SYSTEMS FIRST: THE PFX PROGRAMME AND JF-17 BLOCK III AS THE OPERATIONAL BRIDGE

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Pakistan's PFX (Pakistan Fighter Experimental) programme, publicly showcased at IDEAS 2024, is framed as a 4.5 Generation (Gen) leap focussed on sensors, Electronic Warfare (EW), and avionics sovereignty.[1] This article explains the programme's aims and architecture, traces the JF-17's evolution to Block III [KLJ-7A AESA (Active Electronically Scanned Array) radar, expanded EW/defensive aids, modern cockpit and Helmet Mounted Display (HMD/S), and outlines weapons options and export context.[2]

INTRODUCTION

Over the past two decades, the Pakistan Air Force (PAF) has modernised along three reinforcing lines: (1) recapitalising legacy fleets through co-development and licensed production; (2) growing airborne sensing and

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1. Farhan Bokhari, "Pakistan Unveils JF-17 PFX Fighter," *Jane's*, November 26, 2024, https://www.janes.com/osint-insights/defence-news/air/pakistan-unveils-jf-17-pfx-fighter. Accessed on November 16, 2025.
2. "Pakistan Signs Contract to Sell JF-17 Fighter Jets to Azerbaijan," Reuters, September 26, 2024, https://www.reuters.com/business/aerospace-defense/pakistans-military-says-it-has-signed-contract-sell-jf-17-fighter-jets-2024-09-26/. Accessed on November 19, 2025.

Rather than a clean-sheet stealth jet on day one, the PFX is positioned as an integration and sovereignty programme.

battle management capacity; and (3) iterating avionics faster than airframes. The Central Air Command/Pakistan Aeronautical Complex (CAC/PAC) JF-17 programme replaced the ageing A-5/F-7/Mirage types and, crucially, established a domestic assembly and upgrade base at PAC Kamra. In parallel, the PAF added Airborne Early Warning and Control (AEW&C) capacity (Saab 2000 Erieye and Chinese ZDK-03), tightening the sensor-to-shooter chain and informing doctrine for distributed air defence and strike control. More recently, the induction of the J-10C in 2022 provided a medium-weight node with advanced radar and weapons to complement the JF-17's light/affordable mass.[3] Against this backdrop, the Pakistan Fighter Experimental (PFX) concept was presented at IDEAS 2024 in Karachi.[4] The PFX is framed as a 4.5-Gen push expected to conclude its initial development cycle before the decade's end. Rather than a clean-sheet stealth jet on day one, the PFX is positioned as an integration and sovereignty programme: drive ownership of the high-value stack—AESA radar, EW, mission computing, and secure national datalinks while using the JF-17 industrial line as the pragmatic launch pad. Concretely, the PFX is already moving in near-term spirals via an operational upgrade track colloquially dubbed PFX Alpha, coordinated through the National Aerospace Science and Technology Park (NASTP).[5] The idea is to mature indigenous radar/EW/avionics increments on in-service airframes (starting with the late-build JF-17s), collect test data, and de-risk the eventual PFX air vehicle. This "systems-first" staging acknowledges earlier

3. "Pakistan Adds Next-Generation Chinese J-10 C Jets to Air Force Fleet," Reuters, March 11, 2022, https://www.reuters.com/article/world/pakistan-adds-next-generation-chinese-j-10-c-jets-to-air-force-fleet-idUSL5N2VE2MR/. Accessed on November 11, 2025.
4. Bokhari, n. 1.
5. "PAF's NASTP Sets Upgrade Path for JF-17 (or 'PFX Alpha')," CombatAircraft.com, December 9, 2024, https://www.combataircraft.com/en/News/2024/12/09/PAF%E2%80%99s-NASTP-Sets-Upgrade-Path-for-JF-17-%28or-%E2%80%98PFX-Alpha%E2%80%99%29/. Accessed on November 17, 2025.

From a management standpoint, the PFX formalises the habit honed during the sanctions: decouple airframe and avionics, preserve production momentum, and reintegrate electronics as allowed by sources and funding.

lessons (e.g., Project Azm's difficulties) and keeps capability flowing to squadrons while deeper Research and Development (R&D) proceeds. Technically, three levers define the PFX's early emphasis. First, AESA-first sensors: local content in Transmit/Receive (T/R) modules and beamforming hardware, plus growth modes [Track-While-Scan (TWS), Synthetic Aperture Radar (SAR)/ Ground Moving Target Indication (GMTI)] and reliability targets Mean Time Between Critical Failures (MTBCF) that enables persistent multi-role tasking. Second, EW as a system: indigenous Electronic Support Measures/Electronic Intelligence (ESM/ELINT) receivers and Digital Radio Frequency Memory (DRFM)-based self/stand-in jamming fused with Radar Warning Receiver/Missile Approach Warning System (RWR/MAWS) and, ultimately, AESA assisted jamming. Third, open architecture and sovereign links: a hardened mission computer and national waveform/crypto to federate fighters, Airborne Early Warning (AEW), Ground-Based Air Defence (GBAD), and teaming with Unmanned Combat Aerial Vehicle/Collaborative Combat Aircraft (UCAVs/CCA). Together, these shift the centre of gravity from "airframe first" to "brains and network first". The JF-17 Block III is the immediate transition context. Block III centres on the NRIET/CETC KLJ7A AESA (moving beyond the earlier mechanically-scanned KLJ-7), a wide-angle Head-Up Display (HUD) and Helmet-Mounted Display/Sight (HMD/S), integrated Missile Approach Warning System/Radar Warning Receiver (MAWS/RWR), and a modernised mission-computer spine.[6] Pakistan selected the KLJ-7A for the Block III after competitive evaluation; subsequent induction

6. Greg Waldron, "JF-17 to get Chinese-Developed AESA Radar," *FlightGlobal*, March 27, 2018, https://www.flightglobal.com/jf-17-to-get-chinese-developed-aesa-radar/127546.article. Accessed on November 10, 2025.

and carriage of the long-range PL-15/PL15E Beyond Visual Range Air-to-Air Missile (BVRAAM) validate the Beyond Visual Range (BVR) leap implied by the avionics upgrade. In effect, the Block III turns the JF-17 into a credible BVR-first light fighter and a ready host for the PFX Alpha avionics/EW spirals. From a management standpoint, the PFX formalises the habit honed during the sanctions: decouple airframe and avionics, preserve production momentum, and reintegrate electronics as allowed by sources and funding. PAC Kamra's expanding role in structures, assembly and Maintenance, Repair and Overhaul (MRO), plus sustained collaboration with Chinese partners on airframes and sensors, provides the industrial scaffolding. The delta in the PFX is ownership of software-heavy value—beamforming/Electronic Counter-Counter Measures (ECCM), EW management, secure datalinks—so upgrade cycles shorten and exportable variants can be partitioned cleanly.[7]

PROGRAMME MANAGEMENT AND INDUSTRIAL MODEL

The PAF manages fighter modernisation through a systems-first doctrine refined over two decades: preserve airframe momentum, iterate avionics on a decoupled track, and expand domestic sustainment so that upgrades and readiness are not hostage to external shocks. This operating model proven on the CAC/PAC JF-17 line underwrites the PFX, which formalises sovereignty in the high-value layers (AESA, EW, mission computing, and secure datalinks) while leveraging the existing industrial base at PAC Kamra.

Governance Logic: Decouple, Spiral, Reintegrate

Sanctions constraints at the turn of the century forced a structural choice: separate the airframe programme from the electronics stack so that delays in one do not stall the other. That decision produced a repeatable pattern: (1) field a robust baseline airframe; (2) run avionics/radar competitions

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in parallel; (3) spiral-in winning subsystems as they mature; and (4) keep software and integration pathways open for rapid refresh. The PFX takes this logic from platform practice to programme doctrine: an explicit spiral pipeline ("PFX-Alpha") to push indigenous radar/EW/avionics into service jets, harvest test data, and de-risk the eventual PFX air vehicle.

Institutional Roles and Workshare

PAC Kamra serves as the centre of gravity for structures, final assembly, avionics production/repair, and MRO. Under the JF-17 workshare, PAC manufactures a majority share of the airframe and executes final integration; that investment yields assured access to spares, lower life-cycle cost, and the ability to execute block upgrades at home. CAC/AVIC (Aviation Industry Cooperation of China) remain airframe and systems partners; China Electronic Technology Corporation/Nanjing Research Institute of Electronics Technology (CETC/NRIET) anchors the KLJ-7/7A radar lineage. The Avionics Production Factory (APF) at Kamra extends repair/overhaul and licensed builds, and provides an institutional shell for the future T/R module and beamforming work as the PFX matures.

PFX-Alpha: The Bridge from Fleet to Future

Operationally, the PFX-Alpha is the near-term capability engine: an Operational Capability Upgrade (OCU) path for the late-build JF-17s that prioritises radar/EW, open-architecture mission computing, and secure national datalinks plus integration of new munitions (including the indigenous A2G). Organisationally, the OCU is run through the NASTP, which frames it as the first sequential step towards the PFX while building local test/qualification capacity [anechoic/Radar Cross Section/Radio Frequency (RCS/RF) benches, EW range instrumentation]. This "fleet first" staging keeps squadrons relevant and creates the data/Quality Assurance (QA) backbone the PFX will need in the flight test.

Industrial Model and Supply Security

The industrial design point is assured readiness. Three lines matter:

1. **Domestic Content and MRO:** Expand the local content beyond structures into radar/EW Line Replaceable Units (LRUs) and mission-computer boards; strengthen depot-level MRO and module-swap Turnaround Time (TAT) to keep Mission Capable (MC) rates high.
2. **Dual-Source and Buffer:** Where parts cannot be localised, dual-source and hold buffer stocks [especially RF (Radio Frequency) semiconductors and high-power General Adversarial Network/ Public Address (GaN/PA) modules].
3. **Open Interfaces:** Enforce Interface Control Documents (ICDs) and software modularity so that vendor rotation does not trigger system-wide requalification.

This model reduces the cost/risk tail of long-life fleets and makes export support (MRO, spares pools, line modifications) a revenue engine rather than a drain.

Avionics and Radar Selection Practice

On the JF-17 Block III, the selection of the KLJ-7A AESA formalised the doctrine: pick a radar with multi-mode growth (TWS/SAR/GMTI), acceptable reliability (air-cooled architectures), and a vendor with integration and export posture aligned to Pakistan's needs. The PFX extends this logic by aiming to internalise more of the AESA value chain (T/R manufacture, beamforming, calibration/test) over time, while preserving upgrade freedom (future modes, cooperative EW, and datalink-driven sensor fusion).

Software, Datalinks and IP Governance

The heart of the PFX is software: beamforming/ECCM algorithms, EW threat libraries, and a secure, sovereign waveform. Programme rules emphasise:

- Partitioned software baselines (sovereign vs. exportable) to sustain exports without leaking core Intellectual Property (IP).
- Public Key Infrastructure (PKI) and secure-boot across mission computers and radios to harden against tamper;
- Data rights and toolchains retained in-country (build servers, firmware signing, EW library management).

Certification, Compliance and Exportability

To make sovereignty durable, the PFX couples capability insertion with certifiable processes (DO-178C/254like methods for software/hardware) and export control governance (feature-tiering, mode limiting, and redaction of sensitive ECCM). The result is a catalogue that can be sold with matching MRO/ToT (Transfer of Technology) packages, keeping the PAC's lines warm and feeding the R&D flywheel.

Risk Register and Mitigations

Supply chain fragility (RF semis, precision machining) is mitigated via dual-source and buffer. Vendor claims vs. fleet reality are handled by incremental spirals and instrumented trials before wide release. EW fratricide/ interop risk is managed by common EW orchestration middleware and rigid emission deconfliction procedures. Workforce throughput risk is addressed by NASTP pipelines and vendor-shadow teams embedded at Kamra.

What Changes with the PFX?

Relative to past practice, the PFX shifts the centre of gravity from "airframe first" to "brains and network first," institutionalises a spiral pipeline (PFX-Alpha) to keep capability flowing, and deliberately grows the domestic share of radar/EW/mission-computer value. The end-state is not just a new aircraft; it is an industrial capability to continuously insert sensors, software, and network effects at home and for export.

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PFX: TECHNICAL AIMS AND SYSTEM ARCHITECTURE

The PFX is a systems-first programme that concentrates investment and governance on the high-value layers of a modern fighter: an AESA radar, an integrated EW complex, an open-architecture mission computer, and a sovereign, secure datalink fabric that fuses airborne and ground sensors. Rather than pursue a one-shot clean-sheet airframe, the PFX proceeds in spirals, pushing sensors/EW/avionics increments into service aircraft ("PFX-Alpha") while de-risking the eventual air vehicle. The aim is to localise more of the sensor/EW value chain, shrink upgrade cycles, and tighten the sensor-to-shooter loop across fighters, AEW, GBAD, and unmanned teammates.

AESA-First Sensors

The radar thrust prioritises (1) multi-mode capability (TWS, SAR/GMTI, maritime); (2) reliability/MTBCF improvements; and (3) increasing local content in T/R modules and beamforming hardware. On the JF-17 Block III, the PAF selected the KLJ-7A AESA, which open literature describes as supporting multi-target track/engage and improved ECCM; vendor statements cited by trade media have referenced fighter-sized detections at nominal ranges and the ability to track ~15 targets and engage several concurrently. The PFX extends this logic by building domestic capacity around array manufacturing, calibration, and mode growth, while keeping upgrade freedom for future waveforms and cooperative sensing.

EW as a System

The PFX treats EW as a federated system, not a bolt-on. The target stack includes: wideband ESM/ELINT receivers; DRFM-based self-protection and stand-in jamming; AESA-assisted jamming modes; and tight fusion with the defensive aids suite (RWR/MAWS/CMDS). Orchestration middleware is required to (1) deconflict emissions so jammers do not blind own-ship sensors; (2) prioritise effects by phase of flight (ingress/strike/egress); and (3) expose machine-to-machine hooks for UCAV/CCA escort jammers. Instrumented range trials (L–X bands) with red/blue cells are integral to tune tactics and avoid EW fratricide.

Open Mission Computing

The mission-computer spine follows open-architecture principles: clean Interface Control Documents (ICDs), process isolation for safety-critical and mission-apps, and a development toolchain owned in the country. Sovereign control over the beamforming/ECCM code and EW threat libraries is a central design rule. Practically, the stack should support: (1) fast mode insertion for radar/EW; (2) plug-in sensor/weapon drivers; (3) deterministic timing for sensor fusion; and (4) exportable partitions so that the features can be tiered by the customer without exposing the core IP.

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Sovereign Datalinks and Sensor Fusion

A secure national waveform (or a hardened gateway layer between mixed vendors) underwrites the PFX's network effects. The fabric must: authenticate with a sovereign PKI; support low-latency target handoff from the AEW to the shooter; and bridge airborne and GBAD/ISR (Intelligence, Surveillance, Reconnaissance) nodes. Planning targets include: AEW→shooter hand-off < 200 ms for BVR stacks; time-synchronised tracks across fighters/AEW/GBAD; and graceful-degradation modes for Global Positioning System (GPS)-denied or Emissions Control (EMCON)-constrained operations. Crypto keying and emergency revocation procedures are part of the operational concept.

Manned–Unmanned Teaming (MUM-T)

The PFX assumes teaming with UCAVs and CCA: attritable escorts for jamming/decoy roles; stand-in ISR/targeting; and weapons trucks to extend magazine depth. The mission computer and datalink layers, therefore, expose human-in-the-loop control, autonomy guard-rails [fail-safe behaviours and Rules of Engagement (RoE) thresholds], and data taps for post-mission learning.

Test, Calibration and Sustainment

Delivering sensor/EW sovereignty requires ground infrastructure: anechoic chambers and array calibration benches; RCS ranges; EW test ranges with threat emitters; and avionics repair/overhaul lines. PAC Kamra's Avionics Production Factory (APF) anchors radar/avionics MRO today; the PFX's roadmap expands that role toward board-level manufacture, T/R module test, and long-term software sustainment. Depot-level processes (fast line-replaceable unit swaps, Low Observable (LO) coating repair where applicable) are part of the sortie-generation calculus, not an afterthought.

Architecture Checklist (Engineering View)

- AESA front-end (array, T/R modules, phase shifters) with calibration and on-board Built-In-Test (BIT); beamforming DSP with mode growth (TWS/SAR/GMTI).
- EW complex: ESM/ELINT receivers; Digital Radio Frequency Memory (DRFM) jammers; Defensive Aids Suite (DASS) fusion (RWR/MAWS/CMDS); EW orchestration server for emission control.
- Mission computer: partitioned OS; deterministic middleware; plug-in radar/EW/weapon apps; secure boot and code-signing;
- Datalink: sovereign waveform or gateway; PKI; AEW/GBAD bridging; low-latency hand-off targets GPS-denial resilience.
- Test and MRO: anechoic/RCS/EW ranges; APF upgrade lines for radar/EW Line Replaceable Units (LRUs); software toolchains and EW library management.

Indicative KPIs and Milestones

Table 1: Illustrative Engineering KPIs for PFX Spirals (Planning Targets)

Domain	**Target (illustrative)**
AESA reliability	MTBCF improvement vs. baseline +25–40% over 24 months
Mode growth	SAR resolution < 1 m (flight test); GMTI track quality thresholds met
EW effectiveness	Stand-in/self-protect jamming success ≥ 70% in range trials
Fusion latency	AEW→shooter hand-off < 200 ms (BVR chain)
Security	Fleet-wide secure-boot/PKI; key revocation < 5 min
Local content	Radar/EW LRUs with domestic repair rate ≥ 60% (36 months)

JF-17 BLOCK III: AVIONICS, RADAR, AND COCKPIT

Block III is the operational bridge into the PFX era. Its centrepiece is the NRIET/CETC KLJ-7A AESA radar, wrapped in a modernised mission-computer spine, an integrated Defensive-Aids Suite (DASS), and an updated Human-Machine Interface (HMI) comprising a wide-angle HUD and HMD/S. The design intent is twofold: (1) shift the JF-17 from a budget multi-role fighter to a BVR-first light fighter with credible electronic protection; and (2) provide an open, software-forward backbone for rapid capability insertion in the PFX spirals.

KLJ-7A AESA Radar (Modes, Reliability, Growth)

The KLJ-7A replaces the earlier mechanically scanned KLJ-7 with a solid-state AESA that supports multimode tasking. Air-to-air modes include search, TWS, and multi-target engagement; air-to-surface modes include strip/spot SAR and GMTI. In the maritime roles, sea-search and surface-track modes support anti-ship targeting. Open literature attributes improved ECCM and Low Probability of Intercept (LPI) behaviours to the array's agile beamforming; vendor quoted figures (as relayed by trade media) describe fighter-sized detections at nominal ranges with the ability to track on the order of ~15 targets and engage several concurrently. Architecturally, Block III emphasises reliability and maintainability: modular LRUs, BIT for fault isolation, and thermal design choices (air-cooled subarrays) intended to balance cost, weight, and Mean Time Between Critical Failures (MTBCF). Growth provisions include room for mode expansion (e.g., higher-resolution SAR, cooperative EW-assisted modes) and tighter coupling to the mission-computer fusion layer.

In line with the PFX's "EW as a system" intent, the Block III avionics spine exposes interfaces for external escort/stand-in jammers and future AESA-assisted jamming behaviours, while enforcing deconfliction so that self-protection effects do not blind own-ship sensors.

Defensive-Aids Suite and EW Coupling

Block III's Defensive-Aids Suite (DASS) integrates a Radar Warning Receiver (RWR), Missile-Approach Warning Sensors (MAWS), and a Counter-Measures Dispensing System (CMDS) under unified control. The EW manager fuses RWR and MAWS cues with radar/HMD/S symbology to shorten pilot reaction time and to coordinate expendables and jamming under emission-control rules. In line with the PFX's "EW as a system" intent, the Block III avionics spine exposes interfaces for external escort/stand-in jammers and future AESA-assisted jamming behaviours, while enforcing deconfliction so that self-protection effects do not blind own-ship sensors.

Cockpit and Human–Machine Interface

The Human–Machine Interface (HMI) moves to a pilot-centric layout: a wide-angle holographic Head-Up-Display (HUD) for primary flight and weapon symbology; a Helmet-Mounted Display/Sight (HMD/S) enabling high off-boresight cueing and cue-toslew of sensors and missiles; and enlarged Multi-Function Displays (MFDs) with page sets for radar, EW, stores, and targeting pod video. Hands-on-Throttle-And-Stick (HOTAS) mappings reduce headdown time for air-to-air merges and time-critical surface strikes. Symbology integrates datalink tracks (friend/hostile/unknown), EW threat rings, Launch-Acceptability Region (LAR) for BVR shots, and cueing for PL-10-class Within Visual Range (WVR) missiles.

Built-in-test, crash/error logging, and sovereign code-signing/secure-boot are used to harden field updates and preserve data rights.

Mission Computer, Data Buses, and Software

The Block III's mission-computer spine adopts open-architecture design: clean ICDs; partitioned software to separate safety-critical functions from mission apps; deterministic middleware for sensor fusion; and digital backbone buses (hybrid Ethernet/MIL-STD style) for growth. This enables:

1. Rapid mode insertion for radar/EW;
2. Plug-in drivers for new sensors and weapons;
3. Low-latency fusion of on-board and off-board tracks; and
4. Exportable software partitions for feature-tiering.

Built-in-test, crash/error logging, and sovereign code-signing/secure-boot are used to harden field updates and preserve data rights.

Sensor Fusion and AEW/GBAD Hands-off

The avionics layer fuses KLJ-7A tracks with HMD/S line-of-sight, DASS cues, targeting-pod video, and off-board datalink tracks (e.g., AEW hand-offs). Operator-visible effects include: stable track quality across sensors, lower shot-latency for BVR employment, and improved Identification (ID) confidence when EO/SAR corroborates radar returns. Planning targets for the PFX era emphasise sub-200 ms hand-off latency from AEW to shooter for BVR stacks and robust operation under EMCON or GPS denial (via INScentric timelines and waveform agility).

Targeting and Stores Management (Context)

The Block III commonly pairs with the WMD-7 class targeting pod for Earth Observation (EO)/laser designation. Stores management software spans Beyond Visual Range/Within Visual Range (BVR/WVR) A2A (e.g., PL-15/PL-10 families where integrated), precision A2G glide weapons (e.g., LS-6/GB-6 series), maritime missiles (e.g., C-802/CM-802AKG), and Suppression of Enemy Air Defence (SEAD) options (e.g., LD-10), with page sets for Pre-Planned (PP) and Target-Of-Opportunity (TOO) flows.

Growth, Maintenance, and Sustainment

The Block III's avionics were specified with sustainment in mind: fast LRU swaps, accessible trays for radar/EW modules, and support tooling for BIT and calibration at PAC depots. Software refresh cadence is governed by flight-safety gates and cyber/crypto policies (secure-boot, PKI, and emergency key revocation). These practices tie directly to sortie-generation metrics and underpin the PFX goal of shortening the sensor/software upgrade loop.

WEAPONS INTEGRATION AND STRIKE CONCEPTS

The Block III shifts the JF-17 from a budget multi-role fighter to a BVR-first light fighter with credible standoff and SEAD options, while preserving growth room for PFX spirals in radar/EW and networking. This section summarises air-to-air, air-to-surface and maritime, and SEAD/DEAD integrations for procedural context.

Table 2: Block III Avionics—Indicative Subsystem View

Domain	**Representative Block III Direction**
Radar	KLJ-7A AESA: TWS, multi-target engage; SAR/GMTI; improved ECCM
DAS/EW	RWR + MAWS + CMDS under EW manager; interfaces for escort/stand-in jamming
HMI	Wide-angle HUD; HMD/S; enlarged MFDs; HOTAS workflow
Mission Spine	Open-architecture computer; partitioned SW; deterministic fusion middleware
Datalink	Secure, sovereign-crypto ready; AEW/GBAD hand-off; EMCON/GPS-denied resilience
Targeting	WMD-7 class pod integration; PP/TOO page sets for precision A2G
Sustainment	BIT, modular LRUs, depot calibration paths; secure-boot/PKI for updates

Air-to-Air (BVR/WVR)

BVR: Open-source imagery and defence reporting in 2024–25 confirm the carriage of the PL-15/PL15E family on JF-17 Block III airframes, marking the platform's intended move to a long-range BVR posture. Earlier SD-10/PL-12 remains in service as a cost-effective medium-range option and for mixed loads.

WVR: The PL-10E combined with the Block III HMD/S provides high off-boresight cueing and closein agility. The cockpit/HOTAS updates and datalinked track symbology shorten the sensor-to-shooter loop in merges.

Air-to-Surface and Maritime

The Block III's stores management and mission computer support a mixed A2G/maritime loadout consistent with prior public material on the JF-17 family. Representative categories include:

- **Precision Glide Munitions:** LS-6/GB-6 families (pre-planned and target-of-opportunity workflows), providing JSOW-like employment logic;
- **Maritime/Land-Attack:** C-802/C-802AK (pre-planned and inertial/radar-guided antiship) and. CM-802AKG man-in-the-loop cruise missile (TV/INS), used for land/sea targets depending on the variant.

- **Targeting/Sensor Pods:** The WMD-7 EO/laser pod for search/track/designation and LGB guidance. Cockpit pages provide PP/TOO flows, video, and line-of-sight cueing.

Operational specifics vary by customer configuration and export controls; in all cases, standoff employment doctrine integrates AEW hand-offs and GBAD deconfliction through the datalink layer.

SEAD/DEAD

For suppression and destruction of enemy air defences, Block III leverages the LD-10 Anti-Radiation Missile (ARM), an ARM derived from the SD-10/PL-12 body with a passive seeker for emitter homing. In PFX spirals, EW orchestration (RWR/MAWS, AESA-assisted jamming, and escort jammer control) is intended to reduce EW fratricide and to shape survivable ingress/egress windows for ARM shots.

Stores Management, Datalink Employment, and Fusion

The Stores Management System (SMS) communicates with weapons via a MIL-STD-style digital bus and presents PP/TOO flows for glide weapons, ARM hand-offs, and antiship profiles. The fusion layer combines KLJ-7A tracks, EW cues, HMD/S line-of-sight, and AEW datalink tracks for mid-course updates (BVR) and Launch Acceptability Region (LAR) computations. PFX targets sub-200 ms AEW→shooter hand-off to improve first-shot probability in BVR stacks.

Configuration Variance and Export Posture

Exact weapon compatibility depends on customer licensing, export approvals, and software baselines. Programme practice emphasises partitioned software so export tiers can be configured without exposing sovereign ECCM, threat libraries, or datalinks.

EXPORTS, SUSTAINMENT, AND MRO IMPLICATIONS

The PFX treats sustainment as a design domain, not an afterthought. PAC Kamra's factories, notably the Avionics Production Factory (APF) and Aircraft Rebuild Factory (ARF) provide the industrial backbone for line, intermediate, and depot maintenance, with an explicit roadmap to expand radar/EW repair and software sustainment as the PFX spirals mature. For export users, the same infrastructure enables MRO, spares pooling, and upgrade paths aligned to partitioned software baselines.

Sustainment Philosophy and Industrial Posture

The near-term goal is assured readiness: keep Mission-Capable (MC) rates high via fast LRU swaps, strong depot capacity, and tight feedback from flightlines to engineering. Structurally, the JF-17 programme already localises a majority share of the airframe and final assembly at PAC Kamra; the PFX shifts more of the high-value sustainment into avionics/radar/EW, shortening upgrade loops and insulating fleets from external shocks.

Table 3: Representative JF-17 Block III Weapons Integration

Family	Role	Integration Notes	Source
PL-15/PL-15E	BVR AAM	Block III carriage shown in 2025 imagery/reporting	Open reporting
PL-10E	WVR AAM	HMD/S cueing; high off-boresight employment	Open reporting
SD-10/PL-12	BVR AAM	Legacy/medium-range; mixed-load use	Open reporting
LD-10	ARM (SEAD)	SD-10-derived ARM; emitter-homing employment flows	Open + sim procedures
LS-6/GB-6	Glide A2G	PP/TOO flows; standoff profiles	Open + sim procedures
C-802/C-802AK	Anti-ship	Pre-planned inertial/radar antiship profiles	Open + sim procedures
CM-802AKG	Cruise (MITL)	Man-in-the-loop TV/INS (land/sea variants)	Open + sim procedures
WMD-7 pod	Targeting	EO/laser designation; LGB guidance pages	Open + sim procedures

The APF originated as a radar maintenance centre and now covers a wide span of avionics work, including repair/overhaul and MRO for ground and airborne radars, integration, and production support.

PAC Kamra Roles (APF/ARF) and Today's Scope

The APF originated as a radar maintenance centre and now covers a wide span of avionics work, including repair/overhaul and MRO for ground and airborne radars, integration, and production support. ARF executes overhauls for fighter/trainer/transports (e.g., JF-17, F-7P/PG, K-8, C-130 props), plus structures and accessories. These roles let PAC perform depot-level inspections, structural work, and avionics repair under one campus, reducing cycle time for major checks and upgrades.

Radar and EW Sustainment Under PFX

The Block III's KLJ-7A AESA introduces new MRO needs: array health monitoring, subarray T/R module test, and calibration within anechoic facilities. PFX spirals add:

1. Array and RF benches: verification of T/R gain/phase, noise figure, sidelobe control; environmental/thermal screens
2. Calibration infrastructure: near-field scanning, boresight tools, and automated Built-In Test (BIT) upload paths.
3. EW complex MRO: DRFM jammers, ESM/ELINT receivers, DASS integration (RWR/MAWS/CMDS) with orchestration middleware.
4. Sovereign software sustainment: beamforming/ECCM code, EW threat-library curation, secureboot/PKI pipelines for field updates

These investments make radar/EW support domestic, cut shipping delays, and enable faster mode insertions (e.g., SAR/GMTI refinements, cooperative EW behaviours).

Supply Chain, Spares and Repairables

To stabilise MC rates, PAC's provisioning model builds buffer stocks of high-failure LRUs and dual sources items that cannot yet be localised (notably RF semiconductors and high-power GaN/PAs). Repairables flow to the APF benches for triage and board-level fix; rotables (e.g., pumps, actuators) cycle through ARF. Standard work cards and failure trend dashboards drive procurement and obsolescence actions.

The PFX incorporates Condition-Based Maintenance (CBM): streaming health data from engines, avionics, and AESA BIT are analysed to predict failures and schedule interventions.

Condition-Based and AI-Enabled Maintenance

The PFX incorporates Condition-Based Maintenance (CBM): streaming health data from engines, avionics, and AESA BIT are analysed to predict failures and schedule interventions before Aircraft On Ground (AOG) events. International practice (e.g., the US Air Force's PANDA predictive-maintenance programme) shows that Machine Learning (ML)-driven anomaly detection and fleet-wide pattern mining can raise availability and reduce life-cycle cost; the PFX adopts the same principles with sovereign toolchains and on-prem data lakes for security.

Software, Data Rights, and Export Baselines

Sovereign control of mission-computer images, radar/EW firmware, and threat libraries is central to MRO. PFX standardises:

- Partitioned baselines (sovereign vs. exportable) so exports can be supported without exposing core ECCM or crypto.
- Secure-boot/PKI across mission computers and radios, with emergency key revocation procedures and audit trails.
- Tooling in-country: build servers, code-signing, calibration databases, and EW library management hosted at PAC/NASTP.

Export Customer Support and Regional Hubs

For export operators, PAC offers MRO and line-mod services backed by Kamra depots, with options to stand-up second-line hubs (inspection benches, calibration rigs, spares vaults) in-country. Software partitions allow feature tiering to match licensing; common training syllabi and documentation reduce error rates and turnaround time.

Indicative Sustainment Key Performance Indicators (KPIs) (Planning Targets)

Table 4: Illustrative MRO KPIs for JF-17 Block III/PFX Spirals

Metric	Target (illustrative)
Mission-capable (MC) rate	≥ 0.80 baseline; ≥ 0.85 with CBM fully deployed
Depot TAT (C-check equivalent)	≤ 45 days (airframe); ≤ 20 days (avionics bay)
AESA MTBCF uplift	+25–40% vs. baseline within 24 months
Repair yield (avionics LRUs)	≥ 85% first-pass at APF benches
Spares coverage (critical LRUs)	18–24 months buffer; dual-source where possible
Software release cadence	Quarterly non-safety updates; semi-annual radar/EW mode drops
Crypto response	Key revocation/rollover < 5 minutes fleet-wide

CONCLUSION

This article set out the PFX programme as a systems-first path that shifts the centre of gravity from airframes to avionics, electronic warfare, mission computing, and sovereign datalinks. The JF-17 Block III operates as the practical bridge: the KLJ-7A AESA, an integrated defensive-aids suite, an open mission computer spine, and a cockpit with HMD/S that together enable a BVR-first posture and rapid capability insertion. The programme logic consolidates a decouple, spiral, and reintegrate model through the PFX-Alpha, using in-service airframes to mature radar, EW, and software increments while de-risking the eventual air vehicle. The industrial posture at PAC Kamra anchors structures, MRO, and avionics work, and provides the scaffolding for deeper ownership of beamforming, EW libraries, and secure waveform management. Within this architecture, weapons integration across A2A, A2G/maritime, and SEAD is framed as an expression of the avionics spine and datalink fabric rather than a standalone catalogue. Sustainment is treated as a design domain, with APF/ARF capacity, condition-based maintenance, and partitioned software baselines positioned to keep availability high and upgrade cycles short. In sum, the PFX is presented as a governance and integration pattern that continuously inserts sensor, software, and network effects across the force, with the JF-17 Block III as the near-term carrier and the industrial base in place to sustain momentum.

ADDITIONAL SECTIONS

Present Status of the PFX Programme and Proposed Timelines

Public-domain reporting indicates that Pakistan's "JF-17 PFX (Pakistan Fighter Experimental)" was publicly displayed as a scale model at IDEAS 2024 (Karachi). The concept was described as a "4.5-plus Generation" fighter direction, with an ambition—reported from statements at the event—that development could be completed before the end of the decade.[8] At this stage, open sources do not provide a publicly verifiable prototype/flight-test timeline or an official milestone plan in the public domain.[9]

In parallel to the longer-horizon PFX concept, open reporting also points to a near-term, incremental pathway: Pakistan's NASTP has been linked to an "Operational Capability Upgrade (OCU)" effort for the JF-17, described as "PFX Alpha," with emphasis on radar and avionics upgrades and potentially

8. Bokhari, n. 1.
9. Ibid.

expanded munitions integration.[10] From an assessment perspective of the open source reporting, the observables are: (a) a publicly signalled concept programme at IDEAS 2024; (b) a stated emphasis on sensors/mission systems sovereignty; and (c) a structured bridge via JF-17 upgrade increments ("PFX Alpha/OCU") while the broader PFX air-vehicle pathway evolves.[11]

Impact on India and the Regional Neighbourhood

For India, the PFX is best assessed as a modernisation signal rather than a single-platform determinant: it indicates Pakistan's intent to improve the effectiveness of its air combat system through sensors, electronic warfare, networking, and weapons reach. In such competition, the decisive margin increasingly lies in resilient command-and-control, secure communications, and the ability to compress the sensor-to-shooter cycle under contested electromagnetic conditions. India's doctrinal and institutional direction provides a clear, stability-oriented frame for such challenges. India's Joint Doctrine emphasises safeguarding sovereignty and national interests across the spectrum of conflict through robust deterrence, while also underscoring that military power should be integrated with other instruments of national power, reflect national values, and align with international norms—remaining an instrument of last resort.[12] The Indian Air Force (IAF) Doctrine similarly notes that diplomacy is the first option for conflict resolution and that military power provides deterrent capability to reinforce diplomacy when required.[13] Accordingly, the practical implications for India are best framed around reinforcing national security outcomes: deterrence, readiness, and escalation control through three capability priorities: networked air defence

10. "PAF's NASTP Sets Upgrade Path for JF-17 (or 'PFX Alpha')," CombatAircraft.com, December 9, 2024, https://www.combataircraft.com/en/News/2024/12/09/PAF%E2%80%99s-NASTP-Sets-Upgrade-Path-for-JF-17-%28or-%E2%80%98PFX-Alpha%E2%80%99%29/. Accessed on November 17, 2025.
11. Ibid.
12. Joint Doctrine, Indian Armed Forces, PDF, https://bharatshakti.in/wp-content/uploads/2015/09/Joint_Doctrine_Indian_Armed_Forces.pdf. Accessed on November 18, 2025.
13. Doctrine of the Indian Air Force, 2022, PDF, https://cms.spacesecurityportal.org/uploads/IND_Doctrine_Air_Force_832d5b6c62.pdf. Accessed on October 13, 2025.

and resilient C2: the Air Force Network (AFNET) was publicly described as the IAF's digital information grid enabling net-centric operations and forming an enabling backbone for integrated air operations.[14] Indigenous long-cycle capability and industrial depth: the Advanced Medium Combat Aircraft (AMCA) programme execution model has been approved to strengthen indigenous defence capabilities and a domestic aerospace industrial ecosystem.[15] Weapons and seeker sovereignty: the Defence Research and Development Organisation (DRDO)/IAF flight tests of the Astra BVRAAM with an indigenous RF seeker underline continued progress in critical sub-systems and performance validation through national test infrastructure.[16] At the regional level, a sustained Pakistan pathway of incremental upgrades and external subsystem flows can influence procurement and planning among neighbouring air forces. For India, however, the most consequential counter remains the same: preserve a credible, defensive deterrent posture and a modern, integrated airpower system that protects India's airspace and national interests while supporting regional stability.

14. Press Information Bureau, Government of India, Ministry of Defence, "Antony Dedicates AFNET to the Nation," September 14, 2010, https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=65739. Accessed on November 13, 2025.
15. Press Information Bureau, Government of India, Ministry of Defence, "Raksha Mantri Approves Advanced Medium Combat Aircraft (AMCA) Programme Execution Model," May 27, 2025, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2131528. Accessed on November 13, 2025.
16. Press Information Bureau, Government of India, Ministry of Defence, "DRDO & IAF Conduct Successful Flight-Test of Astra BVRAAM with Indigenous Radio Frequency Seeker," July 11, 2025, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2144118. Accessed on November 13, 2025.