The Collapse of American Air Power: The Global Impact of Anti-Access Weapons

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Anti-Access Weapons

- "Anti-access" weapons are designed to inflict prohibitive combat losses upon high value assets or capabilities, thus denying entry into areas which are within the reach of such weapons.
- By design, anti-access weapons are difficult to defeat and the current generation can only be countered by the highest performing US stealth systems.
- Anti-access weapons are mostly optimised against specific target types, such as aircraft carriers, Intelligence Surveillance Reconnaissance (ISR) platforms, tanker aircraft, or combat aircraft.
- *Global proliferation of high technology anti-access weapons presents the greatest strategic risk to US military forces since the Cold War.*

Anti-Access Weapon Categories

1. Advanced Air Defence Weapons, including Surface to Air Missiles and Counter-Stealth sensors.
2. Advanced fighter aircraft capable of carrying precision guided munitions and cruise missiles.
3. Very long range Air to Air Missiles and Surface to Air Missiles intended to destroy ISR platforms, Electronic Warfare platforms and tanker aircraft.
4. Supersonic and subsonic cruise missiles designed to destroy aircraft carriers, amphibious ships, surface combatants, transports / civilian shipping, and fixed basing infrastructure.
5. Terminally guided ballistic missiles designed to destroy aircraft carriers, amphibious ships, transport vessels and fixed basing infrastructure.

Anti-Access Weapon Delivery Systems

- Advanced Air Defence Weapons and Surface to Air Missiles intended to destroy ISR platforms, Electronic Warfare platforms and tanker aircraft are self propelled systems, or fitted to warships.
- Advanced fighter aircraft can self deploy rapidly.
- Very long range Air to Air Missiles are carried by fighter aircraft, typically of the Flanker family.
- Supersonic and subsonic cruise missiles can be carried by surface combatants, submarines, aircraft or wheeled self-propelled launchers.
- Terminally guided ballistic missiles can be carried by surface combatants, submarines, or wheeled self-propelled launchers.
- *Delivery systems are diverse and flexible.*

Anti-Access Weapon Exporters

- Russian industry is currently the largest developer and exporter of anti-access weapons.
- Post Soviet defence budgets inadequate to sustain industry base, resulted in survival pressures to develop and export high technology weapons.
- Russian industry has absorbed and integrated most advanced Western technologies since 1991, resulting in systems which match or outperform most or all US legacy weapons, and most planned new US weapons.
- Chinese industry is emulating the Russian industry model and increasingly focuses on exporting advanced weapons technology globally.
- *Exports driven by profit motive, not ideology.*

Anti-Access Weapon Buyers

- Most frequently anti-access weapons are being procured by nations which are denied access to US, EU and Israeli high technology weapons, due to embargoes or other political restrictions mandated by US Congress or the EU.
- Russian and Chinese industry have exploited such opportunities repeatedly, as this is a secure market where they do not have to compete with US, EU and Israeli defence contractors.
- *Confluence of interest – nations buying anti-access weapons cannot buy Western weapons, are often hostile to the West, while Russian and Chinese industry has a ready made, secure and well paying market for advanced weapons products.*

Anti-Access Weapon Strategic Aims

- Investment in anti-access weapons is intended to achieve two inter-related strategic aims:

1. Discourage or wholly deter military intervention by the US, a US led coalition force, or intervention by US allies in that region.
2. Provide a coercive military capability targeting neighbouring states, especially if these are close allies or friends of the US.

- The prospect of incurring high combat losses in aircraft, naval vessels and attacks on regional basing will clearly discourage US interventions.
- US allies may balk at basing US assets on their territory, if this incurs the risk of attack.
- *Anti-access weapons will disrupt US alliances.*

Anti-Access Weapon Technological Strategy

- Anti-access weapons are typically "asymmetric" in that they have no direct US equivalents, and are designed to target specific vulnerabilities in US capabilities and US military force structure .
- Anti-access weapons are intended to elicit a "disproportionate response" in defending against them, to drive up the operational and force structure costs incurred in dealing with them.
- Anti-access weapons typically leverage high technology to maximise lethality and survivability.
- Many anti-access weapons evolved from late Cold War designs, but many are entirely new designs.
- *Most anti-access weapons are well engineered products, and often very innovative in design.*

Global Anti-Access Weapon Proliferation

Anti-Access Weapon Case Studies

- Anti-access weapons are actively marketed across the globe, most as anti-access weapons, but sometimes as high performance substitutes for more conventional alternatives.
- Three case studies – Venezuela, Iran, and China.
- While all three have widely differing national agendas, they all share an interest in deterring US interventions and in coercing neighbours which are politically close to the US.
- Iran and Venezuela have limited domestic high technology industries and rely on imports.
- *China has a well developed domestic defence industry and is both a procurer and proliferator of anti-access weapons, globally*.

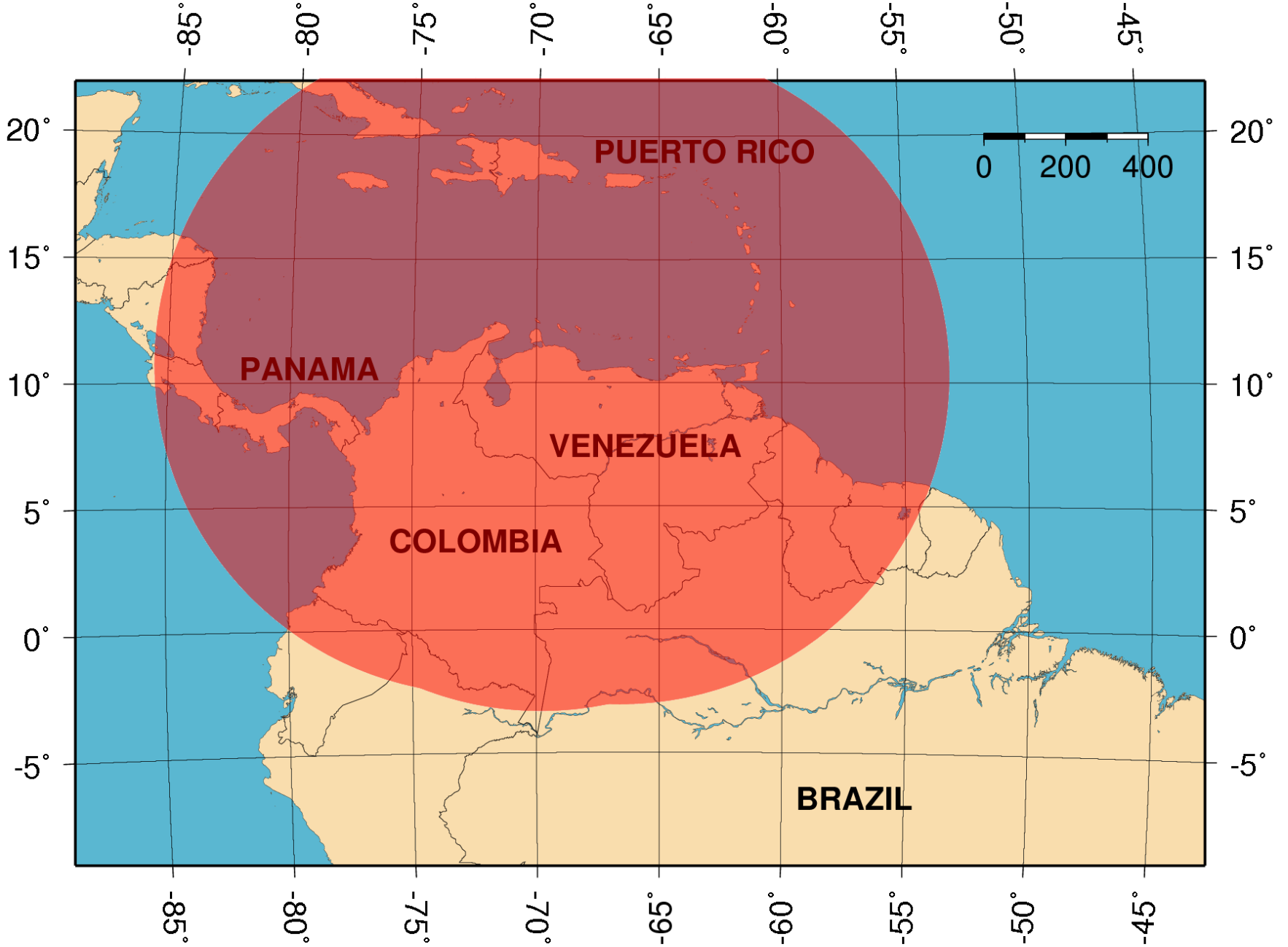
Venezuela Case Study

- Chavez authoritarian regime hostile to the US.
- Former US ally subjected to internal takeover.
- Confrontational foreign policy.
- Regional ambitions to increase national stature.
- Good long term revenue prospects due to abundant natural energy resources.
- Limited domestic technology base and industrial capabilities, but growing defence industrial base.
- Key geographical location covering Panama Canal and Caribbean region.
- *Venezuela has procured a large, in regional terms, inventory of very modern Russian built equipment, and some modern Chinese built equipment*.

Venezuela Case Study

- 24 Sukhoi Su-30MK2 Flanker G long range multirole fighters procured and now deployed, additional 12 aircraft now likely.
- Russian Kh-59, Kh-29 and KAB PGMs procured.
- Reports that two Il-78 Midas tankers procured.
- Fifty Russian Mi-17B, Mi-35 and Mi-26 helicopters, 10 Ilyushin Il-76E Candid airlifters procured.
- 10 Chinese JYL-1 acquisition radars procured.
- 12 Tor M1 / SA-15 Gauntlet point defence SAM systems procured.
- S-300PMU2 / SA-20 Gargoyle publicly canvassed.
- Kilo class SSKs being publicly canvassed.
- Advanced Su-35-1 being publicly canvassed.

SURFACE TARGETS AT RISK – IMPACT OF Su–30MK DEPLOYMENT



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AZIMUTHAL EQUIDISTANT PROJECTION

Venezuelan AF Sukhoi Su-30MK2 Flanker G

Ilyushin Il-78 Midas Aerial Refuelling Tanker

Venezuela - Strategic Impact

- Su-30MK2 Flanker G long range high performance multirole fighter is lethal against most US legacy jets if well operated, and superior to planned F-35 in most cardinal parameters.
- Armed with smart bombs and missiles the ~800 NMI reach provides the capability to hold Puerto Rico at risk, as well as the Panama Canal.
- Deployment of supersonic anti-shipping missiles such as Sunburn, Stallion, Sizzler provides additional maritime anti-access capability.
- The Il-78 Midas tanker provides the Su-30MK2 with reach into the Gulf of Mexico.
- *Further growth in fighter/tanker fleet will provide significant anti-access capability across region.*

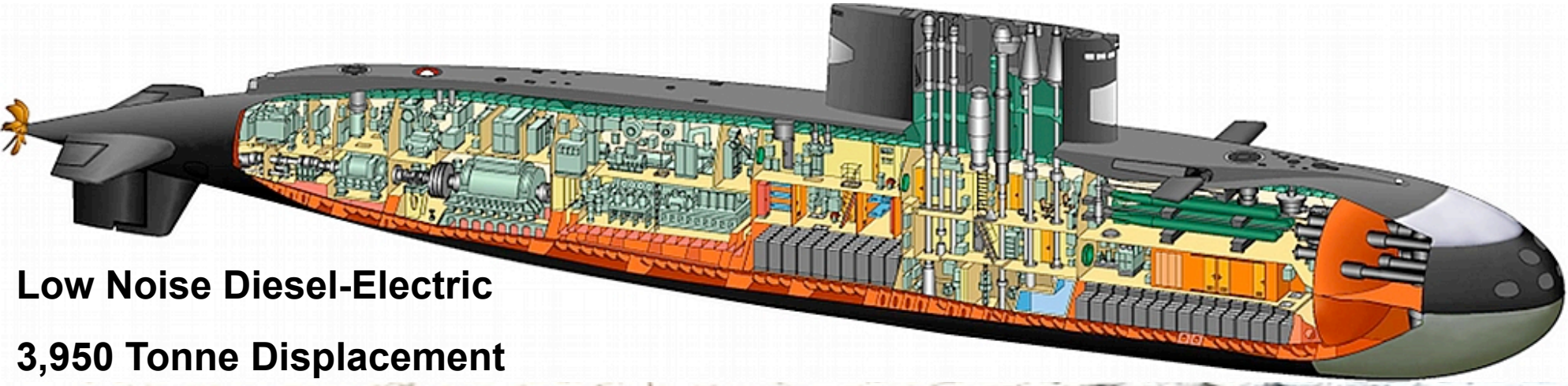
Iran Case Study

- Fascist regime extremely hostile to the US.
- Former US ally subjected to islamist coup in 1979.
- Confrontational foreign policy, anti-Israel.
- Regional ambitions to increase national stature.
- Exceptional long term revenue prospects due to natural energy resources, esp. natural gas.
- Limited but steadily growing domestic technology base and industrial capabilities.
- Key geographical location covering Persian Gulf, Straits of Hormuz and Western Afghanistan.
- Iran has procured a large, by regional terms, inventory of Russian and Chinese built equipment.
- Some Chinese weapons licensed for manufacture.

Iran Maritime Anti-Access Capabilities

- Iran inherited large inventory of US equipment including F-14A, F-4C/D, F-5E fighters and Hawk SAMs, but mostly these are in disrepair.
- Iran acquired a large portion of Saddam's air force including Su-24 Fencer and MiG-29 Fulcrum.
- Iran acquired Kh-55 / AS-15 Kent strategic cruise missiles from Ukrainian warstocks in 2001.
- Procurement of Russian Kilo SSKs, a super -cavitating torpedo based on the Russian VA-111 Shkval, and a large warstock of mobile shore based Chinese anti-ship cruise missiles.
- *Credible maritime anti-access capability within the Persian Gulf, with the potential to severely impact tanker traffic to and from the Persian Gulf.*

Type 877EKM "Kilo Class" SSK



Low Noise Diesel-Electric

3,950 Tonne Displacement

6 x 533mm torpedo tubes

24 x Naval Mines

Warload 18 Rounds

Mix of Heavyweight Torpedoes or

3M54/3M14 Sizzler ASCM/LACM

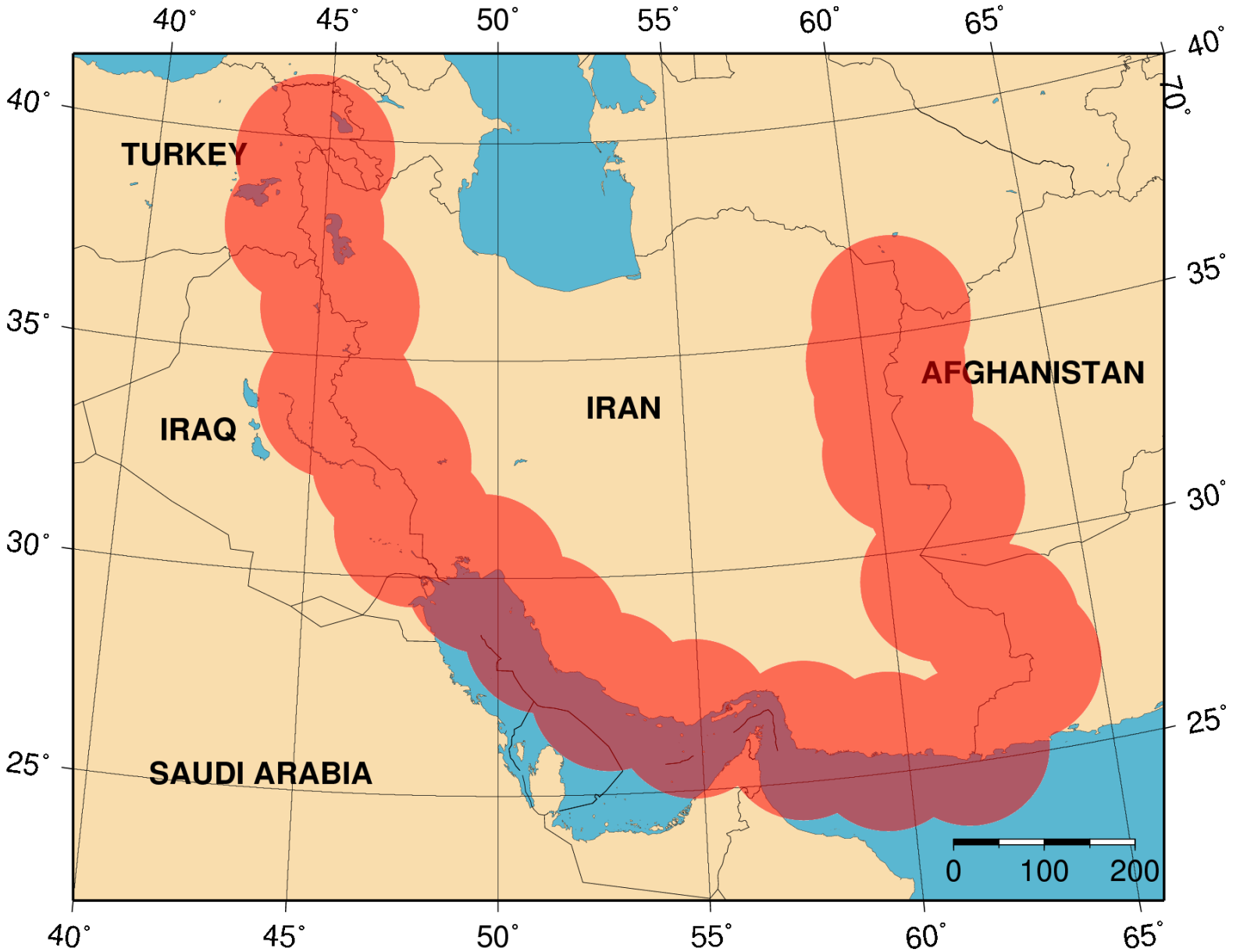
Iran Air Anti-Access Capabilities

- Iran procured several batteries of Russian 160 NMI range S-200 / SA-5 Gammon legacy SAMs.
- Tor M1 / SA-15 Gauntlet point defence SAM procured, providing a terminal defence capability against US cruise missiles and smart bombs.
- Iran taking delivery of Russian S-300PMU1 / SA-20 Gargoyle long range SAM systems.
- Public speculation about procurement of Chinese HQ-9 / FD-2000 long range SAMs, similar to Russian SA-20, to replace Chinese HQ-2 SAMs.
- Public speculation about procurement of 200 Su-30MKM Flanker, S-300PMU2 and S-400.
- *Iran is now developing a credible anti-access capability against US F-35 JSF and legacy aircraft.*

Almaz S-300PMU2 Favorit / SA-20 Gargoyle

Image Vestnik-PVO/APA

AIRSPACE AT RISK – IMPACT OF S–300PMU1/HQ–9/SA–20 DEPLOYMENT



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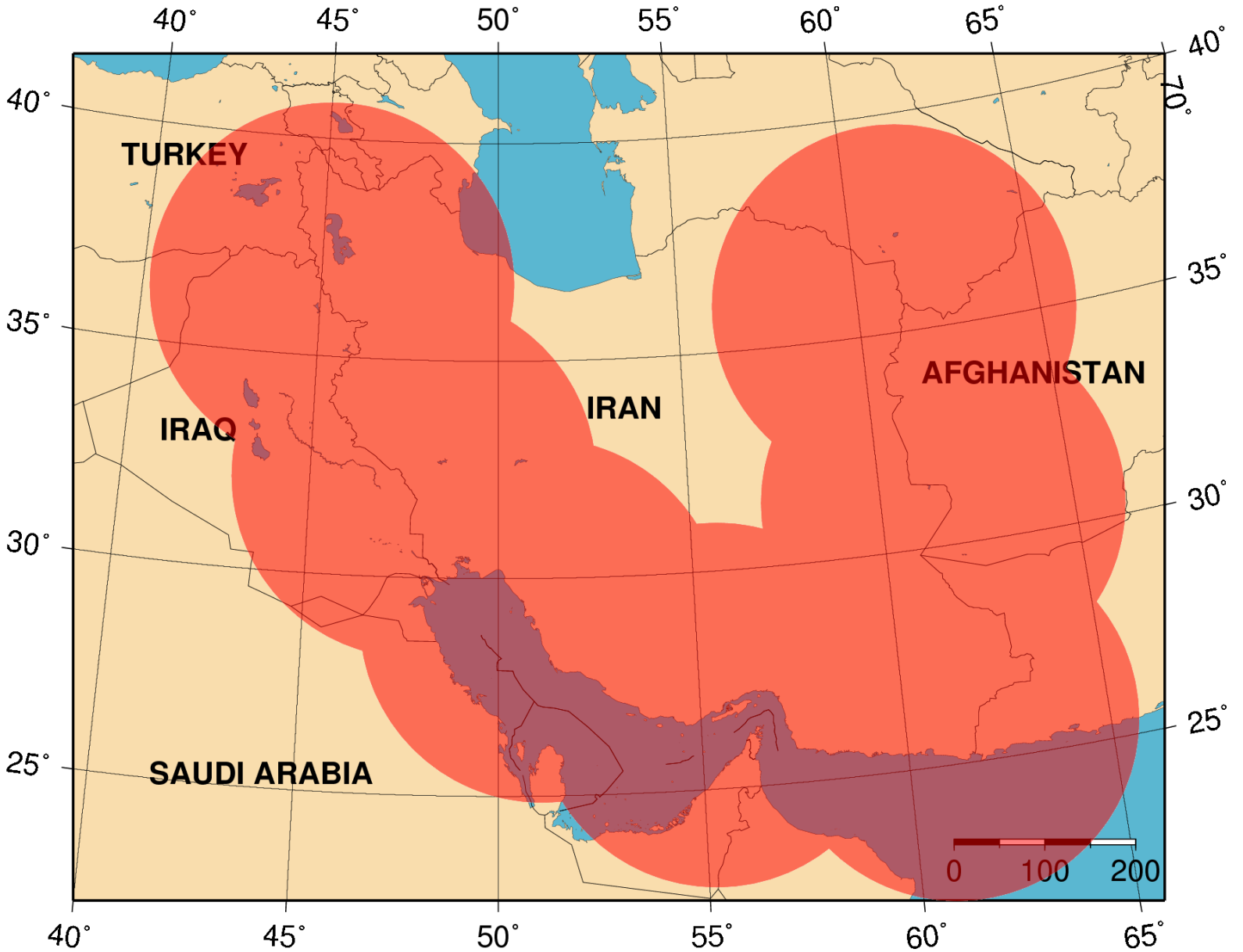
AZIMUTHAL EQUIDISTANT PROJECTION

AIRSPACE AT RISK – IMPACT OF S–400/SA–21 DEPLOYMENT



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Iran - Strategic Impact

- Iran's long range SA-5 will provide a robust capability to kill US ISR platforms, most legacy aircraft; the SA-20 provides a credible capability to kill the above and the F-35 JSF.
- If forward deployed, the SA-20 provides a significant capability to deny airspace at high and medium altitudes outside Iran's territorial boundaries; the SA-5 provides a capability between the SA-20 and SA-21 footprints.
- Airspace denial can cripple logistical resupply by threatening airlift, CRAF and civil air traffic.
- *Iran is a likely candidate for the export of the longer ranging S-300PMU2 / SA-20 and S-400 / SA-21 SAM systems, extending denial footprint.*

China – Case Study

- China is a nascent regional superpower intent on securing its regional strategic position despite and at the expense of the US and its WestPac allies.
- While China is not overtly hostile to the US, its large size and key strategic location result in significant strategic risk to US if intent changes.
- Chinese force structure planning is a fusion of domestic, US and Russian concepts.
- A key focus of Chinese modernisation is the development and deployment of a range of anti-access weapons of Russian and domestic origin.
- The PLA "Second Island Chain" and "String of Pearls" denial strategies are both centred on the anti-access model of warfare.

China – Terminally Guided Ballistic Missiles

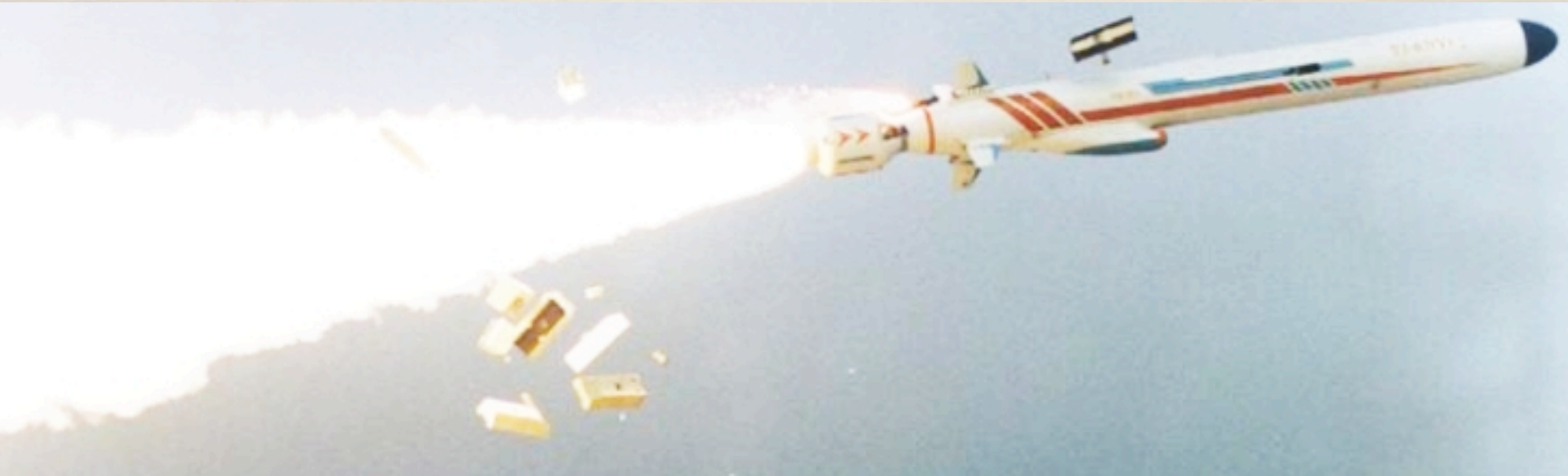
- The terminally guided variant of the DF-21 Intermediate Range Ballistic Missile is modelled on the US Cold War MG-31 Pershing II / RADAC design, using Russian and Chinese technology.
- Airframe based on JL-1 SLBM design, but carried on high mobility launcher vehicle.
- Airframe was base vehicle for PLA ASAT design.
- Weapon intended to kill aircraft carriers and to deny the use of fixed basing such as Guam, Palau, Kadena, Yokota and other key US WestPac sites.
- The high mobility of the DF-21 launcher vehicle makes it difficult to track and destroy, as DF-21 units can be rapidly dispersed across wide areas.
- Guidance accuracy will improve as satnav matures.

DF-21 Terminally Guided Ballistic Missile

China – Cruise Missiles

- China manufactures a range of indigenous cruise missiles, and operates a range of imported Russian supersonic and subsonic designs.
- Russian supersonic 3M81 / SS-N-22 Sunburn, 3M55 Yakhont / SS-N-26 Stallion and 3M54E / SS-N-27 Sizzler deployed by PLA-Navy combatants.
- Chinese DH-10, HN-3, YJ-62 emulate US Tomahawk cruise missile concept.
- China involved in 2001 theft of Russian Kh-55SM Granat / AS-15 Kent ALCMs from Ukrainian stock.
- H-6K Badger turbofan powered cruise missile carrier system in late development, with reach to threaten fixed basing such as Guam, Palau, Kadena, Yokota and other key US WestPac sites.

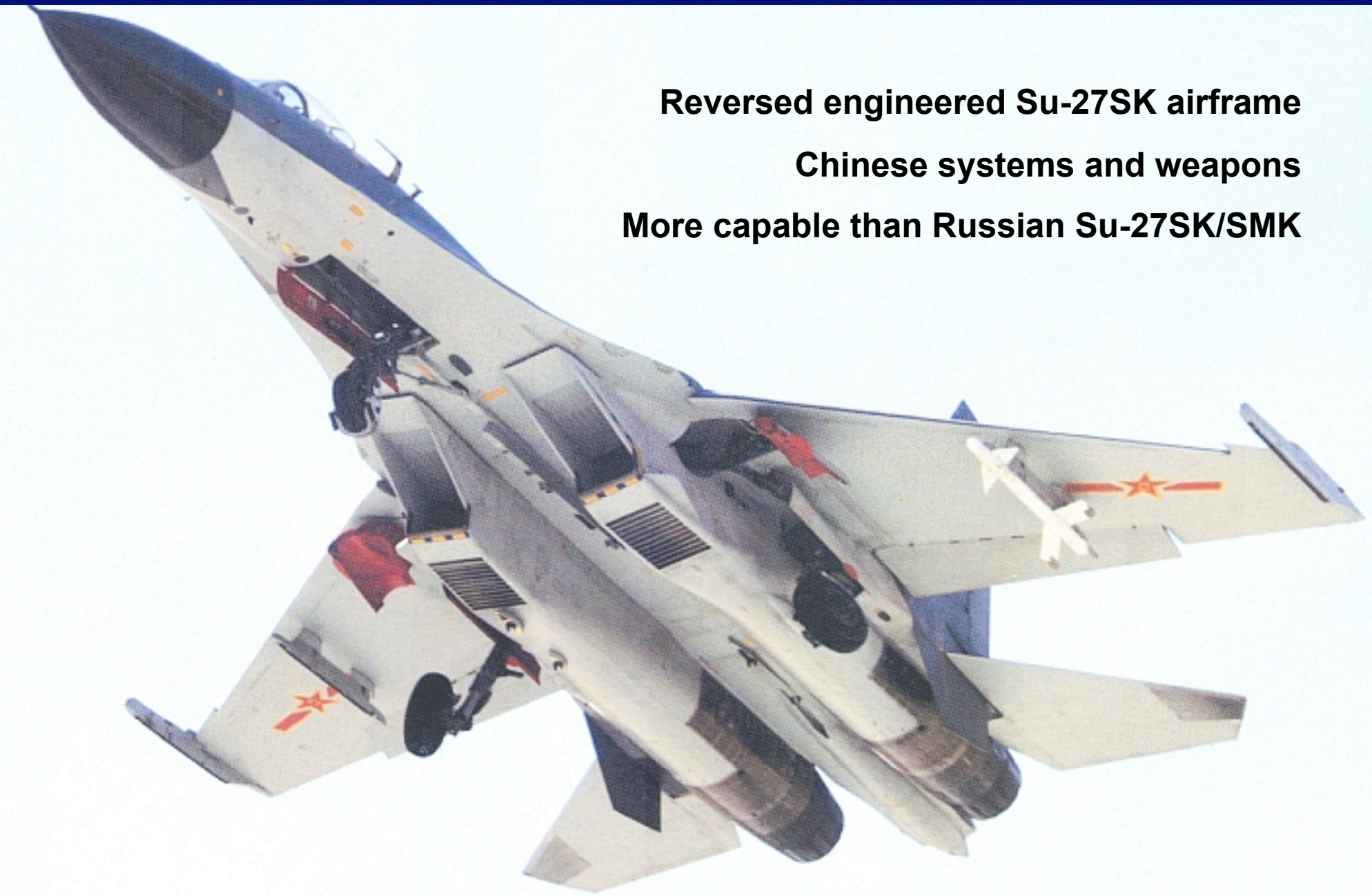
Xian H-6K Badger / YJ-62 Cruise Missile



China – Air Anti-Access Weapons

- China is the single largest export customer for Russian Sukhoi Su-27/30 Flanker fighters, S-300PMU / SA-20 SAM systems, and other air defence equipment.
- China's Flanker fleet is likely to exceed 550 aircraft by 2015-2020, and an indigenous derivative has been produced.
- China's HQ-9 / FD-2000 SAM is based on the early model SA-20 and provides similar capabilities.
- China manufacturing point defence gun systems and other defensive measures capable of frustrating smart weapon attacks on PLA SAM batteries.
- Significant and growing air anti-access capability.

Shenyang J-11B "Sino-Flanker"



Reversed engineered Su-27SK airframe

Chinese systems and weapons

More capable than Russian Su-27SK/SMK

America's Options vs Anti-Access Weapons Capabilities

The Strategic Failure in US Planning

- Post 9-11 most US force structure planning remains centred in 1990s era or immediate post Cold War concepts of nation state warfare.
- Implicit assumptions are manifold:

1. The US will have unchallenged technological superiority in all areas – *no longer true.*
2. The US will have unchallenged numerical superiority in all theatres – *no longer true.*
3. High technology weapons mostly operated by nations which developed them – *no longer true.*
4. Other nations will not pursue focused technological strategies in planning – *no longer true*.

- *The world of today is not the world US force structure planners envisaged during the 1990s.*

US Planning Focus No Longer Realistic

- The US commitment to counter-insurgency campaigns in Iraq and Afghanistan, and other related operations in Africa and Asia has diverted focus away from nation state conflicts and related capabilities and strategic risks.
- Funding and intellectual effort has been diverted away from understanding and countering modern capabilities such as anti-access weapons.
- Post Cold War draw down damaged key capabilities in technical intelligence and technological strategy.
- Further damage resulted from post 9-11 funding cutbacks and policy imperatives eg “next-war-itis”.
- *Current US planning focus reflects the past world, not the current world, and is simply not realistic.*

A New Focus Required for US Planning

- Unless the US adopts and implements a new focus in its defence planning, it will lose over the coming decade the ability to deal with nation state conflicts on non-trivial scale.
- *This will force future US leaders into greater reliance on nuclear weapons over conventional.*
- A deep, systematic and comprehensive reassessment of US strategic thinking is required.
- The US needs a new long term technological strategy for dealing with high technology capabilities, especially anti-access weapons.
- At this time the only two US capabilities which are survivable mid-long term are the B-2A and F-22A.
- *Currently planned and legacy capabilities irrelevant.*

Defeating Anti-Access Weapons

- Most anti-access weapons are high technology post Cold War designs ➔ difficult to defeat.
- *The technology employed is typically much more advanced than what the Soviets would have had, if the USSR had not collapsed.*
- Most anti-access weapon designs are crafted intentionally around specific vulnerabilities in US technology or force structure.
- There are no simple fixes as anti-access weapons span a wide range of capabilities and leverage existing and new delivery systems.
- "*Trendy*" capabilities such as *Cyberwar*, *Network Centric Warfare* and *UAVs* are mostly *irrelevant* when dealing with modern anti-access weapons.

Defeating Anti-Access Weapons

- The best strategy for defeating anti-access weapons is to prevent their employment by attacking and destroying the launch platform.
- *"Kill the archer before he shoots the arrow"*
- If the weapon is launched, then it must be intercepted and killed as early as possible in the engagement.
- Potential targets must be equipped with comprehensive countermeasures and terminal defence weapons to defeat "leakers" which get past the first two layers of defence.
- *These are all challenging technical and operational needs which will require major long term force structure investments by the United States.*

US Air Power is THE Pivotal Capability

- The survival of all US air, land and maritime surface assets is predicated on the ability to deny an opponent opportunities to attack.
- This denial is most readily achieved by controlling airspace, as it prevents an opponent from getting close enough to launch an anti-access weapon, or if close enough, the launch will betray the location of the opponent's platform allowing attack upon it.
- Unless US aircraft can operate in contested airspace without hindrance, the US cannot defeat anti-access weapons launched by aircraft, ships, subs or vehicles, by killing these launch platforms.
- Air power planning focus on *"recapitalisation of aircraft fleets with like aircraft"* is now obsolete.

US Terminal Defences ARE NOT Pivotal

- A force structure planning model where the focus in defeating anti-access weapons is placed upon terminal defence systems such as SAM/ABM systems and gun / high power laser weapon batteries has critical and unavoidable weaknesses:

1. Initiative is inherently ceded to the opponent, who chooses the time and place to attack.
2. Saturation missile attacks will be designed to overwhelm defensive batteries with numbers.
3. Magazine size matters – once defensive battery magazines are exhausted, the fight is over.

- *The US needs further investment in new defensive weapons technology but it is not a substitute for air power in dealing with anti-access weapons.*

US Recapitalisation Strategy Failure

- The 1990s developed force structure plan for recapitalising Air Force and Navy/Marine Corp fighter fleets is no longer viable due to the global proliferation of modern anti-access weapons.
- The US needs a combat fleet capable of penetrating hostile airspace and surviving to destroy aerial and surface based launch platforms used for anti-access weapons such as advanced SAMs, counter-ISR missiles, guided ballistic missiles and supersonic cruise missiles.
- OSD mandated F-22 termination and focus on F-35 locks in bad choices made during the 1990s.
- *Anti-access weapon evolution and proliferation has invalidated planning assumptions.*

Key Fighter Recapitalisation Plan Problems

- Legacy fighters including F/A-18E/F/G completely unusable for most likely future contingencies.
- Navy and Marines will have NO capability to deal with advanced fighters and SAMs – wholly reliant upon supporting Air Force F-22 force.
- Ten combat coded F-22 squadrons will be overused and service life will be burned out very early.
- Unrealistic delivery schedules for replacement fighters will result in significant "fighter gap" in maintaining operational fighter squadrons.
- Delivery of 600 new fighters by 2020 requires production rate of 60 annually from 2010 – feasible for mature F-22 but not for new designs.
- *Certainty of US fighter fleet collapse by 2020.*

Unmanned Systems Not a Viable Alternative

- UCAVs often advocated as substitutes for manned fighters despite the reality that a UCAV with like speed, range/payload, sensors and stealth to a manned jet will cost just as much, if not more.
- Smaller UCAVs susceptible to existing Russian and Chinese counter-stealth technologies.
- Unresolved basic technology problems – *fully autonomous operation requires yet to be invented Artificial Intelligence (AI) cognitive technology.*
- Unresolved legal problems - *delegating weapons release authority to autonomous AI system.*
- *Satellite uplinks for semi-autonomous control susceptible to jamming, while US lacks satellite bandwidth in already congested radio spectrum*.

F-22 Only Viable Alternative in 2010-2020

- Only F-22 can defeat advanced Flanker variants.
- Only F-22 can defeat the new PAK-FA fighter.
- Only F-22 can survive against advanced SAMs.
- Only F-22 has performance and systems growth capacity to match evolving threat systems.
- Only F-22 mature enough for volume production in 2010 – 2020 timeframe.
- Only F-22 mature enough to provide predictable Unit Procurement Costs and delivery schedules in 2010 – 2020 timeframe.
- Only F-22 has potential to yield a viable navalised air superiority fighter design before 2020.
- F-22 termination guarantees recapitalisation plan failure after 2010 and strategic consequences.

Conclusions

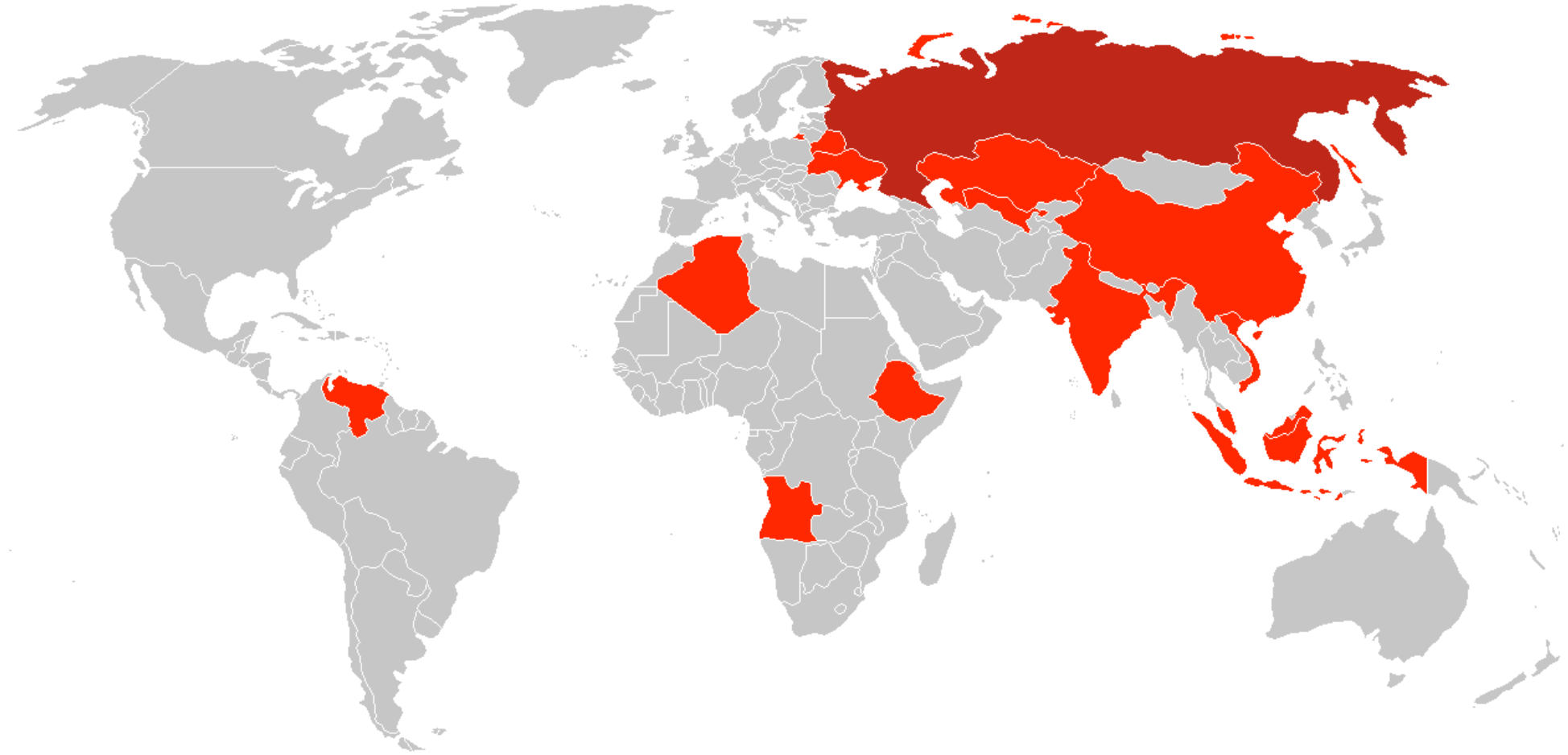
- Unless the US builds and deploys many more than the currently planned 187 F-22A Raptors, it will not be able to guarantee success in any contingencies where opponents deploy advanced anti-access weapons.
- The US force structure across all four services is predicated upon achieving and maintaining air superiority, without which there are high odds of heavy combat losses in US personnel and materiel.
- Unless the US intends to opt out of fighting wars with nation state opponents, armed with modern weapons, over the next three decades, it will have to abandon the OSD mandated force structure plan for the Air Force, and procure many more F-22A Raptors.

Anti-Access Weapons Technology

Russian / Chinese Fighter Evolution

- 1990: Su-27S Flanker eq. F-15A/C / F-14A
- 1990: MiG-29SM Fulcrum eq. F-16A/C
- 1992: Su-27M/Su-35 eq F-15C
- 1994: Su-30MKK eq. baseline F-15E
- 1997: Su-30MK2 eq. baseline F-15E
- 2002: Su-30MKI eq. F-15E + APG-63(V)2 ESA
- 2005: J-10 Sinocanard eq F-16C
- 2007: Su-30MKM eq. F-15E + APG-63(V)2 ESA
- 2007: J-11B SinoFlanker eq. F-15C
- 2007: MiG-35 eq. F-16C Block 60
- 2008: Su-35-1/Su-35BM eq. F-15SE plus supersonic cruise capability.
- 2009: T-50 PAK-FA intended to match F-22A

Flanker Proliferation



- Su-35-1 currently of offer to China, Brazil, Venezuela and several other nations.
- Yet to be proven claims that Su-30MKM has been offered to Iran.

Flanker Proliferation

- China remains largest client to date, with ~550 Flanker variants in service or on order.
- China may continue to manufacture reverse engineered J-11B, eq. to Russian Su-27SM.
- Baseline Su-27SK exported to China, Vietnam, Indonesia, Ukraine, Belarus, Angola, Eritrea, Ethiopia, Kazakhstan. Russia operates ~400.
- Su-30MKK/MK2 exported to China, Vietnam, Indonesia, Algeria.
- Su-30MK variant ordered by Venezuela.
- Su-30MKI exported to India.
- Su-30MKM exported to Malaysia.
- Su-33 CV shipboard fighter ordered by China.

Diverse Flanker Variants Exported

- Flankers exported globally are typically "customised" with specific avionics and weapons.
- Indian Su-30MKI includes French avionics and Israeli electronic warfare systems.
- Su-30MKK/MK2 supplied to China includes unique radar and weapons configurations.
- Chinese redesigned J-11B includes unique planar array radar, systems, glass cockpit, MAWS and Chinese PL-12 Sino-AMRAAM missiles.
- The large number of different avionics systems, especially radar, presents genuine difficulty in designing electronic countermeasures to defeat the Flanker.
- Midlife upgrades further complicate this problem.

Proliferation Considerations

- Flanker remains most widely proliferated modern fighter aircraft, after the smaller US F-16.
- J-10 Sinocanard and J-11B SinoFlanker intended for export.
- Fulcrum was widely exported and remains in use.
- Stealthy PAK-FA also intended for export, with India likely to be first client.
- Export contracts often include support personnel from former Warpac nations, and in some instances, also combat pilots.
- *US forces could therefore encounter very modern fighters, with modern avionics and weapons mixes, flown and maintained by experienced and competent personnel, in any theatre of operations.*

Sukhoi Su-35BM/Su-35-1 Flanker E+

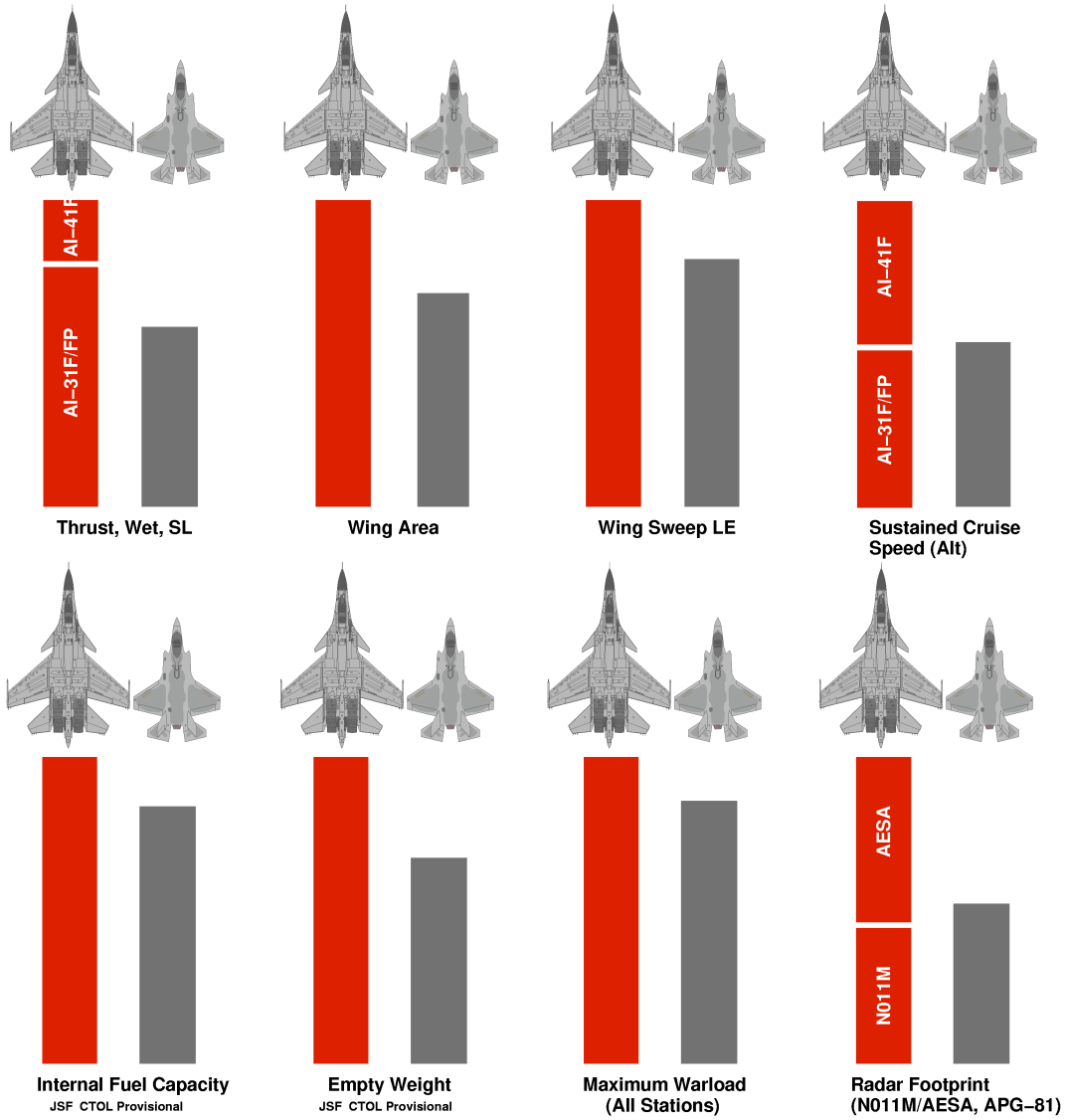
Intended IOC 2011

Sukhoi Su-35BM/Su-35-1 Flanker E+

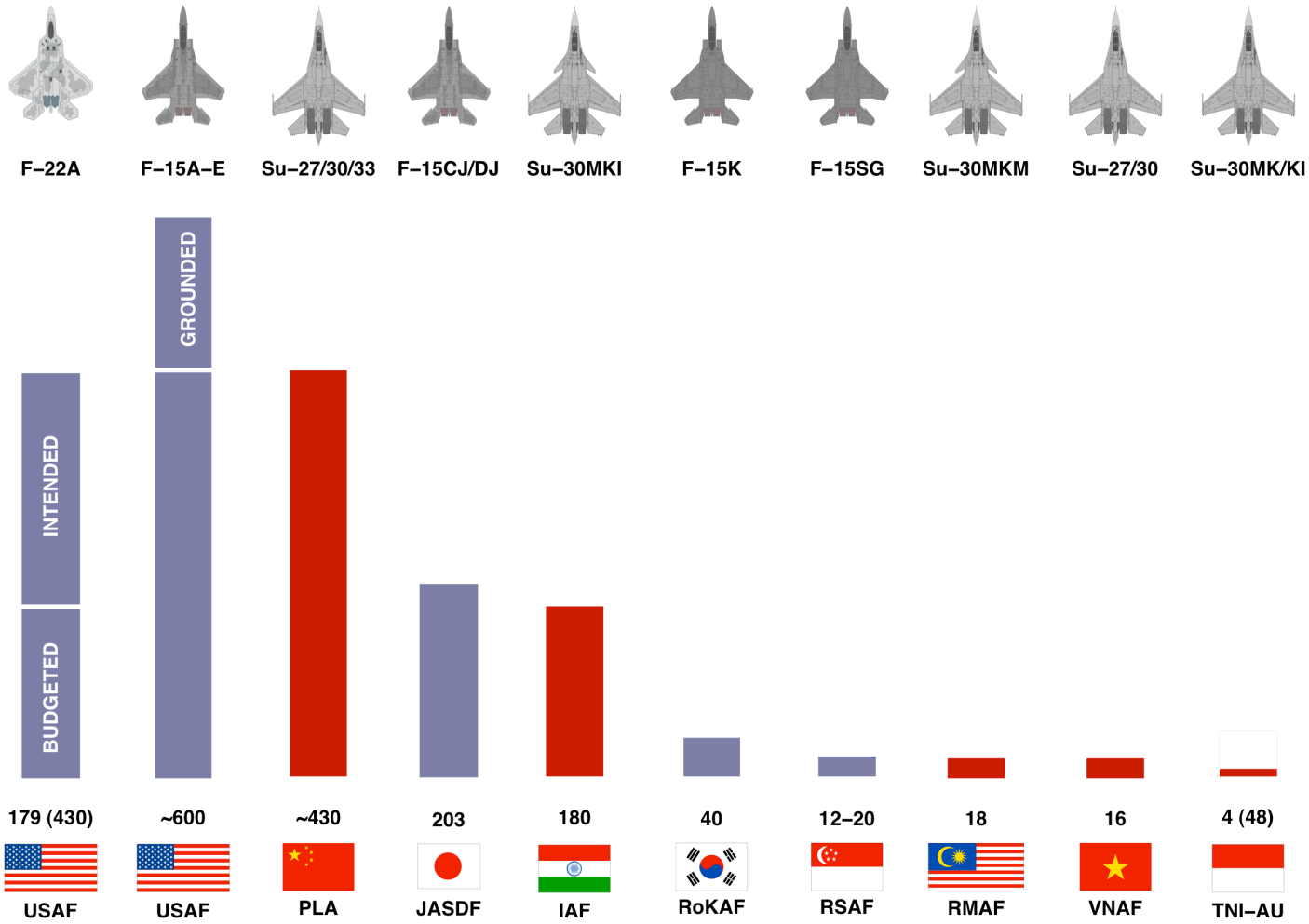
Sukhoi Su-35BM/Su-35-1 Flanker E+

- "Deep" redesign of Su-35 – fully digital weapon system, flight controls, systems
- Supersonic cruise AL-31FU-117S engines
- Large area glass cockpit emulating JSF
- Digital datalinks – TKS-2 and "JTIDS-ski"
- Radar absorbent materials – inlets
- Advanced 20 kiloWatt Irbis E hybrid ESA
- Optional Zhuk ASE 20+ kiloWatt AESA
- R-172, R-77M, RVV-AE-PD, R-27, R-74 AAMs; mostly digital designs
- Superior to all F-15, F-16 and F/A-18 variants, and Eurocanard fighters
- IOC ~ 2010-2011, Intended for volume export

Flanker vs JSF



High Performance Fighters in Asia - 2009



Su-35-1 Flanker – BVR Missiles (MAKS2007)

- R-172 also designated as R-100 and KS-172.

Su-30MKM Flanker H Malaysia – IOC 2009

- Based on Su-30MKI Flanker H but with improved systems, and French Thales Damocles EO targeting pod fitted.

Russian Beyond Visual Range Missiles

Counter-ISR

Seeker Technology:

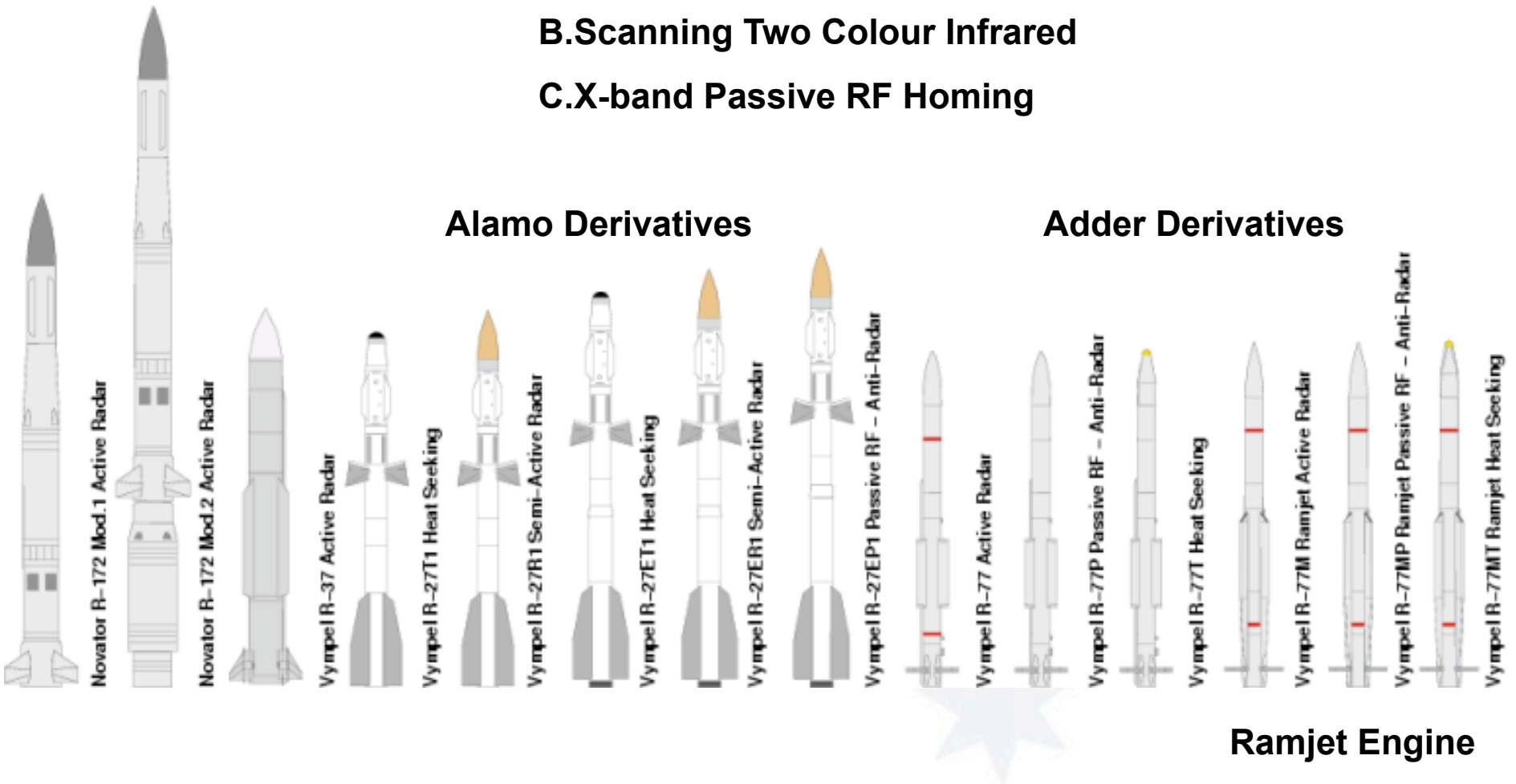
A.Monopulse Active Radar

B.Scanning Two Colour Infrared

C.X-band Passive RF Homing

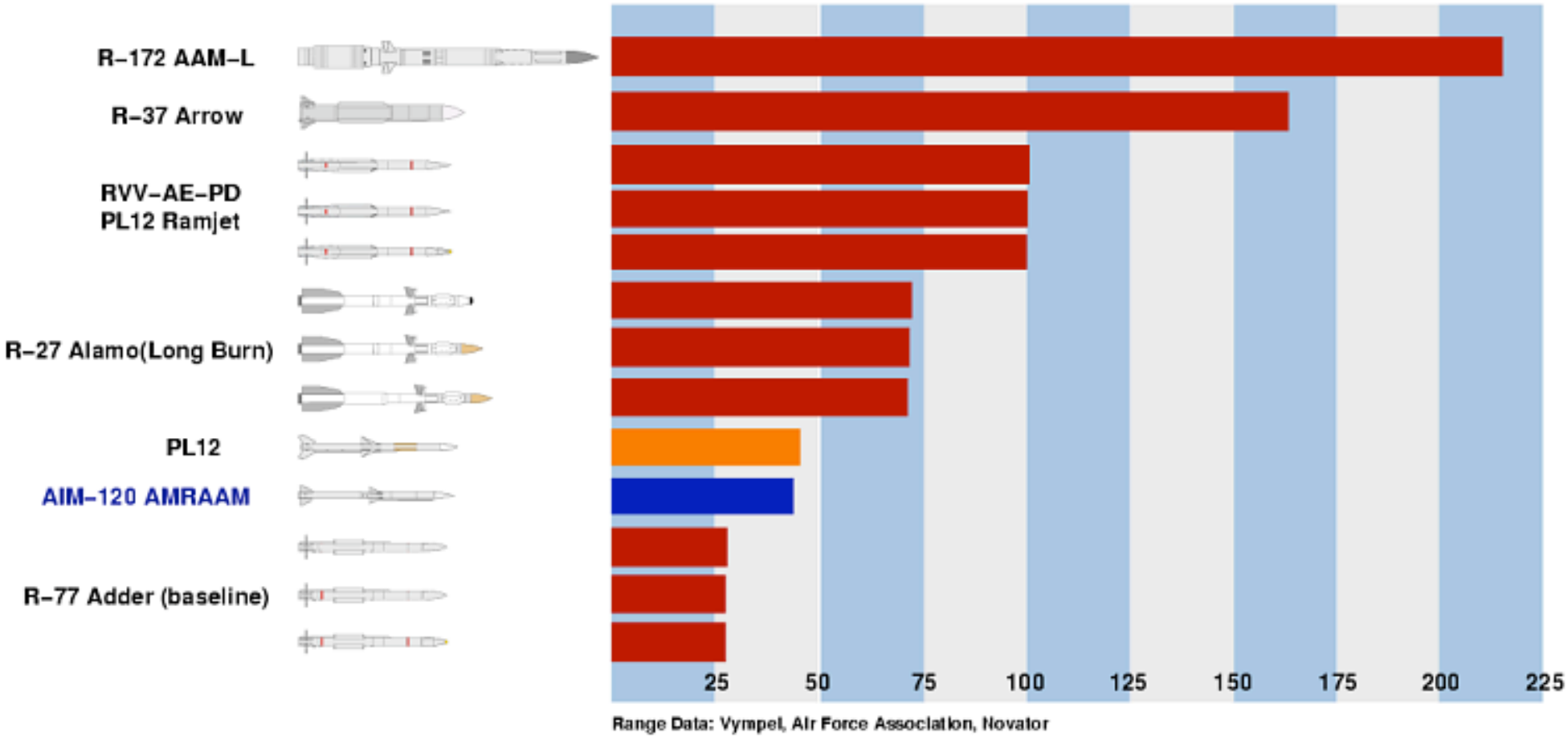
Alamo Derivatives

Adder Derivatives



Ramjet Engine

How do Russian BVR AAMs Compare?

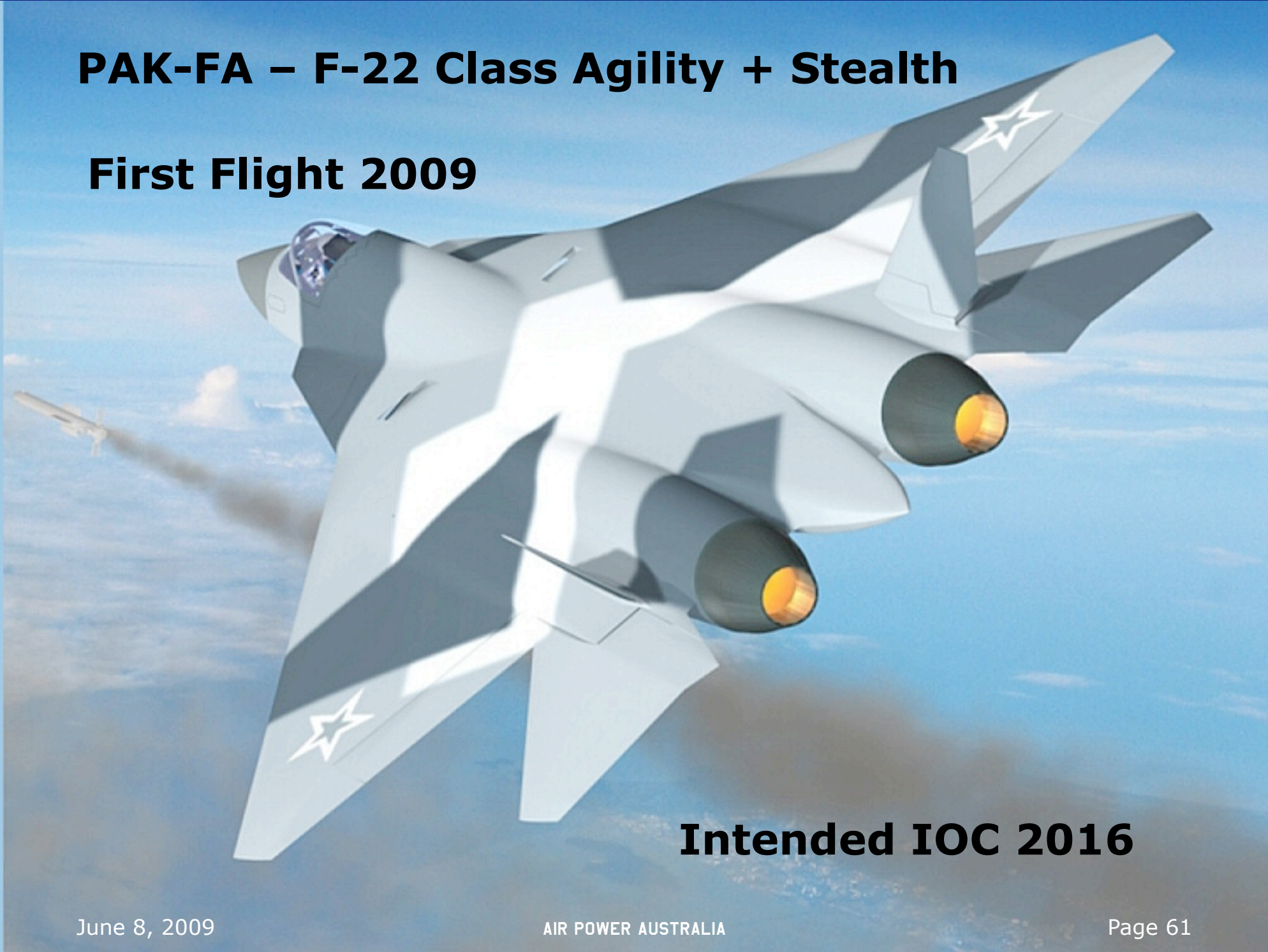


- R-27 Alamo, R-77 Adder and RVV-AE-PD – active radar, anti -radiation and heatseeking guidance equipped variants.
- PL12 Ramjet reported development of baseline Chinese PL-12 AMRAAM analogue.

RSK MiG-35 Fulcrum – First Russian Zhuk AE AESA Radar

PAK-FA – F-22 Class Agility + Stealth

First Flight 2009



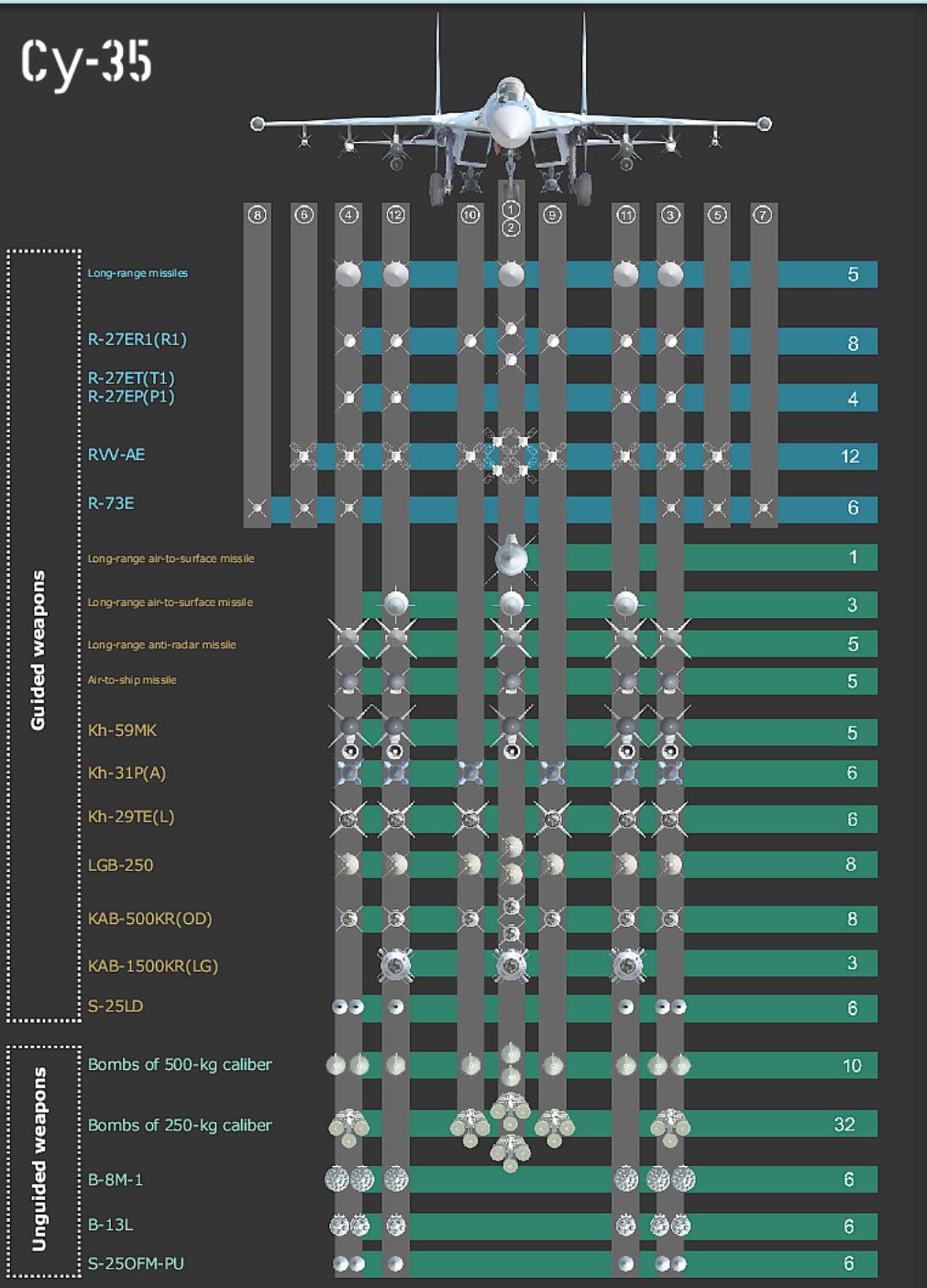
Intended IOC 2016

Guided Bomb Proliferation

- Russia and China are exporting a range of smart bombs which are equivalent to US designs, and some which have no US equivalents.
- Russian KAB-500/1500 bombs supplied with satellite, laser, imaging infrared or TV image correlator guidance, with and without datalinks.
- Blast/fragmentation, bunker busting, fuel air and thermobaric warheads are available for all KAB-500 and -1500 subtypes.
- China is marketing a range of laser and satellite guided bombs, including a glidebomb design similar to the US-Australian JDAM-ER weapon.
- *The only US advantage is in more mature seeker technology and anti-jam GPS antennas.*

EXTERNAL STORES LOADOUT

Russian Su-35-1
Weapons Capabilities
2008 Brochure



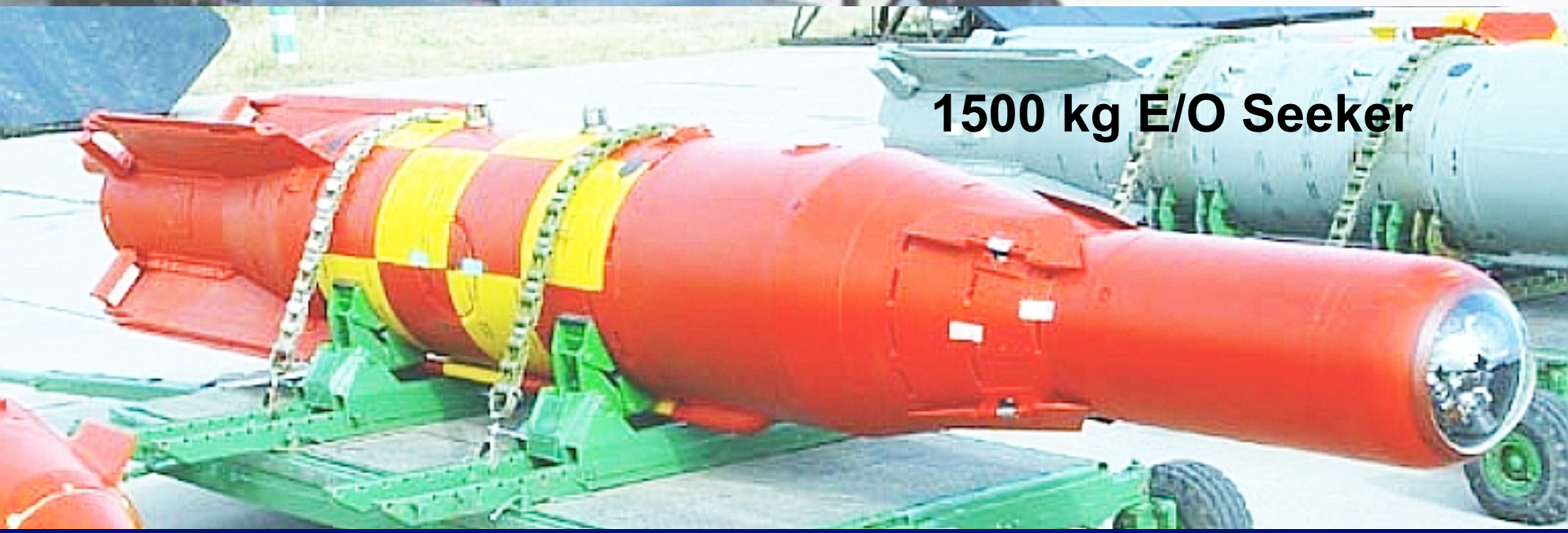
Smart Bombs – GNPP KAB-500/KAB-1500

- Fusion of Paveway and HOBOS technology
- Modular design – warheads and seekers
- Equivalents to Paveway/GBU-15/JDAM
- Warheads – blast/fragmentation, concrete piercing, Fuel Air Explosive / Thermobaric

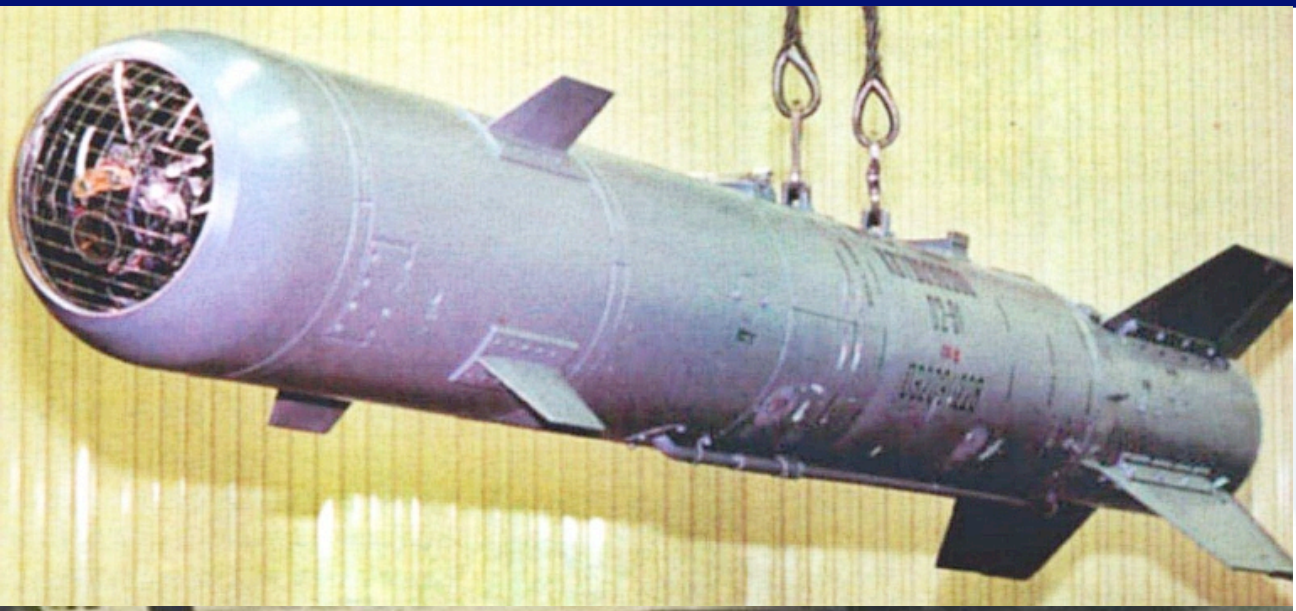
1. ElectroOptical Correlator – cf US DSMAC
2. ElectroOptical Datalink – cf US EGBU-15
3. Semiactive Laser – cf US Paveway II/IV
4. GPS/Glonass – cf US JDAM and SDB
5. 1,000 lb and 3,000 lb standard warheads

- KAB-500/1500 guided bombs provide equivalent capabilities to all US weapons other than 500 lb and Small Diameter Bomb PGMs.

Smart Bombs – GNPP KAB-1500



Smart Bombs - GNPP KAB-500



500 kg E/O Seeker

500 kg Laser Seeker

500 kg Satellite Guidance

Cruise Missiles

- Novator 3M54E/3M14 Sizzler – air, sub, ship and ground launched; subsonic and supersonic terminal stage variants; anti-ship and land attack variants;
- Kh-61 Yakhont/PJ-10 Brahmos A/S air, sub, ship and ground launched supersonic
- Raduga 3M80/81/82 Sunburn – air and ship launched supersonic ASCM
- Raduga Kh-55SM – eq US AGM-86
- DH-10 – eq US Tomahawk
- YJ-63 – eq US Tomahawk MRASM

Cruise Missiles – 3M54/SS-N-27 Sizzler

Kilo SSK; DDG/FFG SLCM

Su-27/30/35; MiG-29/35 ALCM

MZKT-7930 8 x 8 GLCM

Supersonic Variant Available

Cruise Missiles – Yakhont/Brahmos / SS-N-26

Tatra 815 8 x 8 GLCM

Supersonic CM

Su-27/30/35 ALCM

SSK, DDG/FFG SLCM

3M80/81/82 Moskit / SS-N-22 Sunburn

Supersonic Cruise Missile

Ship Launch – Type 956 DDG

Air Launch – Centreline Flanker

Thermobaric or Shaped Charge W/H

Cruise Missiles – Kh-55, DH-10, YJ-62

YJ-62 SLCM/ALCM

AGM-86/109 Analogues

Raduga Kh-55SM ALCM

DH-10 SLCM

Sukhoi Su-33/33UB Flanker D - CV

Su-33 Navalised Flanker

PLA-N – 48 Ordered

Tailhook/Ski-Jump

Full Su-30MK Capabilities

Single/Dual Variants

Equivalent F-14D Tomcat

Recent Upgrades:

Phased Array Radar

Smart Weapons Interfaces

3M54 Sizzler Cruise Msl

Sukhoi Su-34 Fullback – LRIP for RuAF

Long Range Strike Fighter – F-111 Class

PESA Attack Radar

Khibiny M Emitter Locating System

All Su-30MK Smart Weapons

LRIP in 2007 – On Offer to PLA-AF/PLA-N

Chengdu J-10 Sino Canard Fighter

KJ-2000 AWACS – AESA Technology

- The L-band AESA radar in this Chinese design is two generations of antenna technology ahead of the E-3 AWACS APY-2 radar.

Counter-Stealth Proliferation

- Russia and China continue to develop and deploy a range of counter-stealth technologies.
- Digital VHF-band / "metric" and L-band / "decimetric' radars will defeat typical stealth shaping techniques in US fighters and UAVs.
- Digital processing upgrades to legacy VHF band radars: Spoon Rest, Tall King, Tall Rack.
- New VHF radars: Vostok E, YJ-27, Rezonans NE.
- New AESA radars: NNIIRT Nebo SVU, Nebo M RLM-M/D, VNIIRT Gamma DE series.
- All recent Russian radar designs VHF or L-band.
- Networking of radars and passive RF sensors.
- Passive RF TDOA/interferometer sensors: Orion /Vega, Kolchuga, Avtobaza, YLC-20 series.

NNIIRT Nebo M VHF AESA 3D Search Radar

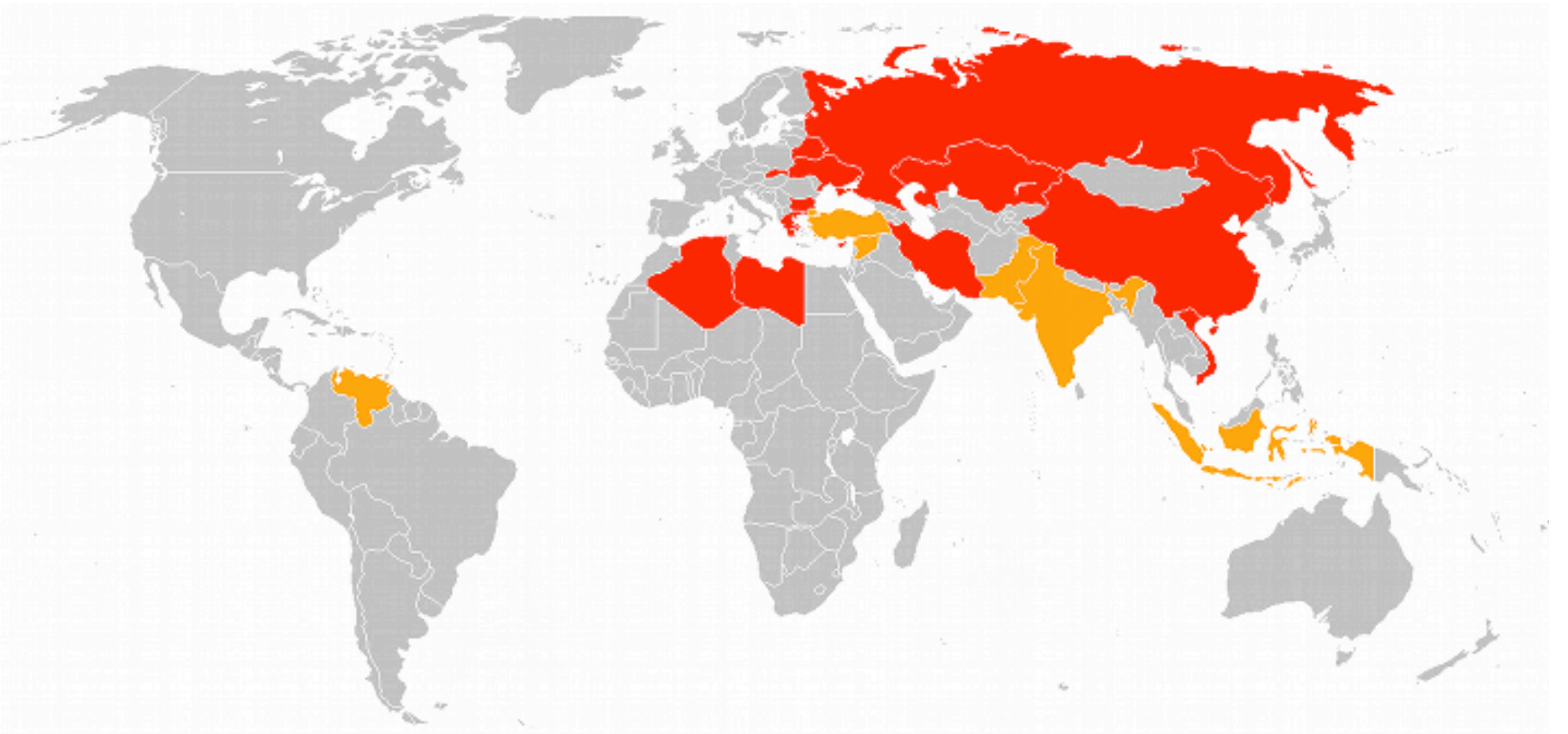
2 Metre Band VHF Operation
Digital MTI Processing
Automatic Frequency Agility
STAP Clutter Processing
Modern COTS Digital Processing
Solid State COTS RF Amplifiers
Networked with SAM Batteries
High Mobility "Shoot and Scoot"
All Terrain Vehicle Chassis

Modern Counter-VLO Radar Examples

NNIIRT Nebo SVU VHF AESA 3D Search Radar

KBR Vostok E VHF Solid State 2D Search Radar

Advanced SA-20/21/HQ-9 Proliferation



- SA-21 – Russia, Belarus; SA-20 Russia, China, Iran, Libya, Algeria, Kazakhstan, Vietnam, Greece; HQ-9 China.
- Stated interest by Venezuela, Syria, Indonesia, Turkey, India, Pakistan.

S-400 Triumf / SA-21– 130-200 NMI

92N2E Grave Stone Engagement

4/16 Round 5P85TE1 TEL

Missiles 48N6E3, 40N6, 9M96E/E2

Equivalent Patriot PAC-3 / ERINT

96L6 Cheese Board – Acquisition

S-300PMU1/2 / SA-20 Gargoyle – 80-110 NMI

30N6E/E2 Tomb Stone Engagement

64N6E/E2 Big Bird Acquisition

48N6E/E2 Missiles

4 Round 5P85TE TEL

S-300PMU1/2 / SA-20A/B Gargoyle Radars

5N66M/76N6 Clam Shell / 40V6MD

5N66M/76N6 Clam Shell / 40V6M

Low Level Acquisition Radar

40V6M – 24 Metre Elevation

40V6MD – 39 Metre Elevation

Both masts available for:

Flap Lid / Tomb Stone / Grave Stone;

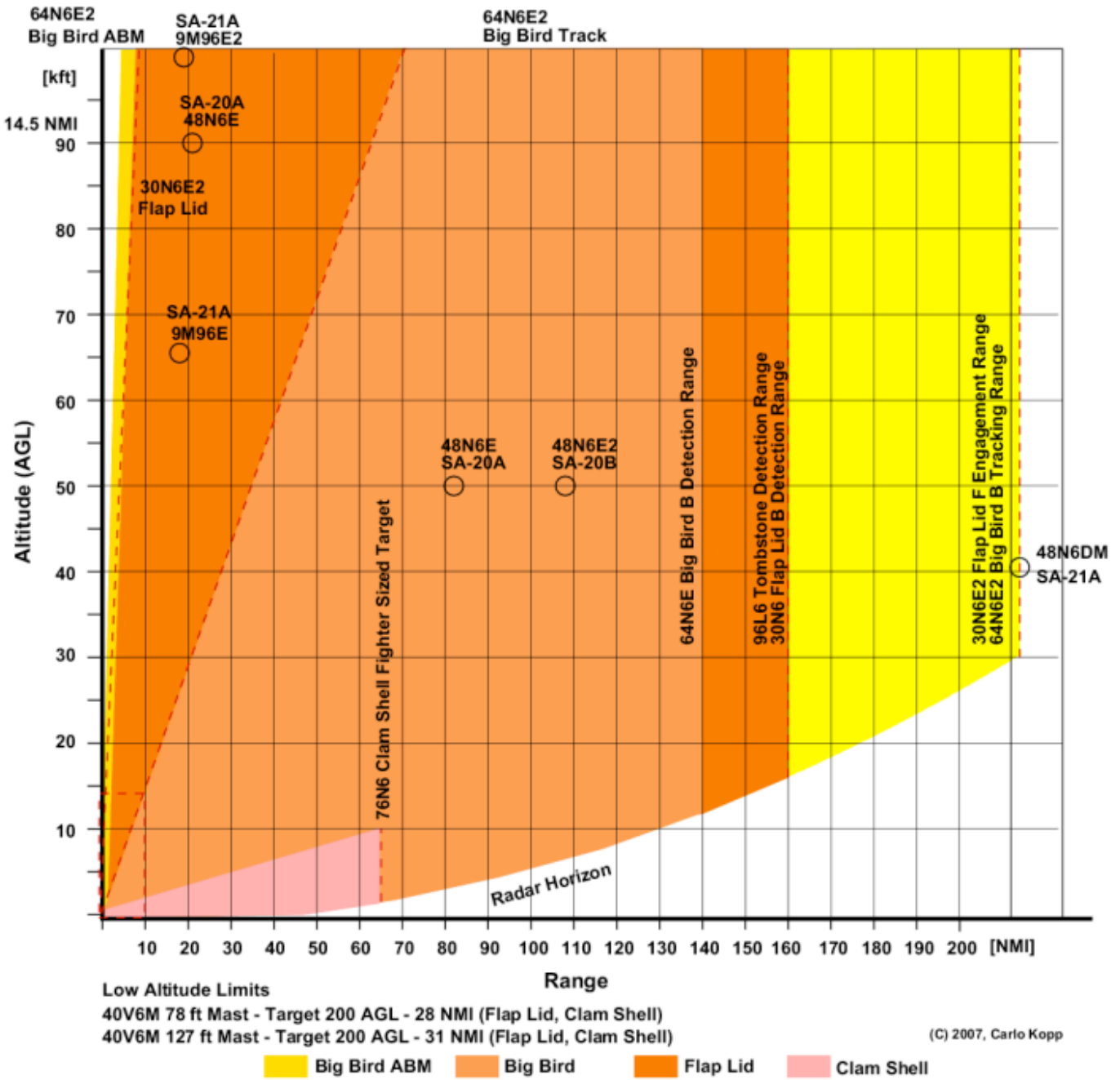
Tin Shield ; Cheese Board; Gamma DE

Cruise Missile Defeat

2-4 hr Deployment Time

S-300PMU2 vs Aegis/Patriot - Comparisons

S-300PMU-2 Favorit (SA-20 Gargoyle) Engagement Envelope
S-400 Triumf (SA-21 Growler) Engagement Envelope



CPMIEC FD-2000 / FT-2000 / HQ-9

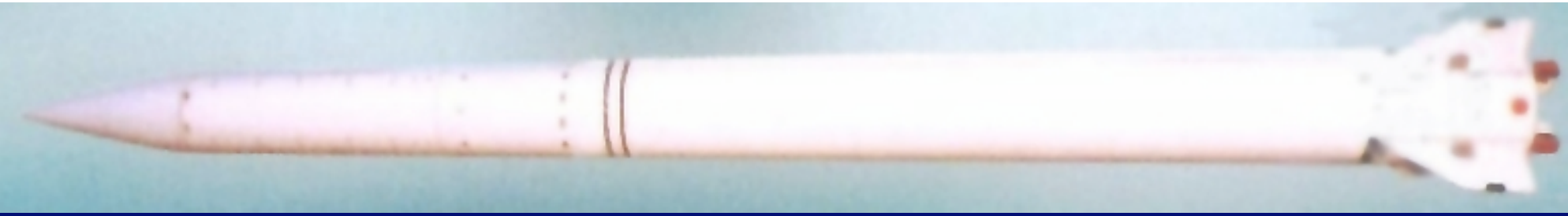
HT-233 Engagement Radar

YLC-2V Acquisition Radar

SA-10/20 technology

FT-2000 anti-radiation round 2-18 GHz

Globally marketed as replacement for more expensive Russian SA-20



SA-5 Gammon/SA-20 Hybridisation

Legacy 5N62 Square Pair controlled by modern 30N6E Tomb Stone / 92N2E Grave Stone phased array

Improve jam resistance and lethality of SA-5 Gammon

HQ-2/SA-2 Guideline Hybridisation

H-200 phased array engagement radar for KS-1A SAM

Candidate Fan Song replacement in hybrid SA-2 batteries.

End Presentation