



**Dr Silvio Finkelstein**

## **MEDICINE ABOVE THE CLOUDS**

### **INTRODUCTION**

This story of a love affair with a non-traditional medical discipline began in 1955 when I was conscripted as a soldier and inducted into the Argentine Air Force. At that time, military service was compulsory in Argentina and males 20 years of age were drafted to serve for at least one year. As such, I served in the Air Force for fourteen months. Since I was already a fourth year medical student, my military assignment, in addition to standard soldier's duties, was to the National Institute of Aviation Medicine, a unit in which physicals for pilots were given and where my specific scientific interest started.

I am very grateful to my many friends, students and colleagues in the five continents whose repeated requests for a narrative account of my worldwide adventures prompted me to write down these notes. In addition, my deepest gratitude is extended to my wife and children, whose patience and understanding allowed our adventurous travels throughout the world permitting an easy adaptation to the many interesting environmental and cultural changes in our lives.

The year 1955 was one in which an internal revolution deposed the President of the Nation, General Juan D. Perón, and substantial reforms in the country's social, political, economic, international and institutional spheres were initiated. I was then barely aware of the magnitude of events taking place in my country. My mind was more preoccupied with the significance in civilian pilots of high blood pressure, substandard vision and other medical matters that could affect flight safety.

My love affair, of over 50 years, can be subdivided into three phases.

### **PHASE 1 (1959-63)**

The first phase, real field practice of aviation medicine started in Argentina in 1959 when I was a 25-year-old aviation physician working at the Civil Aviation Official Base where one of the squadrons was Search and Rescue. The helicopter was a Sikorsky S-51, nicknamed Dragonfly (built in 1955 in the United Kingdom). Sick and/or injured persons were transported in two metallic coffers on the outside of the cabin. I was doing search and rescue missions with helicopters even before the word MASH (Mobile Army Surgical Hospital) came into popular knowledge. Those were the helicopters crossing the Andes in 1960 (through a low-altitude pass) to help Chile after a major earthquake had hit the city of Valdivia.

### **PHASE 2 (1963-65)**

The second phase of my career reflects research and academic activities in aviation medicine during 1963-1965 when I was doing chamber runs with patients in the altitude chamber at the Ohio State University (where I obtained my Master of Science degree) in the United States. At that time (in my case as a foreign doctor doing post-graduate work), we were a group of investigators trying to determine cardiopulmonary tolerances to simulated altitude in order to derive guidelines for air travel. Published results served for many years as practical indicators of tolerable cabin altitudes related to pressurization systems. Continuing with the second phase of my career, I worked for five years in Albuquerque, New Mexico at the Lovelace Foundation for Medical Education and Research on projects related to aviation, astronautics and space medicine. The Foundation, where the first group of astronauts were selected was in a city where three cultures, Anglo, Spanish and Native Americans mixed and therefore ample sociocultural activities took place continuously.

I had the opportunity to participate, as a Senior Staff Scientist in the evaluation of experimental test pilots, astronauts and doing research on the effects of aging in flying personnel. This project (the Aging Project as it was named) was commissioned by the US National Institute of Health in response to the regulation establishing a mandatory retirement age for Commercial Pilots.

Of the pilots belonging to the Society of Experimental Test Pilots, it is worth to mention a particular anecdote related to Gary Powers, a U-2 pilot, which had significant political implications.

The “Operation Skunkworks” was a joint Lockheed-CIA project to fly high altitude missions for observation and photographic reconnaissance. On May 1, 1960 a U-2 spy plane piloted by Francis Gary Powers was shot down over Russian territory. The pilot was captured, judged and imprisoned for three years at the Lubyanka prison. He was later exchanged for Colonel Rudolph Ivanovich Abel, a Russian spy.

It is interesting to note that in the medical records there were several annual evaluations of a pilot named Francis Gary Palmer followed by an absence of notes during the three-year period he spent at the Russian prison, returning to his real name after his release. In his Book - Operation Overflight - he indicated that he was worse treated by the US on his return than at the Lubyanka prison in Russia. Comments made at the Lovelace Foundation indicate that he was not forgiven by the CIA for not killing himself after his capture (he was in possession of a cyanide poisoned needle). Unfortunately, Gary Powers/Palmer died in a traffic helicopter accident in Los Angeles.

During my confidential research work in Albuquerque I held a Security clearance but in order to obtain a higher level (top secret) I would have had to resign my Argentine citizenship which I, obviously, did not do.

### **PHASE 3 (1965-94)**

The third phase of my aviation-related involvement took me around the world. Developing and managing civil aviation medical programmes (including their regulatory and implementation aspects) while in service with the International Civil Aviation Organization (ICAO) made me aware of the significance of cultural differences. I have learned, understood and very much respected such differences.

During my career, I faced hypoxia, decompressions, accelerations, toboggan jumping, etc., all on an experimental basis. But I had never imagined that I would have had to escape from a burning aircraft during a real emergency! This happened in Ezeiza, Buenos Aires when an engine of a B747 caught fire! In February 1992, after pushback, flames came out of one of the engines. The captain ordered an emergency evacuation. All the toboggans were inflated properly but one was non usable since a high heel punctured it. All passengers were properly evacuated, albeit there were several with minor injuries which were treated in the airport dispensary.

As a result of all the above considerations and trying to put together ideas, biased with affective and emotional overtones, of my professional and family life, I decided to describe as *Medicine Above the Clouds* the fascinating discipline which attracted me for over 50 years. This attraction started when I was conscripted as a soldier and culminated when I took over the Presidency of the highly prestigious collegiate body, the International Academy of Aviation and Space Medicine.

Pilots, cabin attendants, passengers and the aviation industry in general profit from the specialty of AVMED which aims at keeping humans healthy even under the adverse effects of environmental and operational conditions different from those the population at large is exposed to on a daily basis. At the same time, practitioners of AVMED obtain great opportunities while dealing with such intelligent populations in a variety of lands with significant cultural differences. These notes provide a narrative account of those aspects of the practice of the specialty which brought about significant socio-cultural benefits.

## **ARGENTINA**

As indicated earlier, in Buenos Aires an Air Force soldier (inducted by draft) on duty at his post was barely aware of the significant institutional events taking place in his native country, Argentina. My initial activities as a soldier were in the First Air Brigade (El Palomar - located on the outskirts of Buenos Aires), a historical place which, already in 1934 made the news deserving a write up in a London aviation magazine. During my two month stay in El Palomar I went through basic (or boot) training, at the completion of which I was assigned to the Directorate of Civil Aviation. Since I was already a fourth year medical student at the University of Buenos Aires Medical School, my final placement was the Gabinete Civil (a unit in which physicals for pilots were given).

After graduation from Medical School (1958), I worked as a civilian flight surgeon in the Argentine Air Force until 1963. In addition, I graduated from the Aviation Medicine course given at the Instituto Nacional de Medicina Aeronáutica in 1959 having completed the required program.

In addition to the practice of aviation medicine, my clinical practice was in a private, ambulatory setting (“consultorio” in Spanish) in San Miguel, a town in the outskirts of Buenos Aires, while my hospital practice was twofold, as an emergency physician on duty once a week in the Hospital José María Bosch. Nowadays the facilities of the Bosch Hospital house the National Burn Hospital. Also I worked mornings at a large hospital called then Policlínico de San Martín, where I was performing duties in the clinical ward having admitting privileges as well.

During my time in San Miguel I was picked up and brought back to my home by a vehicle from the Official Air Base. However, since the streets were not paved, in some circumstances I was brought home by helicopter, which the neighborhood children enthusiastically told my wife, “the doctor is coming!”

Many times I had to spend the night at the base since one of the responsibilities of such base was the night flight instruction and, as required by law, a doctor had to be present. Once I was given the job of performing an aeromedical evacuation by a commercial airline. There was a need to bring back to Argentina a senior officer of air traffic management who had a major medical problem in Tulane, New Orleans.

Fortunately, the patient's pick up and the return flight were accomplished without any major problems.

Since my desire for further studies and training in the discipline was significant, I contacted and applied to several high learning institutions both military and civilian, mostly in the U.S. After rounds of correspondence related to my eligibility as a foreign graduate, including the possibility of receiving a stipend (since the Argentine Air Force was willing to give me a leave of absence without pay), on the 1<sup>st</sup> of January 1963, to my pleasant surprise, I received a handwritten telegram (PC's and e-mail were non-existent then), which I treasure as a memento, signed by Dr. William Ashe, Chairman of the Department of Preventive Medicine indicating that I had been accepted and giving me 15 days to reply. After carefully checking family, personal and professional considerations I gladly replied in the affirmative.

With my wife and two daughters we went to the US Embassy, Consular Section in Buenos Aires to start the administrative procedure to obtain the student visa as a foreign national. But I was advised and given a permanent visa. Later on, I found out that since I was an MD and the US was involved in the Vietnam conflict, every doctor was given such a visa which permitted the US Selective Service to draft them for military service. As such, I was called for a medical examination and found eligible for military duties (see below).

Having transferred some of our financial reserves to the Bank of Boston for our initial subsistence, I embarked (DC4 Ini Airlines) with my wife and two children for Columbus, Ohio, U.S. on the 31<sup>st</sup> of May 1963 in order to have one month of preparation and adaptation prior to the commencement of classes.

## **UNITED STATES**

Having checked with the Foreign Students Department of the Operations Support Unit (O.S.U.), I started with the administrative procedures in order to register for the Graduate School, which was in addition to the residency program. I took the test related to knowledge of English and barely passed it. I was under the impression that my English would be enough to adequately take the courses and profit from them.

But, ALAS! Reality was totally different. FORTUNATELY, A GUARDIAN ANGEL NAMED LEONARD J. THOMPSON came to my rescue. As the two foreigners in a group of eight doctors, four in industrial and four in aviation medicine, there was an immediate empathy amongst us. And I immediately discovered the meaning and the value of the word solidarity! I would have not been able to complete the studies if it wasn't for Len Thompson. He took care of me and made copies of the notes taken during the lectures. By the way, the notes were taken in duplicate with REAL carbon copies since other means of reproduction were not readily available yet! His help was very significant, particularly for the lectures given by Professor Dinman who spoke in a soft voice, with his mouth barely opened and with a pipe hanging from his lips!!

We had a team of excellent teachers, starting with the Chairman, Dr. William Ashe, assisted by Drs. Fred Shillito, Bert Dinman, Martin Keller and Charles Billings. We developed a particular friendship with the latter one for multiple reasons. I vividly remember a couple of Dr. Len Thompson's activities which made me to be very proud to be his friend. One of them relates to his parachuting projects. I had been indoctrinated during my courses in Argentina that parachuting as a sport required a careful evaluation, particularly mental, of the person. All my misgivings were properly dispelled in my conversations with Len.

On account of Len having already a pilot's licence and the fact that another classmate, Dr. Bill Evans was also a licenced pilot, with the allotment that the University provided us to attend an Aerospace Medical Association Meeting we rented a private plane from the School of Aviation of the O.S.U. and went not only to the meeting but we also visited the School of Aviation Medicine of the U.S. Navy in Pensacola. By the way, the four aviation medicine residents received a citation from the O.S.U. School of Aviation on account of our support to their programs.

Upon receiving our Master's degrees and having completed the third practical year of the required program, both Len and I returned to our native countries but soon after I went back to the U.S. and continued doing research at the Lovelace Foundation. (At that time, the President of the Foundation indicated to the U.S. Selective Service that on account of my research work for the Space program I was more needed there rather than to serve as a military Officer.)

### **ICAO and CANADA**

In 1971 I joined the International Civil Aviation Organization. Notwithstanding that we were miles apart from each other, our friendship continued and I had the pleasure of receiving Len as a guest both in Albuquerque and Montreal. Likewise, my wife and I were royally received and treated by Len and his wife Colleen in New Zealand. Len's outstanding career did not allow him, on account of national duties, to attend the yearly meeting in the U.S. or the Academy sponsored Congresses. But we managed to see each other in different locations of the world such as London, Budapest, etc. And, as a corollary, as luck would have it, in the 1990s we occupied the two top executive positions in the prestigious, collegiate body, the International Academy of Aviation and Space Medicine which gave origin, in international circles, to the rumour that the Academy was merely a branch of the famous Ohio State University.

All in all, I am very grateful to the O.S.U. for having provided very good training and particularly to my friend and colleague, Dr. Leonard J. Thompson since, without his help I could have not completed the post-graduate program at O.S.U.

My wife and I have always been interested in the culture of countries geographically located in many areas of the world. Perhaps our feelings were biased by the emotional overtones of having ancestors born in Romania, Spain and Russia. And, as luck would have liked, an event in 1986 provided the beginnings of an excellent

relationship with colleagues and friends. By then, my professional assignments had already permitted us to visit countries in Africa, Asia, Europe (eastern) and America.

The IAASM convened its 1986 Congress in Belgrade (then the capital city of Yugoslavia, until 2006). It was an excellent meeting and its location and the organization of the event permitted us to visit Dubrovnik, a beautiful medieval city where we were treated to a tour and a chamber music concert. Another great side trip was to Novi Sad where we had a chance to see (and to buy) naïf paintings by the famous Martin Jonas. Naïf art in the area was born at the beginning of the fourth decade of this century, when Janko Brasic, a painter from the village of Oparic, appeared with his first artistic works. When visiting Budapest, Olga, my wife, fell in love with the style and bought two still life paintings, requesting from the museum export certificates to be able to take them out of the country. The Director of Civil Aviation took us to the airport in his official car with the siren on! And, surprise, the Exit Customs Officers could not care less about exporting those paintings and let us through without any problem.

My first exposure to Africa was to Nigeria, where I had the pleasure of teaching the first ICAO Civil Aviation Medicine Seminar in Lagos (then the capital city of Nigeria). It was well attended by Anglophone medical examiners.

The flight from London to Lagos made stops in Kano, Kaduna and then Lagos and food served on board were “empanadas” (meat pies) which is a common staple food in my native country.

Programs for South East Asia were coordinated through the Regional Office in Bangkok which became for me a second home and where Tom Yum soup and a bowl of rice became my staple food. I had the extraordinary support and assistance there by a Scandinavian Officer - Carl Nordlander, and Mrs. Kanniga Varunprabha - her husband was the Chief Helicopter pilot in charge of providing transportation and protection to King Phra Chaoyuhua Bhumibol Adulyadej.

An interesting side effect of a Seminar I directed in Lima in 1984 relates to the fact that in my introductory comments I made mention of the Jesuit Father José de Acosta which in 1590 described high altitude hypoxia. The Peruvian authorities were impressed by the description of the event taken place in the Pariacaca mountain and placed a helicopter at my service to go there. The end result was that such flying machine was nicknamed “the Finkelstein Helicopter”.

## **POST RETIREMENT ACTIVITIES**

In 2006 I was recruited by ICAO to work as a Team Leader in assessing the problem and develop measures to treat and mostly prevent, the Severe Acute Respiratory Syndrome, SARS, which appeared and had a heavy human toll in South East Asia. Fortunately, with the full cooperation of the Singaporean Authorities, specifically Dr. Jarnail Singh the problem was assessed and measures were developed which proved to be quite successful.

Similarly, I was assigned to work on the issue of Avian Flu which had a significant effect in several worldwide areas.

As a corollary to this monograph, I wish to state that Dr. de Hart in the third edition of his classic textbook, *Fundamentals of Aerospace Medicine*, invited me to write the introduction. I did so stressing the classical parameters of the discipline and adding not only the evolutionary aspects but I also emphasised the cultural differences around the world. My introduction is copied at the end of this document.

A major event took place in 1981. Dr. Stanley Mohler (former AsMA President) nominated Dr. Harry Armstrong, also a Past President of AsMA, to receive the prestigious ICAO Edward Warner Award. This award, in the words of a former Director of ICAO's Legal Bureau is the "Nobel Prize equivalent for aviation". I was chief of the ICAO Aviation Medicine Section (C/MED) at the time and was summoned by ICAO's President (who chairs the Council's Edward Warner Award Committee) to answer questions related to the nominee and the nominator. Very satisfied with my comments, the Committee recommended to Council that the award be given to Dr. Armstrong. It was the only time in ICAO's history that the ceremony did not take place in connection with an ICAO Assembly (the 3-yearly gathering in Montreal of all ICAO member States). Since Dr. Armstrong was very ill, Dr. Assad Kotaite, President of the ICAO Council at the time, flew to San Antonio and presented the award there.

It should be noted that the granting of the award was a recognition by ICAO's Council of the importance of the discipline of aviation medicine. On two more occasions the award was presented to an aviation medicine related organization or individual, once to the International Academy of Aviation and Space Medicine itself, and the other to myself.

During my tenure as the Chief of Aviation Medicine Section at ICAO, standardized courses for Designated Medical Examiners (DMEs) commenced. The second edition of the MED Manual was published in English, French, Spanish, and Russian. A Standard calling for obligatory training in AVMED for DMEs was adopted (although it was not until 2005 that this training was made mandatory prior to appointment). The ICAO Warner Award was granted to a physician, a French-speaking aviation medical officer was recruited and a non-smoking policy for ICAO meeting rooms was adopted. Assistance was provided to French-speaking ICAO Contracting States and improvements of French versions of ICAO MED documents were published. Regional seminars were provided for francophone African states. A major study on flight fatigue and on smoking in aircraft was initiated as were studies on prevention of substance abuse in the workplace, human factors, and implications of AIDS. ICAO worked with European States on a major revision of ICAO medical standards, co-operated with Canadian authorities to develop programs for post-graduate education and research in civil aviation medicine, and liaised with WHO on matters related to substance abuse and smoking in aircraft. The resolution A29-15 calling for a ban on smoking in aircraft was adopted by the ICAO Assembly.



Thus, when retiring in 1994 from ICAO and returned to Argentina, the soldier felt happy to have contributed to ICAO's AVMED programs and activities.

## **INTRODUCTION TO THE THIRD EDITION OF FUNDAMENTALS OF AEROSPACE MEDICINE**

This third edition of the already classic textbook, Fundamentals of Aerospace Medicine reflects and covers in detail contemporary trends in the evolution of a fascinating medical discipline, which in many areas of the world has achieved the level of a postgraduate university specialty.

Aviation medicine (later on, by natural extension, Aerospace Medicine) started as an indispensable response to a need to regulate the presence of humankind in aviation in relation to operational safety. More recently its scope has been broadened globally by giving emphasis to its preventive aspect; greater attention is additionally given to all occupants of air and spacecraft, including passengers and space tourists. The magnitude of global air transportation of healthy and less well passengers established the need to have a continuous update of knowledge of operational and environmental conditions (potentially) affecting humans. Such need is of paramount importance and this edition includes the most current information available in contemporary Aerospace Medicine.

Humans have adjusted their biological systems to life at or near sea level where they function at a given barometric pressure and a given partial pressure of oxygen with a normal hemoglobin range. Departure from this environment to altitude brings about the need to have adaptation mechanisms, which encompass ventilatory, circulatory and hematological adjustments over time.

Exposure to altitude conditions by aviation is almost immediate and does not allow the time for adaptation mechanisms to appear, therefore technological aids are indispensable and as such, a classical example is given by cabin pressurization systems.

Proper interaction of humans, machines and environments is needed to achieve an optimum level of operational safety. Emphasizing again the need for proper interaction, we should remember that humans are necessary for the design, operation and maintenance of aircraft.

Every year, almost one quarter of the world's population travel by air on scheduled flights with an optimum level of safety compared to other means of mass transportation. In trying to satisfy the needs of the traveling public, experts are working hard in providing solutions to problems, or even better in preventing the appearance of those problems. Our specialty, a significant contributor to such level of safety, has seen a significant evolution of well defined and documented periods: its beginnings were empirical and were followed by observational, experimental, human factors and ergonomic stages. More recently the legal implications attracted the attention of the experts and, in this respect, more studies are being conducted in jurisprudence and ethics before an aeromedical decision takes place.

Over the years, aviation and medical authorities realized that research was needed and studies began to assess human performance and limitations related to aerospace environments and a need arose for a more precise definition of the objective of the specialty.

In relation to civil aviation, most of these studies were conducted at national levels; it soon became apparent that to achieve proper international standardization, medical requirements for aviation duties had to be adopted by an International Organization of the United Nations System, namely the International Civil Aviation Organization.

These requirements were incorporated in Annex 1 to the Chicago Convention and they include physical, mental, hearing, visual and color perception requirements. As a result of these standards and recommendations and their evaluation in the context of flight safety, it became indispensable to further study in detail the proper assessment of human performance, limitations and the consequences of exceeding those limitations.

Paraphrasing two sentences of General Howard Unger's foreword to the first edition of this textbook, it is worthwhile to emphasize that the specialty of Aerospace Medicine reflects a dynamic and progressive nature and that the need to openly share the wealth of information gathered is readily apparent.

Several definitions of Aerospace Medicine are available to readers; it seems indispensable to emphasize that, as far as crew members are concerned, it should be viewed as a multidisciplinary specialty related to valid mental and physical requirements in response to realistic operational needs to properly perform duties with an optimum level of safety. Related to passengers, clinical and environmental aspects are significant in order to achieve a good level of safety, health, comfort and wellbeing.

Summarizing, it is indispensable for practitioners of Aerospace Medicine to continuously assess the adequate interaction needed between humans, machines and environments. Therefore, this edition of Fundamentals of Aerospace Medicine provides information and references useful to the medical examiners as well as to specialists in all aspects of the discipline. The wealth of information presented in this third edition allows practitioners, specialists and researchers to acquire it in a very well organized presentation. Such acquisition will allow us to have optimum exchanges of views and to perform duties in line with the requirements.