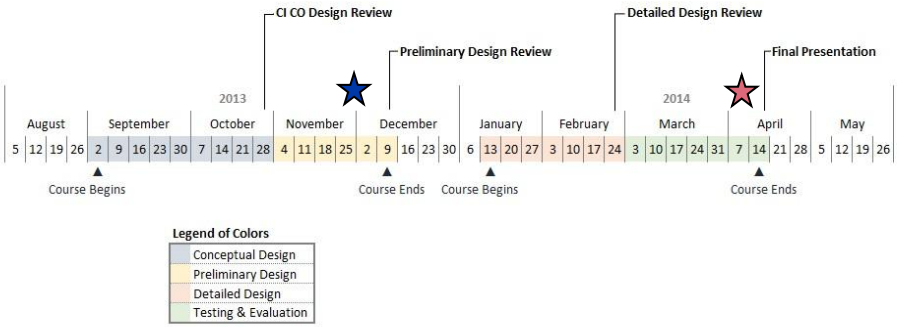
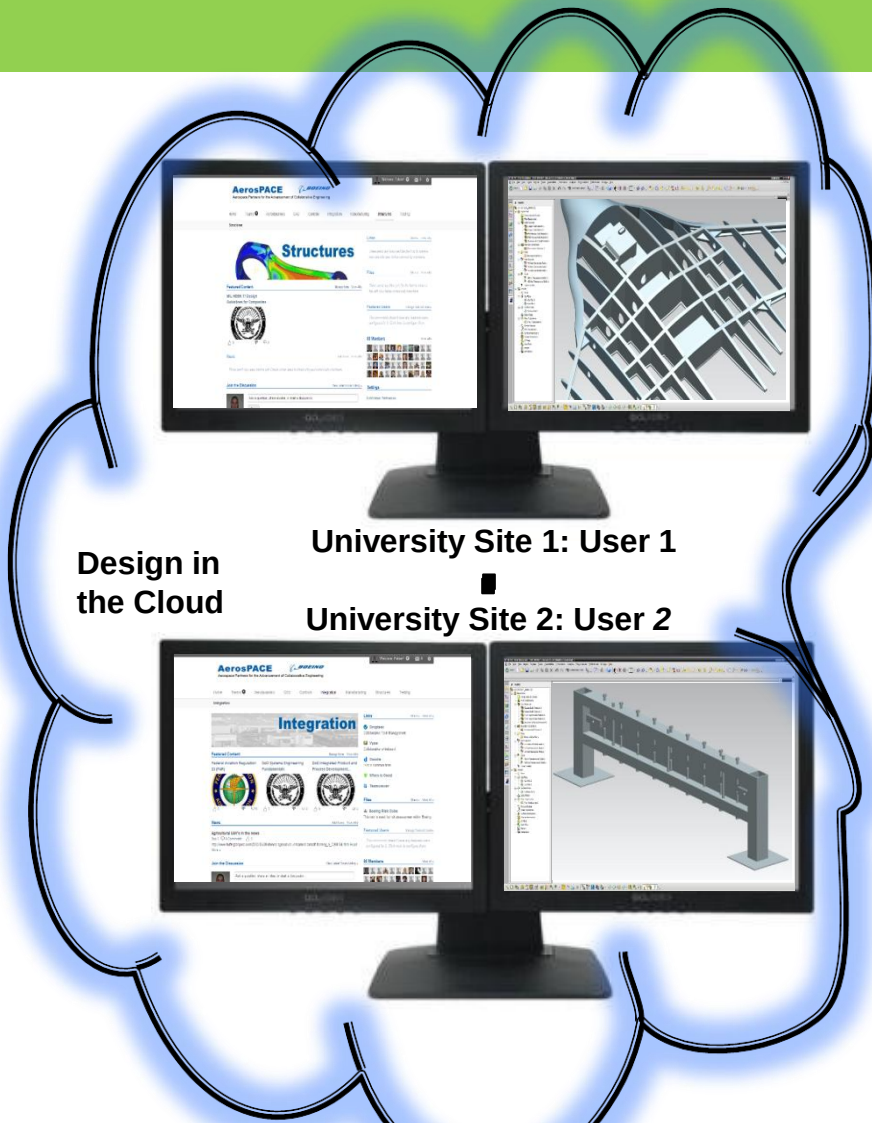
**Student view of global DBF project**




**Two semester Schedule**




**Design in the Cloud**

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# AerosPACE : Aerospace Partners for the Advancement of Collaborative Engineering **2013/2014**

Boeing – Learning, Training, and Development **2013**

## Five Foundational Pillars for a new Learning Environment **2013/2014**

### Lectures and Labs

CORP/U

- Online Learning Platform
- Screen Sharing
- Audio Conference
- MOOC style Lectures (available to external users)
- Chat & Skype design environment

### Engineering Software

CD-adapco

- NX Connect
- Star CCM+
- Ansys
- XFLR5
- AVL
- Microsoft Office

### Business Social Media

CORP/U

- Team Communities
- Functional Communities
- Private & Group Messages
- File Sharing
- Learning Data Analytics

### Advanced Manufacturing

Stratasys

- 3D Printing
- Machine Shop
- Rapid Prototyping
- Tool Development

### Industry Feedback

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- Requirements Definition
- Advisory Board
- Workplace coaches
- Mentor-Mentee Relationship

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# AerosPACE Key Objectives

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The capstone project enabled students to transfer knowledge within a social network, mentored by peers, industry workplace experts and professors. Through this translational framework the students developed strong outcomes in critical thinking, creativity and innovation. Key objectives included:

- Develop an overall concept and architecture for an industry university student capstone and to **develop and motivate the next generation of advanced manufacturing innovators.**
- Develop a **coherent and interconnected curriculum structure** based on **Learning Sciences HPL-UdD** principles – and immersive through hands on DBF Project
- Connect collaborative - distributive teams and design representations in such a way to ensure that **students were exposed to the industry principles of collaborative digital manufacturing**, targeting cyber-mechanical systems of high complexity.
- View learning as a **social-technical process whereby knowledge is co-constructed within a social network**, mentored by peers, industry workplace experts and professors through both face-to-face and a cyber infrastructure.
- Theory to Practice: Competencies and learning strategies **are directly linked to performance in the workplace**
- Target gaps in the Aero student pipeline competencies with implications to **businesses being able to meet future workforce needs**

# AerosPACE Summary: Advance personalized Learning: NAE Grand Challenge

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**Globalization**

- Capstone enables real-world experiential learning within a social networking
- Builds pipeline connecting emergent global competencies enabling businesses meet future workforce, (Quality of Hire)

**Demographics**

- **Faculty are early adaptors, forward thinking technology engaging learners who are willing to take a risk**
- Closes gaps between theory and practice -curriculum- assessment- environment
- Builds next-gen engineering innovators through "**Online Digital Education and Transformed Faculty Roles"**
- Students: leverage distributive cognition, wisdom of the crowd

**Social Web**

- Expanding evidence based learning for a digital world
- Learning Science: Leverage SNA to generate valid inferences from formative – summative assessment from learning outcomes *(SNA provides unobtrusive data (click-stream) for education research (MOOCs, Content Delivery and Assessments)*

★ ***How to create a SUPER ENGINEER***
***Engineering Education as an open dynamic and adaptive system***

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# Multiuser – Multiversity 6x speed

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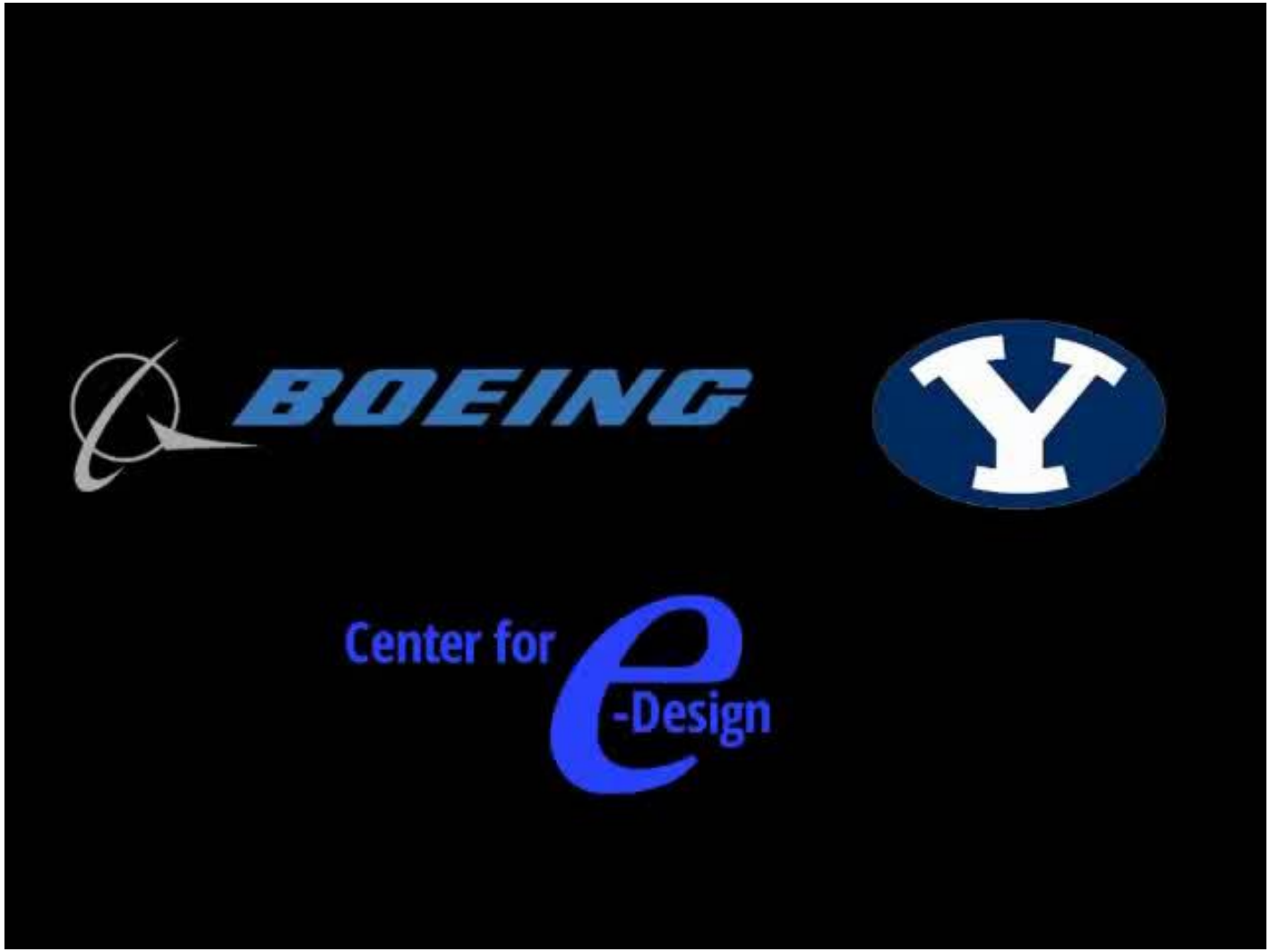


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# UAV BW Rapid Prototype

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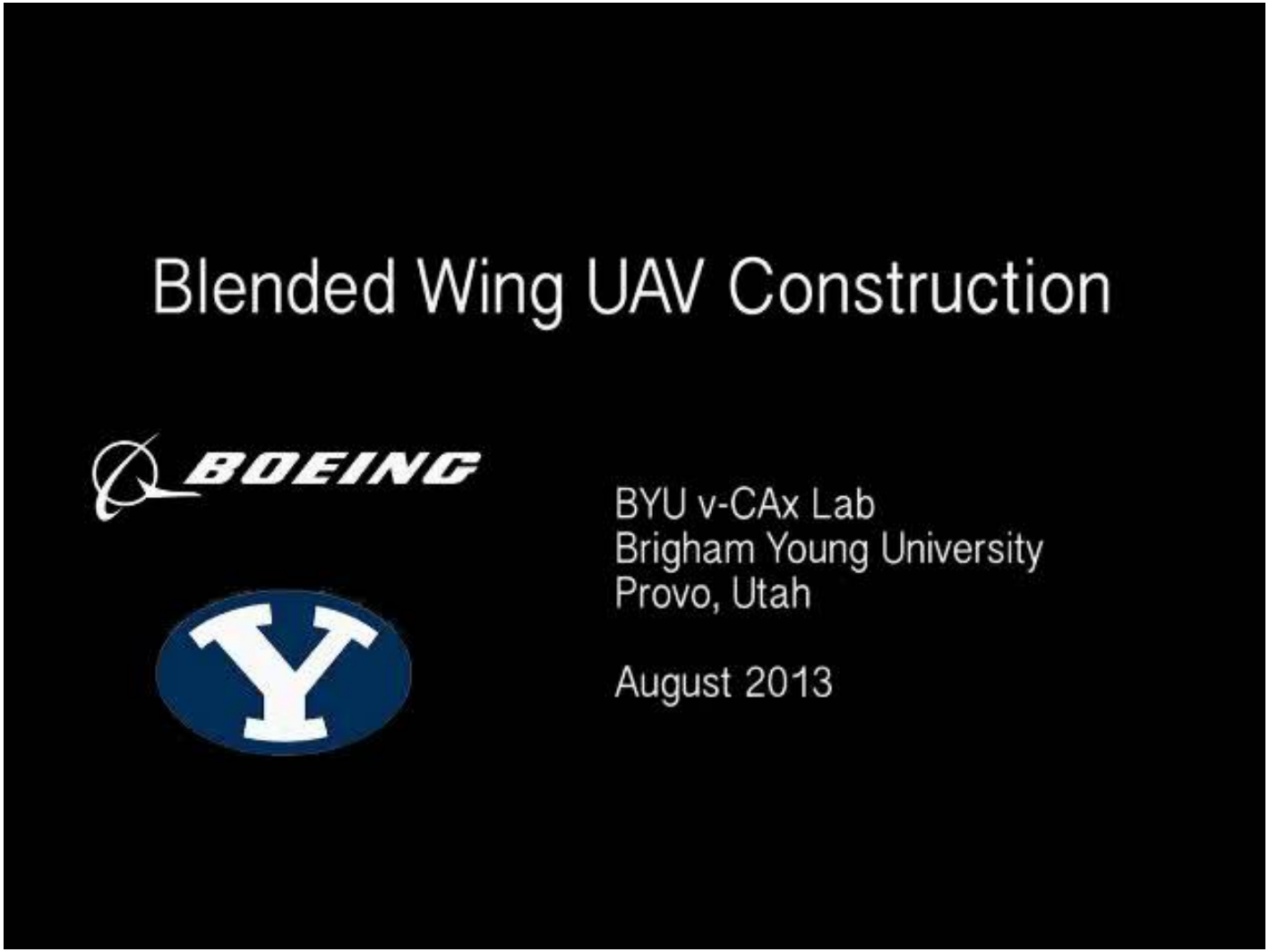

# Questions and Next Steps?

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