UNIT - V

TOPIC-1

MILITARY WEAPON APPLICATIONS

Initially the high computation capability of computers was utilized in major weapon systems and Electronic Warfare (EW). With the advent of microprocessors, each and every area of military equipment and operations has been pervaded by computers. The need for accurate and timely information is vital for Defence. Computers with their high speed and unlimited storage are revolutionizing the concept of warfare. It is believed that in the years to come, major battles will be fought in laboratories, rather than in the battlefields. In fact the Gulf war (covered in Chapter 5) has made a beginning in high technology warfare using computers and electronics.

Rugged Computers

Microprocessors are replacing most of the instrumentation of artillery guns. The tactical boards are being replaced by video display boards displaying real-time battle situation. The entire computation for setting of the guns for azimuth and elevation depending on environmental conditions and charge used, is being entrusted to field-grade ruggedized computers. Figure 5.1 shows the R1630 model of Digital Micro Vax I1 ruggedized computer, meeting military specifications for field use.

Tracked Vehicles

In Armoured Fighting Vehicles (AFV), the battlistic computers are relieving the tank commanders from the task of consulting complex tables and then making judgement, by providing accurate information for engaging the enemy tanks and tactical targets. A ruggedized PC with efficient software can pi-ovide the tank crew valuable information on terrain, obs'tacles, routes and state of the vehicle. Integrating it with

reliable communication of the squadron would increase manifold the efficiency of the amoured fighting column.

Night Vision

Microprocessor-controlled night vision systems are increasingly being used in basic infantry and anti-tank weapons for higher accuracy during nights. Mobile computer systems are being employed for a wide range of communications networks and general purpose computing needs at forward field locations. Figure 5.2 shows one such high performance mobile computer
system, which is easy to operate, is transportable, operates on vehicle power system and is designed to military specifications.

Fly-by-Wire Fighters

Complex computer systems are essentially required for high performance fighter aircraft, as time is of essence in all air battles. Extensive use of microprocessor-based cockpit instrumentation ;s made to give accurate and timely information to the fighter pilot. Separate on-board computer systems to assist in navigation in adverse environmental and tactical situations are also provided. Figure 5.3 shows the US Navy's all-weather attack aircraft A-6F cockpit instrumentation, which was redesigned using computer technology. Computerized fly-by-wire flight control has been introduced on most of the high-speed aircraft for better response. The fly-by-wire concept was developed for aircraft in which the traditional level of natural stability has been exchanged for a high level of instability, thereby benefiting performance, weight and cost. F-16 and F-18 of the US Air Force are both marginally stable aircraft, but have fly-by-wire systems for safe agility and pilot protection at high angle of attack.

Advanced Tactical Aircraft

Almost all tactical aircraft being used by the air forces of different countries make extensive use of computers for various on-board applications. The ATF (Advanced Tactical Fighter) being designed for the US Air Force will be even more dependent on embedded computers than was its ancestor, the F-16. ATF has the distinction of being the first weapon system to be completely coded in ADA from engine control boxes to tactical computations. Aircraft are also using microprocessors for airborne instrumentation for transmitting flight data for processing and displays. Figure 5.4 is a typical example of an airborne instrumentation subsystem which is mostly based on the latest microprocessors.

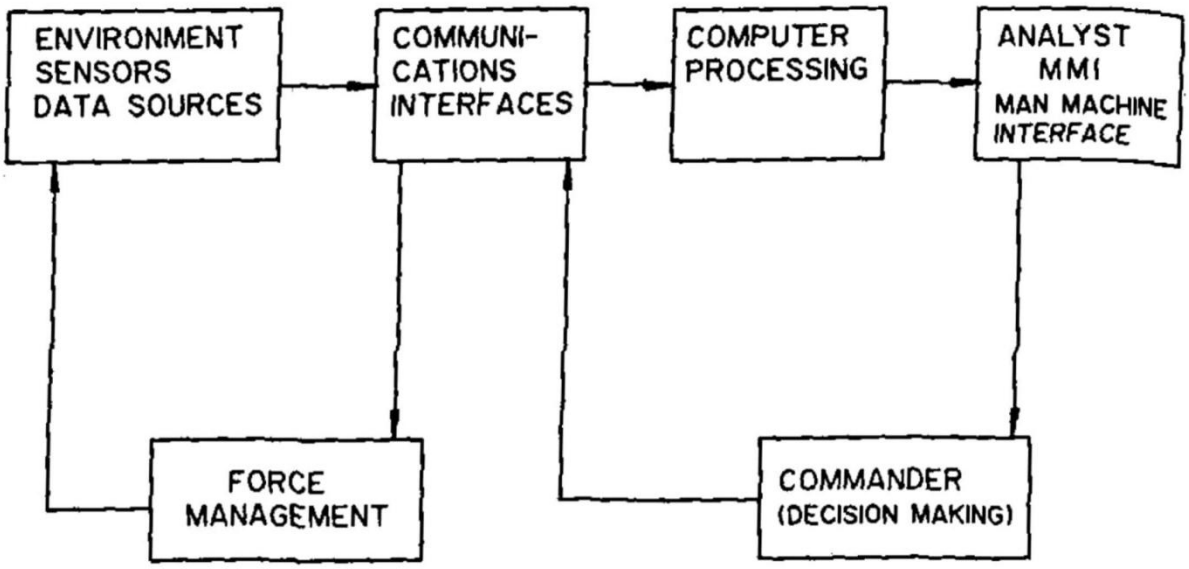
Missiles

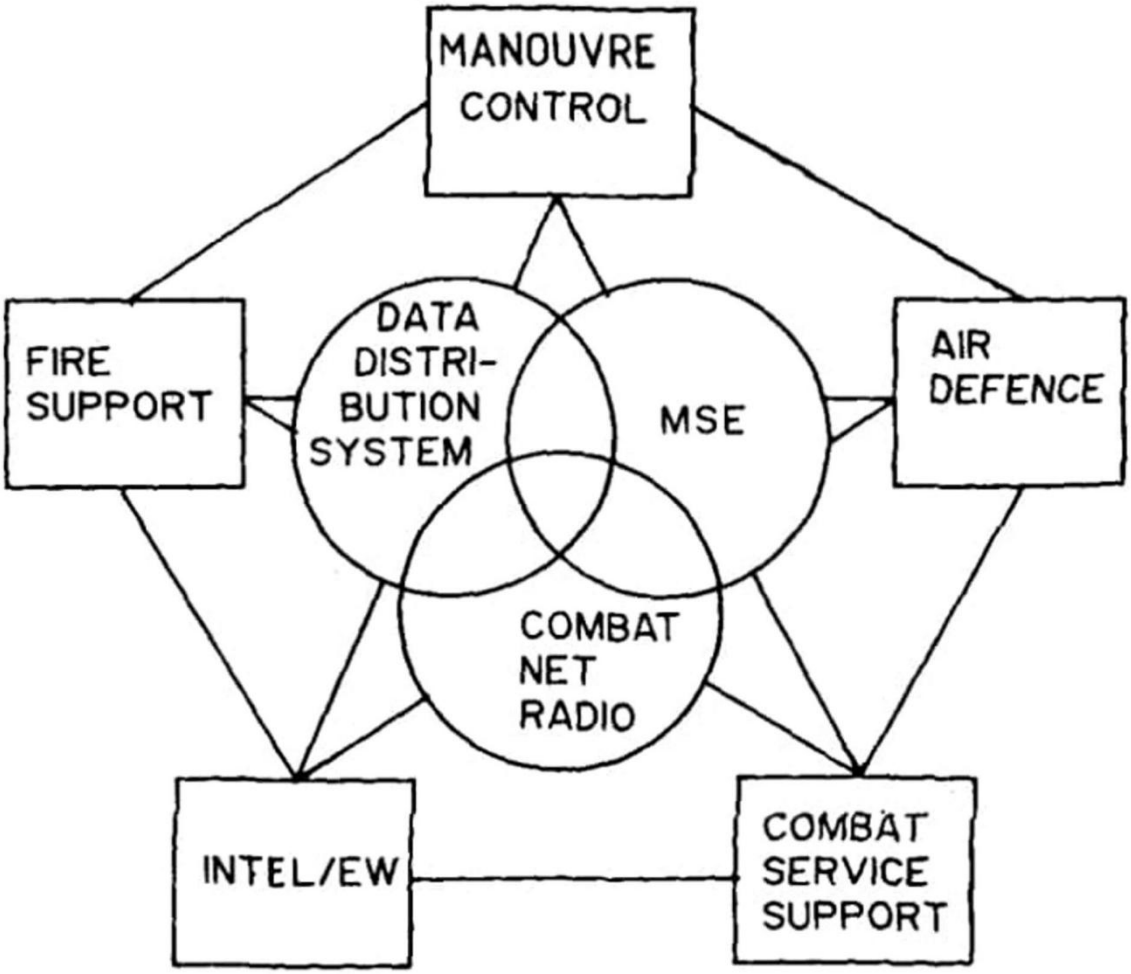
In all types of strategic and tactical missile systems, extensive use of mini and microcomputers is made to improve their accuracy. In surface-to-surface ballistit and cruise missiles, a very powerful on-board processor capable of image processing is used to navigate the missiles to the target. In air-to-surface missiles, microprocessors have extensively been used to process on-board parameters to correct their course. In suface-to-air missiles, both in the ground and the on-board systems powerful computers are utilized to ensure high probability of hit. Even in India's Integrated Guided Missile Development Programme (IGMDP), extensive use of computer

technology has been made by DRDO. The successful launch of Agni is attributed to the use of computers in a big way. In the words of Dr APJ Abdul Kalam, Chairman, Programme Management Board of IGMDP, 'There were two major ways of checking obt Agni. One was the Hardware In-Loop Simulation (HILS) technique and the second the multi-mode automatic check-out. At various stages, until the missile actually reached the launch site, we did various tests and all deviations were recorded and it was put on hold, unless it met the required parameters'. DRDO had last year successfully test-fired Prirhvisurface-to-surface missile having a range of 250 km. Both Agni and Prithvi use strap-down inertial navigation in closed loop guidance system, with on-board computers for guiding the missile in its flight.

Airborne instrumentation subsystem controlled by Intel 8086 microprocessor

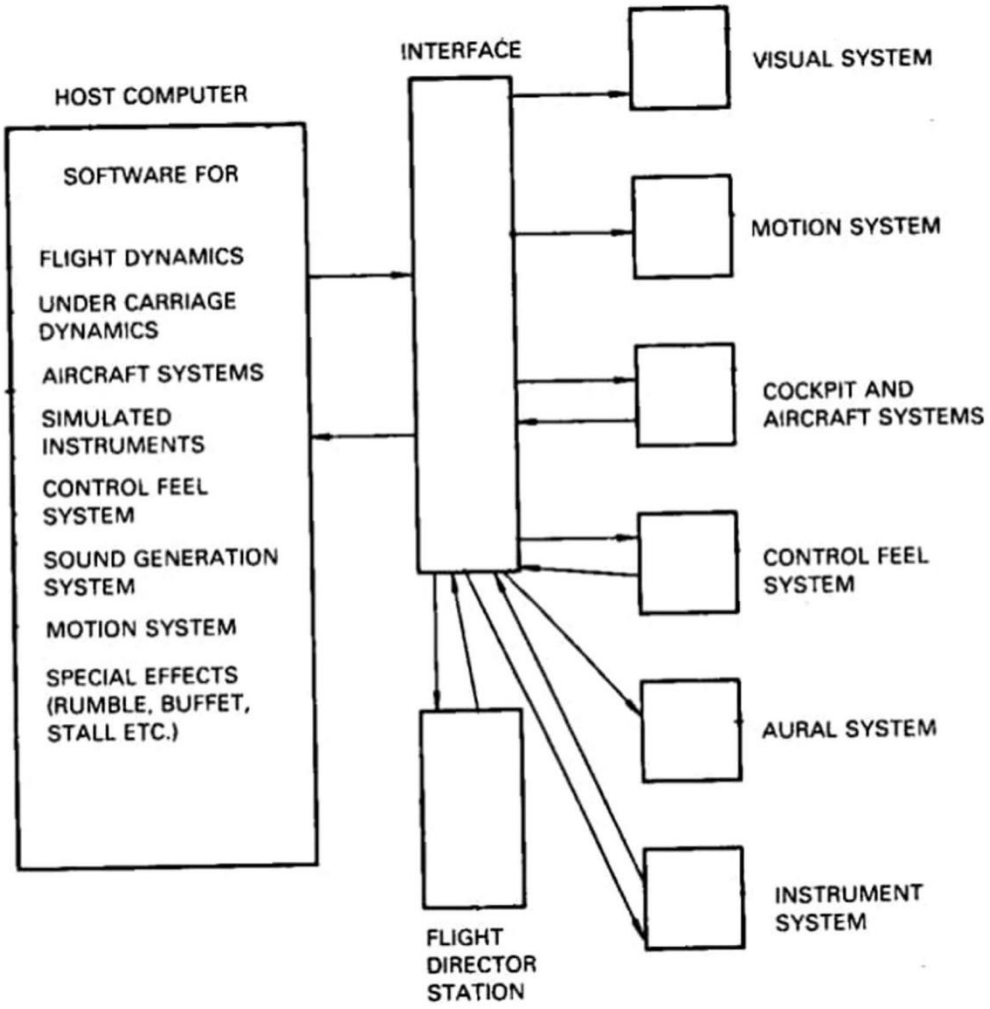
Artist's view of data integration for C^3I system





Block diagram of Army command and control system

Seventh US Army's AN/UYO 30 tactical computer system



Typical flight simulation facility

The use of strap-do\vn inertial guidance system is claimed as a pioneering effort by DRDO against the' conventional platform guidance system, using stabilization by gimbals. In Agni and Prithvi missiles, the gyros and accelerometers are strapped-on and they give their output to the computers, which instantly convert it into inertial measurements. By extensive use of computer technology both the missiles have been able to achieve trajectories very close to the predicted and simulated paths. The other projects under IGMDP, i.e., Trishul, Akash and Nag are utilizing computer systems for design and testing. Nag, the third generation 'fire-and-forget' anti-tank missile, uses computer-based image processing for acquiring the target and then 'homes on' to it.

UNIT-V

TOPIC-3

MIS APPLICATION IN DEFENCE

Pay and Allowances

Probably the first Management Information System (MIS) application of computers was in the area of pay and allowances. Pay and allowances of Service officers, as well as combatants have been computerized and are functioning satisfactorily. By and large, the working level has been convinced about their utility. All such software packages have to be maintained and are regularly modified based on various revisions of pay structures and emoluments.

Inventory System

A large number of major depots/establishments holding high volume of inventory have been utilizing computerized inventory systems for effective control of inventory. Regular ABC analysis, as well as provisioning actions for critical inventory items are being taken by the computerized inventory systems. However, there is a need to integrate various inventory systems held in different depots to ensure overall control of the inventories.

An effective control of inventory would result in taking preventive measures for dead stock and time expired items.

Weapon/Equipment Status

Weapon/equipment status is required to be monitored at regular intervals, especially by the Defence Services to find out their readiness for war.
Though some action towards computerization has been taken, most of such information is still being handled manually primarily because of its classified nature. It is felt that equipment weapon status can be computerized to give more accurate record, so that timely action can be taken for procurement/ discardment of vital equipment. Present computer technology provides a certain degree of secrecy and security for the database, so that the same is not vulnerable.

Production Planning and Control (PPC)

A large number of workshops in Defence, including DRDO, have sophisticated machinery for undertaking design production of various systems/sub-assemblies. Most of these machines are being handled by manual job scheduling, thereby resulting in their non-optimal
utilization. A number of efforts have been made to develop efficient computerized production planning and control systems, incorporating job or machine scheduling, which could be used by major workshops/production units in Defence.

Project Management

Project management of various time bound tasks by the Services, as well as Defence Public Sector Undertakings and DRDO, needs an efficient management system to monitor the various activities for timely completion of the projects. Unfortunately, very few computer applications in this area have been reported. Attempts are being made to develop a computerized programme management system utilising DBMS approach for monitoring and control of the vital projects. With increase in complexity and cost or time of the projects, we can ill-afford the delay in implementation of an efficient computerized system for project management.

Maintenance~Diagnostics System

For battle-worthiness of weapon systems or equipment, there is need for regular periodic maintenance by specialist agencies. Efficient
computer-based diagnostic systems can find effective use for the management, in reducing Mean Time To Repair (MITR). Very little effort has been reported in this area also.

Military and defense software provide military personnel and military contractors with operational support and administrative tools. This software consists of intelligence gathering and tactical communication tools, and radar technology. Also, IoT management software and military asset tracking, as well as specialized software such as Command Management Information Systems (CMIS). Vendors specializing in software for the military often serve exclusively this vertical or other verticals as well, including public safety, aviation, and machine vision or other machine technology.

Features of Military and Defense Software

Military and Defense Software provide the following capabilities:

- Radar technology, enemy location and vision
- Operations support and centralization (e.g. via CMIS)
- Tactical communication, military messaging, handsets & other hardware
- Armor and vehicle management and other asset management
- Aerial technology & aircraft management
- Personnel management
- Battle management (e.g. tactical oversight of assets and personnel)
- Battlefield management, area surveillance

UNIT-V
TOPIC-3

PERSONNEL MANAGEMENT

With the type of tenure rotations of the Defence Services, the personnel management system becomes very important to provide job satisfaction, as well as career prospects to all officers and staff working in Defence Services. Even in DRDO and other Defence Establishments, the need to provide suitable manpower for different jobs needs careful planning and implementation. An efficient Personnel Management system using computers can help' in meeting some of the important requirements of the management.

Thus computer systems have major applications in almost all areas of Defence. The Army, Navy and Air Force are already using a number of weapon systems employing embedded computers. Mainframe systems are also being used as central facilities.

Management Information Systems is a trigger scientific area for all aspects of life. From the business point of view, the military area is an important sector for the using of MIS. This is not only important for decisions or correct behavior of systems but regarding answer speed and connectivity with other systems. Today's military operations are similar to business systems with more complexity and more risk factors. Therefore there are implemented many software applications for a different area in the military. On the other hand, military uses a standard application as well, such as ERP, HR or inventory control.

Many operations research and planning systems were firstly implemented in the military area and then in business or industry areas. Military applications are a trigger for many areas. Today applications are the same with the using of the internet or big data, and the military is a trigger for other sectors again. This trigger can be interpreted regarding business models, concepts, national and global innovation strategies and education. The central aspect today is digitalization.

Today's military applications depend on some technological developments, one of them being information and communication technologies, which are used to digitize information and integrate systems at all stages of mission development and mission life, both inside a part of systems or cross-systems. It depends on decentralization, virtualization, interoperability, real-time capability, and service orientation. Technology trends are forming the building blocks for applications. Industry 4.0, big data and analytics, augmented reality, simulation, additive manufacturing, the cloud, cybersecurity, the (industrial) internet of things, horizontal and vertical system integration, and autonomous robots and software integration. These technologies will lead to higher efficiencies and change traditional applications for specialized applications, suppliers, producers, and customers, as well as between human and machine.