

PRESIDENTIAL ADDRESS

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INTRODUCTION

Air Chief Marshal AY Tipnis PVSM, AVSM, VM, ADC Chief of the Air Staff, Mrs Molina Tipnis, President AFWWA (Central), Air Marshal JS Rai AVSM VM & Bar AOC-in-C Training Command, Mrs Pamela Rai, Lt Gen R Jayaswal AVSM, PHS, DGAFMS, Surg Vice Admiral JC Sharma, VSM, PHS, DGMS (Navy), Lt Gen SC Verma PHS, DGMS (Army), Padmashree Dr Naresh Trehan, Dr MS Thimmappa, Dr T Varghese, Padmashree Dr G Padmanabhan, distinguished guests, delegates and my dear friends.

It is my privilege to welcome our Chief Guest and Chief Patron of the Society, Air Chief Marshal AY Tipnis, Chief of the Air Staff and Mrs Molina Tipnis, President AFWWA (Central), on this occasion of the inauguration of the 40th Conference of the Indian Society of Aerospace Medicine. They have been gracious to spare time from their busy schedule and be with us here today. A number of our distinguished guests here this morning have been friends and well wishers of the society for the past many years. To them and to each one of you I extend a very warm welcome.

The Society is honoured today, by the august presence of Padmashree Dr Naresh Trehan, Executive Director Escorts Heart & Research Centre, a well renowned cardio thoracic surgeon not only in India but as well as on the International platform. He has been selected this year for delivering the prestigious Air Mshl Subroto Mukerji Memorial Oration. This morning he will be giving us an insight into - **The new frontiers in the management of cardiac and cardiovascular disorders**. I am sure that everyone in this audience is eagerly awaiting the Oration lecture by Dr Trehan.

Unlike in the past years, this year in addition to the Oration we have with us three renowned guest speakers - they are Dr MS Thimmappa Registrar, Bangalore University who shortly after Dr Trehan's talk will be speaking on - **stress management**. On the subsequent days we will be having Dr T Varghese, Ex Director of the National Institute of Communicable Diseases, speaking to us on a topical subject - **Overview of Disaster management - The Indian perspective**. This is indeed very relevant in today's scenario. Last but definitely not the least, is Padmashree Dr. G. Padmanabhan, Emeritus Scientist & Honorary Professor, Department of Biochemistry at the Indian Institute of Science, Bangalore. He will be deliberating on the subject - **Molecular Medicine in the next millennium**.

This Society from its humble beginnings in the early 50's has come of age. Over the last 4 decades it has grown in size and stature and is today a pioneer in the field of Aerospace Medicine in this country and

for that matter in this part of the globe. It has attained National and International recognition and the expertise of the specialists here are comparable to the best available in any part of the world. The basic ideology of this Society is to enable aircrew to exploit the aviation environment to its extreme, to help them successfully accomplish their mission and then to recover them safely.

During this conference issues related to the ideology of the Society will be addressed. Major aeromedical problems which have been a constant bane, will be covered in the form of symposia, such as High-G physiology, Spatial Disorientation, Human Error Accidents, Disaster Management and Ejection related issues. Besides the symposia there are a host of meticulously planned scientific sessions to deliberate on a wide spectrum of aeromedically related issues of concern. Dedicated sessions on Civil Aviation Medicine, Military and Naval aeromedical problems, research and developmental topics from the DRDO labs and a special session earmarked for the Association of Physiologists and Pharmacologists of India. This conference will also be having a Continuing Medical Education programme in the form of Medical and Surgical update sessions and I am sure most of us will definitely benefit from these.

This society is now poised on the threshold of the next millennium-52 days to be precise for the big event. A simple question comes to mind - **Do we have the requisite knowledge and expertise to enter the next century and face the challenges of the future?**

AEROSPACE MEDICINE IN INDIA - THE PRESENT PERSPECTIVE

To begin with, we can look back and be proud of those pioneers who in the 1950's gave a thrust to the fledgling Speciality of Aviation Medicine in this country and set up this Institute. This Institute has and is, the nodal point of most Aviation Medicine related activities in the country and stands out singularly as a Centre of Excellence. It is renowned for its work in the areas of Human Factors, Environmental Physiology, High-G Physiology, Human Engineering, High Altitude Physiology, Human Factors, Aviation Accident Pathology and Hyperbaric Oxygen Therapy. For this I commend you all.

Over the past decades we have had thrust upon us certain aeromedical problems afflicting both the military and the civil aviation scenario. I must say with pride that we accepted these challenges head-on invariably came up with innovative and workable solutions. A case in point is the entrance of ASF class of aircraft into the IAF inventory in the 80's and the 90's. Along with the entry of these aircraft a whole load of aeromedical problems were encountered related to the High-G environment, Spatial Disorientation, Cockpit Workload and Situational Awareness. Though handicapped with aging equipment, we have addressed these problems squarely and in a justifiable manner. On the Civil Aviation front, new medical standards have been evolved keeping in line with the latest developments in the Medical world and which has benefited many an aviator and for that matter the airline as well.

Another major area of achievement which I would like to make a mention about and which will be a part of our destiny, is the realms of Microgravity, its related problems and Space Medicine. This Society and Institute took important steps way back in the mid 70's to further our expertise in the field of Space

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Medicine, so that by the time cosmonaut Rakesh Sharma was launched, we were fully qualified and had the technical know how. This stood us in good stead during the subsequent joint Indo-US space mission in the mid-80's. Unfortunately due to a tragic accident with the space shuttle we did not have a second Indian in space. This Institute has done some pioneering work in areas of Cardiovascular de-conditioning due to Micro-G, Vestibular Instability and Musculo-skeletal degradation. A number of these studies were done in collaboration with scientists from Russia under the aegis of the ICMR.

This Institute has also been in the fore front of Human Engineering activity in the country and has been extending support to the aviation industry. Experts from here have been closely related in the design and development of work stations, aircraft-pilot interfaces, cockpit layouts and the design of aircrew equipment assemblies for a large number of DRDO agencies and for the Indian aircraft industry. To make special mention, is the work related with the design and development of the ASWAC, ALH and now the LCA projects.

AEROSPACE MEDICINE - THE FUTURE PERSPECTIVE

The remarkable upswing in scientific inquiry during the nineteenth and twentieth centuries has provided mankind with basic new insights into the natural laws governing the physical environment. Armed with this knowledge, modern society has systematically developed an interlacing set of technologies enriching the quality of life and providing additional scientific tools to gain even more knowledge. The exponential rise in computing power is one of the most important and pervasive factors likely to shape the technological future of aviation. By this power, there is a new understanding of biologic mechanisms which has wide sweeping implications for the detection and prevention of disease, selection and training of individuals for task specific roles and the design of advanced operator machine interfaces. The complexities and range of applications characteristic of today's aerospace technology transcend even the wildest imaginings of the early pioneers. Consistent with this trend, the exciting advances in aviation have catapulted modern aviation into the aerospace age.

The field of Civil Aviation is all set to explode in the years to come. Designs for New Large Aircraft are already catered for in the software of manufacturers and are projected to carry large numbers of passengers. Long term planning pioneered by Northrop has produced the concept of a flying wing the "Spanloader" airliner. With the use of new composite materials and hydrogen fueled engines, large flying wing passenger airliners are conceivable by the year 2030 that could carry in the neighborhood of some 5,000 passengers. The Concorde SST has been the harbinger of advanced civil airliners flying at twice the speed of sound and at altitudes of 50,000 feet or more. Today NASA is conducting studies to further explore options leading to the development of High Speed Civil Transport which will fly at speeds in excess of 2.4 Mach.

The unrelenting demand for increased performance in frontline combat aircraft has required military aviation research and development to remain on the leading edge of technology. The demands placed on the pilot of modern combat have become increasingly complex. The speed of battle has increased to the point where the pilot is allowed only seconds to assess the situation and take appropriate action. He is expected to sustain continuous operations under adverse conditions and penetrate high threat environ-

ments to strike with pinpoint accuracy. These issues have driven the development of high technology solutions.

With the next generation of combat aircraft the timely management of cockpit information will be one of the critical factors. The virtual world technologies hold promise for meeting this challenge. Such a cockpit is basically one in which the crew member wears - a highly specialized helmet system that incorporates miniature imagery, 3-D virtual display optics, 3-D audio display generators, head and eye sensing elements and a high fidelity voice control interface. Also the operator-machine interface will focus on a general purpose software assistant equipped with a high level of Artificial Intelligence to take over certain cockpit chores. This form of holistic fusion will markedly reduce the workload of the pilot and assure optimal situational awareness.

The manned fighter aircraft quite likely will be around well into the twenty-first century. The emphasis is on technology that will allow fighters to survive and win in combat. In pursuit of this, there is great interest in a particular area of technology that goes under the generic title of "supermanoeuvrability (SM). SM aircraft are capable of significant excursions and accelerations in the X and Y directions as well as sustained Gz load factors, by the use of thrust vectoring and incorporation of new canard and wing geometries. These types of capabilities is generally referred to as the post stall manoeuvring. While technology can be used to produce SM fighters, it might be the physiological capabilities of the human pilot that could put the upper limit on manoeuvrability. For example, the pilot will become Spatially Disoriented when his aircraft moves against intuition and experience. It may take extensive training to get used to flying sideways, flying at attitudes well into the stall regime, or being able to point the nose up or down without climbing or diving. It is envisaged that every sortie will have some component of SD.

For acceleration physiology there is both good and bad news. While the SM aircraft manoeuvres reduce the level of Gz accelerations, the Gx and Gy accelerations will now increase. One area of concern would be head restraint in this sort of situation. Further, the physiological tolerances of high Gx and Gy accelerations will need to be researched as pilots will be pulling G's in directions never done in the days before and stresses will be placed on the human body which have never before been investigated.

With these newer types of aircraft on the horizon, there will be a requirement for doing a whole lot of new research in acceleration physiology in novel axes and under high angular rotation rates. More spatial orientation research will be needed to adequately prepare and equip aircrew for this new environment. Much of this will only be accomplished on advanced Centrifuge based Dynamic Flight Simulators.

Less than three decades have passed since the first person ventured into space. Humans are now on a threshold of a new era of space activity that will see extensive use both in the military and commercial fields. To move towards achieving this goal a permanent orbiting research and development test centre will be needed such as the planned Space Station Freedom. The space station will provide the environment for the conduct of scientific experimentations and investigations on the countermeasures with respect to Micro-G effects on bone, muscle and other bodily systems. From here space crews will explore the nearby

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planets and beyond. Once a significant level of space presence is achieved the process of space colonization can proceed in earnest.

In step with all these scientific breakthroughs man is the weakest link. Solving the biomedical aspects of space flight is decisive in any manned endeavour. The Aerospace physician will have to play a crucial and vital role. He will be charged with the sacred duty of launch, mission completion and safe recovery of all space voyagers. All life support-sustaining systems and protective equipment will be under his overall care and supervision. He will have to come up with innovative and unique solutions to counter the varied stresses of space flight and a near Zero-G environment.

Aerospace Medicine will eventually progress into Intergalactic Medicine that would involve aspects of Genetic Engineering for biological adaptation on austere planets, telemetric medicine for inter-planetary diagnosis and therapy of injuries and sickness and Cryo-medicine for deep freezing space crew for long duration missions.

CONCLUSION

The direction in which we are headed is quite clear - Aerospace Technology will spearhead the development of the Human race in the future. We will see a multitude of advanced flight vehicles fill the skies, Supermanoeuvrable combat aircraft with edge-of-the-envelope flight regimes, Hypersonic flights, Virtual reality cockpits, software generated co-pilots, utilization of Artificial Intelligence, high fidelity voice recognition systems, gigantic civil airships and cargo carriers.

Mankind is now on the threshold of a new era of space activity. Space stations, inter-planet and inter-stellar travel, colonization of space are going to be common place activities. Carl Sagan the noted astronomer has with respect to the end of this world stated - that eventually the Sun on its way to becoming a red giant star will swallow the Earth.. we will need to leave the Solar system. Space colonization will be a necessary investment in the future of human life in the universe and if we are to preserve our species from a Malthusian doom. In this great venture of mankind to conquer the final boundary, the Aerospace physician will be there in the forefront.

Remember ladies and gentlemen that - **"Science fiction of today, is the reality of tomorrow"**. Whether we are looking into our past or charting our future, understanding life on Earth and its relationship to the Solar System and the Universe is crucial. Therefore let us not rest on our laurels, but rededicate our efforts to work towards this goal - a better tomorrow and a better future.