Innovation in Aerospace & Defense Industry
A U.S. Perspective

Robert J. Krieger
President
Boeing Phantom Works
The Boeing Company Has a Very Diversified Aerospace Portfolio
Phantom Works Vision and Mission
Support the Boeing Vision

**Boeing Vision**

People working together as a Global Enterprise for aerospace leadership

**Phantom Works Vision**

Innovators and Integrators working across the Boeing Global Enterprise to create the future of aerospace

**Phantom Works Mission**

To be the catalyst of innovation for the Boeing Enterprise
Phantom Works Leverages Talent From Around the World

Phantom Works Sites
Venture Capital Funds
Strategic Universities
Alliances and partners

Headquarters
St. Louis
Phantom Works is a centrally managed research and development organization.

Boeing Commercial Airplanes

Integrated Defense Systems

Connexion By Boeing
Phantom Works Strategies Align With Boeing Strategies

Phantom Works ... Delivering Value Across All Horizons

Run Healthy Core Business

Technology Thrust

Advanced Systems

Leverage Core Strengths

Enabling Technology

Open New Frontiers

Time
Research & Development Planning Process Is Driven by Operating Group Needs
Transition Metrics Incentivize Working Together

Enabling Technologies

Thrusted Technologies

Multiple Transition

Operating Groups

Program/Skill Transition

Advanced Systems

Technology Graduation

Technology/Skill Transition

Future New Business Opportunities

White Space
Advanced Systems Develop Next Generation Systems That Are Not Derivatives
Thrusts and Enabling Technologies Work Both Near and Long Term Horizons

- Augmented Cognition
- Integrated Aircraft Health Management
- Automated Aerial Refueling
- Efficient Certification of Structural Components
- Structural Amorphous Aluminum
- Network Centric Operations
- Composite Structure Assemblies
- Acoustics & Noise Control
- Composite Structure Assemblies
- Structural Amorphous Aluminum
- Network Centric Operations
- Efficient Certification of Structural Components
- Automated Aerial Refueling
- Integrated Aircraft Health Management
- Augmented Cognition

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Program and Technology Transitions Are Measured by Value to the Operating Groups

- Future Combat Systems
- Barrier Coat Curing Process on 737
- Friction Stir Joining on Delta II, III, IV
- C-17 Composite Horizontal Tail
- Future Program Revenue
- Cost Reducing Technologies
- Revenue Enhancing Technologies
- Reusable Space Systems
- Small Diameter Bomb
- F/A-18E/F Wing Fuselage Redesign

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Advanced Systems Develop Programs and Transition Them to the Operating Groups (Future Combat System Example)

- Strategic Teaming
- Concept & Technology Demonstration
- Integrated Defense Systems
- Army’s Lead Systems Integrator
- Application of Network Centric Operations
- Concept Development (Vision)
- Best of Boeing

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Thrusts Transition Technologies to Existing and Next Generation Programs

Affordable Structures & Manufacturing Technologies

Lean & Efficient Design Processes and Tools

Advanced Platform Systems

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Enabling Technologies Establish Feasibility and Transition to Thrusts

<table>
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<tr>
<th>Proof of concept/feasibility</th>
<th>&gt;&gt;&gt;&gt;</th>
<th>Demonstration of product readiness</th>
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<th>Final Product</th>
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- **Phased Array Antenna Component Development**
- **Composite Delamination Prediction Model**
- **Ultra Small Aperture Terminal**
- **Bonded Composite Stiffener Termination Under Tension**
- **7E7 Fuselage Application**
- **Milstar**
Multiple Transitions Involve People Working Together Across the Enterprise (Friction Stir Joining Example)
Strategic Innovation Planning Identifies Potential New Businesses
(White Space Studies)
Phantom Works – the Catalyst of Innovation for the Boeing Enterprise