

Lift System Overview

Gregg E Pyers



©2016 Rolls-Royce Corporation

NOTICE

THIS DOCUMENT CONTAINS TRADE SECRETS, COMMERCIAL OR FINANCIAL INFORMATION THAT IS PRIVILEGED AND CONFIDENTIAL TO ROLLS-ROYCE CORPORATION. THIS DOCUMENT AND ALL INFORMATION HEREIN MUST BE WITHHELD INDEFINITELY FROM DISCLOSURE TO ANY THIRD PARTY PURSUANT TO THE FREEDOM OF INFORMATION ACT (5 U.S.C. § 552(b)), AND SECTION 40115 OF THE FEDERAL AVIATION ACT OF 1994 (49 U.S.C. § 40115) AS BOTH MAY BE AMENDED OR SUPERSEDED FROM TIME TO TIME

Trusted to deliver excellence



Rolls-Royce

Strong position in all defence sectors



© Northrop Grumman



© Copyright Lockheed Martin



© Crown Copyright



Combat, STOVL, light-attack, trainer, transport, helicopters, maritime reconnaissance and aerial surveillance.



Rolls-Royce

Defence Aerospace



Liftfan



TP400



AE1107C



T56



EJ200



**FCAS – Future
Combat Air System**



CTS800



Rolls-Royce

Key Technology Challenges – Defence Aerospace

Affordable Readiness

Improved Mission
Effectiveness

Designing for the Future

Survivability

Integrated Power Systems



Rolls-Royce

Unmanned Air Systems

Complex landscape – multiple systems in service, and in development and demonstration phases

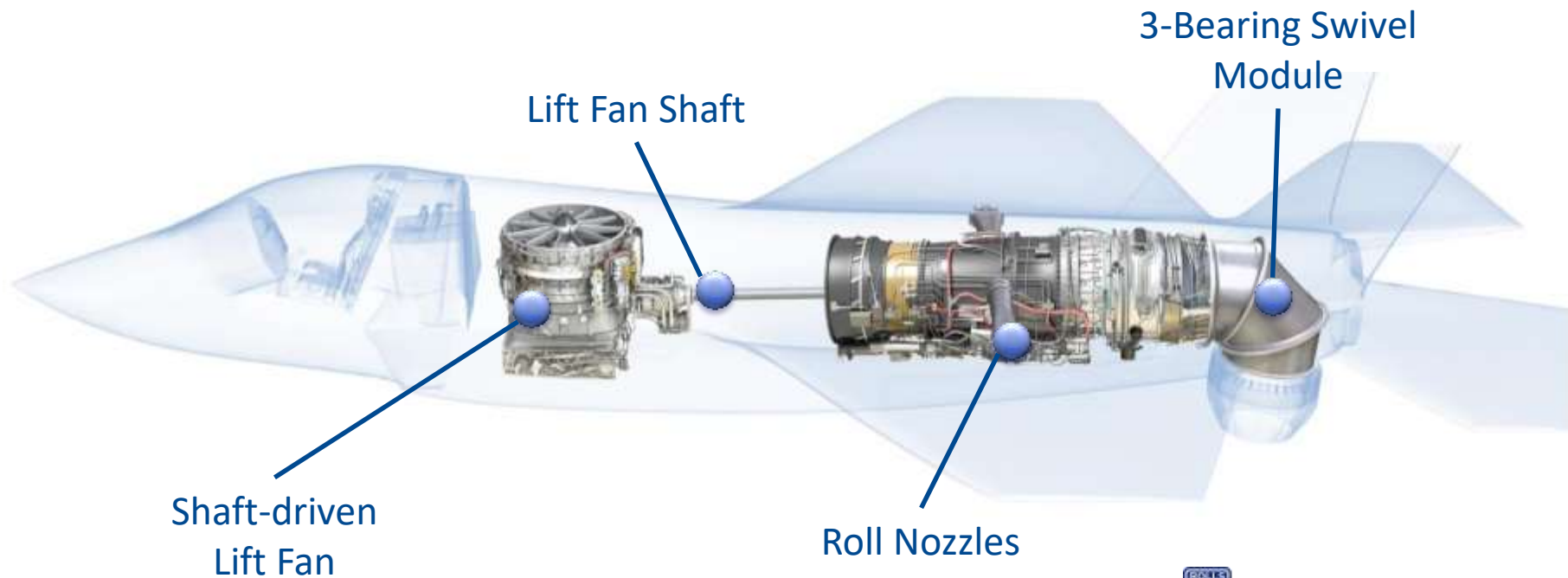
Key technology challenges in integrated power and propulsion system



Rolls-Royce

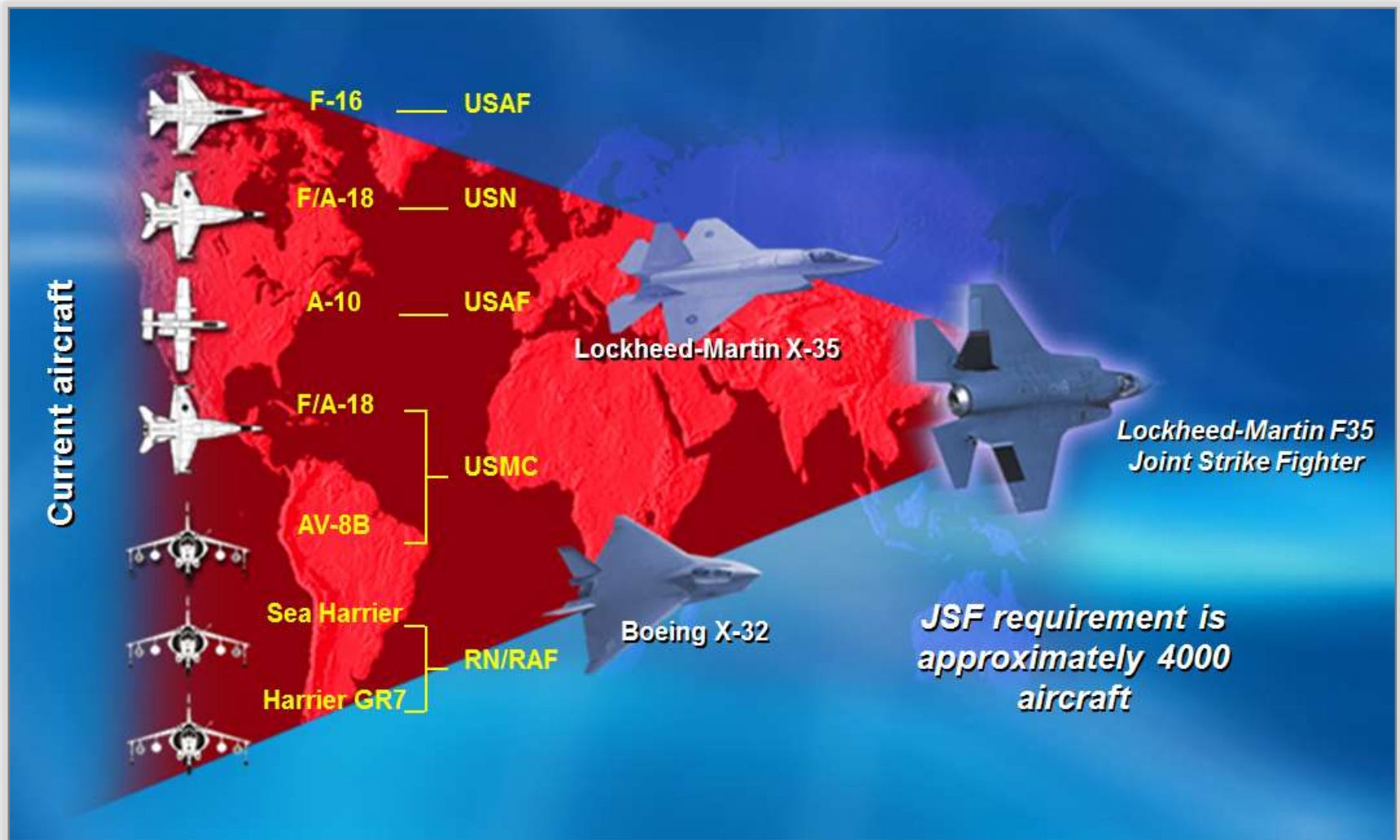
LiftSystem for the F35-B

Unique vertical lift technology for the F35-B
Combined STOVL capability of 40,000lbf



Rolls-Royce

Why was the JSF programme started?



Rolls-Royce

F35 Joint Strike Fighter Program

Joint Strike Fighter Program Three Aircraft Variants

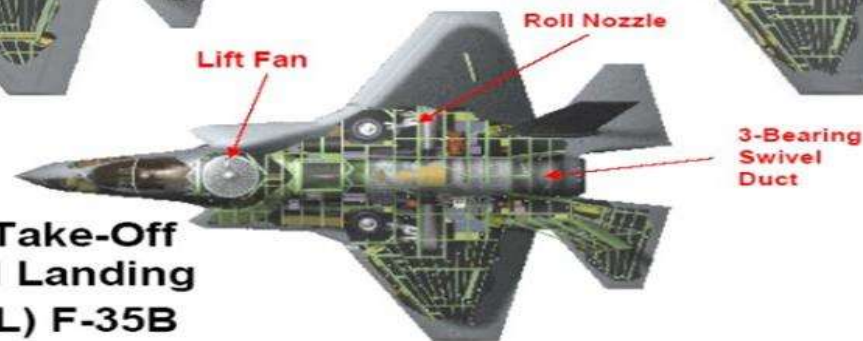
Carrier Variant
(CV) F-35C



Conventional Take-Off
and Landing
(CTOL) F-35A



Short Take-Off
Vertical Landing
(STOVL) F-35B



- Rolls-Royce provides short take-off vertical landing (STOVL) components to the program.



Rolls-Royce

How did we get there?

Concept
Demonstrator
(1996)

Development
(2001)

Production
(2008)

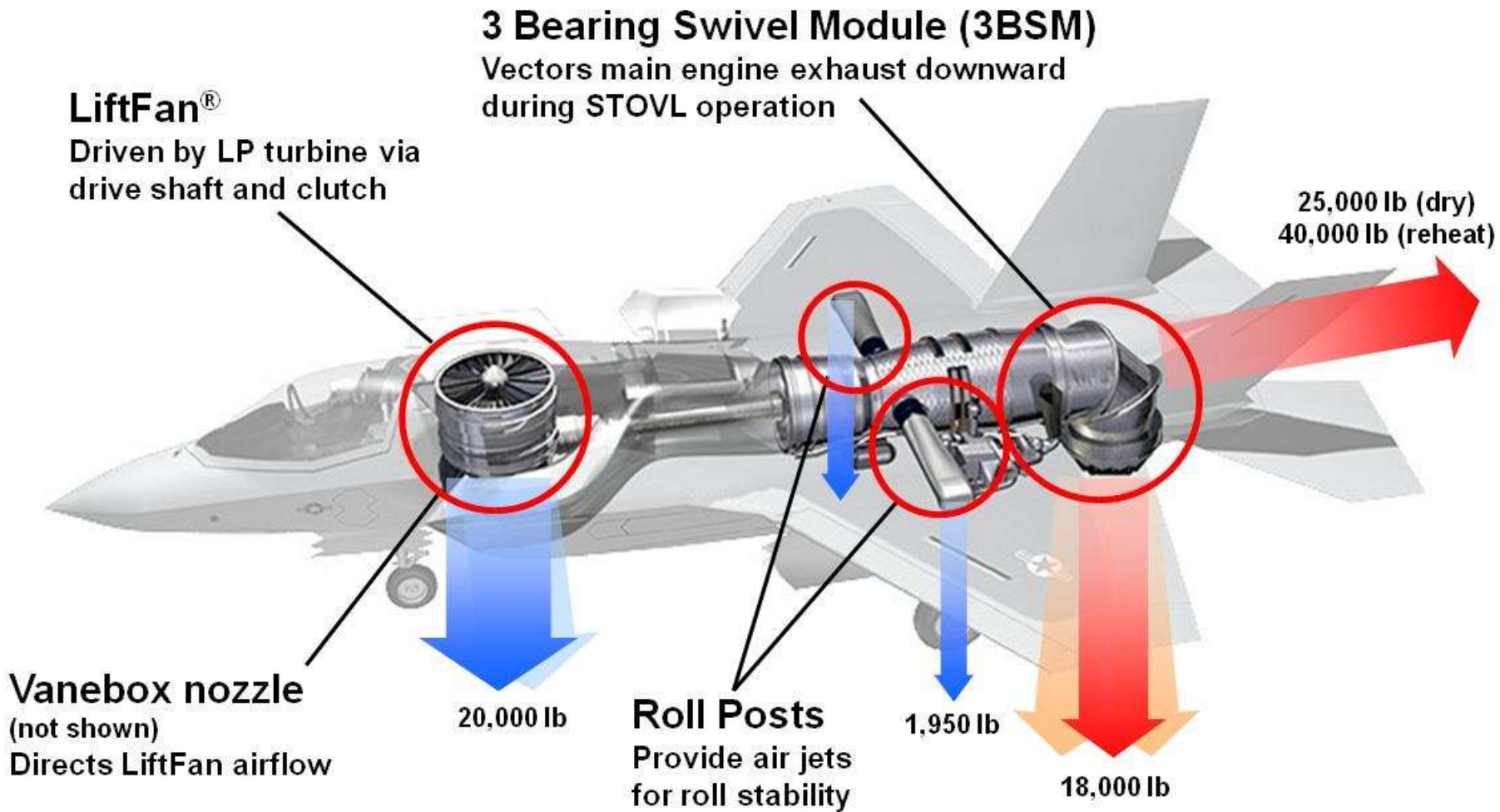
Entry into Service
(2012)

*Initial Operational
Capability (IOC)
(2015 – US)
(2018 – UK)*



Rolls-Royce

Rolls-Royce LiftSystem®

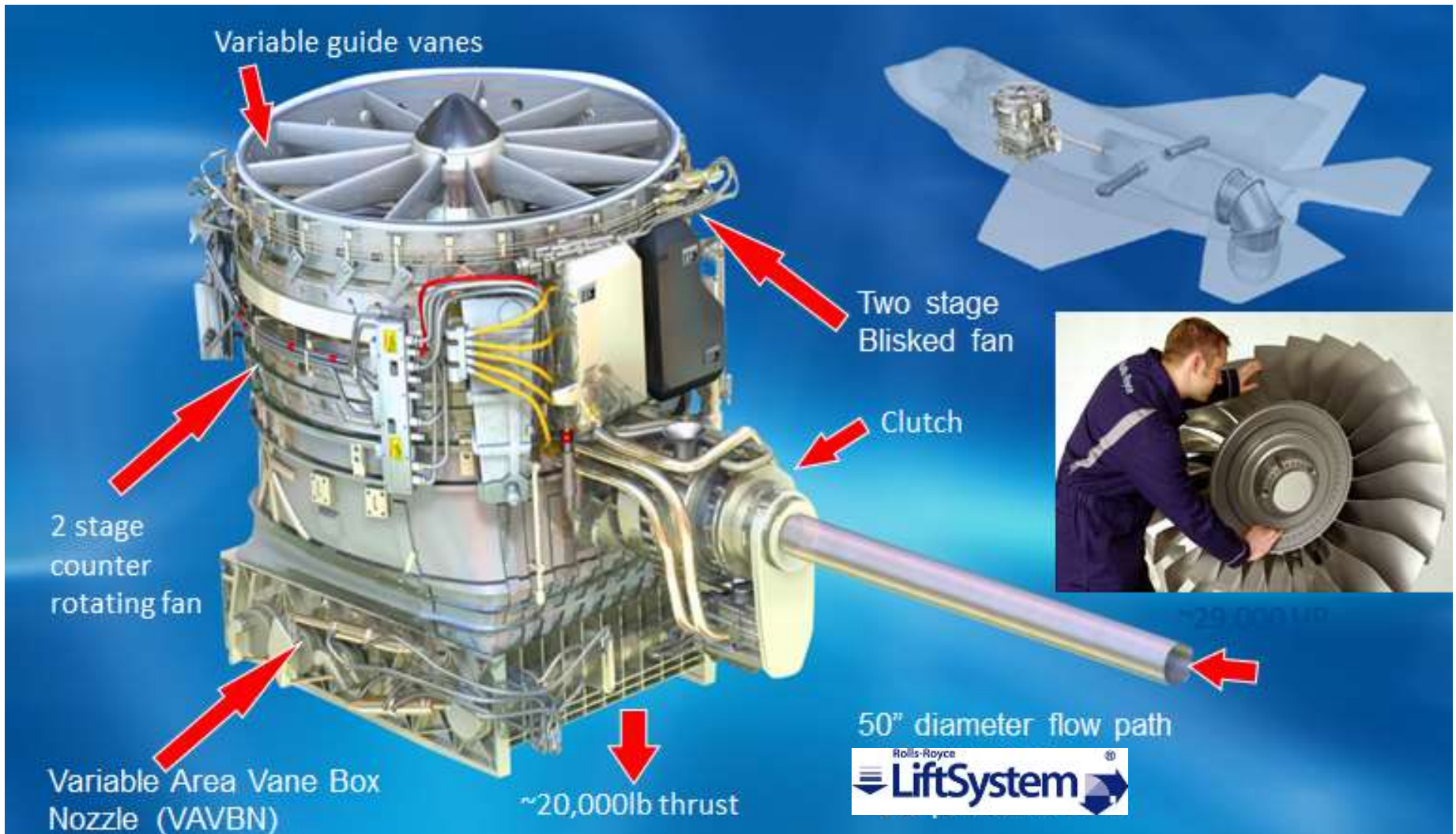


Carrier Trials Video



Rolls-Royce

LiftFan Overview



3BSM Overview

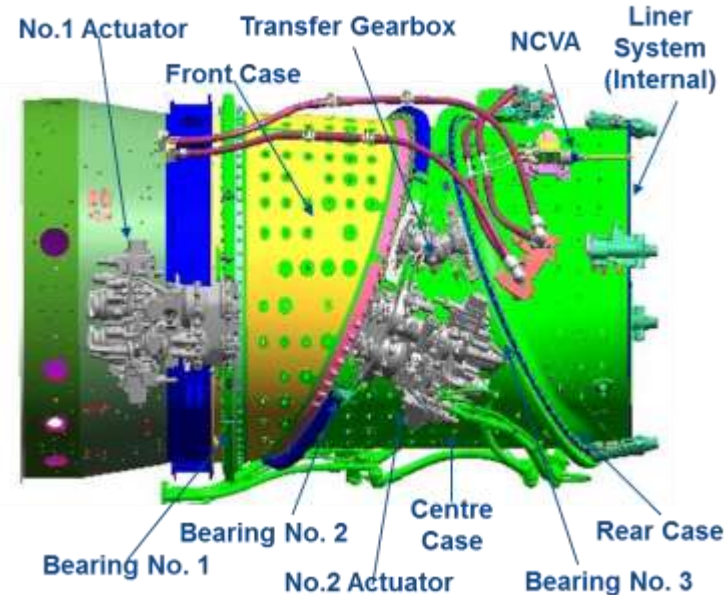
A single vectoring nozzle provides thrust between 0-95° pitch and $\pm 11^\circ$ yaw

- Providing STOVL and Supersonic flight
- 43,000lbf (Afterburner)
- 18,000lbf (STOVL)

3 bearings are mounted at different angles in four casings

- Bearing rotation changes jet vector

3 actuators provide control over thrust vector



Roll Post Overview

Bleed air from
main engine
bypass duct



Roll Post duct
fits inside wing



Nozzle with
actuator



Program Overview

- Development Completed (Jul 2016)
 - 21,000 test hours
 - 20,000 clutch engagements
 - 1,600 Short Take-offs
 - 1000 Vertical Landings
- Delivering Low Rate Initial Production
 - Dedicated LiftSystem Assembly Facility
 - 70 production LiftSystems delivered to date
- Providing Depot MRO Service



Lift System Overview

Gregg E Pyers



©2016 Rolls-Royce Corporation

NOTICE

THIS DOCUMENT CONTAINS TRADE SECRETS, COMMERCIAL OR FINANCIAL INFORMATION THAT IS PRIVILEGED AND CONFIDENTIAL TO ROLLS-ROYCE CORPORATION. THIS DOCUMENT AND ALL INFORMATION HEREIN MUST BE WITHHELD INDEFINITELY FROM DISCLOSURE TO ANY THIRD PARTY PURSUANT TO THE FREEDOM OF INFORMATION ACT (5 U.S.C. § 552(b)), AND SECTION 40115 OF THE FEDERAL AVIATION ACT OF 1994 (49 U.S.C. § 40115) AS BOTH MAY BE AMENDED OR SUPERSEDED FROM TIME TO TIME

Trusted to deliver excellence



Rolls-Royce