Original Article

Anthropometric correlates of aircrew - aircraft compatibility in fighter stream cadets

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The anthropometric assessment of Air Force Flying branch cadets is done periodically at various milestones of their training with a view to ensure aircrew-aircraft compatibility during the training period. Anthropometry-related rejections from the fighter stream have reportedly shown an increase on account of anthropometric limitations in the current trainer aircraft. This study evaluated the effect of the existing policies on a sample of two flying training courses. It brings out the impact of the present anthropometric constraints on fighter training and suggests measures to reduce the wastage.

Keywords: Flying trainnig, aeromedical evaluation, human engineering, anthropometer.

The fighter stream flying training in advance stage is carried out on Kiran (HJT 16), Iskara and MiG-21 (Type 77) aircraft. Stage II flying is done on Iskara and Kiran aircraft and is under the supervision of Training Command. The operational training is carried out at MiG Operational Flying Training Unit (MOFTU). It is therefore of utmost importance that the Flight Cadets selected for the fighter stream be aeromedically compatible with Iskara, Kiran and MiG 21 (Type 77) aircraft so as to ensure a comprehensive training and its completion. To ensure this, a comprehensive medical evaluation system of the cadets is being carried out as per the guidelines laid down in IAP 4303 [1] and is summarised in Table 1 and Fig. 1.

This aeromedical evaluation is aimed at reducing the aircrew wastage during training period by identifying potential aeromedical causes, which may cause such a rejection. The evaluation is hence expected to have a predictive potential, i.e, it should evaluate the present aeromedical fitness of the aircrew and also assess for any causes of rejection/ handicap in flying training on account of aeromedical causes which may develop during the training period.

Anthropometric evaluation is an integral part of such aeromedical evaluation. Anthropometry (*anthropos* – human + *metricos* = measurements) is the study of measurements pertaining to the human beings. Its importance in the fighter stream training is for the purpose of determining the aircrew-aircraft compatibility and for sizing of the flying clothing to be used.

In training scenario, the importance of aircrew aircraft compatibility is paramount. For optimal performance and minimal fatigue during training, it is essential that the physical capacity of the pilot matches the force-control characteristics of the aircraft. This aircrew-aircraft matching is all the more important in trainee/denovo pilots due to lack of

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Fig. 1. Aircrew training milestones and aeromedical assessments

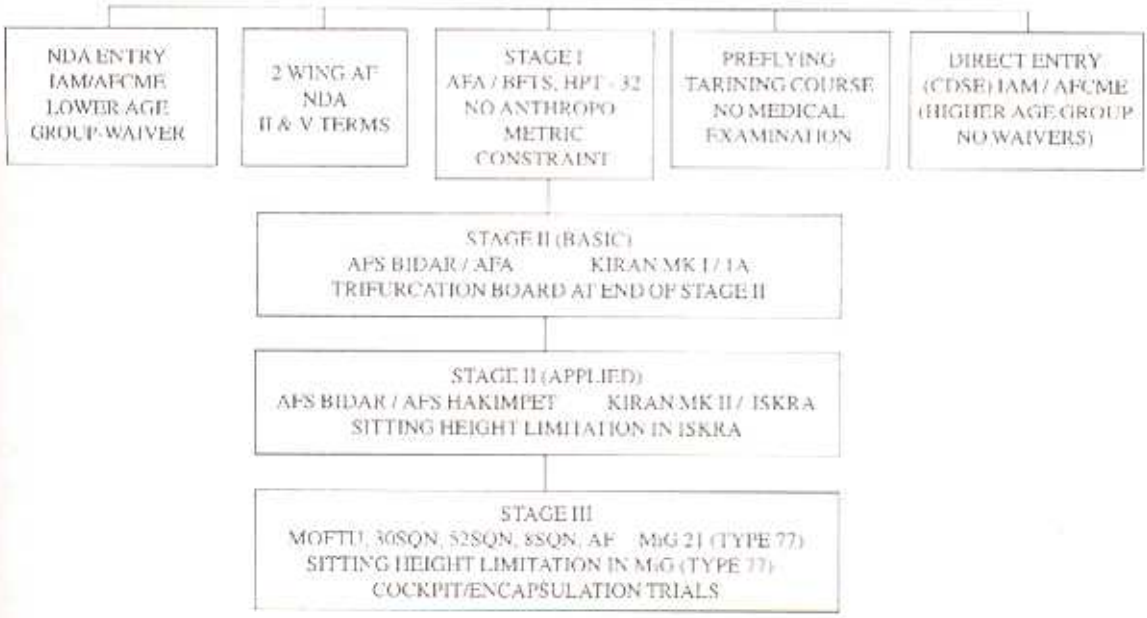


Table 1

Sl. No.	Flying Stage	Equipment used	Center
1.	NDA entry	Anthropometer	IAM / AFCME
2.	CDSE entry	"	"
3.	NDA II term	"	No. 2 Wing
4.	NDA V term	"	"
5.	Prior to Trifurcation Board	"	No. 2 AMTC

Table 2. Anthropometric requirements in aircraft during various stages of fighter training

Stage of flying	Aircraft	Sitting height (cm)		Leg length (cm)		Thigh length (cm)
		Min	Max	Min	Max	
Entry*	-	81.5	96	99	120	< 64
Stage I	HPT-32	81.5	98.8	99	124	< 66
Stage II (basic)	Kiran MK I	82	96.5	99	122	< 67
Stage II	Kiran MK II	82	98.5	99	122	< 67
(Applied)	Iskara	82	94-(Without PSP) 90-(with PSP)	99	125	< 66
Stage III	MiG 21 (T-77)	82	91.5	99	124	< 64

* Waivers given for height (5 cm), leg length (2.5 cm) and sitting height (1.0 cm)

their experience. Anthropometric measurements are important to ensure ideal workspace environment and layout in the aircraft cockpit. Aircrew aircraft physical compatibility is also important in terms of reducing the injury potential. Various measurements of the human body, which are of importance in aviation have been identified. Anthropometric assessment of various aircraft inducted into the IAF have been done to identify the limits of the anthropometric parameters and have been laid down as policy and guidelines as shown in Table 2.

The aircrew-aircraft incompatibility related rejections need to be studied so that the cadets capable of performing fighter flying duties and selected for doing so are not forced into other streams on account of anthropometric limitations. This study was undertaken to assess this aspect of aircrew-aircraft compatibility and its effects on fighter stream aircrew cadets.

Aims

1. To review the administration of the existing system of medical surveillance including anthropometric evaluation of flight cadets from initial selection through completion of flying training.
2. To identify reasons for avoidable wastage of aircrew training related to medical and anthrompometric incompatibilities detected during training period.
3. To evaluate the impact of the current aircrew aircraft compatibility standards on the training of fighter aircrew, with a special emphasis on acquisition of newer aircraft for future training and operational roles.
4. To recommend suitable remedical measures.

Methodology

The study included an assessment of the fighter training protocol vis-a vis the corresponding medical examination periodicity and procedures to determine the possibility of improvements in early detection of anthropometry related wastage. A survey was carried out at all training establishments and air force bases presently flying MiG 21 type 77 aircraft to assess the medical procedures followed at these establishments in terms of equipment used for anthropometric assessment and periodicity/timing of the medical examination. The existing policies on the same subject as issued by Air Headquarters were referred to establish the correctness of the medical surveillance procedures followed in the periphery.

Anthropometric parameters of the sample population of the flying cadets of two previous courses were studied to assess the possible wastage rate due to the existing policies on the subject.

The findings of the survey and the observed wastage rate were correlated to identify the remedial measures.

The percentile distribution table of sitting height of Indian Air Force aircrew was used to assess the impact of aircrew-aircraft incompatibility in MiG 21 (type 77) aircraft. The percentile tables were also studied to assess the impact of sitting height on the future aircraft for training.

Findings and discussion

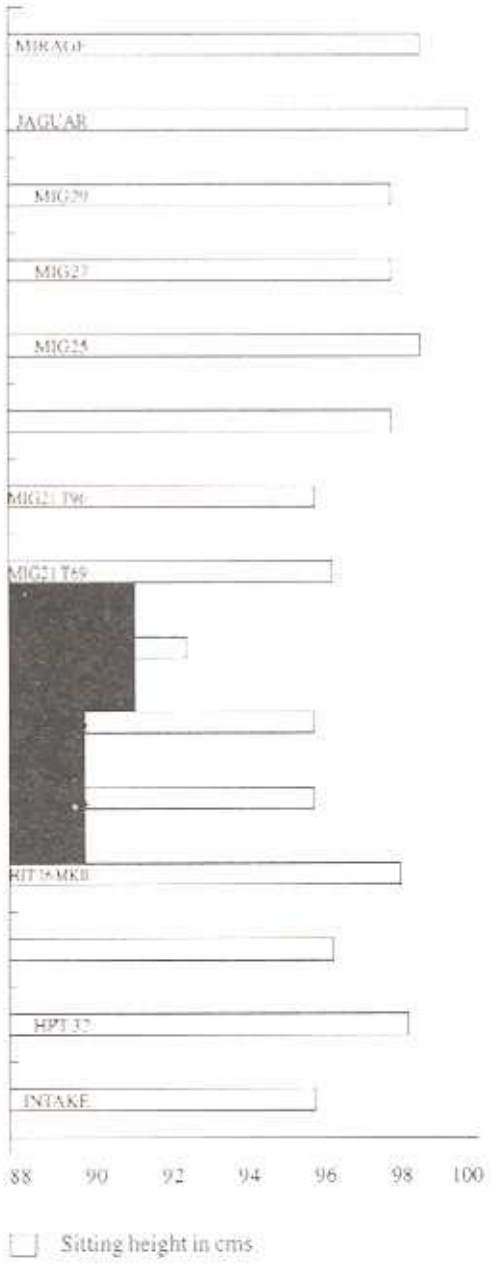
The anthropometric limitations as laid down for the flying branch are given in Table 2. The table also shows the anthropometric limitations of the various aircraft presently being used for fighter training.

Medical equipment for measurement (Portable anthropometer): The equipment used for anthropometric measurements at National Defence Academy (NDA), IAM, AFCME and No. 2 AMTC is considered satisfactory. Presently these measurements are recorded on standardized anthropometric platform developed at IAM. The efficacy of the portable anthropometer developed by Deshmukh, Mohalanobish et al [2], has been standardized and evaluated for field qualified measurement techniques of anthropometric parameters by Upadhyay [3]. Hence the techniques of anthropometric measurements being followed at various examination centres are considered satisfactory.

Perusal of the anthropometric parameters limitations laid down in para 2.2.13 of IAP 4303 [1] and the aircraft specific anthropometric limitations as given in table 2 shows that the parameter of maximum restriction is the sitting height. Sitting height is the height between the rump to the vault of the skull. This dimension is of importance in aviation activities in terms of cockpit geometry. Clearance of the head with helmet from the canopy curvature is essential to ensure prevention of injury. Sitting height also is a direct indicator of the eye level height and hence important for the vision. It is also brought out that the aircraft fitted with Head-Up Displays (HUD) hence have a limitation of minimum sitting height.

A diagrammatic representation of the existing sitting height intake standards for the flying stream and the sitting height limitations of the aircraft used in training and in operational flying, is given as Fig. 2. The figure shows that the intake standards are more permissive than the limitations laid down for the fighter training aircraft. The limitation of sitting height in the operational aircraft is more relaxed than that in the training aircraft and also than the intake standards. Thus there is a sitting height induced 'tunnel effect' in the sequence of progress of flying training and operational career. This has been marked as patterned area in the Fig. 2. Thus,

Fig. 2. Upper limitation of sitting height in the aircraft of IAF



(shaded area shows loss due to sitting height limitation in training and operational aircraft)

a fighter stream cadet has to initially train on the aircraft with sitting height limitations. This limitation of sitting height precludes the cadets with higher percentile values of sitting height to complete the requisite training though they have no restriction on flying the operational aircraft of the IAF. It is brought out that neither the aircraft dimensions can be changed nor the dimensions of a particular human being can be changed to match the two. The sitting height intake standard of 96.0 cms is based on the percentile distribution of the Indian population. The reduction of sitting height intake standard from 96.0 cms to a lesser value matching the training aircraft would eliminate the problem of rejection of aircrew for the training for the fighter stream. However a reduction in this intake standard for sitting height from 96.0 cms will eliminate a large population of Indian males from the fighter stream. A large number of so rejected cadets may actually have good pilot attributes and their rejection on the basis of sitting height as mentioned above will also deprive the Air Force of such cadets; who if not for fighter stream, can at least be utilised for transport/ helicopter streams. Therefore the approach of reducing the intake standard for sitting height to reduce the wastage of fighter stream cadets is considered unacceptable.

The aeromedical assessment of fighter stream cadets begins at entry stage itself. The assessment of cadets medically in pre flying stage is as important as that done during/just before flying stage itself. For the purpose of this study, the medical evaluation procedures followed at the entry stage and those followed during the actual flying stage are treated separately. Also due to the differences in age groups of the cadets joining flying branch through NDA and Combined Defence Service Examination (CDSE), the aeromedical assessment of these cadets is discussed separately.

NDA Cadets

For the NDA cadets of the Air Wing the medical evaluation is carried out during II and V terms. The II term evaluation is carried out to confirm the fitness of the cadets to begin training as an Air Wing cadet. The evaluation includes anthropometric assessment wherein sitting height, leg length and thigh length are also recorded as baseline values. At this stage, the majority of the rejections on account of medical causes are due to the presence of congenital disabilities and the injuries sustained in the childhood which are incompatible with flying. This evaluation also provides a platform to diagnose and treat correctable disabilities at this stage itself so that the cadets found to have such disabilities are completely cured by the time actual flying training starts.

Anthropometric rejections at this stage do not occur as existing policies allow waivers to be granted (for less than minima values) to account for possible growth which is likely on account of the lower age group of the cadets. The cadets falling below the minima laid down for total height, leg length and sitting height are given fixed waivers of 5 cms, 2.5 cms and 1 cm respectively, with the expectation that the cadets would attain the minimum standards with growth. There are obviously no waivers for cadets whose measurements are more than the maxima laid down. It is possible that a particular cadet found to have acceptable anthropometric parameters at this stage may grow further and may exceed the maxima values at a later date. Such cadets, though considered fit at this stage for Air wing, do subsequently become unfit; thereby causing increased rejection rate. Similarly, the cadets who have been granted waivers for a specific parameter, may not actually grow to the minima of the parameter for which they were given waiver, so that such cases would be rejected at a later date for flying training.

It is perceivable that the system of fixed waivers has its limitations for following reasons:

a. The cadets are in the age range of 16 to 20 years. Also all of them are not of uniform age and hence do not have the same fixed growth potential.

Due to this, it is possible that a cadet in second term and of higher age group (hence lesser growth potential) is given the same waiver as that given to another cadet of lower age group (hence higher group growth potential). The medical evaluation carried out in the V term aims at reassessing such cadets whose parameters are borderline.

b. There are no readily available and dependable growth curves based on age variability for various aviation related anthropometric paramaters, to base a system of age based waivers to NDA cadets.

c. The anatomical fusion of epiphyseal end plates resulting into completion of growth is variable in individuals [4].

It is felt that to circumvent this aspect, it is necessary that the waivers should be based on such scientifically developed curves of specific aviation based anthropometric parameters. A detailed study of anthropometric database of Air Force cadets, at IAM, NDA and No. 2 AMTC can be studied to assess the year wise growth of aviation specific parameters. A system can be developed where by the waivers would be granted based on the age of the cadets and should be given individually for all the three parameters based on their specific curves. This would be of advantage in having a better predictive value based on scientific data.

The NDA Air Wing cadets are again examined in V term prior to commissioning in flying stream. This medical evaluation aims at ensuring that the cadets is fit for undergoing all types of military flying. This is therefore logical that this evaluation should be done as close to the date of commencement of flying training as possible. Presently, it is being done near the end of the V term. This permits a cadet who is likely to be rejected for aviation duties to convert to army/navy wing so that the training imparted at NDA is not wasted and the said cadet can be used for non aviation military duties in VI term NDA or thereafter commissioned in service other than flying branch of Air Force. The timing of the medical examination is hence considered satisfactory.

The anthropometric assessment is also carried out at this stage to ensure that cadets are within acceptable limits of aviation parameters. This medical examination also checks that the cadets who were given waivers at earlier stage have grown satisfactorily. Similarly, it is possible that particular cadets who were within normal limits at earlier stage may be found to have outgrown the limits laid down. Such cases are another cause of rejection at this stage and referred to IAM, IAF for further confirmation. The age based growth curves of various parameters mentioned earlier will also be of help in identification of such cases.

A study of a complete database of air wing cadets who were rejected on non-anthropometric causes also needs to be studied. This, however is considered beyond the scope of this study.

It is possible that a composite Aeromedical Evaluation Cell with trained manpower including an Aviation Medicine Specialist and medical assistants along with the portable anthropometer, if raised at NDA/MH Khadakwasla itself may help in maintaining a far more efficient surveillance of NDA Air Wing cadets. The justification for this will however be confirmed only on availability of firm data mentioned earlier. Presently the Aviation Medicine Specialist at 2 wing AF periodically visits the NDA on an as and when required basis. The aeromedical cell can additionally cover other aeromedical areas of training, medical evaluation for the staff of NDA etc. This study however has not considered the administrative implications of this aspect, and has considered this suggestion solely on the basis of the necessity to conduct adequate medical surveillance of the cadets to minimize the rejection of the cadets at a later date.

The anthropometric evaluation at NDA should clearly elicit the type of training aircraft the cadet is likely to be unfit to fly; as it has a predictive value in terms of anthropometric rejection values for fighter stream. This evaluation will yield a rough estimate of cadets likely to be unfit for higher stages of flying training in Iskara and MiG 21 (type 77) aircraft. It is, however, reiterated that even at this stage the cadets may still be growing and hence may become unfit in future if they continue to grow. But by following the practice of declaring the fitness for specific aircraft will definitely be of value as it will play a vital screening role.

Combined Defence Service Examination (CDSE) cadets

The cadets selected through CDSE are of higher age group (> 20 years) and hence not permitted any waivers. Their medical evaluation is carried out at AFCME/IAM. Since the time lag between these anthropometric evaluation and the commencement of flying is relatively short and the candidates are of higher age group, the chances of growth related changes occurring in these anthropometric parameters are lesser. The medical evaluation of these cadets is done prior to commissioning at the specialist centres (IAM / AFCME) ensuring the fitness of cadets for flying duties after considering all the aeromedical aspects and is considered fairly comprehensive.

The CDSE cadets who may continue to show the growth of parameters escape rejection at the initial medical evaluation stage and may be rejected at a later date. However the available literature considers the growth beyond 20 years to be a rare event. Also, the prediction of growth of a specific parameter in a given individual is impossible to diagnose using clinical/investigative/research tools available [4]. To minimise this deficiency, the study mentioned earlier will be of help.

Military flying training

The flying training has been divided into 3 stages viz. I, II and III based on depth of training. Stage I training aims to teach basic skills of flying. It includes 65 hours of flying in 24 weeks and is done on HPT-32 aircraft at AFA and BFTS. This aircraft permits sitting height of 98 cms, which is more than 100th percentile value of the sitting height for the Indian aircrew and hence anthropometric rejection/ wastage do not occur at this stage. Also the leg length and the thigh length intake values are compatible.

The stage II (basic) training is done on Kiran MK I/IA at AFA and Air Force Station Bidar. This aircraft also has anthropometric limitations, which are in excess of the intake standards for aircrew specified in IAP 4303. Hence no cases of aircrew-aircraft incompatibility occur. The initial part of stage II flying includes 75 hrs of flying in 24 weeks. At the end of stage II flying on Kiran aircraft, a trifurcation board is held to consider the specific stream of aircraft that a given cadet is assigned. This board takes into consideration the performance of the cadet in his stage I/II flying. The board hence channelises the cadets into the further course of training in fighters, helicopters and transport aircraft. Prior to the trifurcation board, another aeromedical assessment of aircrew is carried out at No. 2 AMTC and fresh anthropometric measurements are taken. Cadets with borderline anthropometric parameters are evaluated for actual cockpit/encapsulation trials on MiG 21 (type 77) aircraft, which they need to fly if selected for the fighter stream flying. A cadet found to be incompatible cannot complete his fighter training and become operational in the fighter stream.

It is seen that, sitting height parameter is the limiting factor in both Iskara and MiG 21 (Type 77) aircraft. This limitation of sitting height is present because the intake standards permit a sitting height of upto 96 cms where as the training

aircraft Iskara and MiG 21 (Type 77) can not accommodate the pilots with sitting heights more than 94 cms and 92.5 cms (conditionally) respectively (fig. 1). Thus it is seen that such cadets with sitting height of high percentile value, despite being selected for fighter stream on the basis of their performance in training, are anthropometrically unfit to fly MiG 21 (Type 77) aircraft and hence will not be able to enter the fighter stream. In the absence of any anthropometrically suitable aircraft for operational training purposes it is likely that such cadets would have to enter helicopter or transport stream at best. In the past, Hunter aircraft was also being employed for operational training at Hunter Operational Flying Training Unit (HOFTU), which did not have the anthropometric restriction of sitting height. With the non-availability of HOFTU, the problem of sitting height limitations in MiG 21 (Type 77) vis a vis fighter training, appears to have caused higher rates of aircrew wastage from fighter training.

Also, prior to 1994, the evidence of data to restrict the sitting height compatible with MiG 21 (type 77) flying was inadequate and it is possible that a number of pilots exceeding the presently laid down limitations may have flown the said aircraft and not suffered evident incompatibility problems. There are reports of at least two cases wherein this excess sitting height had caused injuries to the pilots during attempted ejections from this aircraft [5, 6].

Due to above mentioned factors viz. non availability of Hunter aircraft for training purposes and laid down limitation of sitting height in MiG 21 (type 77) aircraft, the problem of aircrew aircraft incompatibility and resultant aircrew rejection from the fighter stream has become highlighted. Rejection of cadets who are identified for fighter stream based on their flying skill and performance due to anthropometric reasons, is a cause of concern. This aspect is also a highly demotivating factor in training, especially for cadets who are tall, and was appreciated during personal discussions with such cadets.

The laid down policy on the matter prescribes that the cases unlikely to fly MiG 21 type (type 77) be identified after stage II (basic) flying and their cockpit trial/encapsulation trial be done at 11 Wing, AF, so that if any cadet who fails in these trials need not go through fighter oriented stage II (applied phase) training on Iskara aircraft, only to find himself unfit to become fighter pilot after stage II applied phase as he is unfit for MiG 21 (type 77).

Aircrew-aircraft compatibility is dependent on the aircrew dimensions and the maximum human dimension, which the aircraft can accommodate for reasons of safe operation and flight safety. It is clear that neither the dimensions of the man can be voluntarily changed nor the cockpit geometry can be changed to match one with the other. Thus it is not possible to envisage any reduction in rejection of such cadets whose performance is adequate for fighter stream but unfit for MiG 21 (type 77) aircraft. Such cadets need to be reallocated to some other aircraft with relaxed anthropometric limitations, for the purposes of completion of stage III (operational) flying. Other variants of MiG 21 (viz. type 69, type 75 and type 96) have significantly relaxed anthropometric limitations than type 77 and hence anthropometrically more suitable for training purposes. The study of feasibility of identifying such aircraft for use in the training purposes is beyond the scope of this study due to the flying training related, technical and administrative decisions involved. But anthropometric considerations show that such a decision is likely to reduce the rejection of cadets selected for fighter stream as per their performance and skill.

There have also been conflicting policies regarding the aspect of anthropometric limitation of MiG 21 (type 77) aircraft. The existing policy has considered the aspects of injury potential in ejection as brought out in COI reports on ejection for MiG 21

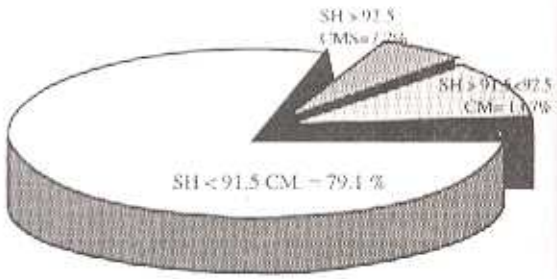
type 77 aircraft (5,6). The technical manuals for MIG 21 (type 77) limits the sitting height to 94 cm (without PSP) and 92 cms with PSP (7). However another policy issued in 1996 has reduced the unconditional clearance of sitting height in MiG 21 (type 77) aircraft to 91.5 cms and has recommended cockpit trials for sitting height between 91.5 cms and 93.5 cms. This is at variance with the limitations laid down in earlier policy letter. It is felt that the existing duplication of policy on the same subject can potentially cause confusion in the medical surveillance system. A clarification directive on this issue needs to be reissued.

A comparison of possible wastage of cadets on application of both the policies was done to evaluate their comparative impacts on flying training using data sample of sitting height measurements of two flying courses (156 PC & 157 PC). The number of cadets who would require cockpit/encapsulation trials while using 91.5 cms as a lower limit was seen to be 7.2% (average) higher than that when 92.5 cms was used as the cut off limit (Fig. 3). This would however not lead to an increase in the rejection rate. A greater number of cadets (7.2%) would have to undergo cockpit/encapsulation trials prior to considering them in the trifurcation board. This is shown in Fig. 3. The rational or scientific basis of using 91.5 cms as cut off limit for cockpit and encapsulation trials is not available for scrutiny. This restriction of sitting height has been deliberated upon by various Courts of Inquiries [5, 6], aeromedical studies [8, 9]. The fact that the recommendations from the manufacturers for sitting height restriction is 92 cms (with PSP) [7] also denies the justification of reducing the cut off value of sitting height to 91.5 cms.

An assessment of the two above mentioned cut off limits for sitting height for cockpit/encapsulation trials was done using available anthropometric percentile distribution of sitting height of Indian Air Force aircrew [10] with an aim to examine the impact of these figures for aircrew population as a whole and as an indicator of its effect on future cadets. It is seen that by using 91.5 cms as a cut off value for sitting height, only 0 to 60th/65th percentile of aircrew population can be considered fit to fly MiG 21 (type 77) aircraft unconditionally. When 92.5 cms is the cut off limit, upto 75th percentile can be cleared unconditionally. It is therefore felt that a cut off limit of 92.5 cms should be followed. It is however also brought out that using the Indian Aircrew population data to consider the fitness of the cadets is not accurate as the cadets are likely to have lesser dimensions than the trained pilots. The database of the anthropometric parameters of the cadets as mentioned earlier, is hence once again considered necessary.

Fig. 3. Sitting height vis a vis % of cockpit trials

(Average for 156 PC & 157 PC)



Sitting HT Limitation in MiG 21 (Type 77) = 91.5 cms
Additional Cockpit Trials = 7.2%

The percentile based review of sitting height as a parameter has a connotation for aircraft requirements of the future also. It is necessary to ensure that the training aircraft acquired in future should accommodate the maximum aircrew population i.e. between 2nd to 98th percentile of sitting height values for the adult instructor population as well as

2nd to 98th percentile of the cadet population. To ensure this, the proposed advanced trainer must accommodate aircrew instructors with sitting heights of 84.5 cms to 96.3 cms without compromising flight safety [10]. The data on the percentile distribution of sitting height in the cadets needs to the studied as brought out earlier. This will ensure that there are minimal rejections on anthropometric grounds in future cadets. It is also therefore necessary, that an Aviation Medicine specialist does a thorough anthropometric assessment of the proposed new trainer aircraft prior to its procurement. The proposed trainer should ideally cater for the entire range of the intake standards for various anthropometric standards so that the rejection rate at training stage will be zero. However such a large range would be futile as the limitations should also match the present day operational fighters.

There have been instances of certain cadets whose anthropometric recordings taken periodically during the medical evaluations at different centres were at variance with each other. Some of these cases were recorded to have sudden increase in the individual parameters, which did not corroborate with the growth in other parameters. Theoretically, although such growth is possible, some of these cases could not be explained satisfactorily. To minimise such errors, the instructions laid down regarding preconditions for anthropometric measurements should be strictly adhered to. This study however did not bring out any specific instances by which deficiencies in the medical evaluation methodology followed at various centres could be pinpointed.

At IAM, another project is presently being planned to improve the method of recording of anthropometric measurements using computerized techniques. It is felt that IAM as a referral centre for doubtful cases of anthropometric incongruities, should have this sophisticated system at the earliest. Such a system would also provide an additional means of calibration of field qualified measurement techniques done on portable anthropometers. The calibration facilities can be utilised by all the evaluation centres on a periodic/ as and when required basis. This project, would aid in reducing the equipment related errors of recording of anthropometric parameters.

Recommendations

Present policy regarding administration of existing system of medical surveillance including anthropometric evaluation of Flight Cadets from initial selection through completion of flying training is considered adequate. The only amendment recommended is that during initial boards at IAM/ AFCME and subsequent Medical Board at V term NDA fitness/unfitness to fly various fighter aircraft, training as well as combat aircraft, must be clearly endorsed. An Aviation Medicine Specialist must be a member of these Medical Boards to look after this aspect.

To identify reasons for avoidable wastage of fighter training related to medical unfitness, retrospective study of such cases at training establishment is recommended. This may bring out specific disability/illness related as well as total extent of the problem so that future solutions can be worked out. This type of study should be taken up once in every 5 years to monitor the problem areas and to find suitable solutions.

To minimise the problem of current aircrew-aircraft compatibility standards on the training of aircrew with special emphasis on acquisition of newer aircraft for future training and operational roles, it is recommended that a proper aeromedical assessment of the newer aircraft by an Aviation Medicine Specialist be made mandatory. This should also include the anthropometric considerations of

the newer aircraft in relation to the existing IAF Pilot population. It is brought out that in the past this practice was followed while acquiring Jaguar, Mirage and MiG-25 aircraft.

Borderline cases of aircrew aircraft incompatibility must be rechecked on specific types of aircraft. This may be necessary even when aircrew are re-posted to fly a particular type of aircraft on instructional duties or otherwise.

Standardisation of anthropometric measurement platforms and techniques is a must. All stations/ centres conducting such measurements should use portable anthropometric platforms. Time of the day for taking measurements should also be standardised to eliminate diurnal variation in standing and sitting height. Aviation Medicine Specialists should record the measurements.

The development of more sophisticated system of measurement of anthropometric parameters viz. Computerized Digital Anthropometer at IAM, IAF be hastened so that the referral centre would have the additional means of assessing the doubtful cases.

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