Commercial Airplanes
Commercial Aviation Services – Digital Aviation

IATA Paperless Conference

Per Norén
Vice President – Digital Aviation

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The Boeing Company

Digital Transformation – Video link
Our Capabilities and Expertise

**OEM Knowledge & Data**
- Airplane Design
- OEM Data
- Engineering & Manufacturing Expertise

**Part Solutions**
- Boeing Proprietary Parts
- Parts Distribution & Logistics
- Logistics & Supply Chain Management

**Airplane Connectivity**
- Airplane Systems
- Connectivity and Sensors
- Data Distribution

**Maintenance & Engineering Solutions**
- Fleet Management Solutions
- Technical Information Management
- Maintenance Optimization

**24 x 7 Customer Support**
- Entry Into Services (EIS)
- Support & Service Engineering
- Field Service Network

**Flight Operations Solutions**
- Navigations Solutions
- Crew Management
- Training & Flight Services

**Digital Solutions**
- Airplane Solutions
- Airline Solutions
- Airspace & Airport Solutions

**Aviation Business Consulting**
- Advisory Services
- Change Management
- Lean & Business Process Management

**Aerospace Analytics**
- Predictive Maintenance
- Flight & Fuel Optimization
- Disruptive Management
Industry, Market and Customer Trends

Airlines will need 38,000 new airplanes by 2034

Airplane deliveries: 38,050

New airplane deliveries by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Airplanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>14,330</td>
</tr>
<tr>
<td>North America</td>
<td>7,890</td>
</tr>
<tr>
<td>Europe</td>
<td>7,310</td>
</tr>
<tr>
<td>Middle East</td>
<td>3,180</td>
</tr>
<tr>
<td>Latin America</td>
<td>3,020</td>
</tr>
<tr>
<td>Africa</td>
<td>1,170</td>
</tr>
<tr>
<td>C.I.S.</td>
<td>1,150</td>
</tr>
<tr>
<td>World Total</td>
<td>38,050</td>
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</tbody>
</table>

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Industry, Market and Customer Trends

Digital Aircraft are here today

Data Transmitted (MB/Flight)
- ~28 MB

Fleet Growth (Aircraft)
- <1 MB
- 777, 787
- 19,140 Airplanes in 2010
- 39,530 Airplanes in 2030

Airplane Data Generation (TB/Year)
- Growth 20,120
- Replacement 13,380
- Retained 6,030
- ~1,000 TB in 2030

Fleet growth and mix drive exponential data growth

Source: Boeing Current Market Outlook
Industry, Market and Customer Trends

Airline Expenses

Economic performance of the airline industry

Aircraft
Fuel
Maintenance and Engineering
Ground and Air Infrastructure
Crew
G&A

~$700B (2015 Expenses)
Industry, Market and Customer Trends

Digital Maturity Assessment

- **Financial Impact**
  - $: CEO Believes
  - $$: Company Believes
  - $$$: Company DNA

- **Corporate Vision**
  - Paper
  - Fragmented Data
  - Always Available Rapid Innovation

- **Digital Infrastructure**
  - Manual Process
  - Cross Departmental, Connected
  - Continuous Optimization

- **Running the Business**
  - Self Planned
  - Tailored
  - Maximized

- **Passenger Experience**
Industry, Market and Customer Trends
Industry, Market and Customer Trends
Paper to Digital Transformation

Paper Paradigm  Digital Paradigm

[Images of paper documents and digital interfaces]
# The Value of Digital Transformation

<table>
<thead>
<tr>
<th>Maintenance Efficiency / Asset Availability Transitions</th>
<th>Paper Paradigm . . .</th>
<th>. . . Digital Paradigm</th>
<th>Value Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Manual monitoring</td>
<td>- Fleet, Airplane Health Management</td>
<td>1-2%</td>
<td></td>
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<tr>
<td>- Paper based operations</td>
<td>- Digital and mobile</td>
<td></td>
<td></td>
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<tr>
<td>- Reactive decision making</td>
<td>- Predictive prognostics and analytics</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Navigation, Flight and Fuel Efficiency</th>
<th>Paper Charts</th>
<th>Mobile Navigation</th>
<th>2-4+%</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Paper Charts</td>
<td>- Analytics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Monthly spreadsheets</td>
<td>- Automated Enabled Processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Manual Process</td>
<td>- Actual vs. optimal</td>
<td></td>
<td></td>
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<tr>
<td>- Actual vs. plan</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Crew Optimization</th>
<th>Semi-manual automation</th>
<th>Continuous optimization/tracking</th>
<th>3-5+%</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Limited scale and integration</td>
<td>- Door-to-Door crew support</td>
<td></td>
<td></td>
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<tr>
<td>- Limited optimization</td>
<td>- Real-time mobile updates</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital Infrastructure</th>
<th>IT limits</th>
<th>IT enables</th>
<th>1-2%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Capacity Planning and Disruption Management</th>
<th>Aviation Infrastructure constraints</th>
<th>System-wide information management</th>
<th>&gt;10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Unconnected automation</td>
<td>- Integrated ops, crew, maintenance, station, passenger decision support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Experience-based decisions</td>
<td>- System of systems optimization</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Operational Analytics, Dashboards, Processes</th>
<th>Used by some</th>
<th>Deep data exploitation, insights, and post-decision reviews</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- departments and people</td>
<td>- All fleets, departments, leadership</td>
<td></td>
<td></td>
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</table>

Digital Airline
Paper to Digital Transformation in Flight Operations
Tablet EFBs approach their 3rd birthday
Digital Transformation
FliteDeck Pro

350 +
Airlines, Corporate accounts

12,000,000 +
Data Updates to Pilots, Annually

250,000 +
Copies of FDPro in Use

30 TB +
Data downloaded, Monthly

300,000 +
Registered Devices

20,000,000 +
Paperless Flights
Digital Transformation
Drivers of the tablet EFB phenomenon

- Breakthrough technologies
- Positive ROI/business cases
- **Simplicity**
  - User-friendly experience
  - Complete ecosystem
- Business side / personal side
- Regulator receptivity

*Simplicity is the ultimate sophistication*
- *Steve Jobs*
Digital Transformation
Regulatory perspective

89% of FAA EFB authorizations in the last six months have been for iPad

273 new FAA authorizations for iPad in last six months (23% increase)

72% of FAA authorizations are for iPad (compared to 60% one year ago)

132 FAA authorizations now involve iPad mini
Today, all mobile paperless airline pilots could easily fill The Gorge Amphitheater.

Within one year, mobile paperless airline pilots will fill The Gorge PLUS Century Link Field in Seattle.
Example #2: Maintenance Operations
Maintenance information at the point of use
Mobile, scalable, interoperable and integrated
Maintenance Data Delivery
Boeing is creating a single, seamless, mobile online and offline experience.

Current Online Products
- Toolbox Non-787
- Toolbox 787
- Maintenance Documents

Current Offline Products
- Toolbox Remote Non-787
- Toolbox Remote Non-787
- Toolbox Mobile Library
Digital Maintenance Transformation

Value throughout the Lifecycle
Reduced Schedule Interruptions / Maintenance Efficiency / Digital Asset Management
The Digital Airline (n): An adaptive, continuously optimized, real-time operation that delivers step changes in efficiency, profitability, and customer experience to drive long-term competitive advantage.