



# SM-29E/F SUPER FULCRUM



## MiG-29 AIRCRAFT UPGRADE

A Transformational Upgrade For MiG-29, MiG-29S/SE/SM/SMT and MiG-29M Tactical Aircraft  
Engineered, Installed and Supported by Aerospace Ltd

# SM-29 UPGRADE

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**The SM-29 Super Fulcrum is an enhanced performance MiG-29 Fulcrum aircraft that has been transformationally upgraded by XXX Aerospace to the “Super Fulcrum” configuration, allowing the aircraft remain a potent and competitive air defense asset through 2040.**

**The upgrade focuses upon modernization of MiG-29, MiG-29A, MiG-29S, MiG-29SE/SM/SMT and MiG-29M tactical aircraft.**

**Aircraft upgrades and improvements resulting in the SM-29 include new:**

- GEAE F414 EPE Afterburning Turbofans
  - Raytheon AN/APG-79 AESA Radar
  - IRST-21 Infra-Red Search and Track
  - New Design Conformal Fuel Tanks (CFTs)
  - Comprehensive Integrated ECM System
  - Sparrowhawk HUD or BAE LiteHUD
  - L3 508mm x 203mm in Large Area Avionics Display (LAAD)
  - New Design External Pylons with LAU-129 MRLs
  - Increased Internal Fuel Capacity to 7,214 Liters
  - Increased External Warload to 6,800 kg
  - Optional Retractable In-Flight Refueling Probe (Cost Plus)
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# SM-29E SPECIFICATIONS

## SM-29E SPECIFICATIONS

**Aircraft:** SM-29E Super Fulcrum  
**Upgrade Of:** MiG-29, MiG-29S/SE/SM/M/SMT/G

**Original Manufacturer:** MiG  
**Upgrade Provider:** Aerospace Ltd

### Accommodation

Crew Single Seat  
 Seating K-36DM Ejection Seat

### Armament

Internal Gsh-301 30mm cannon with 150 rds  
 External 7 External Stores Hardpoints

### Powerplant

Number 2  
 Type Afterburning Turbofan  
 Manufacturer GEAE  
 Model F414 EPE  
 Afterburning Thrust @ SL 11,938 kgf st  
 Military Thrust @ SL 16,800 kgf st  
 Total Aircraft Thrust @ SL 23,876 kgf st

### Avionics & Electronic Warfare

Radar AN/APG-79 AESA  
 IRST IRST21  
 Databus MIL-STD-1553-B  
 HMDS Gen III HMDS or JHMCS  
 HUD Sparrowhawk or LiteHUD  
 HDD 508mm x 203mm in LAAD  
 Comm AN/ARC-210(V) Gen V  
 IFF AN/APX-126/125(V)  
 Data Link TACR-16DL  
 MMDP FV-4000  
 GPS/INS FALCN  
 RF ECM AN/ALQ-211A(V)4 (Optional)  
 RWR AN/ALQ-211A(V)4 (Optional)  
 MAWS AN/AAR-58 (Optional)  
 SPJ AN/ALQ-214 (Optional)  
 Chaff/Flare BVP-30-26M & AN/ALE-47

### Dimensions

Max Wingspan 11.36 m  
 Max Length 16.28 m  
 Max Height 4.73 m  
 Wing Area 38 sq m

### Weights

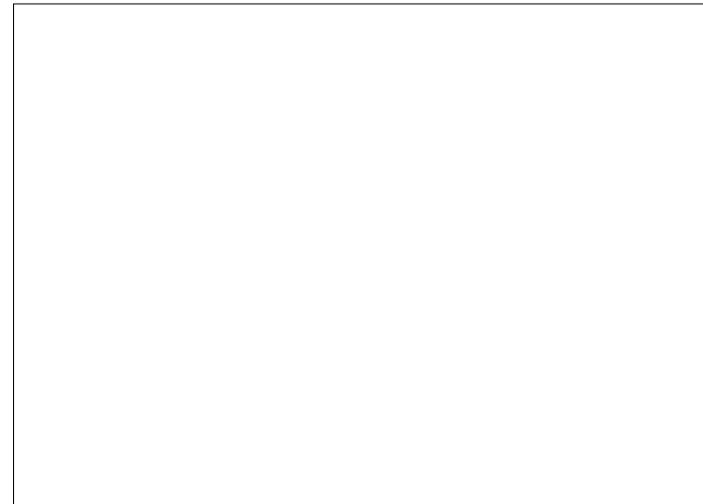
Empty Operating 11,330 kg  
 Max Internal Fuel 5,792 kg  
 Max Internal + External Fuel 8,708 kg  
 Max Warload 6,800 kg  
 Typical Takeoff Weight (TTW) 17,717 kg  
 Typical Combat Weight (TCW) 14,979 kg  
 Typical Landing Weight (TLW) 12,923 kg  
 Max Takeoff Weight (MTOW) 23,604 kg

### Loadings

Wing Loading-TCW 394 kg/sq m  
 Thrust/Weight-TCW 1.35 to 1  
 Wing Loading-MTOW 621 kg/sq m  
 Thrust/Weight-MTOW 1.01 to 1  
 Limit Load Factor-TCW +10.0 g  
 Limit Load Factor-MTOW +7.50 g

### Performance

Stall Speed, TTW-SL 222 km/hr  
 Stall Speed, TLW-SL 189 km/hr  
 Stall Speed, MTOW-SL 256 km/hr  
 Takeoff Speed, TTW-SL 244 km/hr  
 Takeoff Speed, MTOW-SL 282 km/hr  
 Approach Speed, TLW-SL 228 km/hr  
 Approach Speed, MTOW-SL 287 km/hr  
 Max Level Speed-SL 1.22 Mach  
 Max Level Speed-FL360 2.55 Mach  
 Max ROC, TCW-SL 423.7m/sec  
 Service Ceiling 18,898 m  
 Tactical Radius, Internal Fuel 898 km  
 Max Range, Internal Fuel 2,393 km  
 Ferry Range (no inflight refueling) 3,882 km  
 Take-off Run, TTW 228 m  
 Landing Run, TLW 601 m

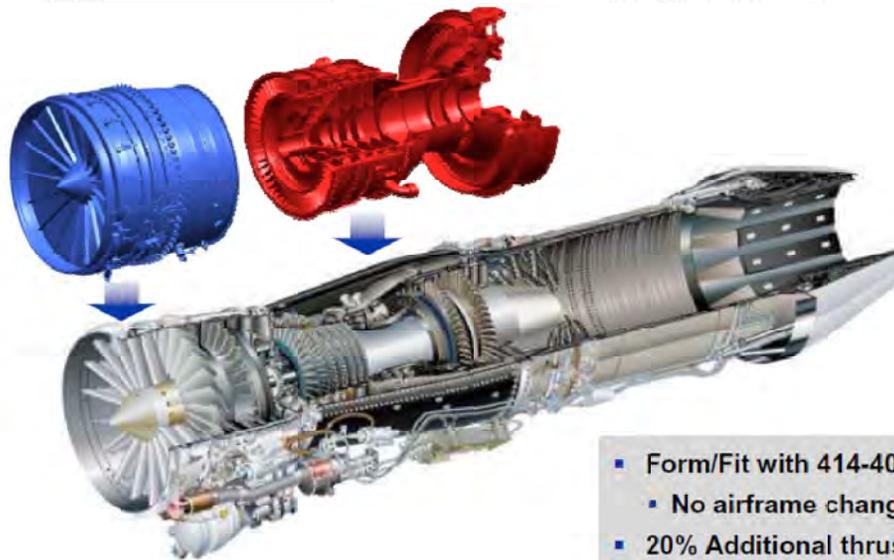


# F414 EPE ENGINES

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The upgrade begins with the installation of new GEAE F414 EPE afterburning turbofans within re-engineered engine nacelles.

The F414 EPE offers greater thrust (11,938 kgf vs 8,307 kgf) lower specific fuel consumption and far better maintainability than the original RD-33s.

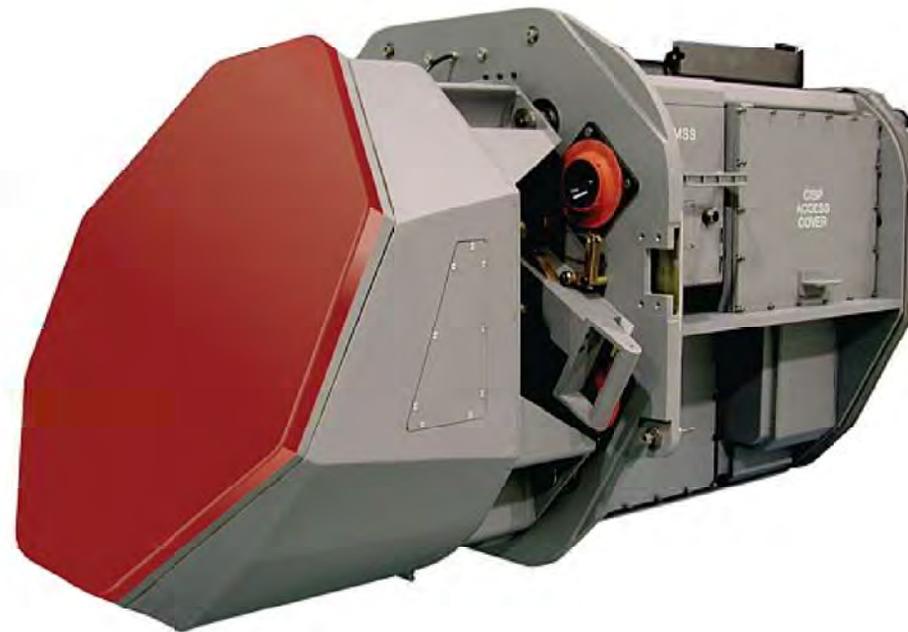


- Form/fit with 414-400 engine
    - No airframe changes
  - 20% Additional thrust
  - X2 Combat acceleration improvement
  - Significant air dominance capability increase
    - Offensive and defensive
  - Improved fuel burn
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# APG-79 AESA RADAR

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Our company then provides a complete sensor, avionics and cockpit update including the installation of a Raytheon APG-79 AESA radar with its active electronic beam scanning the APG-79 optimizes situational awareness and provides superior air-to-air and air-to-surface capability. The APG-79 has a range of up to 150 km (80 nm) with multi-target tracking capability.



# SM-29 COCKPIT

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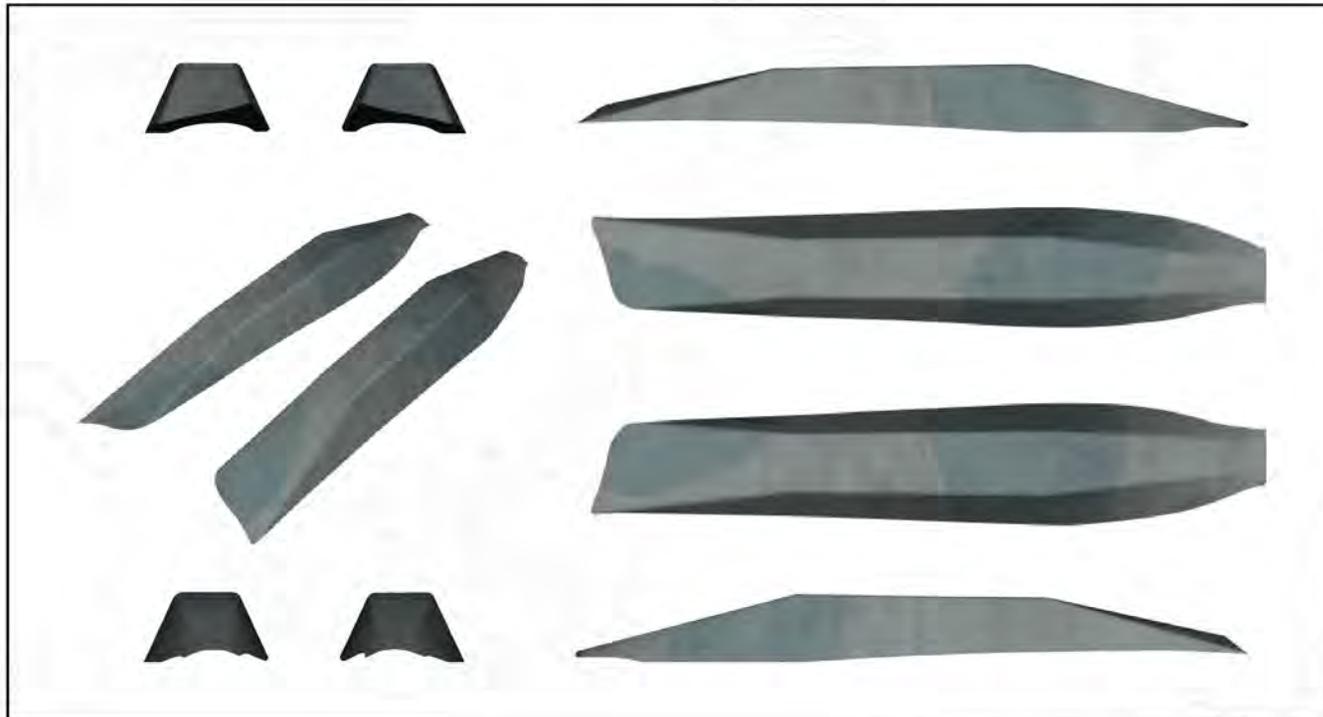
The SM-29 features a cockpit update including the installation a four channel digital fly-by-wire flight control system, F-16 style side-stick and throttle HOTAS flight controls, a L3 508mm x 203mm Large Area Avionics Display (LAAD), an updated HUD as well as optional NATO standard communications, navigation and IFF/Interrogator.



# CONFORMAL TANKS

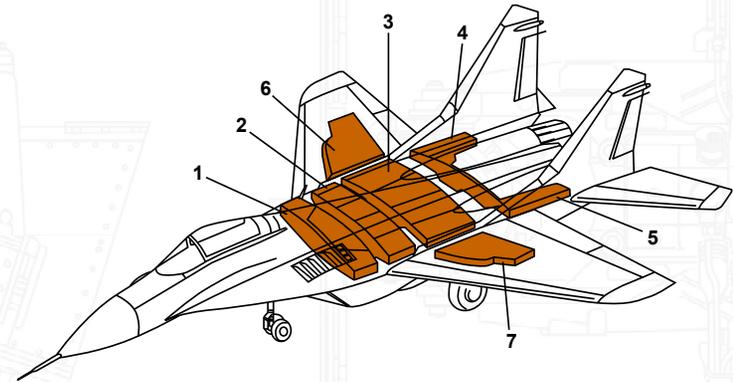
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The SM-29E may be also be equipped with new design proprietary Conformal Fuel Tanks (CFTs). Two CFTs are mounted symmetrically to the SM-29 dorsal fuselage. Each CFT has an internal capacity of 1,457 liters (385 USG) increasing SM-29 fuel load by 2,914 liters/5,158 lbs of JP-8. The CFTs also provide additional volume for avionics and ECM systems.

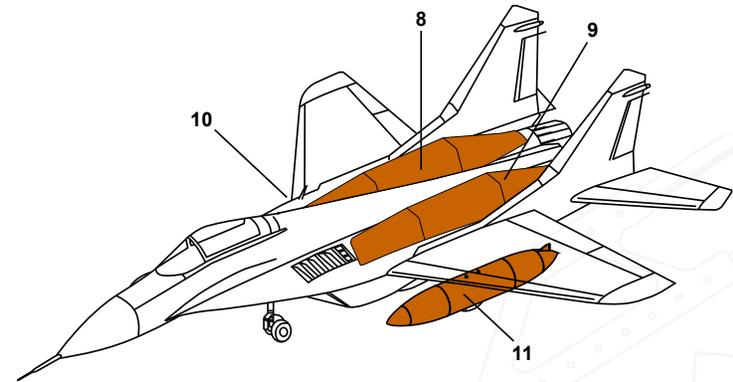


# FUEL QUANTITIES

INTERNAL FUEL TANKS		USABLE FUEL		
TANK #	TANK LOCATION	LITERS	US GALLONS	JP-8 POUNDS
1	Forward Fuselage 1	650	172	1,150
2	Forward Fuselage 2	900	238	1,593
3	Mid Fuselage	1,800	476	3,186
4	Rear Fuselage Starboard	150	40	265
5	Rear Fuselage Port	150	40	265
6	Wing Tank Starboard	325	86	575
7	Wing Tank Port	325	86	575
<b>TOTAL INTERNAL FUEL</b>		<b>4,300</b>	<b>1,136</b>	<b>7,611</b>



CONFORMAL/EXTERNAL TANKS		USABLE FUEL		
TANK #	TANK LOCATION	LITERS	US GALLONS	JP-8 POUNDS
8	Conformal Tank Starboard	1,457	385	2,579
9	Conformal Tank Port	1,457	385	2,579
10	480 USG External Tank 1	1,817	480	3,216
11	480 USG External Tank 2	1,817	480	3,216
<b>TOTAL EXPENDABLE/EXTERNAL</b>		<b>6,548</b>	<b>1,730</b>	<b>11,590</b>



<b>MAXIMUM AIRCRAFT FUEL: With CFTS</b>	<b>7,214</b>	<b>1,906</b>	<b>12,768</b>
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<b>MAXIMUM AIRCRAFT FUEL: All TANKS</b>	<b>10,848</b>	<b>2,866</b>	<b>19,200</b>
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**NOTES:**

- 1) Fuel weights are based on JP-8 at 6.7 lbs/gal and an atmospheric temperature of 59°F.
- 2) Fuel quantities, in pounds, are rounded to the nearest pound.

# NATO WARLOAD

SM-29E SUPER FULCRUM DESIGN WARLOAD



STATION NUMBER	1	2	3	4	5	6	7
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AIM-9 Sidewinder	×	×	×		×	×	×
AIM-120 AMRAAM	×	×	×		×	×	×
R-27	×	×	×		×	×	×
R-73/K-74	×	×	×		×	×	×
AGM-65 Maverick	×	×	×		×	×	×
GBU-38 JDAM/Mk.82	⊗	⊗	⊗	⊗	⊗	⊗	⊗
GBU-32 JDAM/MK.83		⊗	⊗	⊗	⊗	⊗	
GBU-31 JDAM/Mk.84		⊗	⊗	⊗	⊗	⊗	
GBU-12 PAVEWAY II	⊗	⊗	⊗	⊗	⊗	⊗	⊗
GBU-24 PAVEWAY III			⊗		⊗		
CBU-97/105 SFW	⊗	⊗	⊗	⊗	⊗	⊗	⊗
AGM-84E SLAM		×	×		×	×	
AGM-88C HARM		×	×		×	×	
AGM-154 JSOW		⊗	⊗		⊗	⊗	
1,500 Ltr External Tank				⊗			
1,150 Ltr External Tank			⊗		⊗		

Rated Load @ 7.5-g	449 kg	1,135 kg	1,135 kg	1,362 kg	1,135 kg	1,135 kg	449 kg
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For enhanced mission capability, new design external stores pylons are installed to allow the delivery of NATO ordnance including the AIM-120, AIM-9, GBU-31 JDAM, AGM-88 and JSOW.



SM-29 Air-to-Ground  
4 x AIM-9 + 3 x GBU-31 JDAM



SM-29 Air-to-Air  
2 x AIM-9 + 4 x AIM-120

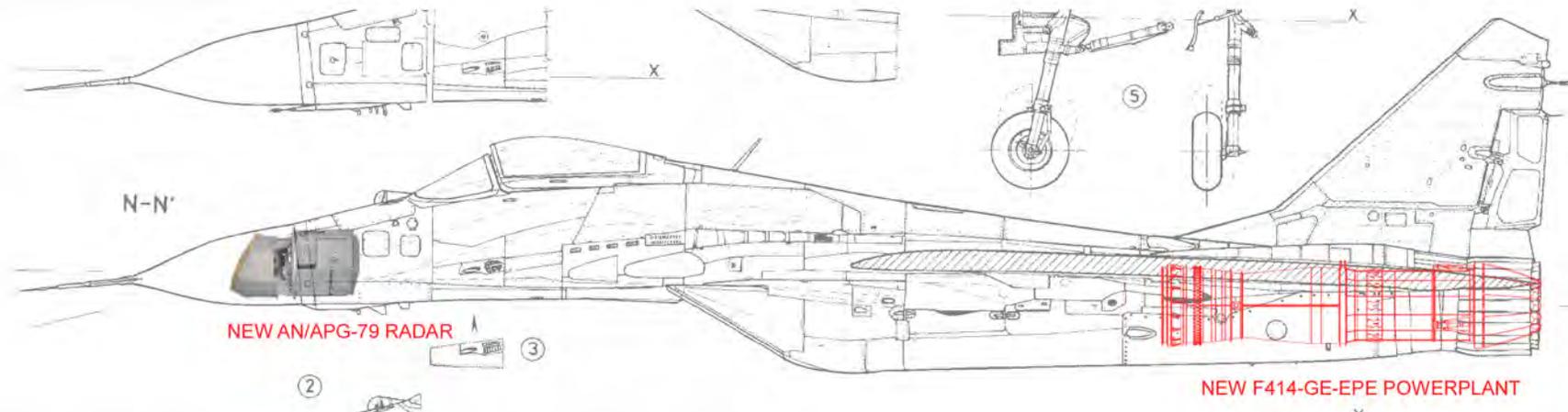
# STRUCTURAL EXTENSION

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To increase range, new fuel tanks are installed, including additional tanks within the new engine nacelles, for an internal fuel capacity of 6,914 Liters.

Major airframe components are inspected and rebuilt, while structures that can benefit from advanced materials are replaced, insuring a new total airframe life of 6,000 flight hours.

SIMPLIFIED PROFILE DRAWING OF MiG-29 WITH OVERLAY OF PROPOSED RADAR AND POWERPLANT UPGRADE



# TIRES, WHEELS & BRAKES

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The SM-29 upgrade includes the replacement of 540 x 140 Nose Gear and 840 x 290 Main Gear Tires/Wheels/Brakes with new 22 x 5.5 or 22 x 6.6-10 Nose Tires/Wheels and 30 x 11.5-14.5 Main Tires/Wheels/Brakes.

The New Tires/Wheels/Brakes are derived from proven F/A-18C/D/E/F units and offer greater availability, supportability and service life.



## SM-29E ECM/EW

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The SM-29 upgrade may include a cost plus optional upgrade of Electronic Countermeasures (ECM) and Electronic Warfare Systems including integration of a variety of systems including:

- AN/ALQ-211A(V)4 Countermeasures Warning and Control Set
- AN/ALQ-214(V)4/5 Electronic Countermeasures Onboard Jammer
  - AN/AAR-58 Missile Approach Warning System (MAWS)
    - AN/ALE-47 Dispensers
    - AN/ALE-50 Towed Decoy



## IRST21 SENSOR

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The SM-29 may include an integrated Lockheed Martin IRST21 long-range, long-wave infrared sensor that is blended into the existing MiG-29 low drag IRST fairing. An alternate integrated fire-control system, the IRST21 is capable of detecting and engaging targets in radar-denied environments.



# LINK 16 DATALINK

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The SM-29 will be equipped with a jam-resistant Link 16 datalink and information distribution system to enable encrypted Network Centric Warfare, interoperability between US tri-services and NATO/Allied Forces and situational exchange between participating airborne platforms. Solutions include the TACR-16DL/Link 16 TacNet™ TTR or the AN/URC-138(V)1(C).



# INDUSTRY TEAM

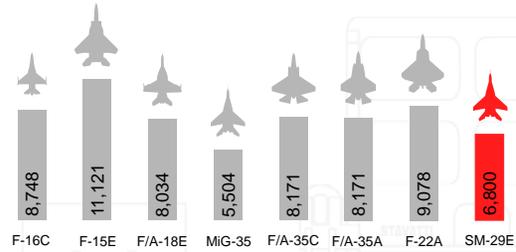
The SM-29 will integrate proven systems including powerplants, avionics, sensors, ECM/EW and replacement airframe structures provided by an established industry team of first, second and third tier suppliers...



# FIGHTER COMPARISON

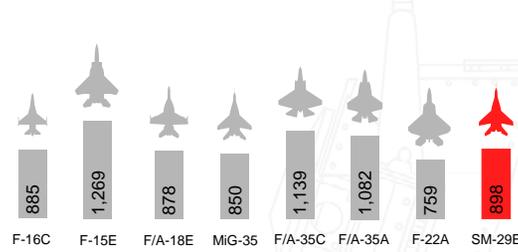
## Maximum Warload (kg)

With Partial Internal Fuel



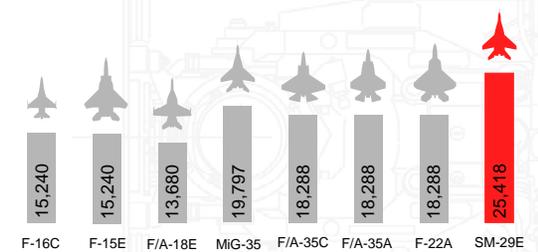
## Tactical Radius (km)

With Maximum Internal Fuel



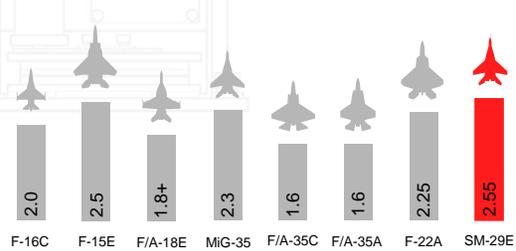
## Maximum Climb Rate (m/min)

Typical Combat Weight @ Sea Level, Standard Day



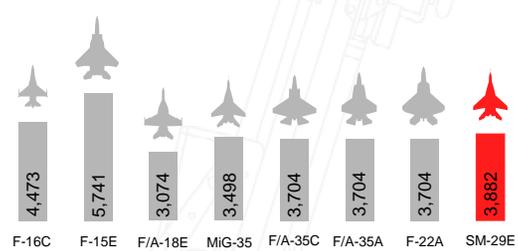
## Maximum Level Speed (Mach Number)

Aircraft in Clean Configuration @ Altitude



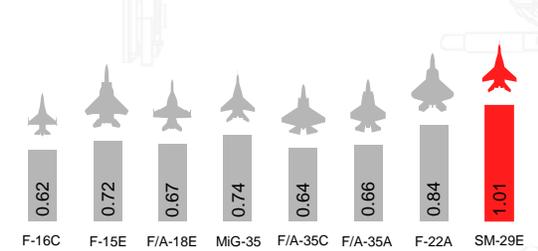
## Ferry Range (km)

With Maximum Internal + Maximum External Fuel



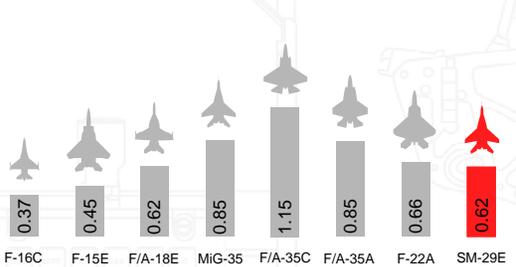
## Thrust to Weight Ratio

MTOW @ Maximum Power



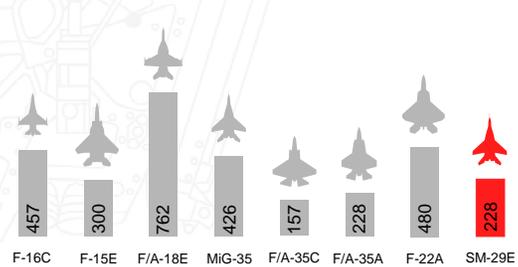
## Relative Fuel Burn Ratio

Fuel (lbs) to move 1,000 lbs of Warload 1 min



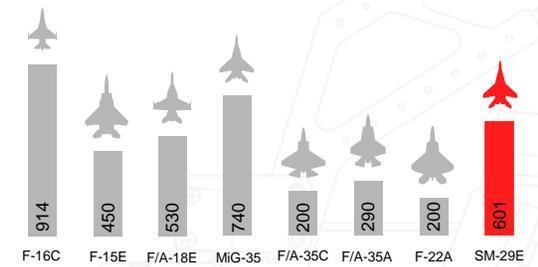
## Takeoff Distance (m)

BFL Over 15.24m Obstacle



## Landing Distance (m)

BFL Over 15.24m Obstacle



# SM-29E CPFH

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The SM-29E will have a Cost Per Flight Hour (CPFH) that is typically 9.5% less than that of a standard MiG-29/MiG-29A as powered by the RD-33. The SM-29E will cost less to operate than a standard MiG-29.

## SM-29E Super Fulcrum Cost Per Flight Hour (CPFH)

COST ELEMENT	SM-29E	MiG-29
Aircrew:	\$586	\$586
Fuel:	\$2,223	\$2,378
Direct Maintenance Personnel:	\$859	\$1,052
Consumable Materials:	\$555	\$555
Indirect Support Personnel:	\$185	\$185
Spares:	\$952	\$1,122
Depot:	\$657	\$774
<b>TOTAL CPFH:</b>	<b>\$6,017</b>	<b>\$6,652</b>

*Cost Per Flight Hour Values are For Relative Efficiency Comparison Only and May Not Be Representative of Specific Squadron CPFH*

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The **SM-29E** comprehensive upgrade will include a powerplant, radar, avionics, cockpit, landing gear systems and weapon systems upgrade as well as the incorporation of new design with Conformal Fuel Tanks.

### **SM-29E Super Fulcrum MiG-29 UPGRADE WITH CFTS COST**

<b>COST ELEMENT</b>	<b>COST (USD)</b>	<b>%</b>
Powerplant Upgrade to F414	\$8,000,000	28.57%
Radar Upgrade to APG-79 With IRST21	\$4,000,000	14.29%
Electronic Warfare Systems Upgrade (ASPIS II)	\$4,000,000	14.29%
Weapon Systems Upgrade to NATO Standard	\$1,000,000	3.57%
Avionics & Cockpit Upgrade	\$1,000,000	3.57%
Comprehensive Structural Service Life Extension	\$3,000,000	10.71%
Conformal Fuel Tanks (CFTs)	\$2,000,000	7.14%
Integration	\$5,000,000	17.86%
<b>TOTAL COST:</b>	<b>\$28,000,000</b>	<b>100.00%</b>

*Costs are Rough Order of Magnitude (ROM) Estimates Only for General Reference Purposes. Final Costs are Provided in a Formal DDTC Approved Proposal.*

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# SM-29E upgrades will be performed at the existing facilities



# DIRECT EXPERIENCE

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**The SM-29 Upgrade Program will be coordinated with our company in the USA. Our industry team has direct expertise of more than 20 years of maintaining, supporting and operating a fleet of privately owned and operated MiG-29s for Dissimilar Air Combat Training (DACT) training purposes.**

