Spirit Research and Development: Improving Flight Today and Tomorrow

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Spirit Is the Leading Global Aerostructures Tier 1 Supplier

Global aerostructures leader

With a balanced aerostructures portfolio

Fuselage (52%)
Propulsion (26%)
Wing (22%)

On all of 12,500 Boeing/Airbus backlog

And an emerging presence in Defense

P-8
Tanker
B-21

SPR backlog = $47B

Source: McKinsey & Company
Spirit Has a Global Footprint

~15,000 Employees across 15M square feet of facilities
High-rate Production Capability

- 787
- 737
- A320
Section 41 of the Boeing 787
The Dreamlifter Carries Two 787 Section 41s at a Time
Current Production Rate: 42 737s / month
Single Aisle

Airbus A320

Boeing 737

LEADING & TRAILING EDGE

LEADING EDGE SLATS
THRUST REVERSER & PYLON
FUSELAGE
FORWARD SECTION
Twin Aisle

Boeing 777

FORWARD FUSELAGE AND COCKPIT

STRUT, THRUST REVERSER, INLET, FAN COWL

Boeing 747

FORWARD FUSELAGE SECTION

STRUT, INLET, FAN COWL

FIXED LEADING EDGE
Twin Aisle

Boeing 787

FORWARD FUSELAGE SECTION
PYLON INTEGRATED LEADING EDGE

Boeing 767

FIXED LEADING EDGE
FORWARD FUSELAGE SECTION
STRUT, THRUST REVERSER, INLET, FAN COWL & CORE COWL
Twin Aisle

Airbus A350XWB

Airbus A380

CENTER FUSELAGE

LEADING EDGE & SPAR

INBOARD FIXED LEADING EDGE
Business and Regional Jet

Bombardier CSeries

Gulfstream G650

Mitsubishi MRJ

PYLON

THRUST REVERSER, INLET, FAN COWL, APRON, ENGINE BUILD UP (E.B.U.)

PYLON
Spirit Research and Development

Mission
Create value through the development and implementation of technology

Drilling
Composite Bladders

Horizon 1
Production Improvements

Ti Joule Forming
Core Forming

Horizon 2
Development Programs

CFD of Cascade Options
Thermoplastics

Horizon 3
Advanced Research
Horizon 2 and 3 Portfolio Process

- **Market Pulse**
  - Assessment of Customer Outlook

- **Spirit Configs**
  - Define Key Needs for Future Products

- **Tech Roadmap**
  - Integration of Technology Roadmaps

- **New Projects**
  - Product-Technology Proposals
Composite Processing Technology

Resin Infusion Technology

Cure Optimization and OoA Technology

Robotic Stitching Equipment

Automated Fiber/Tape/Fabric Layup

World Recognized Composite Processing Expertise
Composite Materials Technology

Development Success with Many Material Types

X-55/ACCA VARTM Fairing
5HS AS4/Hexcel HRH/CPD 4307+4303

Integrally stiffened fuselage panel

Dry Fiber Placed fan Cowl demo;
Hexcel Hi-tape/RTM-6

20 ft. Resin infused Spar
NCF/EP2400

AFP of OOA prepreg-Complex shape
MTM45-1; Cytec 5320

AFP of OOA BMI prepreg tow. SW
demo panel

Stitched Resin
infused wing box
demo panel
NCF/RTM-6
Metals Technology

Titanium Direct Metal Deposition

Integrated Structures

Advanced Titanium Machining

Titanium Forming – Joule Heating

Reconfigurable Tooling

High Performance Machining

Focus on Decreasing Buy to Fly Ratios
Automation Technology

Fastening

Thermal Spray

Prime & Paint

Non-Destructive Inspection

Cleaning & Surface Prep

Stitching

Automation Technology for Rate
Inspection Technology

Spar NDI

Skin NDI

Small Part Robotic NDI prototype

Laser Technology

Trim & Drill Cell

Automating Stringer Inspection

In-Process Inspection with Feedback Control Enables Quality
Advanced Tooling and Support Materials

Rapid Prototypes

INFLEXION® Tooling Process

State of the Art Tooling Software

High Temperature Tooling

Reconfigurable Stretch Forming

Support Materials

Current Bladder

New Bladder

State of the Art in Tooling Technology
Product Design and Analysis

Stress Analysis Tools

Computational Fluid Dynamics

Knowledge Based Engineering Automation

3D Finite Element Analysis

Composite Process Analysis

Integration of R&D and Product Design
Test Lab Capabilities

- Static Testing
- Fatigue Testing
- Damage Tolerance
- Environmental
- Vibration
- Acoustic
- Air Flow
- Structures
- External Partnerships for DO-160G Tests (EME, Fire, Etc.)
Advanced Technology Through Expertise and Creativity