Protection from Ionizing Radiation

Position paper

The airline pilot operates in an environment with exposure to circadian dysrhythmia, chronic fatigue, reduced atmospheric pressure, mild hypoxia, low humidity, and exposure to sound, vibration, radiation (both ionizing and non-ionizing), and electromagnetic fields. These occupational exposures present physiological challenges to their long-term health.

In particular, exposure to ionizing radiation and its carcinogenic/mutagenic potential has received considerable attention. Whereas annual exposures for ground-based radiation workers have been successfully reduced, airline flight crew exposures remain at levels substantially above those of other radiation-exposed workers and are increasing with modern flight operations.

NOTE

While this Position Paper is specific to ionizing radiation, exposure to non-ionizing radiation such as UV-A rays as well as high-energy visible light are increasingly suspected to have adverse health effects on skin and eyes.

This ECA Position Paper closely adheres to the IFALPA position 18POS02 while emphasizing the more comprehensive and legally binding aspects of European jurisdiction compared to UN (ICRP) recommendations.

INTRODUCTION

Despite the international recognition that cosmic radiation poses a workplace health risk to airline pilots, there is an immediate requirement for comprehensive research into all forms of radiation exposures of airline pilots. Keeping in mind the complexity of exposures in the cockpit environment, this Position Paper endeavors to provide for the protection of flight crews with respect to the potential health risks of ionizing radiation exposure.

The International Commission on Radiological Protection (ICRP) is the recognized international body that develops the principles, philosophies, and policies for radiological protection. The guidance for a generic system of radiological protection was published in ICRP Publication 103 in 2007 and specifically for aviation in ICRP Publication 132 in 2016.

Even more importantly, in 2013, the Council of the European Unionissued their current legal framework, the EU Council Directive 2013/59/EURATOM of 05 Dec 2013 (the “2013 EURATOM BSS“). These Basic Safety Standards are to be implemented into national law of the EU Member States by the end of 2018.

These documents make the cornerstones for the ECA position.

European Cockpit Association AISBL

Rue du Commerce 20-22, 1000 Brussels, Belgium I T +32 2 705 32 93 I F +32 2 705 08 77 I eca@eurocockpit.be I www.eurocockpit.be

The International Federation of Air Line Pilots' Associations (IFALPA) recommends the EURATOM BSS as an exemplary legal framework to its Member Associations across the globe.

ECA POSITION

1. Flight crew radiation protection should be categorized as a planned exposure situation

Where ICRP Publication 132 recommends that the exposure of aircraft crew should be treated as occupational exposure in an existing exposure situation, the European Council encourages its Member States to categorize aircrew work as a planned exposure situation, leading to a full classification as planned exposure e.g. in Germany. (EU BSS Intro (26), German StrlSchG)

Within Europe, there is an exceptional opportunity to be a role model and categorize aircrew exposure as a planned exposure situation in national legislation. ECA recommends therefore the national authorities to follow the EURATOM proposition.

2. Flight crew should be recognized as Category A occupationally exposed workers

Flight crew with an effective dose of more than 1 mSv per year should be recognized as occupationally exposed to ionizing radiation. Those who are liable to receive an effective dose greater than 6 mSv per year should be classified as Category A workers. (Art. 40[1])

This allows for better individual dose monitoring and closer medical check-ups. (Art. 41(1), 44(6) and 45[2])

3. Optimization and dose minimization

Initial dose reference levels for all flight crew in each fleet should be set at 6 mSv per year. Flight crew radiation exposure doses should be individually monitored and optimized to As Low As Reasonably Achievable (ALARA), even if the reference level is not exceeded.

Reference levels should only be increased:

- where an appropriate statistical analysis demonstrates a sound application of optimization principles and minimization techniques to reduce both the average annual effective dose and the variation in annual effective doses as increments of 1 mSv.

4. Cumulative radiation dose assessment and recording for flight crew members

Operators should produce individual annual dose records to which flight crew members should have regular access on a permanent basis, unless competent analysis shows that no flight crew member will be exposed to inflight radiation of 1 or more mSv per year.

Exposures caused by energetic particle events (e.g. solar particle events) must be taken into account in dose assessments. (Art 35(3)a).

To allow a better comparison with cancer statistics and facilitate epidemiological studies in the future, dose and medical records - obtained through applicable regulation (and thus containing de-identified data only) - should be kept until the greater of:

1 2013/59/EURATOM
[2] 2013/59/EURATOM

- the crew member reaches or would have reached the age of 75or at least 30 years after retiring from flying.

5. Education of flight crew

Air carriers should inform potential new employees about radiation exposure before recruitment. Crew members should be made aware through extensive educational programs:

- that high altitude flying exposes them to significantly higher ionizing radiation levels and associated health implications,
- of the effects of flying above optimum altitude, and
- of exposure optimization options through avoidance of short time step climbs or lateral rerouting.

Crew members should receive education on applying ALARA principles to minimize their radiation exposure where they can influence their flight duty assignments. Reducing exposure times by flying fewer hours may coincide positively with efforts to reduce yearly limits of flight hours in the interest of flight safety. Similarly, flight crew members may influence their lifelong radiation exposures by making use of their options regarding selection of aircraft type(s) flown, the types of operation (short haul/ long haul), and their retirement age. Operators are encouraged to provide crews with the possibility of such career choices.

Crew members should also be aware that lightning strikes expose crews to additional ionizing radiation doses.

6. Dose minimization through flight plan optimization

Operational flight plans should be optimized for radiation protection, thus contributing to dose minimization.

Flight crews should be provided with regular information of actual and forecasted solar activity on the Operational Flight Plan (OFP) and via SIGMET-type information.

7. Dose Measuring devices onboard aircraft

While present ICAO SARPs only refer to aeroplanes operated above 15.000 meters (49.000 ft.), ECA supports the IFALPA Policy that the relevant SARP provisions should apply to all aeroplanes operated above 8,000 m (26,000 ft.) in polar/subpolar regions. As a general rule in radiation protection, measurements are the preferred method of assessing a dose. Where measuring devices are not available, calculations are reasonable. In recent years, precise compact dosimeters have been developed and become affordable.

During flight, the cockpit crew should have the display of the dose rate and accumulated flight exposure plainly visible.

Collected data should be used to validate, confirm and update mathematical radiation exposure models for individual routes. ECA encourages operators to monitor gamma doses received during lightning strikes.

8. Dose rate warning devices onboard aircraft

All aeroplanes intended to be operated above 8.000 m (approx. 26.000 ft.) in polar/subpolar regions, especially long-range aircraft, should be equipped with a warning device to detect sudden increases in dose rate. During flight, the cockpit crew should have a warning function of the device plainly visible to allow timely response to sudden increases in the dose rates.

9. Measures against sudden increases in dose rates

ECA recommends that EASA sponsors or takes part in current multi-party task force efforts (e.g. LWS SAFESKY, EURADOS) to address all issues associated with an ionizing radiation event, including the possible subsequent descent of large number of aircraft.

10. Pregnant flight crew

Flight crew members should be reminded that radiation exposure to the fetus should not generally exceed the general population limit of 1mSv, since occupationally exposed limits are not appropriate to the fetus. This legally requires pregnant flight crew members to inform their operator as soon as they receive confirmation of their pregnancy.

Noting that a flight crew member may have exceeded that limit before confirmation of pregnancy, operators should have effective provisions in place to ensure that the flight crew member does not exceed a dose of 1 mSv after declaration of pregnancy.

In addition to the limit for the fetus, the operator will have to provide for measures to further reduce the exposition of the fetus according to ALARA. (Art 35(3)d, Art 10)[3]

11. Dose and Dose-Rate Effectiveness Factor (DDREF)

Currently, there is uncertainty regarding the DDREF (Dose and Dose-Rate Effectiveness Factor) of 2, as recommended by ICRP for calculating effective dose. The value will continue to be used, however ECA recommends that efforts be made to clarify the validity of this factor.

12. Reduction of exposure to other ionizing radiation

Aviation security lawmakers should be encouraged to legislate for alternative security arrangements so that flight crews should not be exposed to any kind of ionizing radiation emitted by security scanning devices (e.g. x-ray backscatter).

Crew members should avoid radiological examinations that are not strictly essential. These should not form part of a routine medical check.

June 2018

References

International Commission on Radiological Protection (ICRP) 2007, Publication 103, *Recommendations of the International Commission on Radiological Protection*.

International Commission on Radiological Protection (ICRP) 2016, Publication 132, *Radiological Protection from Cosmic Radiation in Aviation*.

European Union 2013, Council Directive 2013/59/EURATOM [Basic Safety Standards].

[3] 2013/59/EURATOM