



## ASSEMBLY — 40TH SESSION

### TECHNICAL COMMISSION

#### Agenda Item 30: Other issues to be considered by the Technical Commission

#### **EXPOSURE TO IONISING RADIATION BY FLIGHT CREW AND CABIN CREW MEMBERS: NEED FOR DEVELOPMENT OF STANDARDS OR GUIDELINES FOR MONITORING INFLIGHT COSMIC RADIATION EXPOSURE**

(Presented by South Africa)

#### **EXECUTIVE SUMMARY**

Annex 6 — *Operation of Aircraft* does not make provision for aircraft intended to operate below 15,000 m (49,000 ft) to carry equipment to measure and continuously indicate the dose rate of total cosmic radiation being received and the cumulative dose on each flight, whilst the crew is also exposed to ionising radiation.

There is an opportunity for ICAO to forge partnership with the International Commission on Radiological Protection (ICRP) to develop guidelines or Standards for regarding flight and cabin crew members' exposure to cosmic radiation.

There is a long-term risk of radiation-induced cancer (Friedberg et al) because of cosmic radiation; and, in the case of pregnant aircrew, possible harm to the foetus and mainly stochastic effects later in life and to a lesser extent, birth defects.

ICAO is required to lead in the development of guidance material or Standards to address exposure to ionising radiation.

<i>Strategic Objectives:</i>	This working paper relates to ICAO Strategic Objectives on Safety and Environmental Protection.
<i>Financial implications:</i>	The costs implications are limited to administrative functions which can be accommodated within the ICAO Regular Budget.
<i>References:</i>	International Commission on Radiological Protection in Publication 60. ICAO Annex 6, Part 1: Chapter 4: 4.2.11.2 and Annex 6, Part 2: Chapter 3: 3.6.7

### 1. INTRODUCTION

1.1 As determined by the International Commission on Radiological Protection (ICRP), flight and cabin crew members operating at high altitude are exposed to ionising radiation.

1.2 Standard 6.12 of Annex 6 requires all aircraft intended to be operated above 15,000 m (49,000 ft) to carry equipment to measure and continuously indicate the dose rate of total cosmic radiation

being received and the cumulative dose on each flight. Standard 4.2.11.5 requires an operator to maintain records of flights above 15,000 m (49,000 ft) so that the total cosmic radiation dose received by each crew member over a period of 12 consecutive months can be determined. The Annex does not make any such or equivalent provision for aircraft intended to operate below 15,000 m (49,000 ft).

1.3 Despite the lack of Standards and Recommended Practices (SARPs) for aircrafts intended to operate below 15,000 m (49,000 ft), various States consider aircrew to be occupationally exposed to ionising radiation and have prescribed the same recommended limits as per the ICRP recommendations.

## 2. DISCUSSION

2.1 Cosmic radiation consists of a comprehensive spectrum of particles and electromagnetic radiation. Cosmic rays are radioactive particles that hit the earth from outer space and can have energies far in excess of manmade radiation sources. The earth's atmosphere blocks a portion of these rays, but some of them reach the ground.

2.2 The main factors affecting the amount of exposure to cosmic radiation are: altitude (the higher we go, the greater the dose); latitude (the closer we get to the poles, the greater the dose); and duration (the longer we stay aloft, the greater the dose). The further north or south one is from the equator, the more radiation one will receive. This is caused by the Earth's magnetic field deflecting some of the cosmic radiation away from the equator and toward the North and South Poles. Cosmic radiation increases with increasing latitude reaching a constant of about 50 degrees. The dose rates increase with an altitude up to a maximum of about 20 km (66,000 ft). Therefore, the radiation dose will vary between different flights depending on: origin, destination, route, flight level pattern, and solar activity. Aircrew and frequent flyers get the most exposure because of the extra time they spend at cruising altitudes.

2.3 It is estimated, for example, that for a flight from Northern Europe to the Eastern Seaboard of the USA – an effective dose of 30 to 40 microSv is captured. Longer flights from Northern Europe to Japan will result in a dose of 50 to 70 microSv and transatlantic flights at the altitudes used by supersonic aircraft may give similar total effective doses as in subsonic aircraft, the higher dose rates being offset by the shorter flight times.

## 3. OPPORTUNITIES

3.1 There is an opportunity for ICAO to forge partnership with the ICRP to develop guidelines or Standards for regarding flight and cabin crew members' exposure to cosmic radiation.

3.2 This is the opportune moment for ICAO to lead in the development of guidance material or Standards on how operators should adjust aircrew members' rosters to reduce exposure with the aim of preventing, where possible, doses in excess of 6 mSv/annum.

3.3 In developing such Standards or guidelines, ICAO should take into consideration the Standards that are used by States that have already implemented monitoring measures.

3.4 ICAO may form a working/study group or may allocate this task to any of the existing working/study groups. The working/study group will work closely with the ICRP and other interested stakeholders to develop such guidelines or Standards, which may include but not limited to: working

hours of aircrew members on scheduled flights and other commercial activities, flight duration, a period of time when a member of air crew is released of all duties, annual leave of air crew members, the minimum periods for record keeping for individuals exposed to radiation dose that exceeds minimum requirements and how States should manage risks of potential claims relating to occupational hazards.

#### **4. HEALTH IMPLICATIONS**

4.1 The main concerns are the long-term risk of radiation-induced cancer (Friedberg et al) because of cosmic radiation; and, in the case of pregnant aircrew, possible harm to the foetus and mainly stochastic effects later in life and to a lesser extent, birth defects.

4.2 A meta-analysis of both published and unpublished cohort studies of aircrew between 1986 and 1998 concluded that aircrew seemed to be at risk of several types of cancer: melanoma, brain, prostate, and breast. It was not possible, based on these studies, to pinpoint cosmic radiation as the culprit. The authors recommended that future studies must also compare risks within cohorts by flight routes, work history, and exposures to cosmic and ultraviolet radiation, electromagnetic fields, and chemical substance.

#### **5. POTENTIAL CHALLENGES**

5.1 In the absence of ICAO SARPs or guidelines, States may experience challenges implementing and enforcing regulations to operators in line with the ICRP.

5.2 States that are not implementing the recommendations of ICRP are at risk of potential financial claims relating to occupational hazards.

5.3 In the absence of guidance from ICAO, various States have implemented the ICRP as raw as they are, whilst other States may have made changes to adapt them to their situation. This will result in lack of standardization, which may cause challenges to aircraft operators.

5.4 Limited research in developing countries may be a challenge relating to the estimation of doses relating to the radiation dose, between different flights depending on origin, destination, route, flight level pattern, solar activity, etc.

#### **6. CONCLUSION**

6.1 In order to ensure standardisation, it is recommended that ICAO should lead the development of guidance material or SARPs to assist States to adhere to recommendations of the ICRP.

6.2 Partnership between ICAO, ICRP, Member States and other interested parties is essential to address the effects of cosmic radiation exposure.