International Civil Aviation Organization

THIRTIETH MEETING OF THE COMMUNICATIONS, NAVIGATION AND SURVEILLANCE SUB-GROUP (CNS SG/30) OF APANPIRG

Bangkok, Thailand, 06-10 July 2026

Agenda Item 12: Capacity Building, including Human Factors and Air Traffic Safety Electronics Personnel (ATSEP) related training

RF EXPOSURE HAZARDS FOR ATSEP: MEDICAL SURVEILLANCE REQUIREMENTS & SAFETY PROTOCOLS- PROPOSED

(Presented by IFATSEA)

SUMMARY

This paper is being presented w.r.t. human factors issues and their counter measures pertaining to ATSEP while performing their duties & responsibilities. An additional chapter *"RF Exposure Hazards for ATSEP: Medical Surveillance Requirements & Safety Protocols"* is proposed to be added in the Regional ATSEP Human Factors Guidance Material under Agenda Item 12.

1. INTRODUCTION

1.1 ATSEP face significant occupational exposure to non-ionizing RF radiation through their routine work with Com Systems (HF/VHF), Nav Aids (NDB, DVOR, DME, ILS), and Radar systems (ASR, MSSR, SMR). However, current aviation standards lack comprehensive medical surveillance and safety protocols specific to ATSEP work environments. Critically, official RF exposure research systematically ignores ATSEP professionals, instead misidentifying "air traffic controllers" and "airport users" as responsible for CNS equipment maintenance.

1.2 This paper analyzes RF exposure risks based on confirmed and probable health effects, establishes ALARA (As Low As Reasonably Achievable) implementation protocols, defines medical surveillance requirements, and addresses the critical issue of unpredictable maintenance workload impacts on exposure duration and personnel safety.

2. DISCUSSION

2.1 Modern aviation depends on sophisticated CNS/ATM systems that generate significant RF electromagnetic fields. ATSEP professionals regularly work in close proximity to high-power transmitters, antenna arrays, and radar installations, creating occupational RF exposure levels that may exceed those encountered in most other industries. The complexity of ATSEP work environments, combined with unpredictable maintenance demands, creates unique exposure scenarios that require specialized medical surveillance and safety protocols.

2.2 **The ATSEP Invisibility Crisis in RF Exposure Research:**

2.2.1 **Actual RF Exposure Responsibilities:**
Daily maintenance and calibration of navigation aids and communication systems, Conducting ground checks requiring positioning within primary radiation patterns, Performing fault diagnosis involving direct contact with energized RF transmission lines, Executing emergency maintenance works on radar and communication arrays, Carrying out performance testing requiring sustained proximity to high-power RF sources, Detecting and repairing RF leakage on waveguide systems and semi-rigid helical cables.

2.2.2 **Official Research Mis-identification: Studies assign CNS maintenance responsibilities to ATCOs**, Safety documentation refers to generic "airport users" and "workers", RF exposure assessments ignore the professionals with highest exposure risks, Training materials lack ATSEP-specific safety protocols, and Medical surveillance recommendations exclude primary at-risk population.

2.3 **Consequences of ATSEP Invisibility:**

2.3.1 **Safety Gap Creation:** When RF exposure research ignores the professionals most at risk, critical protective measures remain undeveloped. ATSEP continue to work in potentially hazardous environments without Appropriate exposure monitoring protocols, Specialized medical surveillance programs, Recognition-based safety training, and Professional health protection standards.

2.3.2 **Professional Recognition Crisis:** The systematic exclusion of ATSEP from safety research reinforces their invisible status in aviation regulatory frameworks, contributing to the broader professionalization challenges facing ATSEP worldwide.

2.3.3 **Regulatory Blindness:** Aviation authorities demonstrate fundamental misunderstanding of who performs safety-critical technical work, leading to ineffective safety policies and inadequate protection for those most at risk. Current regulatory frameworks address RF exposure in general occupational settings but fail to account for the specific challenges faced by ATSEP, including variable exposure duration due to unscheduled maintenance, the need for precision work near high-power RF sources, and the safety-critical nature of their responsibilities.

2.4 **ALARA Philosophy and Requirements:**
As Low As Reasonably Achievable (ALARA) principle mandates that RF exposure be minimized to the lowest level consistent with operational requirements. For ATSEP, this requires balancing technical precision needs with health protection through:

2.4.1 **Engineering Controls:** Remote monitoring capabilities to minimize proximity requirements, Shielding installation in maintenance areas, Power reduction protocols during non-operational testing, Automated diagnostic systems reducing human exposure time.

2.4.2 **Administrative Controls:** Exposure time limitations based on power density measurements, Job rotation to distribute exposure among personnel, Scheduling

maintenance during low-traffic periods to allow power reduction, Pre-planned maintenance procedures to minimize exposure duration.

2.4.3 **Personal Protective Equipment (PPE):** RF-attenuating clothing for high-exposure scenarios, Personal RF monitors for real-time exposure tracking, Specialized tools allowing increased working distance from RF sources

2.5 PRACTICAL 'ALARA' IMPLEMENTATION

2.5.1 **Power Reduction Protocols during Testing:** Reduce transmitter power to minimum testable levels (typically 10% of operational power), Use dummy loads and directional couplers to redirect RF energy during testing, coordinate with ATC for temporary power reductions during maintenance windows, Implement staged power-up procedures during system restoration.

2.5.2 **Distance Optimization:** Maintain maximum practical distance from RF sources during all activities, Use extended measurement cables and remote diagnostic equipment, Position maintenance personnel outside primary radiation patterns when possible, Utilize fiber optic or other non-RF communication methods for coordination.

2.5.3 **Time Minimization:** Pre-plan all maintenance activities to minimize on-site exposure time, Use remote monitoring to assess system status before physical inspection, Implement rapid diagnostic procedures to identify specific issues quickly, Train personnel in efficient troubleshooting techniques

2.6 Critical Need for ATSEP-Specific Medical Protocols: Current medical surveillance standards fail to address ATSEP-specific RF exposure patterns. While occupational health guidelines exist for general RF exposure, they do not account for the unique combination of high-power, multi-frequency, and unpredictable exposure scenarios that characterize ATSEP work environments. The systematic exclusion of ATSEP from RF exposure research has created a medical surveillance gap that leaves the highest-risk personnel without appropriate health protection.

2.7 The proposed new chapter "(12) RF Exposure Hazards for ATSEP: Medical Surveillance Requirements and Safety Protocols" addresses the following key dimensions:

Human Factor Issues Identified:

- Cognitive overload during complex troubleshooting under operational time pressure
- Fatigue accumulation from unpredictable, extended maintenance periods
- Decision fatigue when diagnosing interconnected automated systems
- Risk normalization – gradual acceptance of unsafe RF exposure as routine
- Inadequate situational awareness regarding cumulative daily exposure levels

Actions Required from ANSPs:

- Establish ATSEP-specific RF exposure monitoring and medical surveillance programs
- Implement dynamic workforce management with tiered response teams for complex faults
- Integrate predictive maintenance scheduling to reduce unplanned high-exposure events
- Provide personal RF monitors and enforce ALARA-based work-time limitations

Actions Required from ATSEP:

- Maintain personal exposure logs and participate in medical surveillance programs

- Apply ALARA principles proactively, including pre-planned maintenance procedures
- Report RF overexposure incidents through formal safety management channels

CONCLUSION

2.8 RF radiation exposure represents a significant but manageable occupational health risk for ATSEP professionals. The implementation of comprehensive medical surveillance, ALARA exposure principles, and dynamic workforce management can effectively protect personnel health while maintaining full operational capability.

2.9 The unpredictable nature of ATSEP maintenance workloads demands innovative approaches to exposure control — including real-time monitoring, flexible workforce deployment, and robust emergency response protocols. Investment in RF safety programs is justified by both regulatory compliance requirements and the long-term value of protecting the specialized human capital that ATSEP represent.

2.10 The systematic exclusion of ATSEP from official RF safety research is not merely a data gap – it is a professional recognition failure with direct safety consequences. This working paper and its proposed chapter provide a concrete mechanism to correct that failure within the ICAO framework.

2.11 This paper emphasizes the need for establishing the ATSEP as recognized occupational health specialists within the aviation industry, consistent with their role as essential aviation safety professionals deserving of comprehensive health protection under ICAO standards.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper.

b) initiate the formal process for drafting and inclusion of the addition of chapter 12 ***"RF Exposure Hazards for ATSEP: Medical Surveillance Requirements and Safety Protocols"*** to the Regional ATSEP Human Factors Guidance Material, Version 2.0.

c) discuss any other matter as appropriate

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