# C⁴I² SR IN AD THEATRE SETUP

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## Introduction

Everything in today's world is happening at a great speed. Be it aircraft, weapons or computing, all are in a competition with themselves to outdo their recent performances. This has led to a complex problem of war fighting in an **electronically dense hostile environment** thus stretching and stressing every cell of the operator. Fully automated environment is a blessing, but a semi-automated one stretches every sinew of the decision maker. Conduct of C⁴I²SR operations in a smooth and seamless manner thus achieves greater importance as it endeavours to **integrate** the **machine logic** and the **human intelligence**. Success in such a complex environment is totally dependent upon **secure and redundant communication** backbone protected from enemy intrusions. Besides the above, **interoperability** between the **systems and manpower** is the game changer which is achievable only thru intense training sessions.

**Confusion** at overlap zones of responsibilities, similar weapons, defending same geographical area and **Fog of war** aggravate the already complex environment which can lead to fratricide and thus loss of clarity required in quick and correct decision making. This can lead to an entirely different outcome of war than envisaged. This gives rise to the requirements of an **Air Defence System** such as the **Theatre Command** for planning and conduct of Air Defence operations thus cutting down on the **delays** and **confusions** which would otherwise prevail due to many agencies operating within the same area.

This article deals with the urgent requirements of dealing with the enemy in a most professional and effective way. The requirements of joint training in simulated and live environment play a great role in sharpening the skills of operators and achieving a very high degree of team spirit.

**Requirements**

A joint **Tri-services** team needs to be put in place to carry out the following tasks in a time bound manner. This team should also have **retired officers** of all operational branches and should **not** be dominated by **any service/ branch**. Requirement of retired officers is a critical necessity owing to their vast experience and ability to express freely.

This team will **define Theatres** covering India and neighbouring countries and **assign** sensors and weapons accordingly. Their **locations** can also be defined based upon the existing threat thus ensuring optimal use of the weapons, no fratricide and safe conduct of operations by the three services. These can be subsequently changed depending upon the situation in that Theatre. Sufficient trained manpower as recommended by the team needs to be stationed in each theatre. No subsequent cutting down of the manpower should be done for the same settings/ task/ role of the Theatre.

Post commissioning, extensive **joint** theoretical and simulated/ live training on Conops, Weapon capabilities and their usage, integration with other elements of three services etc. needs to be carried out. The same trained lot, after they attain seniority should define new Conops besides revising old/ existing Conops.

**Defining roles and tasks** for three services needs to be clearly spelt out so as to have specific weapons for such roles. This would lead to clarity in the use of available weapons and reduce chances of multiple weapons on the same target situations.

Setting up of the Command and Control structure can be handled easily;

however, in a **highly dynamic scenario**, integration of **Radars, Imagary, Aircraft, Weapons** etc. to get ideal solutions taking into consideration their **capabilities, restrictions** imposed by various SOPs/ air and the actual situation on ground is a Herculean task which is likely to fail unless aided by state of the art technology like **Artificial Intelligence**.

To meet the challenges involved in airspace protection and reap the benefits of integrating the **sensors, communication** and **weapon systems**, most defence forces require field proven automated solution that support Tactical, Operational and Strategic level of operations.

The present system in use by the IAF is truly scalable and can be customised for use by the operators in a theatre command. This varies from **multi-level, multi-agency, multi-sensor, multi platform** and **multi C⁴I²SR centre** configuration down to a standalone C⁴I²SR centre (setup that is capable of operations either as a **sub-part** of the Theatre Command **OR** during progress of war, operating independently in areas which are cut-off from/ added to the existing Theatre AoR. The system is **interoperable** with other defense and civil systems and incorporates **state of the art algorithms, mathematical models** and **AI based techniques**. The details of their integration are already spelt out and the current system caters to the same.

Some of the prominent features of the desired system for exploitation by the operator at a Theatre operations centre are mentioned below:-

- **Sensor Integration.** All ground, sea, air and space based sensors of the armed forces/ civil spread far and wide shall be integrated at command centres using available communication networks and a common **Recognized Unambiguous** operating picture will be generated for the conduct of seamless operations.

- **Communication Integration**. The available communication of all forces located at different geographical locations shall

be integrated at the command centre using the available networks. The system can handle **voice and data** exchange with the operators at the remote ends.

- **Flight Plan System.** The flight plan system shall integrate the **civil** flight plan system and also provide the interface for entering the **Mil** flight plans. The system shall automatically perform **collision checks** on receipt of flight plans and also after the aircraft are airborne and suggest resolution in case of collision and also issue clearances to the flights.

- **Identification.** The system shall automatically identify aircraft by usage of **algorithms** on the basis of **Flight Plans**, **IFF, Target signatures** etc.

- **Surveillance System.** The system provides automatic surveillance features by continuously monitoring the airspace and provides alerts and corrections for aircraft likely to violate the existing rules/ SoP. Alerts on friendly aircraft transiting thru or operating over TBA and suitable weapon control orders will be generated for deployed weapon systems.

- **Danger Assessment**. The system continuously scans the airspace and automatically calculates the danger posed to protected assets from enemy platforms. Alerts are provided to the operators in real time.

- **Weapon Solution.**  The threatening target is assessed to automatically suggest best suited weapon (Aircraft/ Missiles/ Guns) to neutralize the threat at the earliest. The system automatically generates **guidance commands** for friendly **Fighters** and **solutions** for the **Weapon systems** enabling them to intercept the hostile airborne objects.

- **Recovery Solution**. The system generates suitable

**guidance commands** for recovery of friendly aircraft based on their specific type/ condition.

- **Display System**. Display in **2D** and **3D** and a highly configurable **user friendly GUI** are the hallmarks of the Display system.

- **Record and Replay.** This module will provide a record of **synchronised** audio and video recordings. This is of great relevance in the analysis of incidents / accidents and effective training of the operators.

- **Simulation.** Simulator provides a **cost effective** means of near real-time training of the operational crew. State of the art simulator which can create scenarios based on enemy deployment of sensors, weapons etc. and using own forces against them will be the hallmark of effective training. The system will also provide analysis of the **operator actions**, **kill validation** etc.

- **Security.** The entire system is protected from **external threats** using multi layer security. **Defence-in-depth** measures of cyber security such as Access control, Data confidentiality, Data authentication, Integrity, Non-repudiation are critical features of the system. To meet these features cyber security technologies including biometric access control, end point security, system hardening, communication security, data encryption (including logs related to system and new versions) etc. will be used.

- **Database.** A robust and redundant database is the heart of the system and will provide seamless operations round the clock. The high end requirements are planned to be met by **resilient database design** having comprehensive industry-standard technologies like active-active clustering,

database auditing, database security for data at rest and data in transit, database firewall solutions and real time data replication solutions across distributed network.

- **Maintenance and Sensor Watch Planner.** This is tool which takes away the major time load of the operators involved in manual planning. It takes into consideration the time a sensor has operated / any restrictions defined, maintenance due, coverage required in a specific geographical area etc.

- **Inventory Status and Planning Tool.** The system will keep a track of various inventories such as weapons, fuel, oil, lubricants, ration, arms and ammunition etc. and provide advance alerts for procurement / replenishment of the same. Equipment hours used and remaining will help in planning their day to day usage.

## Suggested AD Setup at Theatre Level

Following is the proposed setup at the Theatre level for seamless conduct of operations leading to subjugation of the enemy:-

- A Tri services war plan based on relevant Conops should be drafted for such an Air Def Theatre Command. It needs to define the roles and responsibilities of all elements within its AOR.

- The senior most Fighter Controller (Designated as the **Theatre AD Commander** is proposed since this is the **only** profession which is exposed to all aspects of **integration and exploitation** of sensors, weapons, flying operations etc.) in the Theatre AOR who should be the decision making authority under whom Tri-services assets should be placed. The **Theatre AD Commander** will be reporting to the CDS from whose office conduct of operations will be monitored

and controlled. Similarly all other Theatre Commands should also be controlled by the same authority for easy and quick co-ordination amongst all.

- Under the Theatre Commander AD needs to be placed one officer of each service (Designated as the **Deputy Theatre AD Commander** IA, IN and IAF). They will execute all orders given by the Theatre AD Commander using a customised S/W solution providing them with **assessment of Danger** and the **optimum Weapon solution** for neutralising the perceived threat. The operators will also have the facility of report generation, saving and replaying the events at their disposal. Physical safety and redundancy will also be the hallmark of the C2 centre.

- Under each of the Deputy Theatre AD Commanders will be multiple **warrant ranks**, each responsible for a defined number of weapons deployed in the field. The will pass **weapon control orders** and receive **acknowledgements** using encrypted data and voice channels. The entire communication will be in redundant mode so as to ensure NIL communication losses / delays.

**Conclusion**

The tremendous technological developments in the recent years has not only increased the lethality of the aircraft/ airborne threats but has also resulted in concurrent development of equally lethal weapons to counter the threat from such aircraft/ airborne threats. Such high speed and gap exploiting aircraft, operating over friendly **vulnerable areas** and **vulnerable points** provide minimal time for their **Detection, Identification, Interception** and **Destruction.**

**Stealth technology**, exploiting enemy **radar gaps** etc. reduces the detection time considerably; this, coupled with more accurate **Stand**

**Off weapons** further reduce the time available for their **identification**, **calculation of quantum of threat** and choosing **best suited weapon** for neutralising the threat. The situation is further aggravated when more than one service (Army, Navy or Air Force) is operating in the same theatre of war. Moreover, the new scenario wherein a war could only be limited to a specific geographical area with all other flying (civil aircraft) taking place as usual is bound to result in a massive strain on the Command and Control agencies as the co-ordination required for incident/ accident free operations while maintaining secrecy of the missions is of a very high order.

An ideal situation would hence be to have all the resources viz. Sensors, Visual means, Intelligence, Aircraft, UAVs, Weapons, Communication, Electronic Warfare elements etc., located within an **Area/ Theatre** under the command and control of a single agency to deal with the threat in an effective manner.

Another critical issue that needs immediate attention and redressal is the **delayed finalisation/ freezing** of requirements and **scope creep** that lead to extended timelines for roll out of the product when made by the Indian industry. Besides, this various **procedural** and other constraints result in slow acquisition (from foreign OEMs) thereby **impacting training** and **exploitation** of state of the art weapons and sensors. Thus need of the hour is to immediately address these issues particularly in the prevalent uncertain and hostile geo-political environment.

The only mantra is to have a Theatre command **manned** by highly trained and motivated operational staff as suggested before. It may seem impossible while it is being discussed, however, the only way forward is to form the same and have multiple scenarios being practised in a **simulated environment**. This has to followed by a **thorough analysis**

arriving at gaps and loopholes which are then translated into Conops, should be the way to move forward. Such an approach will be the most effective in operationalising the new concept of an Air Defence Theatre Command.

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