Pakistan's Air Defence

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Air Defence (AD) involves the employment of a combination of passive and active measures to nullify or reduce the effectiveness of an enemy air attack. An effective AD system must be able to detect, acquire, identify, intercept, and destroy or neutralise a target before its weapons are released. The components of an efficient AD system are the AD sensors, weapon systems, an effective centralised command and control infrastructure and a secure communications network to link them all. The effectiveness of an AD system, thus, is heavily dependent on its surveillance and early warning systems to provide time in which a range of weapon systems can react against the threat. The degree of success of AD operations depends upon factors such as the quality and timeliness of intelligence, the assurance of detection, response times of weapon systems and the ability of elements of the AD system to remain operational while absorbing battle damage.

Since its creation, Pakistan's doctrines, strategies and policies have remained Indo-centric and defensive in nature and scope. To this end, Pakistan's AD setup came of age in late 80s when it contracted Hughes and Siemens to field; integrated AD Control & Reporting (C&R) systems. With little strategic depth, she had no option but to adopt a forward defence posture with all her AD resources. PAK AD is fully integrated, tri-service organisational setup and rated to be highly efficient. The philosophy of Air Defence has thus been:

- Guided by centralised control of all AD weapons.
- Concept of Area Defence.
- Achieve air superiority over its own air space and battlefield.
- Main weapon likely to be an aircraft.
- SAMs are likely to be used as inner layer of defence.

- In TBA, low flying ac to be engaged by SAMs and AAA.

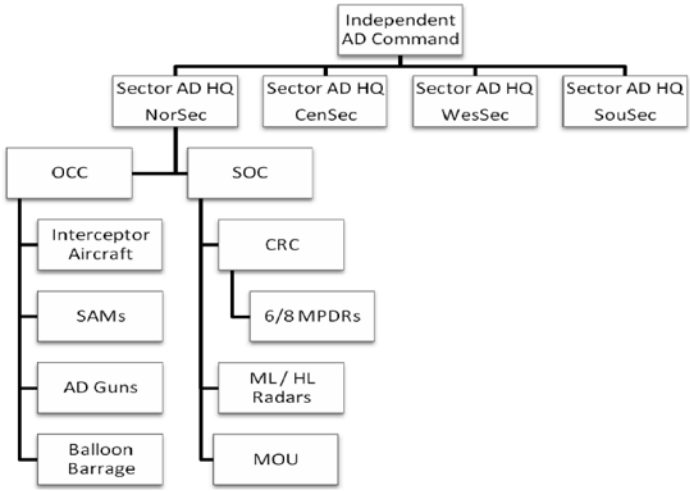
The overall responsibility of the defence of Pakistani airspace is entrusted to PAF in which it is assisted by the other two services and civil defence organizations. The organisation of PAF AD is based on following parameters:

- Nature of threat–From low level (100' AGL) to high level (40,000'AGL).
- Extent of cover–Requirement of a dense radar cover for the protection of VAs/VPs, especially in the Punjab sector and Karachi area.
- Minimum Early Warning–The minimum early warning required for effective interception needs to be 90km for low level attacks and 110km for high level attacks.
- Air Defence of Tactical Battle Area (TBA)–The necessity to locate radars close to the likely TBA to provide assistance to aircraft operating in support of land operations and also to detect and counter air threats in the TBA.

AD structure

The importance of Air Defence in Pakistan's doctrine can be gauged from the fact that it has an independent AD Command based at Chaklala, Rawalpindi. The organisation chart is illustrated in figure 1. Although earlier, the Air Defence

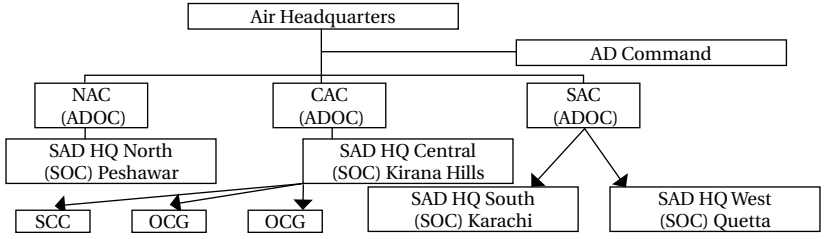
Figure 1



Command exercised control over all AD assets, its present role is restricted to coordination, training and induction of new systems and ADGES. The operational

role is with the respective operational commands. There are four Sector Operation Centres (SOC) HQs subordinate to and co-located with the ADOCs. Early warning is provided in three layers – first by the Mobile Observation Units (MOUs), followed by two layers of MPDRs and finally AR-1/AR-15s providing early warning to selected VAs/VPs. The Control and Reporting Centres (CRC) are responsible for interception of tracks picked up by the associated radars.

The Operational Control Centres (OCCs) are co-located with the SOC. The role of the OCC is to directly control all AD operations within its own area of responsibility. It is responsible for controlling and initiating tactical action on all tracks picked up. It exercises minute to minute control of all AD weapons within its AOR.



Control and Reporting System

PAF has a very efficient and modern AD system which has automated digital data links and SILLACS (Siemens Low Level Air Control System) which provides a comprehensive automated air picture of control of the battle including threat assessment, weapon allocation, interception control and logistic control in real time. The air picture constitutes sensor feeds of the radars as well as inputs from the weapon systems.

MOUs: PAF mobile observer squadrons form the first line of human sensors in the AD C&R chain. They have equipment to feed the details of the sighting directly into the AD communication chain.

MPDRs: These are sophisticated specialised and highly mobile radars deployed in chain along the eastern border of Pakistan.The MPDR 45/60/90 (depending on the maximum detection range) radars provide a near gap free multilayered low level cover along the entire border with India. The system is SILLACS and CRC compatible.

GCI/Surveillance Radars: GCI/Surveillance Radars like AN/TPS 43 G and AN/FPS 20 detect hostile targets at long ranges and evaluate their threat potential, guide interceptors on to the intruder and warn the other specialised AD system

for acquiring more precise target information to counter the threat. The coverage of these radars is deep into the Indian Territory.

SILLACS (Siemens Low Level Air Control System): SILLACS is primarily designed to counter air attacks by providing reliable detection, computerised data processing and secure communications for immediate transfer of information for timely tactical action. It is a compact, mobile and independent system which has be integrated into the overall AD setup. The system consists of Mobile Pulse Doppler Radars (MPDRs) deployed all along Pakistan's eastern border. MPDRs are low looking radars of different ranges. Data from these radars is fed in real time to a Control and Reporting Centre (CRC) which receives, processes and evaluates of target data from the associated MPDRs. One CRC may be fed by upto 8 MPDRs. The system has secure voice and data exchange network through which CRCs are linked to SOCs, ADOCs & Air Defence command at Air HQs.

Hughes C3I Air Defence Ground Environment System (ADGES): The Hughes ADGES was interfaced with SILLACS in the 80s. It is a C3I system which provides a commander an up-to-date air picture in real time and provides computerised evaluation of multiple threats and also indicates the available options.

Airborne Early Warning and Control (AEW&C): PAF, in 2009, inducted first of the four Saab 2000 Erieye aircraft. The aircraft's Erieye radar has a range of 450 km and is also capable of identifying the type of aircraft and the weapons it is carrying. Erieye is connected via data-link to the PAF's command and control ground environment as well as combat aircrafts such as the F-16 Fighting Falcon. Four Chinese ZDK-03 AEW&C aircraft have also been ordered, of which two had been delivered by December 2011. Pakistan is to have a total of eight AEW&C aircraft. These will substantially increase the early warning for Pakistan.

PAF AD Weapons

Interceptor Fighter Aircraft: These form the first line of defence. F-16, Mirage-IIIE, F-7P, F-7PG are the air defence aircraft. Some of these are equipped with AI radars providing night interception capabilities.

Surface to Air Missiles (SAMs): Rather than investing in larger mobile SAMs, Pakistan has opted for flexibility by procuring a large number of shoulder fired SAMs.

Crotale: It is a short to medium range AD system. Pakistan has 05 squadrons, each squadron comprising of two acquisition units and four firing units. MIRADOR II is the acquisition Radar for Crotale SAM. The radar is intended to operate against low and very low flying targets (50-3000M). The maximum

calibrated range is 18 KM and the minimum is 02 KM. It is primarily intended for point defence. MIRADOR II also has optical or TV tracking mode. The effective maximum range of Crotale is about 8.5 km against a fighter class of aircraft and 13 km for helicopters. Crotale missile system is deployed by PAF at airfields. Crotale is expected to be slowly replaced by Spada 2000.

Spada 2000: A low to medium altitude air defence system consisting of a radar with 60 km range and four 6-cell missile launchers. The missile can intercept enemy missiles and aircraft at a range of over 20 km. Pakistan is expected to have 10 batteries, the delivery of which are all expected to be completed by 2013 with further orders possible.

RBS-70 AD missile system: It is a man portable, jam proof, quick reaction missile system. It can be used independently or can be integrated with an acquisition radar. The radar specially made to be integrated with RBS 70/70+ is Giraffe PS-70/R. Giraffe radar even though designed to be used with RBS-70 SAMs, can be adopted for use with any type of short range SAM system or gun system. The radar is designed to detect very low flying targets and is linked with a number of firing units for precision target designation. The radar has a range of 40 kms in surveillance mode and is reduced to 20 kms in designation mode. The RBS 70's guidance for the missile is beam rider (laser). The maximum range of the missile is between 3-5 kms depending on target parameters. The missile is effective up to a height of 3.0 Kms within its launch envelope. By itself, it cannot be deployed to protect VA/VPs effectively and instead is likely to be deployed as a supplement to another SAM system.

MANPADS: The advent of the modern fighter with its high speeds and stand-off weapons has made the use of anti-aircraft guns redundant. Man Portable Air Defence Systems (MANPADS) will be more effectively used against aircraft both at VA/VPs and over the TBA in the future. However, the deployment of this missile is only limited to a clear line of sight or in elevated places.

Stinger: The stinger has been basically designed to pick up the target visually and fire. The guidance system is passive IR homing which means its got a seeker head which picks up IR radiations from the target aircraft. The maximum range is 5 Km and the maximum height at which a target can be engaged is 4.8 Km. During a conflict they are likely to be deployed in TBA in support of the Army. They are unlikely to be deployed for airfield defence.

Anza: The Anza is an indigenous man portable SAM system produced with Chinese collaboration. It has a Passive IR homing head. The maximum range is 4.5 km and the maximum height at which a target can be engaged is 2.5 km.

Mistral: The Mistral missile is a French man portable tripod launched missile. It also has a passive IR homing head. The maximum firing range is 6 km and the maximum altitude for engagement is 4.5 kms. It is expected to be deployed for airfield defence either independently or along with the Crotale or Spada 2000. They have also been deployed at the high altitude areas.

SA-7: These are first generation of Russian man portable SAM. Not effective against modern fighters. They may be on the verge of being phased out along with similar Redeye missiles.

Balloon Barrage: PAF has six balloon barrage wings which provides cover to the selected VAs and VPs. The balloons are expected to be used in conjunction with Crotale missiles.

Pakistan Army

Similar to PAF, Pakistan army has also combined all its AD resources under one separate AD command based at Chaklala Army Cantonment in Rawalpindi, the same as PAF AD command. It functions directly under GHQ Pak Army. It allots all AD resources as attachments to operational forces and is responsible for peace time operations similar to PAF AD command. The Army Air Defence has three AD Divs and 12 AD Bde HQs. Each AD Bde has different AD Regts under it. The deployment is expected to be a mix of MANPADS and AAA, with the SAMs forming the outer ring. The regiments are therefore of two types:

Type I - These are equipped with:-
4x35mm twin Oerlikon guns + sky guard radar
8 x RBS -70 + SAMs with Giraffe radar.

Type II - These are equipped with:-
6X 37 mm AA Guns and 6 X 14.5 mm Quad A-A Guns.
8 RBS-70+ with Giraffe radar.

Control and Reporting System: Overall Pakistan Army C&R system is organised as follows:-

- AD operations centre co-located with HQ Air Command.
- Sector Operation Centres (SOC) located with Sector AD centre. SOC is linked to CRC.
- Operations control centre located within each AD zone.
- Army regiments maintain communication with SOC, thus SOC becomes a hub centre at sector level. The regiments also establish link with AD brigade HQ and the field army.

Pakistan Army AD Weapon Systems

All AD weapons systems held by Pakistan Army fall in the category of short range AD systems (SHORADS). Besides the MANPADs, these consist of LLAD guns, both Radar Controlled (RCGs) and Manually Operated (MOGs).

Battlefield Surveillance Radars: The Early Warning is provided by the overall AD network through the OCCs. The main battlefield radars are RASIT and RB 12 A. These are highly mobile pulse Doppler radars with a range of 30- 40 kms. They can distinguish between personnel, vehicles, and aircraft. The system is deployed on vehicles (although it can be removed from its mount and placed on the ground).

Low Level AD Guns: (RCGs) RCGs offset the limitations of MOGs by replacing estimated data inputs with accurate data. Accuracy is also backed up by employment of computers, which may be part of the fire control radar or a separate system.

- 35mm Oerlikon Gun System–It is deployed with the Sky Guard FCR which controls and coordinates the firing. The search radar can scan an area up to 20 km and locks on the target at 14.5 km. The radar can track one target at a time and provide data to three guns. The range of the gun itself is 4 km. An additional TV camera enables aircraft recognition. The system can be employed both against aerial and ground targets.
- 57mm Medium AD Gun System–Each battery/FU comprises 8 guns, 01 fire control computer and 01 FCR. While operating with FCR, all the 8 guns simultaneously engage the target (one target at a time). However, against targets detected at short ranges of less than its max range of 6 km or in case of mass raids, the guns have the capability to visually engage multiple targets. Due to the inherent limitation of comparatively longer reaction time and low rate of fire, the system is less responsive against successive raids and the hit probability is relatively low.
- 40mm BOFORS (L60)–These are older versions of the L70s used by the Indian Army.

Low Level AD Guns. (MOGs): The bulk of the Pakistan's AD units are equipped with towed MOGs-37mm Twin and 14.5 mm Quad AD guns. Reliance on manual operations, simple construction, immunity to jamming and minimum logistic requirements makes MOGs highly suitable for rugged and sustained military operations.

- 37mm AD Gun–Effective against aircraft but has relatively low rate of fire and maximum range of around 3000m. It is therefore always paired with 14.5 mm Quad gun and is likely to be integrated with SAMS in future conflicts.
- 14.5mm Quad Gun–It offers a relatively high rate of fire. Its high rate of fire is effective against hostile aircraft, but it lacks lethality against modern aircraft. It is therefore always paired with 37 mm AD gun and is also likely to be integrated with SAMS in future conflicts.

Conclusion

The 'lack of strategic depth', which has consistently bothered Pakistan's defence forces has resulted in sufficient emphasis being laid on its air defence. This resulted in a relatively sophisticated AD network which could provide near real time composite AD picture at all levels of command and control. It has large number of radars that give near gap free cover at low level. A well integrated AD network reduces the chances of confusion and fratricide. The primary weapon system was the fighter aircraft supplemented by large numbers of MANPADs and AAA for VAs/ VPs and TBAs.

There have been large setbacks to Pakistan's procurement programmes in the last decade. It has thus not been able to keep pace with the advances in military technology. It is severely outnumbered in its AD fighters which are now being made up with two squadrons of F-16s and procurement of Chinese JF-17s. The induction of AEW&C aircraft has however made a huge contribution to Early Warning. It still needs to procure sufficient replacements for its older SAMs and AAA. Till these are procured, it will offer large vulnerabilities in Air Defence, especially in the TBA.

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