

Aircrew Fatigue in transport aircraft

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ABSTRACT

A study was undertaken at a transport squadron to evaluate the number of hours a set of aircrew flew for a day in different types of sorties, and total duration of time this set of aircrew remained on duty in a day. It was found that flying time and duty time for Route Transport Role (RTR) sorties were maximum. Number of take-off and landing in a day was also highest in RTR sorties. Questionnaire survey amongst aircrew revealed that aircrew found RTR, Training cross country (TCC) and formation sorties highly fatiguing. Views of aircrew on various transit facilities were obtained, and airfields with best and worst transit aircrew facilities were identified.

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The fixed wing fleet of Indian Air Force plays a vital role in north-east sector of India. Major share of the flying task is carried out by AN 32 squadrons stationed at a major Air Force Base in Assam. A study was conducted to understand the diverse flying activities undertaken by one of these squadrons and the degree of flying fatigue experienced by the aircrew.

Peace time role of the squadron can be broadly divided into (a) Air Logistics (b) Route Transport Role (RTR) (c) Training. Air logistics involves flying to Drop Zones (DZ) or landing at Advance Landing Ground (ALG), for supplying ration to local civil population and military troops. This involves flying through mountains terrain at low level, and dropping several tonnes of goods at a particular spot. The weather remains bad at most of the time. Landing conditions at ALGs are primitive. Navigation is mainly visual and it takes

a lot of flying hours to become fully operational at some of the DZs and ALGs [1].

RTR mainly involves flying from the base to various airfields of the country. It involves extensive flying, very akin to that of domestic airlines. However, the flying task involved are more varied and are executed at a very short notice. It usually involves staying away from home base for several days.

Training tasks in the squadron involves training of newly posted aircrew as well as senior aircrew. Different training sorties which are undertaken in the squadron are termed as Continuation Training (CT), Training Cross Country

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(TCC), Low level (LL) and Formation (FORM). These involve both day and night sorties. Apart from these, there are Aircraft & Engine check (AE&S) sorties.

AN 32 aircraft is flown by a set of four aircrew: Pilot, co pilot, navigator and flight engineer. In RTR sorties, the composition of aircrew usually remains fixed for the entire span of flying task, while in other sorties, it may change from sortie to sortie.

This study was conducted to determine the amount of flying carried out by a set of aircrew in a day and the total duration of time this set of aircrew is on duty. The views of aircrew on the subject were obtained through a questionnaire survey.

Materials and methods

The study was conducted in one of the AN 32 squadrons in the North East sector. Total flying carried out for a month was studied by consulting the Authorization Book of the squadron. The sorties were grouped under three main headings: Air logistics, RTR and training. The sorties flown by a set of crew in a day were clubbed together and termed as composite sortie. Total flying time

and number of sorties flown were determined. Total duty time was calculated from the time of briefing of aircrew to one hour after last landing. Averages of total sorties flown, flying time and duty time were calculated. Maximum value of number of sorties flown, flying time and duty time were also determined. A questionnaire survey was conducted among aircrew to determine their views about aircrew fatigue. They were asked to grade different types of sorties on the basis of fatigue associated with them, and identify the sorties for which there was a need to revise flight duty limitations. They were also asked whether they were able to cope up with the flying schedule for the month. Their views on transit aircrew facilities available in different airfields were taken, and the best and worst airfields in terms of transit aircrew facility were identified.

Results

Total number of sorties flown by the squadron in the particular month was 314, out of which, 293 sorties were taken into account for this study. Out of these, 118 sorties were of Training group, 120 of RTR group and 55 of Air logistics group. Total number of composite sorties flown were 148, out of which 77 were of Training group, 45 of RTR group and 26 of Air logistics group (Table 1).

Table 1 : Details of sorties

INDIVIDUAL SORTIES		
Type of sortie	No. of sorties	Hours flown
Air logistics	55	53.00
RTR and allied flying	120	169.40
CT and allied flying	118	114.30
Total	293	337.10

COMPOSITE SORTIES

Type of sortie	No. of sorties
Air logistics	26
RTR	45
Training sorties	77
Total	148

In Training group, average number of sorties flown by a set of crew per day was 1.5, and maximum number of sorties in a day was 4. Average duration of a composite sortie was 1.29 hours, while maximum duration of a composite

sortie was 5.30 hours. Average duration of duty hours for a set of crew per day was 3.54 hours, and maximum duration on duty was 8.30 hours (Table 2).

Table 2 : Analysis of sorties

	Sorties flown	Hours flown	Hours on duty
Training group			
Total	118	114.00	303.25
Average	1.5	1.29	3.54
SD	0.64	0.47	1.90
Maximum	4	5.30	8.30
RTR group			
Total	120	169.40	352.50
Average	2.7	3.46	7.50
SD	1.45	2.14	2.45
Maximum	6	7.45	16.15
Air logistics group			
Total	55	53.05	125.05
Average	2.1	2.03	4.49
SD	1.2	0.52	1.47
Maximum	5	4.15	8.20

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In RTR group, average number of sorties flown by a set of crew per day was 2.7, and maximum number of sorties in a day was 6. Average duration of a composite sortie was 3.46 hours, while maximum duration of a composite sortie was 7.45 hours. Average duration of duty hours for a set of crew per day was 7.50 hours, and maximum duration on duty was 16.15 hours.

In Air logistics group, average number of sorties flown by a set of crew per day was 2.1 and maximum number of sorties in a day was 5. Average duration of a composite sortie was 2.03

hours, while maximum duration of a composite sortie was 4.15 hours. Average duration of duty hours for a set of crew per day was 4.49 hours, and maximum duration on duty was 8.20 hours.

A total of 40 aircrew responded to the questionnaire survey. There were 17 pilots, 6 navigators and 17 flight engineers. Pilots found formation sorties (both day and night) highly fatiguing, followed by RTR and TCC sorties. Navigators and flight engineers found RTR sorties to be highly fatiguing, followed by night formation sorties (Table 3).

Table 3: Fatigue level of different sorties

Type of sortie	Pilot	Navigator	Ft Engineer
RTR	6	7	9
TCC	6	5	4
CT day	5	4	5
CT night	5	4	6
Air Logistics	5	5	7
LL day	5	5	5
LL night	6	6	5
Formation day	8	6	7
Formation night	8	6	8

* (Grading score: 1 - least fatiguing, 10 = most fatiguing)

29% pilots and 50% navigators found RTR and formation flying to be the cause of aircrew fatigue, and wanted a revision in the flying time limitations in these categories. 71% flight engineers found RTR sorties to be the main cause of aircrew

fatigue, and wanted a revision in the flying time limitations. For other types of sorties, there was negligible demand for revision of flying time limitations (Table 4).

Table 4: Requirement of revision of flying time limitations

	RTR	TCC	CT	LL	Formation	Air logistics
Pilot (n=17)	5	0	1	0	5	0
Navigator (n=6)	3	1	0	0	3	0
Flt Engineer (n=17)	12	0	0	0	3	0

When asked about their ability to cope up with daily fatigue levels, 17.5% pilots, 17% navigators and 41% flight engineers were experiencing fatigue which they were unable to cope up with most of the days of the month. 65% pilots, 83% navigators and 53% flight engineers

were unable to cope up with fatigue for some days of the month. 17.5% pilots and 6% flight engineers were able to cope up with fatigue all days of the month. The overall figures for all the aircrew were 28%, 63% and 10% respectively (Table 5).

Table 5: Ability to cope up with flying fatigue

	Pilot (n=17)	Navigator (n=6)	Flt Engineer (n=17)	Overall (n=40)
Most of the days	03 [17.5%]	83 [17%]	7 [41%]	11 [28%]
Some days	11 [65.0%]	05 [83%]	9 [53%]	25 [63%]
Never	03 [17.5%]	Nil	1 [6%]	04 [10%]

As for transit aircrew facilities, officer aircrew found aircrew room, transport, accommodation and food to be of satisfactory quality in most air bases. Transit snacks were found to be of below satisfactory standard. Non-officer aircrew found

aircrew room (where available), transport, transit accommodation and food to be of satisfactory level. They too, found transit snacks to be of poor quality in most air bases. (Table 6).

Table 6: Transit aircrew facilities

	Officer aircrew (X: 1 = least satisfactory)	Other aircrew (XX: 10 = most satisfactory)
Aircrew room	5	4
Transit snacks	3	3
Aircrew transport	5	6
Transit accommodation	4	6
Transit food	5	4

X: 1 = Least satisfactory XX: 10 = most satisfactory

Officer aircrew of this squadron found Hashimara, Pune and Bangalore to have the best transit aircrew facilities, and Agra, Barrackpore and Palam to have the worst transit aircrew facilities

(Table 7). Non officer aircrew found Jodhpur, Guwahati and Kanpur to have the best transit aircrew facilities, while Jaisalmer, Naliya and Suratgarh to have the worst transit aircrew facilities.

Table 7 : Airfield with best and worst transit aircrew facilities

	Best	Worst
Officer aircrew	Hashimara, Pune, Bangalore	Agra, Barrackpore, Palam
Other aircrew	Jodhpur, Guwahati, Kanpur	Jaisalmer, Naliya, Suratgarh

Discussion

Transport squadrons of IAF play an omnipresent role in terms of logistics, communication and carriage of passengers. Their role in the north eastern and northern sectors of the country is further enhanced due to the geopolitical situation of these regions. AN-32 aircraft is the main workhorse used for various tasks in these sectors. However, very little has been discussed about aircrew fatigue in AN-32 squadrons of IAF. In this study, various problems faced by aircrew have been brought out.

Average flying task given to an AN-32 squadron is about 300 hours of flying, out which 60 hours comprise of night flying. Within this time frame, the squadron has to carry out its varied roles i.e., training, logistics and route transport. With decreasing availability of aircraft and fully operational pilots in valley flying, and adverse weather conditions, it becomes difficult to carry out the commitments of the squadron.

Manual of Air Transport (MATO) (IAP 3314) provides guidelines for duty hours of transport aircrew [2]. It states that total flying hours should be limited to six hours per day, extendible to eight hours. However, in case of any fatigue, the crew

can decide not to fly, and abort the task given. Total permissible duty period is taken as 8 hours, with maximum of 10 hours. However, in case aircrew fatigue these periods can be reduced as per requirement.

In the present study, flying hours of an AN 32 squadron in a month has been analysed. It is seen that RTR and allied flying tasks like casualty evacuation ferry and VIP commitments form the maximum number of sorties (120), followed by training sorties (118). Air logistics sorties were less in number (55). However, in terms of composite sorties, in which the composition of the crew remained the same, maximum number of sorties were of training group (77), followed by RTR (45) and Air logistics (26). In terms of flying hours, RTR group clocked the maximum with 169.40 hours, followed by training group with 114.30 hours and Air logistics group with 53.05 hours. Average flying hours is the maximum for aircrew flying RTR sorties (3.46 hours).

Maximum duration flown by a set of aircrew in a day for the month was 7.45 hours. It occurred in a RTR sortie. Maximum duration of flying, for a training sortie was 5.30 hours, while for Air logistics it was 4.15 hours. Thus, flying hours for the three different groups were within the maximum

permissible limit laid down by MATO.

Average duty time for RTR group was 7.50 hours; for Air logistics group it was 4.49 hours, and for training group it was 3.54 hours. Maximum duty time, a set of crew experienced in that particular month was 16.15 hours for a RTR composite sortie, 8.20 for Air logistics sortie and 8.30 for training sortie. Thus, in RTR group, average duty hours extended almost to the limit of 8 hours, while maximum duty hours once exceed double the limit. In fact, the limit of 8 hours was crossed in case of 26 composite RTR sorties (out of a total of 45). In case of training and Air logistics composite sorties, duty time limit was exceeded only once for each group. This indicates that RTR sorties at most instances are likely to lead to fatigue of aircrew.

No limitation has been set by MATO regarding number of take-off and landing per day. Average number of landings for RTR, Air logistics and training sorties were 1.45, 2 and 1.5 respectively. Maximum number of landings for a set of crew in a day for the month was 6. This again occurred in a RTR composite sortie. As take-off and landing are the most critical phases of flying, they impose considerable workload on the aircrew. Take-off and landing conditions at AIGs are quite formidable, with very less ground for compromises. There is a requirement to determine the number of sorties that can be carried out in different types of flying conditions and terrain, and proper guidelines set for the same.

It has been proved that in a fully rested individual, performance rises in the first five hours of waking. It then precipitously falls over the next few hours, and levels off around 16 hours [3]. As far as the time of the day is concerned, performance rises during the day, and falls during late evening and overnight to reach its nadir at 0500 h. These observations must be kept in mind

while planning out sorties for transport aircrew. Due to sudden commitments given to the squadron, proper rest schedules are difficult to follow by the aircrew. This too, lead to cumulative fatigue of the crew

Questionnaire survey carried out among aircrew revealed certain important facts about aircrew fatigue. Formation flying, which is usually of short duration, was rated as highly fatiguing by almost all aircrew. Pilots and navigators found RTR sorties was causing moderate degree of fatigue. Flight engineers rated these sorties to be highly fatiguing. Aircrew had commented in the questionnaire that lack of proper co ordination by loading/off loading agencies, unrealistic briefing time, unplanned commitments and unscheduled sorties contribute to the fatigue level in RTR sorties. Non officer aircrew had commented on the non availability of housing facilities for their families within the campus, which make them vulnerable to worries and mental fatigue while away from base. Quite a number of aircrew wanted a revision in the flight duty time limitations for RTR and formation sorties. This again proved the point that these two types of sorties were leading to considerable degree of fatigue among aircrew.

It was alarming to note that 28% of all aircrew found that they were unable to cope with fatigue associated with daily flying. 63% of aircrew were feeling fatigued some days of the month. Very few aircrew (10%) did not feel fatigued throughout the month.

Transit aircrew facilities required improvement in most of the air bases. While most of the facilities were of average standard, transit snacks were found to be lacking in most airfield. It is disheartening to note that aircrew had commented in the questionnaire that at some places, even a glass of water or tea was not offered to aircrew during stop overs. Non officer aircrew commented

that proper transit aircrew room was available only at Palam, while transit accommodation was often difficult to get due to misuse, or non availability of accommodation member.

Transport aircrew deserve a lot of commendation for their role in providing service in the face of lot of short comings. However, as this study has shown, their flying schedules require a thorough re-thinking. After analysing the data on flying fatigue present among aircrew of an operational squadron, it is time that some concrete decisions are taken to decrease the stress among aircrew. The main thrust areas will be proper planning of sorties, proper co ordination of load handling agencies, realistic task allotment, improvement of transit aircrew facilities and providing basic facilities like accommodation at home bases.

Conclusion

Fatigue is an inherent stress of aviation duties. Erratic schedules, noise and vibrations, detrimental environmental conditions, difficult terrain and associated personal problems are likely

to take their toll on the transport aircrew. Therefore, in aviation, fatigue is always a potential threat to flight safety. Though fatigue is difficult to be determined objectively as far its contribution to performance decrement is concerned, it must be the endeavour of everyone associated with flight safety to take suitable preventive measures, so that the transport aircrew lead a more fruitful and fulfilling life. For AN-32 aircrew, there is a need to revise RTR and formation flying schedules, plan realistic commitments, keeping in view the availability of serviceable aircraft and trained aircrew, and provide better transit aircrew facilities. This will go a long way in helping transport aircrew to carry on with their task in a healthier work environment.

References

1. Kartik K, Sishu MK. Air maintenance operations: An accident/incident analysis. *Ind J Aerospace Med* 1996; 40(1): 1-6
2. IAP. Manual of Air Transport Operations. IAP 3314, India 1987; 19-20.
3. Nicholson AN. Aircrew and their sleep. In: Ernsting J, King PE, eds. *Aviation Medicine*, 2nd edition. London: Cambridge Univ. Press, 1988: 576 - 584.