Precision Strike Technology Symposium

JSF Pneumatic S&RE and Beyond

19 October 05

Mr. Lynn D. Seal

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Abstract

Existing pyrotechnic ejection racks use erosive pyrotechnic cartridges to release weapon stores. The explosive nature of pyrotechnic cartridges causes pitting damage and residue build-up in the racks which increases required maintenance, decreases rack performance, and reduces the overall life of the rack. Also, pyrotechnic cartridges have associated storage, inventory, handling and disposal/hazardous waste clean-up costs, which significantly add to life cycle costs. Thus, when the JSF efforts began, the program office required that the S&RE suite for the aircraft be non-pyrotechnic. This requirement resulted in studies that determined pneumatic powered S&RE would best meet the JSF needs. This presentation illustrates the approach used for the JSF bomb racks and eject missile launchers and the hardware/protocols used for the pneumatic compressor and logic control, respectively, and presents future applications for pneumatic powered S&RE.

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Biography

Lynn D. Seal
Manager, Advanced Armament
EDO Corporation

Mr. Lynn D. Seal graduated in 1965 from Case Institute of Technology with a B.S. in Metallurgy. Upon graduation, he spent four years in the United States Air Force as an aircraft maintenance officer on C-130 aircraft. In 1969, Mr. Seal joined Dayton T. Brown, Inc. Testing Laboratories, where for the next ten years he was responsible for the testing of aircraft armament equipment and systems, as well as being a member of various industry and government armament groups. Mr. Seal joined EDO in 1979 and has since been intimately involved with all armament production which includes the Tornado, F-15E, F-22, BRU-57, JSF, SDB and B-1B PAR Programs, as well as all R&D efforts and continued involvement with armament groups.

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History and Leveraging Technologies

- ★ **Air Bag Ejection (FO8635-84-C-0317)**
  - ➢ ***Northrop***
  - ➢ ***Air Bag Expands to Eject Store and Fill Opening***
- ★ **Conformal Ejector Rack (FO8635-84-C-0317)**
  - ➢ ***Rockwell***
  - ➢ ***Remote-controlled, Hydraulic Rack with Self-contained Hydraulic System***
- ★ **Alternate Conformal Ejector Rack (FO8635-85-C-0170)**
  - ➢ ***EDO***
  - ➢ ***Remote-controlled and Self-contained Pneumatic/Hydraulic Rack***
- ★ **Advanced Missile Ejection Launch Technology (FO8635-86-C-2085)**
  - ➢ ***MDA***
  - ➢ ***Hydraulic Powered Trapeze for AIM-120 Ejection***

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History and Leveraging Technologies

- **Dual Mode Launcher (FO8630-92-C-0011)**
  - *EDO*
  - *Hydraulic Powered Trapeze for AIM-9 and AIM-120 Ejection*
- **Advanced Weapon Carriage Technology (FO8630-92-C-0012)**
  - *Boeing/MDA*
  - *Adoptable and Relocatable S&RE with Reusable Energy Sources*
- **Weapons Carriage Technology (FO8630-95-C-0010)**
  - *Boeing/EDO/Vickers*
  - *Pneumatic Powered Rack and Missile Launcher Combination*

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"The Bottom Line"

★ Pneumatics Win Out Over Hydraulics

- ***Legacy Aircraft Specifies "No Carts" for AIM-120 Launcher But Still Uses Pyro Racks***
- ***JSF Specifies "No Carts" for Racks and Launchers***
- ***SDB Specifies "No Carts" for its Multiple Store Carrier***

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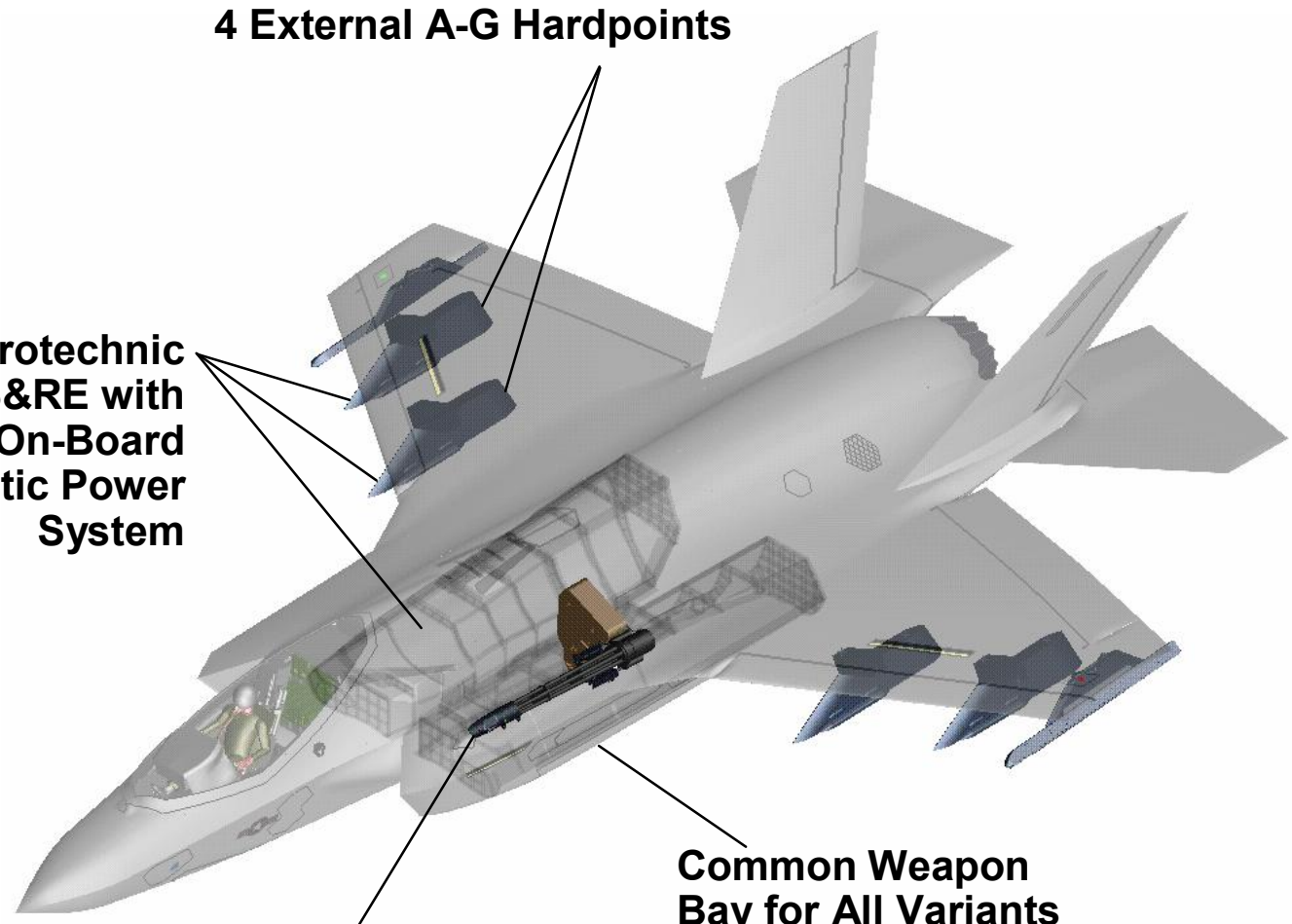
JSF Weapons Carriage Overview



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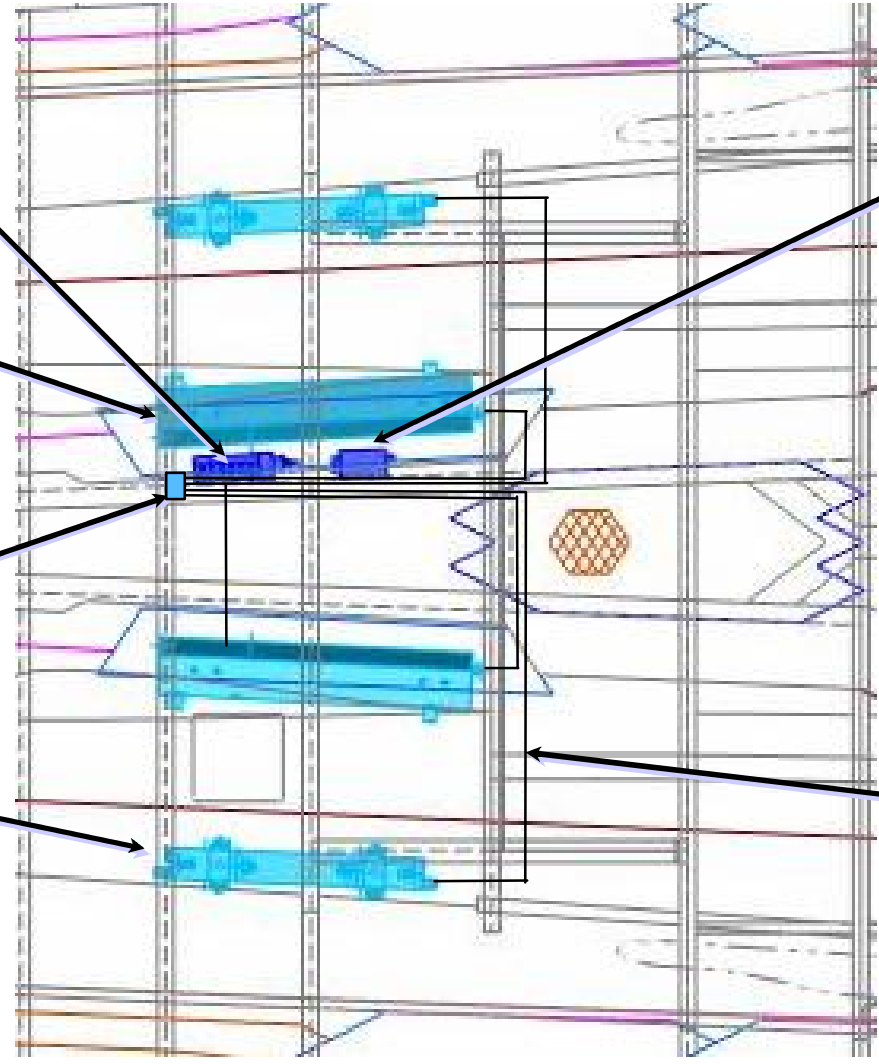
JSF S&RE System Weapon Bay Installation Schematic



Pneumatic Power System

NuLAU120

FWD

Filter & Valve Manifold

NuBRU30

Electronic Control Unit (ECU)

VIEW LOOKING UP

Manifold Lines to Each NuBRU-30 & NuLAU -120

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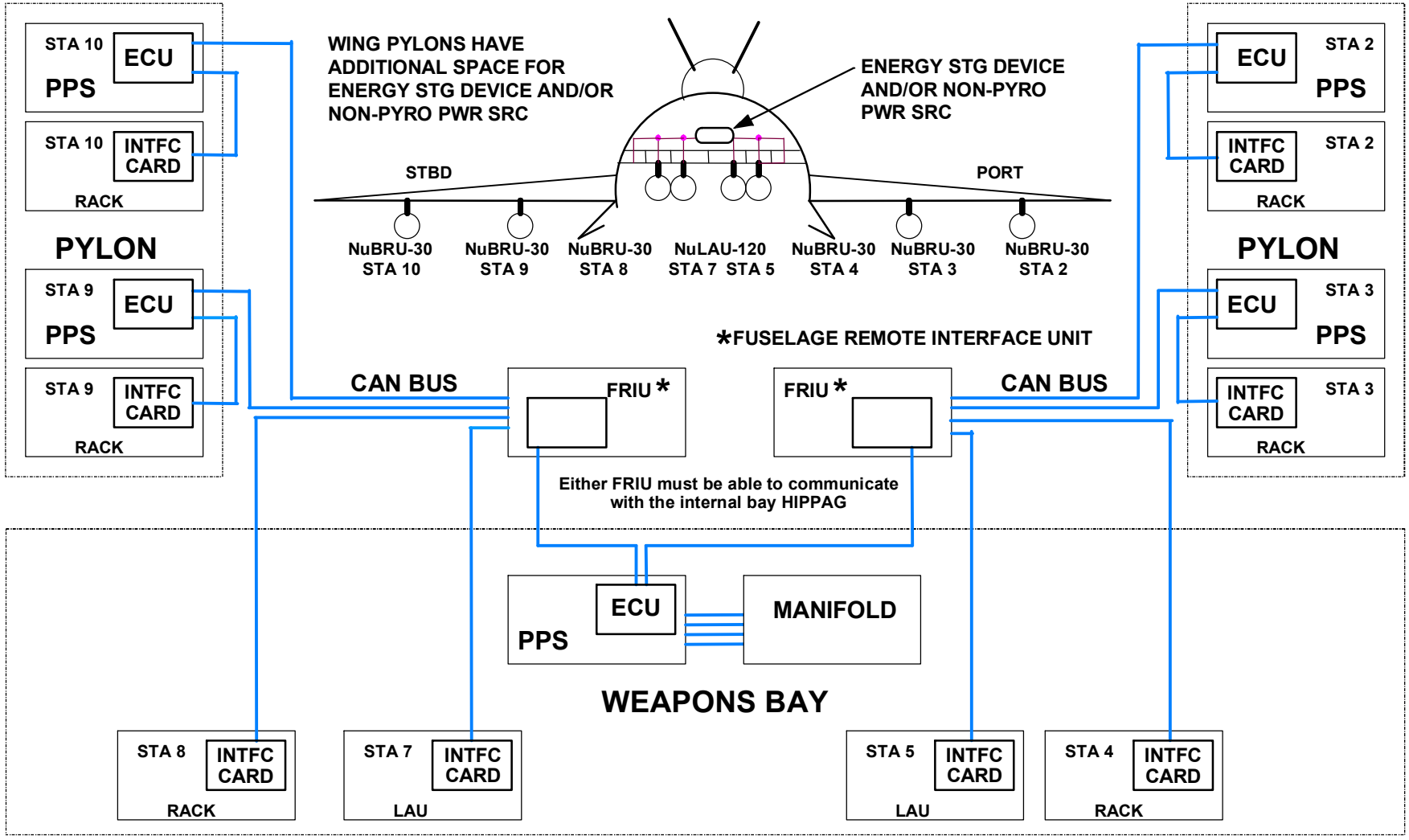
Overall Aircraft Interface



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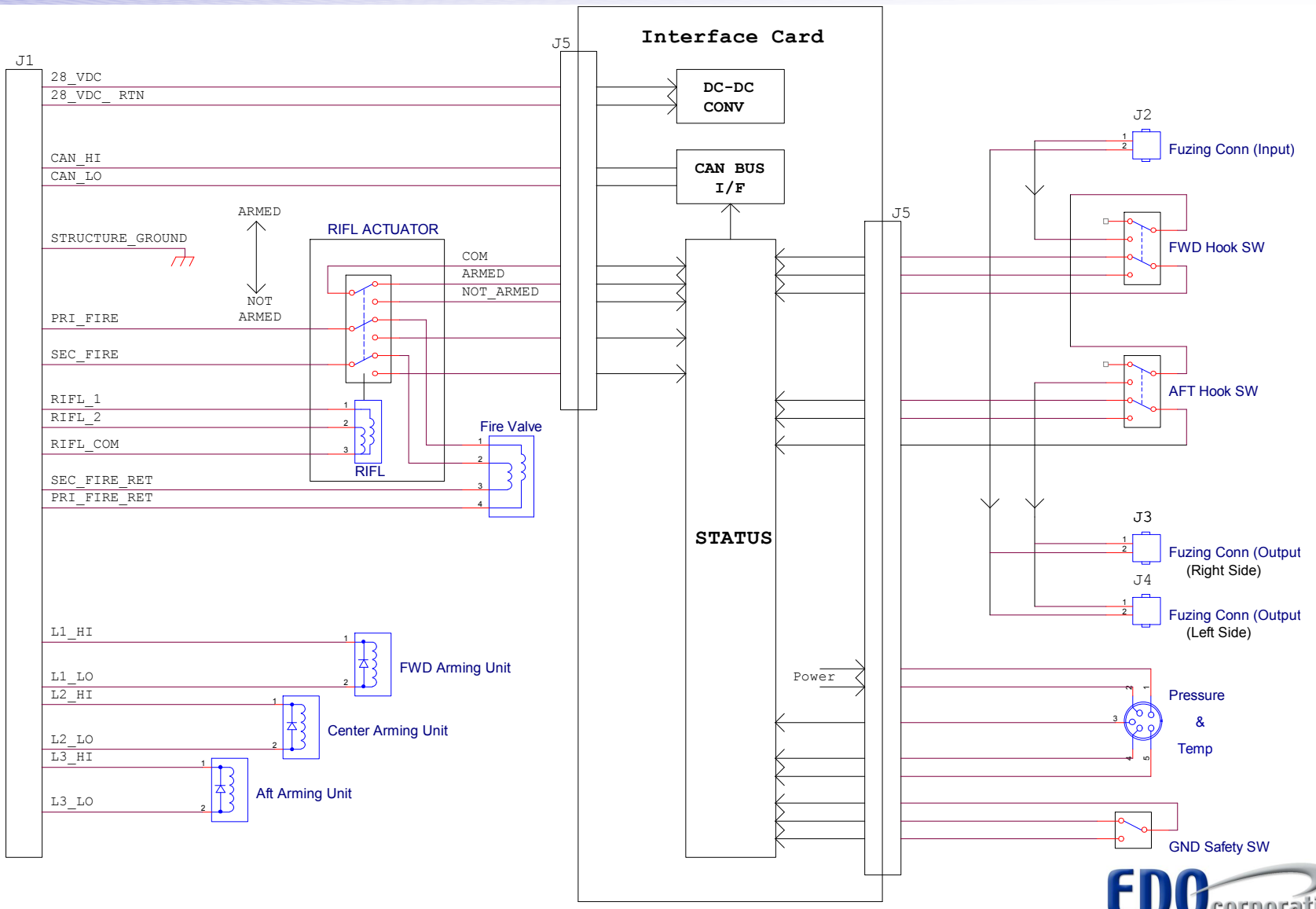
S&RE Electrical Schematic



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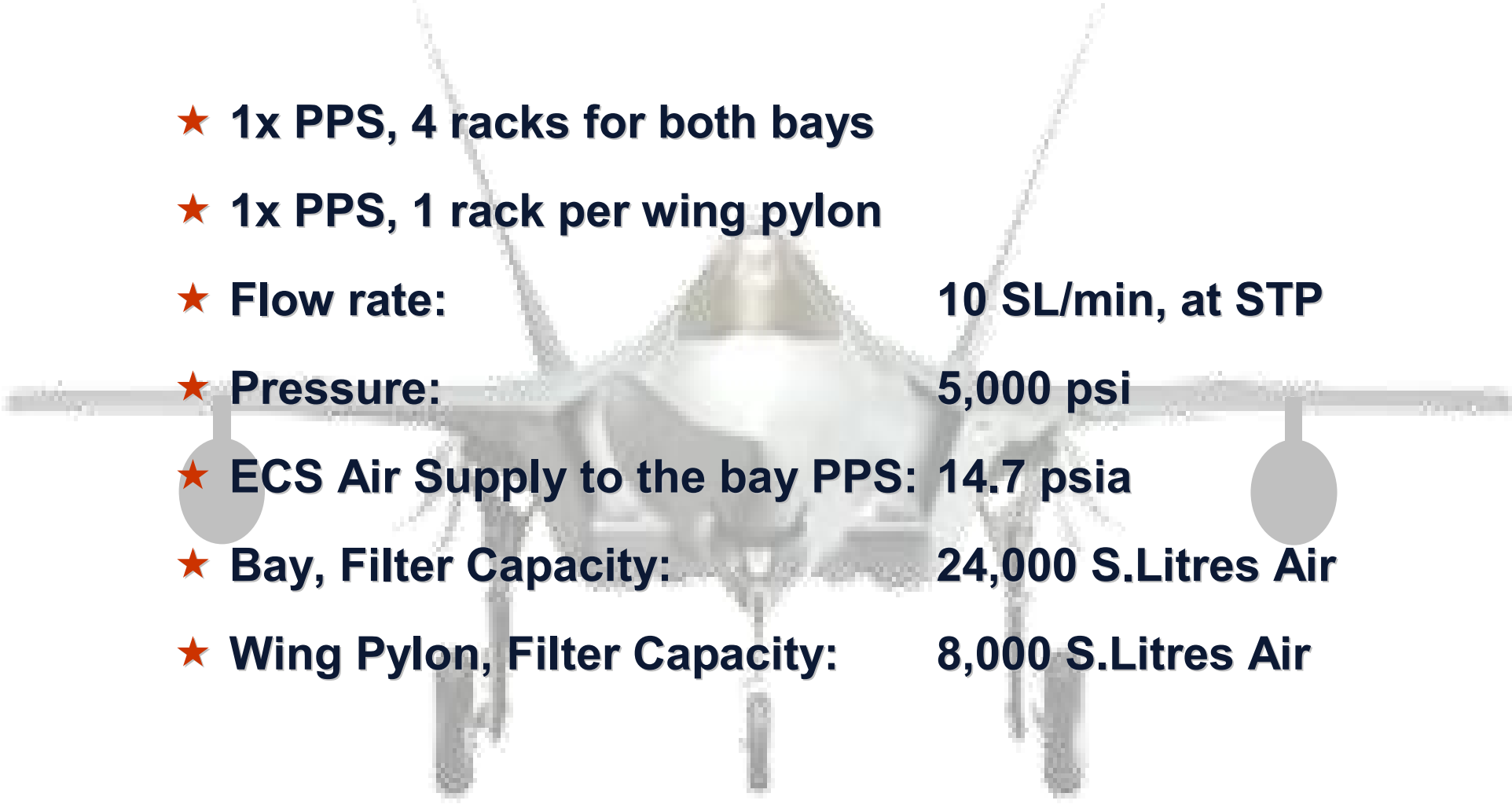
JSF Baseline Pneumatic Power System Configuration



- 1x PPS, 4 racks for both bays
- 1x PPS, 1 rack per wing pylon
- Flow rate: 10 SL/min, at STP
- Pressure: 5,000 psi
- ECS Air Supply to the bay PPS: 14.7 psia
- Bay, Filter Capacity: 24,000 S.Litres Air
- Wing Pylon, Filter Capacity: 8,000 S.Litres Air

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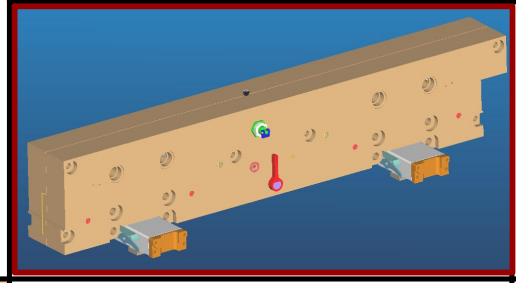
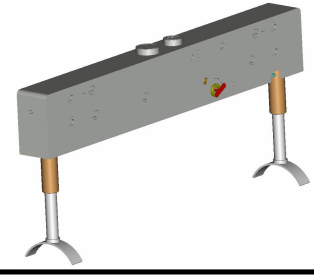
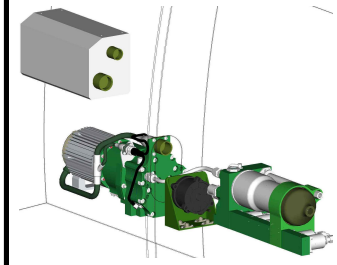
S&RE System Components (LRCs)

	14/30” Rack	Missile Ejector	PPS
			
Envelope (L x H x W)	36.0 x 4.0 x 5.63	39.6 x 4.0 x 6.9	
Max Weight (lb)	90.0	69.0	25.5
Min Eject Performance (ft/sec)			
350 lb Store		25.0	
500 lb Store	20.0		
1000 lb Store	15.0		
2000 lb Store	11.0		
Departure Control	Yes	Yes	
Stroke Length	7.5	7.5	
Aircraft Uses	Int : All Ext : All	Int A/A : All	Int : All RH Bay Ext: All Pylons

Note: **STOVL will now use 14” only rack for weight considerations**

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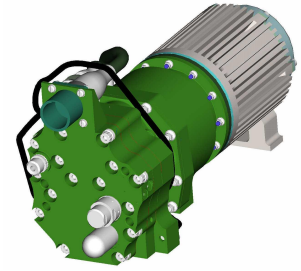
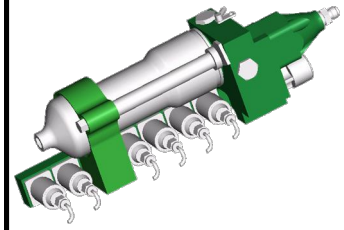
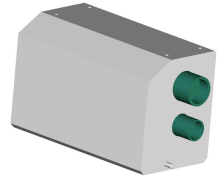
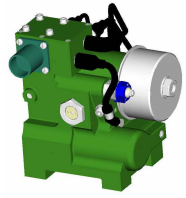
Pneumatic Power Source (PPS) Components (LRCs)

	Compressor	Filter/Manifold	Electronics (ECU)	Pylon Filter
				
Envelope (L x H x W)	11.00 X 3.54 X 4.10	13.50 X 3.51 X 3.91	9.00 X 3.15 X 3.54	5.30 X 4.13 X 4.76
Weight (lb)	11.4	9.5	4.6	3.8
Electrical Power	540 Watts@270VDC			
Aircraft Uses	Int : All RH Bay Ext: All Pylons	Int : All RH Bay	Int : All RH Bay Ext: All Pylons	Ext: All Pylons

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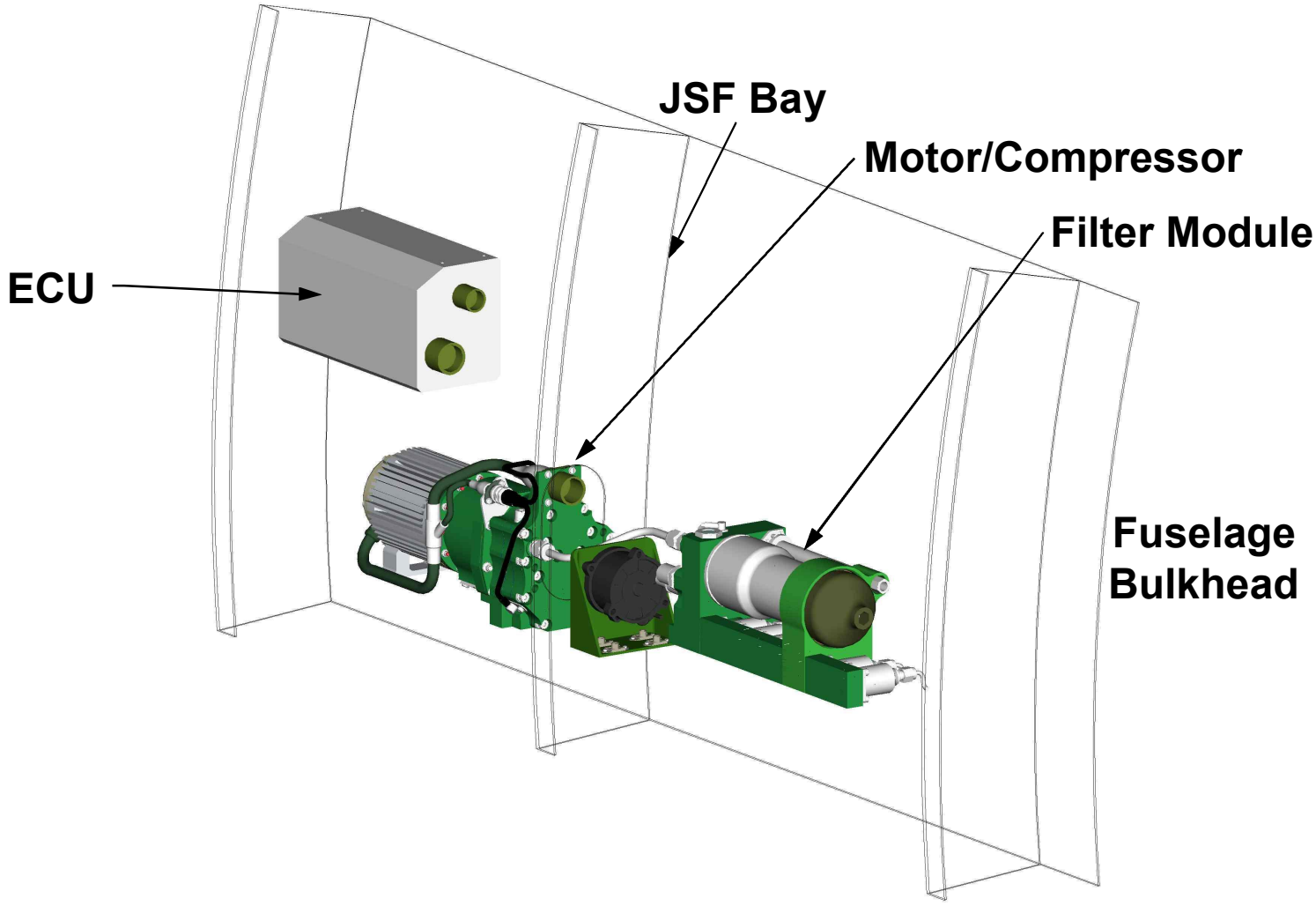
PPS Bay Installation



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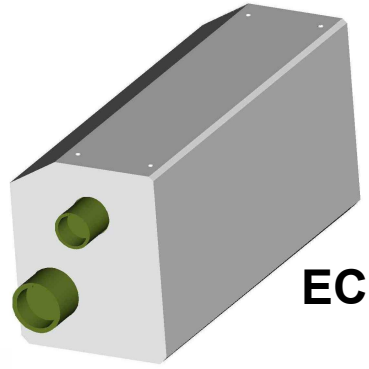
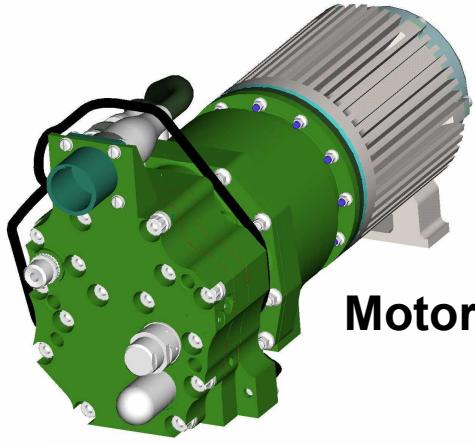
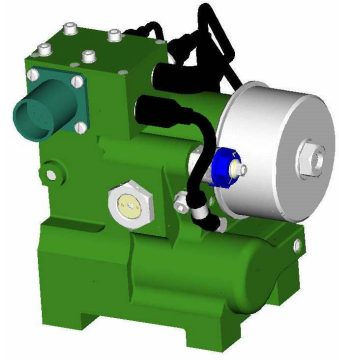
PPS For Pylon Installation



ECU



Motor/Compressor



Filter Module

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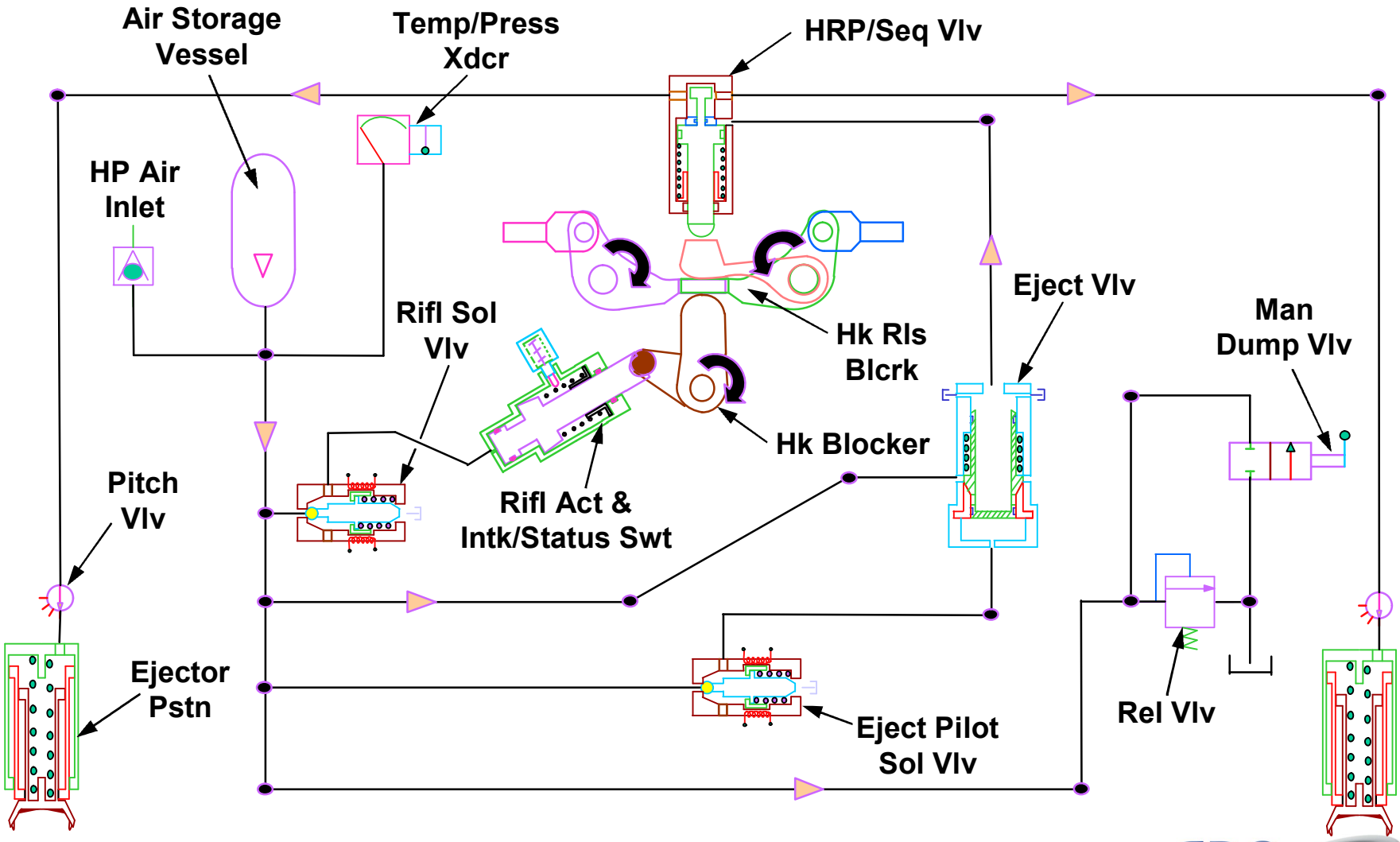
JSF S&RE Pneumatic System Schematic



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JSF S&RE Key Features/Concepts

- ★Must Fully Charge Before Flight (Based on Emergency Jettison)
- ★Can Recharge During Egress
- ★Considering Manual Fill Point for Ground Carts
- ★Considering Having Off the Shelf Units Pre-Charged
- ★Pneumatic RIFL will Mechanically Block Hook Release Piston Even When Hooks are Open
- ★Manifold Distributes High Pressure Air to Particular S&RE Based on Need/Priorities

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JSF S&RE Key Features/Concepts

- **Interface Card Collects All Data from S&RE's and Passes on to Aircraft for Health Prognostics Management**
  - ***Pressure***
  - ***Temperature***
  - ***Hook Status***
  - ***Safety Status***
  - ***Self Test/Bit Results***
  - ***Host Rack Identification (BRU/LAU)***
- **Fire and RIFL Solenoids Have Dual Coils**
- **Fire and RIFL Solenoids Fail Safe with Loss of Power by Venting to Atmosphere**
- **Common Electronics and PPS for BRU/LAU**
- **PPS Compressor Mounted on Coolant Plate**

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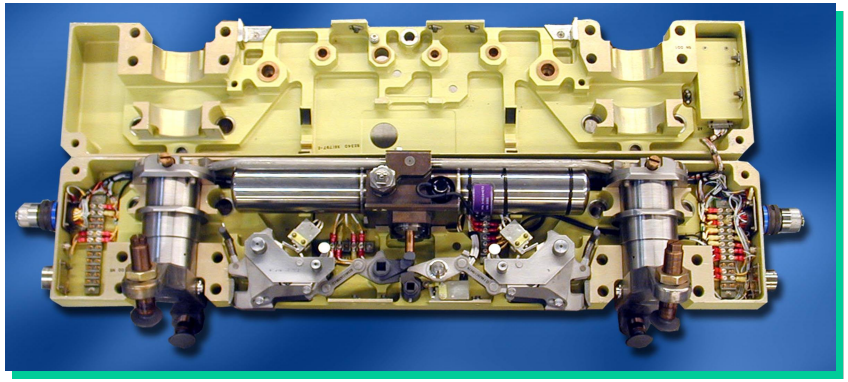
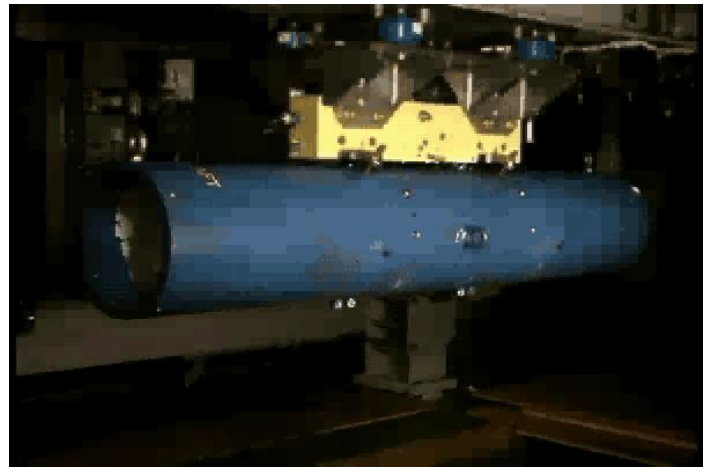
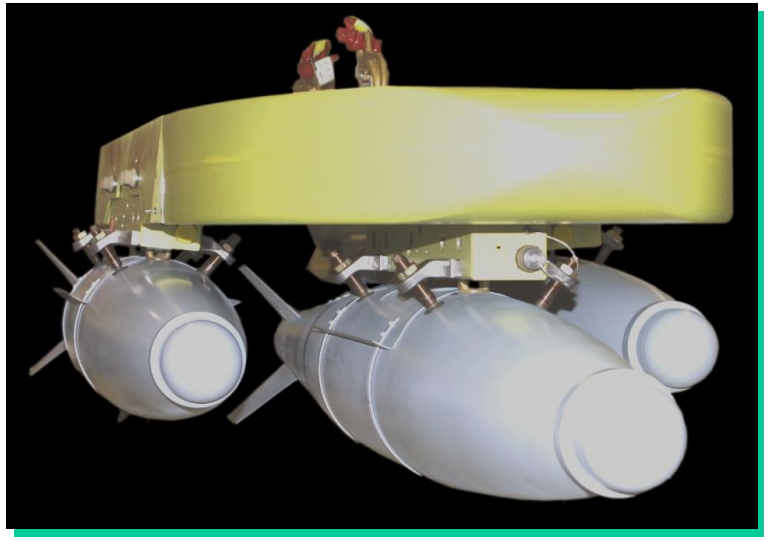
Pneumatic Technology IR&D Program to Verify JSF Concepts



Pneumatic Demonstrator





Strongback with Pneumatic Racks and 500lb JDAMS

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SCS Flight Test

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B-1B PAR Flight Test

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Pneumatic Rack S&RE Applications

- ★ F-22
- ★ SDB/BRU-61
- ★ JSF
- ★ MMA
- ★ J-UCAS
- ★ B-1B
- ★ UAV's
- ★ Twin Store Carrier

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