The Malaysian Angkasawan Programme Remembered

Mohammad Razin Kamarulzaman, MA (Aviation Med)*, Zulkeffeli Mat Jusoh, MPH*, Mohammed Haizar Haron, DipAvMed**, Rosman Ab Rahman, MMed (Int Med)***, Badli Mahmud, MMed (Psy)****, Mohd Asri Din, FRCD (UK)*, Alvin Wee, Dip AvMed*****, Zuki Othman, DipAvMed******, Mazdy Ismail, DipAvMed*, Rosli Kolob, DipAvMed*, Saravanan Annamalai, DipAvMed*, Zulkefley Mohammad, DipAvMed*, Mariah Hussein, DipFMed*, Amei Farina Rashid DipAvMed*, Izwan Hussein, MPH***, Shahidah Leong, MA (Clinical Psychology)******* & Zahari Jusoh, DipAvMed**.

* Tuanku Mizan Armed Forces Hospital, Kuala Lumpur **Institute of Aviation Medicine, Kuala Lumpur ***Health Services Division, Malaysian Armed Forces Headquarters, Kuala Lumpur ****94 Armed Forces Hospital, Terendak Camp, Melaka *****Sydney, Australia ******Langkawi, Kedah *******Faculty of Medicine and Defence Health, National Defence University, Kuala Lumpur

ABSTRACT

Between August 2005 until October 2007, the Institute of Aviation Medicine (IAM), Royal Malaysian Airforce (RMAF) Kuala Lumpur acted as the medical adviser to Agensi Angkasa Negara (ANGKASA), the lead agency, for the Malaysian Angkasawan Programme. This space endeavour came as a result of an off-set package on the procurement of the Sukhoi SU-30 MKM by Malaysia from Russia in 2003. The medical selection process involved (1) online registration, (2) the Angkasawan Run, (3) the Basic Medical check-up, (4) the Aeromedical I,(5) the Aeromedical II check-ups, (6) Survival Test, (7) Final Medical Tests and (8) the Selection Panel Interview. A total of 11,275 Malaysian citizens from all walks of life registered online to be the Angkasawan Negara. The multi-phased selection process narrowed the candidates down to the final two. On 10 October 2007, Malaysians watched on life telecast as the Soyuz TMA-11 carrying Dr Sheikh Muszaphar Shukor launched from Baikanur Cosmodrome, Kazakhstan to the International Space Station. It was a historic achievement in the year Malaysia celebrated its 50 years of independence. This paper is a retrospective review of the Angkasawan Medical Selection Process.

Keywords: Institute of Aviation Medicine (IAM), Malaysian Angkasawan Programme, Dr Sheikh Muszaphar Sukor, Medical Selection Process

INTRODUCTION

In 2003, the Ministry of Defence, Malaysia (MINDEF) signed an agreement for the procurement of the Multi-Role Combat Aircraft (MRCA) Sukhoi SU-30 MKM with the Russian Government. As one of the off-set packages, it was agreed that the Federal Space Agency of Russia (ROSCOSMOS) will send one Malaysian to space on board the Soyuz spacecraft to the International Space Station (ISS).

Agency Angkasa Malaysia (ANGKASA) of the Ministry of Science, Technology and Innovation (MOSTI) was appointed as the lead agency to the Programme. Unlike many other National Space Programme where the main objective was to show National Aerospace might, the Malaysian Angkasawan Programme puts place education as the core objective with the purpose of advancing in science, technology and engineering in a new frontier [2].

Table 1. Angkasawan general selection criteria

Citizenship	Malaysian
Age	21 years and above
Qualifications	Degree in Science, Engineering, ICT and other deemed fit by the Technical Committee. Pilots who possess ATPL/CPL/Military
Medical	Fit and healthy

The Angkasawan Programme was open to Malaysians from all walks of life to encourage its citizen to participate in this National Project. The general criteria for selection are referred in **Table 1**.

Technical Committee

The Technical Committee was drawn out from the experts in-country with the RSA Director as the external adviser. The committee was chaired by the Director General of ANGKASA herself, Datuk Mazlan Othman. It comprised of representatives from the Royal Malaysian Air Force (RMAF), The Malaysian Armed Forces Health Services (MAFHS), Ministry of Education, Ministry of Health (MOH), University Hospitals, Ministry of Youth and Sports as well as representatives from the Private Universities. Since it was decided that the Angkasawan will be selected from the general public, the selection programme was modelled based on the 1992 Canadian Space Programme [4].

Appointment of IAM as Coordinator to the Medical Selection Process

The Director of the Federal Space Agency of Russia (Roscosmos) visited the IAM on 29 March 2005 with the Director General of ANGKASA to endorse the technical capability of IAM to conduct the Medical Selection Process of the Angkasawan Programme. At this stage, the IAM had a medical clinic with capability of visual testing, audio-metric testing, cardiac screening, radiology, and a medical laboratory. The IAM was also in possession of the aero-physiology altitude chamber which can ascend to 60,000 feet and the newly installed high performance human centrifuge with the capability of pulling 9 Gz+. The then Colonel (Dr) Zahari b Jusoh, Director of IAM was appointed as the National Flight Surgeon. The aeromedical selection process

would be divided into several phases to ensure cost-effectiveness of the screening process [6].

At this stage, the medical standards set for the category of Angkasawan or Space Flight Participant (SFP) far exceeded the requirement of the interim SFP medical standards which was only published later by the ISS Multilateral Space Medicine Board (MBSB) in 2007 [3].

MEDICAL SELECTION PROCESS

As the programme was for the the general public, a careful phased selection process was conducted to ensure the right person was selected for the right job. It was divided into an online application, medical screening, survival test and a panel interview. Once the candidates were narrowed down, they will be subjected to an additional medical test in Russia.

(1) Online Registration (n=11,275)

The online registration process was opened in November 2003 and up to the closing date in May 2005, 11,275 persons applied. ANGKASA narrowed done the number of candidates to 2,895 people based on the general selection criteria. Of this figure, 894 candidates confirmed their participation in the Angkasawan Run.

(2) Angkasawan Run (n=894)

The Angkasawan Run was conducted in six centres with the official launch done in Kuantan on 28 August 2005 by the MOSTI Minister YB Jamaludin Jarjis followed by runs in Kota Kinabalu, Kuching, Butterworth, Subang and Kluang on 03 September 2005. The Angkasawan Run was based on the United States Army Physical Fitness Test (APT) of 2 miles in 20 minutes.

This was adapted into a requirement of 3.5 kilometres in 20 minutes. A total of 22.2% (199/894) passed the Angkasawan Run with a significant number of candidates failed to turn up for the run 48.6% (435/894). Of these, 97.9% (195/199) were male and 2.1% (4/199) were female. The breakdown of candidates who passed the Angkasawan Run by occupation is listed in **Table 2**.

(3) Basic Medical Check-Up (n=199)

A basic medical check-up was conducted post-run to those who qualified. The examination used the Initial Military Medical Selection Standards which included a medical questionnaire, basic urine test and physical examination. These medical selections were conducted by a specialist from the MOH assisted by IAM. Of these, only 29.6% (59/199) of the candidates met the Medical Standards.Of those disqualified, 29.6% (59/199) were due to visual acuity, 7.0% (14/199) due to staff. various ENT conditions; 5.0% (10/199) due to urine abnormality; 4.0% (8/199) due to hypertension; 4.0% (8/199) due to various musculo-skeletal disorder; 1.0% (2/199) due to high BMI and 0.5% (1/199) due to admission to substance abuse.

(4) Aeromedical Screening I (n=59)

The next selection phase involved the Aeromedical Screening I which was conducted at IAM from 25 to 30 September 2005. The standards used was adapted from the RMAF Aircrew Initial Medical Screening (IAM, 2003) guided by the Indian Space Programme and the Programme and the Aerospace Medicine Task Force guideline mentioned above. This phase included further 13 medical tests including urine testing for drugs; blood panel; body anthropometry measurements; body mass index; eye and visual testing; ENT tests; cardiovascular screening as well as multitude dental examination. An initial mental health screening was also conducted on the candidates. A battery of General Health Questionnaire and Personality Test PF16 were conducted. Of the 59 candidates, 28.8% (17/59) failed the personality tests; 11.8% (7/59) due to abnormal lipid profile; 8.4% (5/59) due to audiometric assessment; 3.3% (2/59) due to ophthalmic reasons and 1.6% was a Hepatitis B carrier. These examinations were conducted by IAM staff assisted by Military Medical and Dental Specialist. The laboratory tests were counter-checked by a University Hospital Medical Laboratory.

Table 2. Breakdown of Angkasawan candidates who passed the Angkasawan Run (n=199)

Occupation	Number (%)
Engineers	73 (36.6)
Bankers/HR/Management	29 (14.5)
Teachers/Lecturers	16 (8.0)
Support Engineers	13 (6.5)
Scientists/Researchers	12 (6.0)
IT Specialists	12 (6.0)
Airline Pilots	10 (5.0)
RMAF Pilots	10 (5.0)
Doctors	6 (3.0)
Unemployed Graduates	2 (1.0)
Dentist	1 (0.5)
Army Officer	1 (0.5)
Lawyer	1 (0.5)
Graduate Farmer	1 (0.5)
Graduate Rubber Tapper	1 (0.5)
Journalist	1 (0.5)
Unknown	1 (0.5)

(5) Aeromedical Screening II (n=29)

A total of 45.7% (27/59) candidates qualified for the Aeromedical Screening II conducted from 16 to 20 January 2006 at IAM. The Aeromedical Screening II included more extensive medical test such as Exercise Stress Test and Aero-physiology tests such as Altitude Chamber for hypoxia tolerance at 25,000 feet and Human Centrifuge Test for +Gz tolerance at 9Gz. This phase also included the psychological assessment and observation by the Mental Health Group on the candidates. Other non-medical assessments included swimming test, public speaking and command of basic Russian language. At this stage 66.6% (18/29) qualified for the next phase. The casualties at this phase included 10.3% (3/29) due to psychological assessment; 10.3% (3/29) due to poor +Gz tolerance; 6.8% (2/29) due to abnormal findings on abdominal ultrasound and 3.4% (1/29) due to poor tolerance

to altitude.

(6) Survival Test (n=18)

The next selection phase involved land and sea survival test with a psychological assessment conducted throughout. This phase was conducted by the Royal Malaysian Navy (RMN) Special Forces in Lumut between 21 to 24 January 2006. The test was assisted by the MAFHS Mental Health team led by Colonel (Dr) Badli Mahmud and Colonel (Dr) Haizar Haron. Subjectively, it involved assessment of leadership, teamwork, communication skills, navigational skills and solo survivor instincts. A total of 44.4% (8/18) of the candidates were deemed unfit to proceed further for the final medical examination.

(7) Final Medical Screening (n=10)

The final medical screening test was conducted at 96 Armed Forces Hospital Lumut between 25 to 26 Jan 2006. This involved further six medical tests including bone scan, oesophago-gastro-duodenoscopy, CT scan of the brain, full blood picture, repeat of biochemistry profile and mammogram for the sole female candidate. Two of the 10 or 20% of the candidates were disqualified, one due to an anomaly in blood picture analysis and the other due to overt peptic ulcer disease.

(8) Selection Panel Interview (n=8)

The final eight candidates who were deemed medically fit comprise of 87.5% (7/8) male and 12.5% or one female. The youngest candidate was 25 years old and the oldest was 35 years old with the average age of 29.1. The occupation breakdown was 50.0% (4/8) were pilots and the rest were a quality engineer, a mechanical engineer, a doctor and a military dentist.

The panel was headed by Tun Hanif Omar the former inspector General of Police, Tan Sri Nik Ismail Nik Mohamad, the Chief of RMAF; Tan Sri Tajuddin Ali, former Chairman of Tenaga National Berhad; Professor Datuk Ghauth Jasmon, Vice-Chancellor of Multimedia University; and Datuk Mazlan Othman, the Director of ANGKASA.

The Selection Panel interview consists of questions on candidates' aspiration and vision on being an Angkasawan, communication skills, general knowledge, diplomatic skills, and technical knowledge on space science.

The final four candidates were announced during the Officiating Ceremony of the Pusat Penyelidikan dan Latihan Simulator G (PULLS-G) at RMAF Subang on 14 Mac 2006. The four were then sent to Russia for further evaluation by Roscosmos.

ISSUES AND CHALLENGES

The MAFHS specifically IAM was given the honour to assist ANGKASA in the Medical Selection process of the Angkasawan Programme. This is due to the knowledge and skills of the IAM practitioners in Aviation and Aerospace Medicine assisted by other MAFHS and Government Specialists. The other reason is due to the existing Aero-Physiological capability of the altitude chamber and human centrifuge.

Malaysia took the National Programme pathway of selecting the Angkasawan similar to the Canadian Space Programme. This generated interested amongst the Malaysian public as testified by the number of online applicants. The guiding document for the medical selection process was based on the Canadian, Indian and the Aerospace Task Force documents. The selection process was divided into many phases to accommodate the high number of candidates. The progression from simple to more complex investigation proved to be time efficient and cost effective. Of the 33 tests listed in the ISS MSMB Medical Guideline document, a total of 30 tests or 90.9% were carried out in Malaysia. The tests that were not carried out were PSA, Carotid Ultrasound and Coronary Calcium Scores because none of the Angkasawan candidates were above 40 years of age.

The main area of concern in the medical selection of a space explorer or Angkasawan is to ensure there is no medical risk which could cause sudden incapacitation in flight or in space. The other area of concern is the mental resilience of the Angkasawan. This is due to the many uncertainties in flight, the period of isolation, living in confined space, inter-cultural differences, and abnormal circadian rhythm. In view of these concerns, the mental health assessment had to be stringent and thorough [7].

During the Angkasawan Run and Medical Check Up, the highest reason for disqualification was a failure to turn attend for the run at 48.6%. At the medical check-up post-Angkasawan Run, ophthalmological causes 29.6% were the main reasons. At the Aeromedical Screening I, the main causes for disqualification were Mental Health findings 28.8% and serum cholesterol abnormalities at 11.8%. The major disqualifying reasons at Aeromedical Screening II were equally due to poor psycho-social skills and poor tolerance to +Gz force at 10.3% each. Further evaluation during the land and sea survival phase revealed a failure to adapt to stressful conditions in 44.4% of candidates. The final medical screening caused disqualification in two cases due to peptic ulcer disease and abnormal haemoglobin analysis.

One of the main challenges faced by the Technical Committee was the conduct of Mental Health Screening tests on the candidates. The Mental Health sub-group deliberated on the Mental Health Screening tools to be used and came out with some standard tools as well as adapting some tests for others [7].

In all, it took approximately six months to conduct the six-step medical selection process involving almost 60 medical and dental practitioners. It was estimated that the medical cost to the whole medical selection process was approximately RM 650,000.00 not inclusive of the Angkasawan Run and the land and sea survival tests [6].

The final four candidates announced were Captain Faiz Ahmad, MAS Pilot, 34; Ms Vanajah, Quality Engineer, 35; Captain (Dr) Faiz Khaleed, Military Dental Officer, 25; and Dr Sheikh Muszaphar Shukor, Orthopaedic Registrar, 34.

The four candidates underwent further medical evaluation at

the Russian Space Agency and the final two candidates selected were Dr Sheikh Muszaphar and Captain (Dr) Faiz Khaleed. The two candidates underwent 12 months training in Yuri Gagarin Cosmonaut Training Centre in Russia before it was decided by the Prime Minister of Malaysia under the advise of the Programme Director that Dr Sheikh Muszaphar Shukor was nominated as the primary candidate and Captain (Dr) Faiz Khaleed as secondary candidate.

Colonel (Dr) Zulkeffeli Mat Jusoh was appointed as the Angkawasan Programme Director once the Angkasawan Programme moved to Russia. After 12 months of training, Dr Sheikh Muszaphar Shukor was selected to fly to space with an American Astronaut and a Russian Cosmonaut. Malaysians watched eagerly the launch of the Soyuz TMA-11 which carried Dr Sheikh Muszaphar Shukor on 10 October 2007 in the year Malaysia celebrated its 50 years of independence. Dr Sheikh Muszaphar Shukor returned back to earth safely after spending ten days in low earth orbit and the ISS.

The Malaysian Angkasawan became the sixth Space Flight Participant (SFP) after Tito, Shuttleworth, Olsen, Ansari and Simonyi.

BENEFITS OF THE ANGKASAWAN PROGRAMME TO AEROSPACE MEDICAL PRACTICE IN MALAYSIA

The Angkasawan Programme has:

1. Created a template for future Angkasawan Medical Selection process. This template is archived in the AFMATI for reference purposes.

2. Provided a platform for the creation of Aerospace and Aviation as a specialty in Malaysia.

3. Established networks among the medical and scientific community within the country as well as overseas for future collaboration.

4. Stimulated research as well as training opportunities in the field of Aerospace and Aviation Medicine.

CONCLUSION

The Angkasawan Programme has put the practice of Aerospace and Aviation Medicine to the forefront. A stringent medical selection process was designed to ensure the Angkasawan Candidates would be able to undergo a 12 months cosmonaut training and perform the mission in space successfully. The achievement of Dr Sheikh Muszaphar Shukor as well as Captain (Dr) Faiz Khaleed is something to be proud of by all Malaysians. The involvement of MAFHS namely IAM in the Angkasawan Selection process is worth a mention in the history books of Kor Kesihatan DiRaja.

REFERENCES

1. Aerospace Medical Association Task Force on Space Travel, 2001. Medical Guidelines for Space Passengers, Aviation, Space and Environmental Medicine, Vol 72, No 10, Oct 2001, pg 948-50.
2. ANGKASA, 2011. Angkasawan Selection Process. Downloaded from www.angkasa.gov.my/selection/angkasawan/ run on 17 April 2017.
3. Bogomolov et al, 2007. International Space Station Medical Standards and Certification for Space Flight Participants, Aviation Space and Environmental Medicine, Vol 78, No 12, Dec 2007, pg 1162-69.
4. Davis PA, 1992. The 1992 Canadian Astronaut Recruitment Campaign. Downloaded from www.alandavis.com/pdfs/astronaut%20recruitment.pdf on 17 Apr 2017.
5. Dogra MM, 1986. Selection of Male and Female Candidates for Space Flight: Aeromedical Aspects and Role of IAM. Downloaded from www.isam-india.org/essay/cme_ selection.shtml on 17 Apr 2017.
6. Kamarulzaman, 2007. Laporan Program Angkasawan. Personal communication.
7. Leong S, 2007. Psychological Programme for Angkasawan. Personal communication.
8. Space Passengers Task Force, 2002. Medical Guidelines for Space Passengers – II. Aviation, Space and Environmental Medicine, Vol 73, No 11, Nov 2002, pg 1132-34.

Correspondence: Brigadier General Dato' (Dr) Mohammad Razin Kamarulzaman. Department of Military Medicine, Tuanku Mizan Armed Forces Hospital, Kuala Lumpur, Malaysia. Tel: +6019386384. Email: razin@mod.gov.my