



## **PATHWAYS FOR INDIAN AEROSPACE PROGRAMMES : NEXT 25 YEARS**

R.M. Vasagam\*

The centenary of Wright brothers' flight of a heavier than air vehicle has recently been celebrated all over the world. The advent of airplane has transformed the means of transport across continental distances and ways of fighting a war. Similarly the field of Astronautics based on rocket propulsion has emerged as the backbone of creating manned and unmanned space systems in less than 50 years with the launch of Sputnik on 4th October 1957. As climaxing events the flight of US \$10M Ansari X-prize winning Space Ship One vehicle and the X - 43 A Scram jet touching Mach 10 are demonstrating the marriage of aircraft, rockets and advanced air breathing engines to pave the way for exciting new developments in aerospace systems. A US \$ 50M Ansari prize has been announced for space tourism with reusable vehicles.

A whole new industry has come into existence using space systems for communication, remote sensing and space sciences. Worldover US \$1000B have been spent so far for the space programme and annually about US \$30B is earmarked for the space programme every year. More than 8000 transponders in more than 200 geostationary orbit satellites are a vital component of domestic and international communication systems. Imaging by Tens of satellites are enabling monitoring the weather, water resources and natural calamities. Robotic spacecraft are engaged in mapping the planets and their moons. The US \$ 60B International space station is in implementation phase. Hubble and Chandra Space observatories have contributed to unravel the mysteries of the stars and the early days of the expanding universe after the Big Bang.

India with its modest share of US \$ 0.5B budgetary allocation annually has demonstrated the imaginative and selective application of space technology for accelerated national development as envisioned by Dr. Vikram A. Sarabai. It is in its 42nd year of the first launch of a sounding rocket from Thumba on 21st November 1963. The programme has grown manifold and the decade pro-

files have been achieved well within the projected cost and time estimates. Indian programme has been a role model for the entire world.

Similarly the design and development of combat and transport aircraft and missile projects are progressing to meet the needs of our country in a self reliant manner.

At this moment goal setting for next 25 years is in order. The key themes to be focused are

- Serviceable long life satellites and space platforms
- Partly / Fully reusable space transportation systems with eventual man rating
- Marketing of the system and services globally including the emerging areas of space tourism.
- Closed cycle life support systems for biological payloads and manned missions
- Self reliance in aircraft design, development and manufacturing
- Cost effective missile systems for national defense
- Enlarging the role of industries to emerge as total solution providers and
- Nurturing the youth to pursue career in aeronautics and astronautics

The key space technologies yet to be mastered are

- Space based Navigation systems
- Microwave Remote sensing
- Air breathing propulsion

---

\* Vice Chancellor, Dr MGR Educational and Research Institute (Deemed University), Periyar E.V.R. High Road (NH4 Highway), Maduravoyal, Chennai-600 095, India

*Keynote Address presented at the National Seminar on "Aerospace Opportunities and Challenges (AOC 2004) - Indian Scenario" held at Vikram Sarabhai Space Centre, Thiruvananthapuram during 3-4 December 2004*

- Advanced materials and manufacturing process and facilities
- Rendezvous and docking in orbit
- In orbit servicing of satellites and space platforms
- Ballistic and lifting entry vehicles
- Robotic vehicles for lunar and planetary missions
- Solar power satellite technologies
- Space processing of materials
- Use of resources on Moon
- Nuclear and Electric propulsion
- Man rating of Space Vehicles
- Space debris management

Similarly the missions for cost effective defence will need technologies for

- Unmanned air vehicles including micro air vehicles
- Airborne early warning systems
- Inflight refueling systems
- All electric aircraft
- Missile shield
- Command, communication and control systems

An orchestrated plan to develop and exploit the opportunities in the Aeronautics and Astronautics field may involve close to 100000 strong work force. The infrastructure has to cope for eight space launches a year - two for communication, two for remotesensing, two for outside customers and two for science and new technology testing. 500 transponders for communication provided by 12 satellites in GSO, 12 imaging satellites in polar orbits and

their associated ground systems may become the vital national assets with rewarding returns. Similarly the reliable cost effective defence capability and enhanced defence effectiveness using force multipliers will prove to be highly rewarding in aerospace sector. The need for 100's of aircraft and helicopters for civil aviation calls for joining international consortia as partners in development and commercial exploitation. The US \$ 50 B world market for Aircraft maintenance is an area worth pursuing immediately.

The catch phrase of NASA - "Better, cheaper and faster" is apt here. The Clementine mission and Lunar prospector and Mars Rover missions are examples of such an approach which has made turn around times from decades to years and mission costs down to million from billions of US \$.

Routine Economic Access to space will be based on launch costs coming down by two orders of magnitude and turn around times for flights with reusable hardware coming down to hours and days. Any contribution to usher in Space Tourism will go a long way to establish the long term viability of the space programmes.

The orbital manufacturing and solar power satellite systems are equally challenging for Indian aerospace teams. Enabling technologies have to be mastered at the earliest.

European Commission projections on European Aeronautics : Vision 2020, OECD projections on Space 2030, New Space Initiatives of NASA, Chinese and Japanese space plans upto 2030 and reinvigorated Russian plans delineate exciting programmatic goals. India should formulate its 25 years Aerospace programme in tune with the approaches recommended in CII - TIFAC Vision 2020 Strategic Industries Panel report.

Let India emerge as a pioneer in originating innovative and newer solutions in the aerospace field to meet its own needs and also the global demands with its abundant technical talent and visionary leadership.