Original Article

Centrifuge training for ab-initio pilots (Stage IIA) of Indian Air Force : Results

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A total of 129 trainees have been trained on the human centrifuge so far. All except one was convinced about the increase in +Gz tolerance by using the AGSM and also about the utility of the course, 125 pilots requested for the course to be repeated. Most pilots requested for a regular refresher course. Nine (7%) of the trainees underwent G-LOC during training. This is in keeping with the world statistics. It thus appears that the course is effective and the pilots being trained realise the benefits.

Keywords: Aircrew training, anti-G straining manoeuvre (AGSM), G-induced loss of conciousness (G-LOC).

The Institute of Acrospace Medicine (IAM), IAF, Bangalore started training for Stage II-A, advanced pilot trainces in 1998. Trainces learning to fly for the Indian Air Force are trained in three stages. The Stage I of training for flight cadets is done either at the Air Force Academy (AFA) or at the Basic Flying Training School (BITS). This is done on the HPT-32. The Stage II of training is done on Kiran (HJT-16) at AFA and Air Force Station Bidar. This is followed by trifurcation into fighter, transport and helicopter streams. The Stage II trainees go for specialized training in their respective training wings. Stage II-A training for fighter pilots, is done at AFS Hakimpet (AP) in Iskra and Kiran Mk-II aircraft.

Stage II-A trainees come to IAM for +Gz training. The object of the training is to indoctrinate the pilots in the effects of high +Gz and impart AGSM training in the human centrifuge.

We had two aims in starting this training at such an early stage:-

- (a) The first was that if the pilot trainees learned the correct AGSM at an early stage, they would 'grow up' with it, and hence would be able to use it naturally.
- (b) The second was that training would prepare them for the next stage of flying viz operational training on MiG-21 (T-77) aircraft.

In this paper we would use the pilots' feedback and their response to training to try and answer these questions.

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Material and Methods

Centrifuge training was done for 129 trainee pilots undergoing stage II-A training. The pilots reported to IAM during their stage II-A phase, prior to their induction into operational flying at the MiG Operational Flying Trianing Unit (MOFTU). During the course they were subjected to +Gz tolerance runs, and Rapid Onset Rate (ROR) runs at +1G/s to 4, 5 and 6 Gz. At a later date, on request of the pilots, a Simulated Air Combat Manocuvre (SACM) with peaks of 4 Gz (15 s) and 6.5 Gz (10 s) was added.

At the end of the course, the pilots were given a questionnaire, in order to determine their opinion regarding the course. Pilots who underwent G-LOC were asked to fill an additional questionnaire, describing their episode of G-LOC.

Results

129 pilot trainees have undergone this course so far. Their mean age was 21±0.33 years. The mean (±SD) +Gz experienced by pilots before the course was 6.1±0.64 Gz. 127 (98.5%) trainees completed the course successfully. Two trainees could not complete the stipulated +6 Gz for 30 sec. These pilots were sent back with advice to improve

their physical fitness and dietary habits and then repeat the course. It is noteworthy that these two individuals claimed to have undergone +6 Gz in the aircraft.

128 (99.22%) trainees were convinced that AGSM would increase their +Gz tolerance. 128 felt certain that physical conditioning would help them combat +Gz in the aircraft. 125 (96.4%) agreed that the course should be repeated after some time to consolidate the gains.

33 (25.6%) of the trainces felt that the duration of the course should be increased beyond two days. 16 (12.4%) believed that an exposure to higher +Gz levels than the present +6 Gz is required. One individual asked for deliberate induction of G-LOC to give the pilots a better idea about G-LOC, which was, however, not given in view of the current policty in vogue.

Nine (7%) of the trainees developed G-LOC in the centrifuge. Two of these could finally not complete the course as mentioned above. Two of these nine had experienced G-LOC in aircraft prior to reporting for the course. In both cases the G-LOC had occurred during a tail chase sortie while performing a roll-off-the-top. The mean (±SD) +Gz levels at which G-LOC occurred in the centrifuge was +5.7 (±0.84) Gz. The various

Table 1: Indicates characteristics of G-LOC in the centrifuge

SINo	Exercise	Run Type	+Gz value	Additional factor
1	No	Relaxed Tolerance	5.3	
2	Regular	SACM	6.5	No Pro-flight meal
3	Regular	ROR	5	5
4	Regular	ROR	5	
5	No	ROR	5	Stopped AGSM Improper AGSM
6	No	ROR	6	
7	No	SACM	6.5	
8	No	ROR	4.7	

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SM SM characteristics of G-LOC are mentioned in tables-1&2. The mean period of absolute incapacitation was 9.7 (±1.32) sec. The period of relative incapacitation was 5.8 (±2.6) sec. The period of total incapacitation was 15.4 (±2.9) sec.

Table 2: Characteristics of G-LOC

Characteristic	Present in (n=9)	
Amnesia	3	
Dreams	5	
Convulsions	5	
Tingling	6	
Confusion	5	

Discussion

129 pilots have been trained during the Stage II A course since its inception 18 months ago. This number is relatively higher than that for the Advanced Fighter Aircrew Indoctrination Course (AFAIC), where Agarwal et al reported 259 pilots trained between 1991 and 1997 at the same laboratory [2]. The reason for higher numbers is the much shorter duration of the Stage II-A course, which lasts for two days. In contrast, the AFAIC lasts for two weeks. Sekiguchi et al reported having trained 138 fighter pilots between 1982 and 1986, in a one week course, which is similar in construction to our AFAIC [3]. On the other hand, Gillingham and Fosdick, in their study published in 1988 [4] reported results from training of 741 fighter aircrew of the USAF between 08 Jan 85 and 12 Feb 86.

99.7% of our trainees felt that the course was useful. This number is much higher than that reported by Gillingham and Fosdick for USAF pilots, only 73% of whom found the course useful [4]. The USAF course is for trained pilots. It consists of only five centrifuge runs viz GOR and 6,7,8,9 Gz ROR runs. It lasts for one day only [4,5].

The authors are of the opinion that the higher acceptability of the Stage II-A course may be due to a longer duration of the course. Even with a two-day course, 25% of the trainees in this study feel that the duration of the course needs to be increased, 96% trainees felt that the course should be repeated at least once, 46% felt that the course should be repeated at regular intervals, to maintain currency. This further indicates the feeling of the pilots, that they require more AGSM practice in the human centrifuge.

7% trainces developed G-LOC in the centrifuge. Gillingham and Fosdick reported an incidence of 9% G-LOC during the USAF high +Gz course [4], despite the shorter duration and much less centrifuge runs. This figure is much lower than 35.5% reported by Agarwal et al during the AFAIC [2]. Whinnery in his study involving 56 medical officers, reported G-LOC in 15 trainces (26.7%). The Japanese high +Ciz course had an incidence of 23.9% [3]. The authors are of the opinion that the lower incidence of G-LOC in the Stage II-A course is because of the lower +Gz levels to which the pilots were exposed in this course and the relatively short duration of the course, involving lesser number of centrifuge runs. The other contributory factor may be the absence of gradual onset rate (GOR) runs in Stage II-A course. Gillingham et al have blamed GOR runs as a major contributory factor for G-LOC in the centrifuge [4]. This has, however, not been supported by various reports from our laboratory [2.6].

In seven out of the nine trainees, the G-LOC was accompanied by dreams or myoclonic jerks. This is considered to imply a greater neurologic insult [7], and is associated with longer periods of absolute and relative incapacitation. Despite this, the average duration of relative incapacitation and total incapacitation was much lower than that reported by other authors [7,8]. This is primarily due to the fact that G-LOC during this course

occurred at lower +Gz levels, as the highest +Gz levels during the course were +6.5 Gz during simulated air combat manoeuvers (SACM).

In response to the pilots' demands for higher +Gz levels, recently SACMs were instituted as a part of the course. The response of pilots to this addition was enthusiastic, with all trainees agreeing that it enhances their understanding of high +Gz and coping strategies.

Conclusion

Thus the training course for Stage II-A is still evolving. Still, the number of trainces that we trained during the past one year, have given us a very encouraging feedback. It is felt that this course would go a long way in increasing the efficiency of aircrew during their operational flying training phase and thereafter.

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