



Progress on Meeting Industry Challenges

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The Challenge

“Just as employees mastered “impossible” challenges like supersonic flight, stealth, space exploration and super-efficient composite airplanes, now we must focus our spirit of innovation and our resources on reducing greenhouse-gas emissions in our products and operations.”

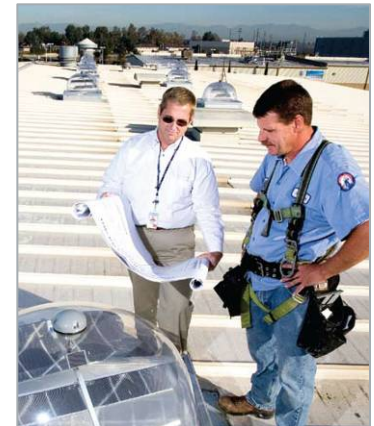
W. J. McNerney
Chairman, President and CEO
The Boeing Company



Boeing's 2012 operational targets

25%
Improvement

- **Energy Efficiency**
- **Greenhouse Gas Emissions Intensity**
- **Hazardous Waste**
- **Solid Waste Recycling**



On Track, Outperformed Our 2008 Plan

All Major operational sites certified to ISO 14001



- Auburn, Washington
- Anaheim/Huntington Beach, California
- Bankstown, Australia
- El Segundo, California
- Everett, Washington
- Exmouth, Australia
- Fishermans Bend, Australia
- Frederickson, Washington
- Huntsville, Alabama
- Kent, Washington
- Kennedy Space Center, Florida
- Long Beach, California
- Macon, Georgia
- Mesa, Arizona
- Philadelphia, Pennsylvania
- Portland, Oregon
- Renton, Washington
- Seattle, Washington
 - North Boeing Field
 - Developmental Center
 - Military Flight Center
- St. Louis, Missouri
- Salt Lake City, Utah
- San Antonio, Texas
- Sylmar, California
- Wichita, Kansas
- Winnipeg, Canada

ISO 14001 Is the Global Environmental Standard

Committed to transparency

- Sharing progress and successes
- Identifying areas for improvement
- Encouraging feedback

Annual Report



2009 Environment Report



Reporting on Our Targets and Commitments

Integrated Defense Systems customers seek innovative solutions

- Reduce hazardous chemical use
- Increase energy efficiency and decrease energy demand
- Develop and integrate alternative energy generation & storage
- Minimize environmental footprint



Applying new technologies to meet customer energy needs

- Environmentally preferred materials
- Advanced aerodynamics, structures & materials
- Electric aircraft systems
- Efficient logistics & operations
- Platform, facility & grid energy assurance
- Virtual-live training
- Distributed/remote power generation & storage
- Solar cells & concentrators
- Sustainable biofuels



Our Commercial Airplanes plan and commitments

Relentlessly pursue manufacturing and life cycle improvements



100%

Improve performance of worldwide fleet operations



25%

Deliver progressive new products and services



15%

Pioneer new technology

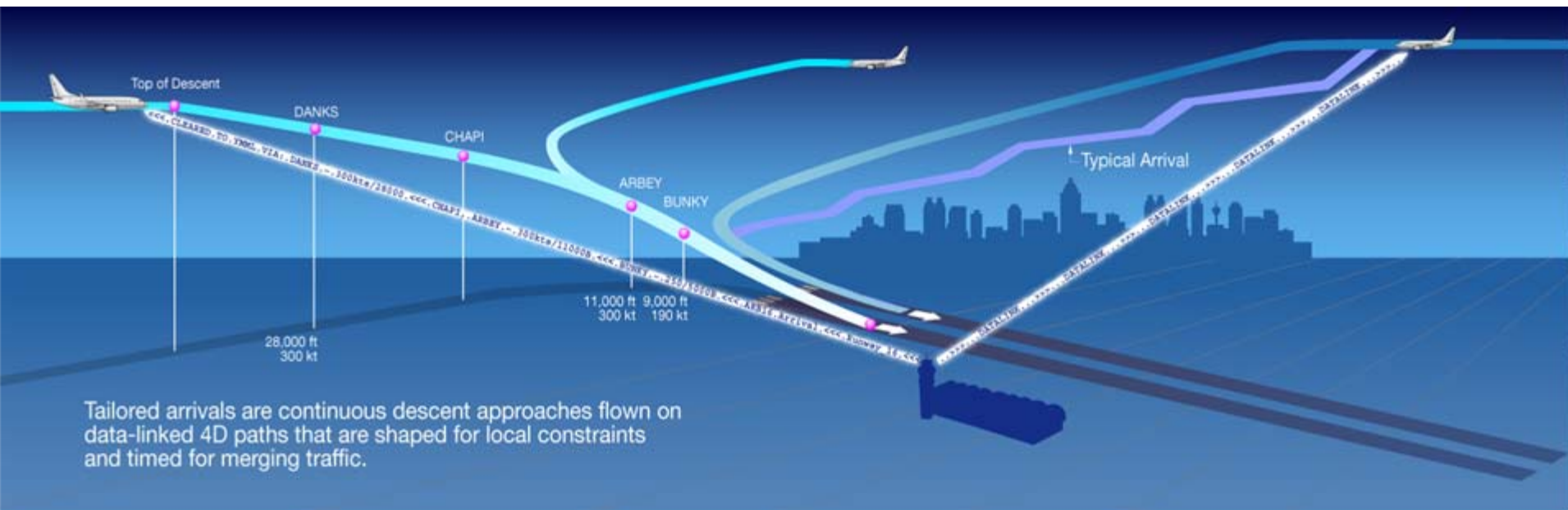


75%

Focus on 25% efficiency improvements in worldwide fleet fuel use and CO₂ emissions by 2020.

Boeing Air Traffic Management initiatives

- ATM offers near-term gains in environmental performance
- Boeing and industry developing technology solutions that cut fuel burn and carbon dioxide emissions
- An example is Tailored Arrivals, which has demonstrated significant benefits



Tailored Arrivals implementation is underway



Tailored Arrivals: San Francisco

- **December 2007 to present, involving more than 1,700 complete and partial Tailored Arrivals**
 - 777 and 747 aircraft used to validate benefits
- **Uninterrupted Tailored Arrivals save an average of 2,100 pounds (950 kilograms) of fuel and approximately \$950 USD per approach**
- **Complete Tailored Arrivals saved approximately 40 percent of the fuel used in arrivals**
- **For a one-year period, four participating airlines saved more than 1.1 million pounds (524,000 kilograms) of fuel and reduced carbon emissions by 3.6 million pounds (1.6 million kilograms)**

Tailored Arrivals: Schiphol

- To optimize Tailored Arrivals, additional controller automation tools are needed
- Trial of Speed and Route Advisor (SARA) controller tool completed with Dutch air traffic control agency (LVNL) and Eurocontrol in April/May 2009
- SARA delivered traffic within 30 seconds of planned time on 80 percent of approaches
 - Compared to within 2 minutes on a baseline of 67 percent
- **Benefits of improved accuracy:**
 - Reduced fuel and emissions
 - Lower controller workload
 - Increased predictability for airlines and passenger connections



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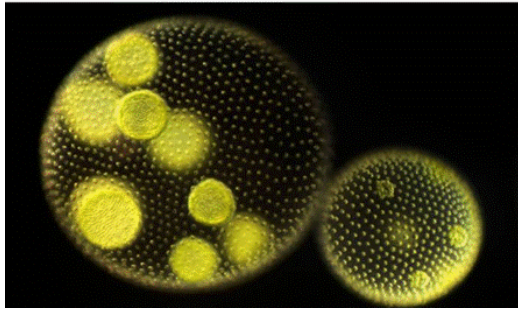
75%

Devote more than 75% of R&D toward benefiting environmental performance

Viable Bio-SPK feedstock alternatives

Algae

Ready in 8 to 10 years



Challenges

- Technological innovation needed for processing

Jatropha

Ready in 2 to 4 years

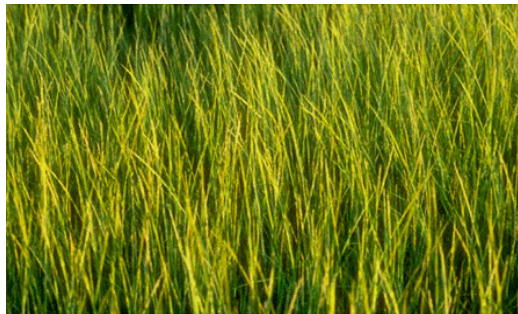


Challenges

- Limited to warm climates only
- Mechanical harvesting isn't mature

Halophytes

Ready in 2 to 4 years



Challenges

- Proven at pilot scale
- Improve agronomy for cost reduction

Camelina

Ready Now



Challenges

- Limited total potential owing to yield
- Somewhat tied to grain market swings

Viability is based on timing, technology and local resources

Sustainable Biofuels Research and Technology Program

- **Evaluation focused on bio-derived Synthetic Paraffinic Kerosene (Bio-SPK) for aviation use**
- **Conducted comprehensive laboratory, engine and flight test program**
- **Broad industry involvement and support**
- **Executive summary of industry findings available today**

Key fuel property comparisons: Neat

Property		Jet A/Jet A-1	ANZ Jatropha	CAL Jatropha/Algae	JAL Jatropha/Algae/Camelina
Freeze Point °C	Max	-40 Jet A -47 Jet A-1	-57.0	-54.5	-63.5
Thermal Stability JFTOT (2.5 hrs. at control temperature) Temperature °C	Min	260	340	340	300
Viscosity -20°C, mm ² /s	Max	8.0	3.663	3.510	3.353
Contaminants Existent gum, mg/100mL	Max	7	<1	<1	<1
Metals ppm.	Max	0.1 per metal	<0.1	<0.1	<0.1
Net Heat of Combustion MJ/kg	Min	42.8	44.3	44.2	44.2

Table 2-3: Properties summary of neat Bio-SPKS against existing jet fuel specifications

Key fuel property comparisons: Blends

Property		Jet A/Jet A-1	ANZ Jatropha	CAL Jatropha/Algae	JAL Jatropha/Algae/Camelina
Freeze Point °C	Max	-40 Jet A -47 Jet A-1	-62.5	-61.0	-55.5
Thermal Stability JFTOT (2.5 hours @control temperature)	Min	260	300	300	300
Viscosity -20°C mm ² /s	Max	8.0	3.606	3.817	4.305
Contaminants Existent gum, mg/100mL	Max	7	1.0	<1	<1
Net Heat of Combustion MJ/kg	Min	42.8	43.6	43.7	43.5

Table 2-5: Properties summary for Bio-SPK jet fuel blends

All Bio-SPK blends met or exceeded aviation jet fuel requirements

Next steps on sustainable biofuels

- **Preparing a comprehensive report for submittal to ASTM International fuel approval process**
- **Anticipating ASTM approval in 2010 in support of industry goal to accelerate availability and use**
- **Working across the industry on regional biofuel commercialization projects**
- **Continuing lifecycle analysis to verify sustainability of feedstocks and methods**

Progress on Global Aviation Policy

- **ICAO progress through the Group on International Aviation Climate Change (GIACC)**
 - Continuous improvement in fuel efficiency of in-service fleet
 - Technology driven solutions
 - ICAO framework for implementing market-based measures
 - Aviation Fuel Efficiency Standard
 - An efficiency standard for new airplane designs makes sense
 - Easier to implement and regulate than a standard for aircraft operators
 - ICAO should lead the development of that standard

Environmental performance remains a priority

Creating
a better future

Pioneering
new technologies

Measuring
our progress

Reducing
our environmental footprint

We continue to accelerate our efforts on all levels

http://www.boeing.com/aboutus/environment/environmental_report_09

