DANGEROUS GOODS PANEL (DGP)

TWENTY-SIXTH MEETING

Montréal, 16 to 27 October 2017

Agenda Item 6: Resolution, where possible, of the non-recurrent work items identified by the Air Navigation Commission or the panel:
6.3: Mitigating risks posed by the carriage of lithium batteries by air *(Job card DGP.003.01)*

REPORT OF THE SECOND MEETING OF THE CARGO SAFETY GROUP (CSG)

(Presented by the Secretary)

SUMMARY

This information paper contains the report of the Second Meeting of the Cargo Safety Group (CSG) held in Paris from 19 to 21 July 2017.

(10 pages)
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SECOND MEETING OF THE CARGO SAFETY GROUP (CSG/2)

(Paris, 19 to 21 July 2017)

1. INTRODUCTION

1.1 The Council (C-DEC 211/6, 14 June 2017), during its discussion of the report of the introductory meeting of the multidisciplinary Cargo Safety Group (CSG), held from 1 to 2 June 2017, agreed on the need for coordination and cooperation between the CSG and the Aviation Security Panel Task Force on Improvised Electronic Devices (AVSECP TF IED) and agreed that the second meeting of the group should be held in parallel with the meeting of the Task Force. The CSG with appropriate experts, was tasked to address the work programme developed during the first meeting, to ensure the prioritization and consolidation of ICAO's cargo safety-related tasks, specifically related to portable electronic devices (PEDs).

1.2 Accordingly, the second meeting of the CSG, opened by Jean-Louis Pirat, Chairperson, Aerodromes Panel (ADOP), on behalf of the French DGAC STAC, was held in Paris, from 19 to 21 July 2017, immediately following the meeting of the AVSECP TF IED. In attendance were experts from the same seven relevant panels that attended the first meeting ((ADOP, Airworthiness Panel (AIRP), Dangerous Goods Panel (DGP), Flight Operations Panel (FLTOPS), Safety Management Panel (SMP), Aviation Security Panel (AVSECP) and Facilitation Panel (FALP)) together with experts from States with testing facilities and from the battery manufacturing industry (a list of participants is provided in the appendix to this report). During this second meeting, the group documented existing provisions and started work on the deliverables outlined in the work programme and allocated outstanding tasks to appropriate experts.

2. PRESENTATIONS AND ANALYSIS

2.1 Security

2.1.1 An update on the outcome of the meeting of the AVSECP TF IED held in Paris from 17 to 19 July 2017 was delivered to the group by the Task Force Chairperson. The Task Force assessed the threat and risk posed by IEDs concealed in passengers' personal items, including PEDs, using a holistic approach. Different measures, equipment and processes that Member States and industry stakeholders could consider in their efforts to mitigate the risk posed by IEDs were discussed. The Task Force agreed that any measures developed to mitigate the IED threat should address all sorts of concealments and similar threats and should not be specific to PEDs only.

2.1.2 The Task Force recognized that significant time is always needed for the efficient introduction of new screening equipment not only for purchasing and installing equipment but also essential accompanying processes without which the equipment would be ineffective. The Task Force recognized that there is no *one-size-fits-all* single technological solution to mitigate the threat posed by IEDs concealed in personal items and that a coordinated system of screening equipment and processes, coupled with appropriate training, remained the best approach to address such a threat globally. It was also confirmed that PEDs should be screened separately when using conventional X-ray equipment.

Coordination between security and safety

2.1.3 The new ICAO Global Aviation Security Plan GASeP places an emphasis on holistic coordination. In its global priority action 1C, it mentions the need to "When considering aviation security risks and measures, ensure appropriate holistic consideration of the aviation sector. Where relevant, early and appropriate coordination with aviation safety, air navigation and facilitation experts to take place at global and national levels." The importance of such coordination mechanisms should be included in guidance material both for aviation security and aviation safety (as aviation safety measures may have an impact on the efficiency of aviation security measures such as detection, or aviation security measures may have an impact on safety).

a) **Screening for dangerous goods:**

Whether aviation security screening procedures could be adapted to include screening for dangerous goods is not a new topic. Should this idea be taken up again, it would require due consideration of all relevant factors and appropriate consultation of aviation security experts. Security screening equipment is currently undergoing a technological evolution and the full extent of the capabilities of new equipment is not yet known. However, any additional factors to be added to the screening process cause additional challenges on both detection and false alarm rates. Optimization of these would need to be carefully studied before taking any decisions.

b) **FAL perspective:**

i) *Information of passengers*

Measures that influence the behaviour of passengers regarding how they prepare/pack for a trip should be communicated clearly to allow for optimal preparation of passengers. Should the DGP decide to change the recommendation regarding the transport of PEDS in hold baggage, this communication would need to be handled carefully as it could be the exact opposite of the security measure implemented this year.

ii) *Potential spreading out of risks*

The group was informed that certain air carriers had requested passengers to pack their PEDs in hold baggage upstream, to alleviate processing at transfer locations during the implementation of the cabin ban for PEDs. This had the effect that such PEDs were carried on feeder flights. Such feeder flights might have had different aircraft characteristics than the aircraft used for the long haul flights originally targeted by the last point of departure security measures. The interconnected nature of air travel and the characteristics of transfer passengers are operational realities that should be taken into consideration when carrying out risk assessments. The potential safety risks were most probably spread out also to feeder flights.

2.2 **Safety**

2.2.1 In the context of the proposed ban of large PEDs, including many powered by lithium batteries, from passenger aircraft cabins and their probable relocation in aircraft cargo compartments, both the Federal Aviation Administration (FAA) and European Aviation Safety Agency (EASA) reviewed aircraft designs and fire occurrences to understand the change of probabilities for cargo compartment fires and the resulting impact to flight safety. Based on the assumption that such large PEDs would be placed into the cargo compartment, either in the passenger's checked baggage or in a dedicated packaging when collected by the airline prior to the flight, two potential safety concerns were identified:

a) increase of the probability of a fire event in the cargo compartment of a passenger aeroplane; and

b) change to the type of fires that will occur in the cargo compartment and the associated risk that current aircraft cargo fire protection systems may be unable to control such fires.

2.2.2 To quantify the first concern, the FAA and EASA performed separate data reviews of the available reports of accidents, serious incidents and incidents related to PEDs and lithium battery fires in commercial air transport operations (FAA examined data from 2002 to 2011 whilst EASA examined data from 2012 to 2016). Whilst noting that a recently commissioned study (DOT/FAA/TC-16/49 Research into Fire, Smoke or Fumes Occurrences on Transport Airplanes) suggested that over the period from 2002 to 2011, there were, conservatively, three detected cargo fires in United States registered aircraft, the FAA review concluded there could be in the order of five cargo compartment fires per year in United States registered aircraft attributable to affected PEDs if PEDs normally transported in the cabin were simply moved to the cargo compartment. The EASA review concluded, based on the current occurrence data and factoring in the continuous increase in the number of large PEDs carried by passengers and the new incidents that would result as a consequence of a ban (e.g. due to improper stowage of PEDs in checked baggage and/or improper handling causing damage) that it can be reasonably estimated that EASA Member State operators will experience around five to ten incidents per year involving large PEDs.

2.2.3 As a result of the two separate analyses, both groups came up with the same conclusions i.e. there would be approximately an order of magnitude increase in potential cargo fires when PEDs are shifted from the cabin to the cargo compartment.

2.2.4 To quantify the second concern, the FAA conducted testing to assess the types of fires that could result when lithium batteries contained in PEDs placed in aircraft cargo compartments go into thermal runaway. EASA has started, in cooperation with the test facilities of EU Member States, a series of fire tests to quantify the consequences of lithium battery fires caused by large PEDs in passenger checked baggage and, in particular, plan on examining the risk generated by a large concentration of PEDs.

2.2.5 The conclusions drawn by the FAA and EASA from the initial testing suggest that PEDs in passenger checked baggage introduce risks and hazards that the existing aircraft fire protection systems may not be equipped to safely manage (see paragraph 2.2.4.1 for further details). As a result, mitigation measures such as the use of fire protection equipment (covers or containers) are being considered. Additionally, EASA is considering the need for a specific standard for lithium battery generated fires, as the existing standards do not consider these types of fires.

2.2.6 A presentation, "The safe transport of PEDs in transport passenger aircraft", given by the FAA, outlined the design capabilities of aircraft fire suppression systems, the risks posed by PEDs, and recent initial testing conducted to determine how these risks could be mitigated to an acceptable level. Different scenarios regarding PEDs removed from the passenger cabin and placed in cargo compartments were tested by the FAA. All PEDs tested were at a 100 per cent state of charge to replicate the condition of PEDs likely to be carried by passengers.

2.2.7 Significant findings showed that:

a) **PEDs collected by the operator from the passenger:**

i) it can be confirmed that the PED is switched off thus limiting the potential for initiating a fire;

ii) if laptops are placed in a cardboard box with bubble wrap and a cell goes into thermal runaway, a resulting fire can easily penetrate the box and potentially spread;

iii) if laptops are placed in a cardboard box with bubble wrap, segregated from other cargo and dangerous goods, and cells go into thermal runaway, there is a likelihood that the halon system (if working as certified) can control a resulting fire involving such packages/boxes in a Class C compartment;

iv) if laptops are placed in commercially available fire resistant packaging or under fire resistant covers or in fire hardened ULDs, the halon system in a Class C compartment, if working as certified, can control a resulting fire involving such packages. However, explosive gases might still be present; and

v) it was noted that a Class D compartment might not control similar fires as stated above as there is no halon system in this compartment.

b) **PEDs by passengers in their checked baggage:**

i) there is no verification/little control to determine that the device has been turned off or not damaged, therefore increasing the risk that a cell goes into thermal runway, which would result in a fire initiated within the concerned checked bag;

ii) in tests where other personal items containing permitted dangerous goods (such as aerosol cans) are placed in the same checked baggage as a PED, an explosion may occur, not related to the gases from the battery; there is a likelihood that the halon system in a Class C compartment might not be sufficiently discharged and reach a suppression concentration of 3 per cent before such an explosion would occur. For an equivalent example tested in a Class D compartment, there is a poor likelihood that the resulting fire could be controlled or contained and no protection is provided to prevent the event of an explosion.

For detailed information on tests conducted and videos of the tests, please visit https://www.fire.tc.faa.gov/temp/icao 6 17 modified.pptx.

2.2.8 The group was presented with an update of the work being done by the Cargo Safety Sub-group (CSSG) by the rapporteur of the CSSG who stated that it is a cross-discipline group, led by the FLTOPSP, with members from FLTOPSP, DGP, AIRP and the Secretariat. The group was created in October 2017 following the approval by the Air Navigation Commission (ANC) of job card FLTOPSP.43.01 relating to the mitigation of risks posed by the carriage of cargo by air, in particular, the carriage of lithium batteries as cargo. The CSSG has started drafting proposed amendments to Annex 6 — *Operation of Aircraft*, to introduce requirements for operators to conduct safety risk assessments on the carriage of cargo and will develop detailed guidance material to support such risk assessments.

2.2.9 The CSG was further presented with the “Cargo Compartment Fire Containment Characteristics on Aircraft” by the International Coordinating Council of Aerospace Industries

Associations (ICCAIA). The presentation outlined that cargo compartment fire suppression systems were designed to *suppress*, not extinguish, fires. Tests have shown cargo compartment temperatures of a suppressed fire could be far above 200°C, that is, temperatures greater than required for thermal runaway involving lithium cells. The design standards were based on fires likely to occur at the time these standards were initially developed, i.e. typically Class A fire loads (combustible materials such as wood, cloth, paper, rubber, and plastics). For non-accessible cargo compartments (Class C, D and some E) the design principle was to suppress / contain a fire for the rest of the flight, not to extinguish it. Accordingly, it is likely that a suppressed fire, containing enough energy, inside a "Class E" cargo compartment could re-ignite during the descent phase. In addition, cargo compartment fire suppression systems are designed assuming a fire probability of typically 1E-7 per flight hour. This figure was conservatively developed from the actual rate of occurrence of a cargo fire as seen in the world fleet. As explained in paragraph 2.2.2 above, the increase in the carriage of lithium powered PEDs in checked baggage would significantly increase the likelihood of a fire thereby potentially undermining the assumptions considered for the design and certification of the cargo fire suppression system.

2.2.10 The Secretariat also presented the combined draft Glossary of Terms

https://www.icao.int/safety/cargosafety/Documents/Draft Glossary of terms.docx

from security, facilitation, dangerous goods and safety management documents of ICAO. Links to the above-mentioned presentations are provided in:

https://www.icao.int/safety/cargosafety/Presentations/Forms/AllItems.aspx.

3. DISCUSSION

3.1 The CSG proceeded with reviewing the work programme, discussing the issue of PEDs placed by passengers in checked baggage versus those removed from the passenger by the operator and packaged appropriately; the need to balance legitimate security concerns against displacement of the risk resulting in an adverse impact on safety; and focused on the immediate safety hazard and mitigation measures. It was noted that a clear definition of exactly what was included by the term PED would be helpful for all involved in this multidisciplinary work.

3.2 The group decided as a result of the FAA testing which supported the analyses done by both the FAA and EASA that: there would be approximately an order of magnitude increase in potential cargo fires if PEDs were moved from the cabin to the cargo compartment; and PEDs should not be permitted in checked baggage in the aircraft cargo hold on the basis this was an unacceptable increase of fire risk for one single cause and that the resulting fire may not be controlled. Noting the differing results which would be obtained depending upon the specific cargo compartment fire containment characteristics, it was recognized that additional mitigation measures could be taken by operators if the transport of PEDs were directly under their control and that this should be taken into account when formulating a recommendation for an amendment to the *Technical Instructions for the Safe Transport of Dangerous Goods by* Air (Doc 9284). It was agreed that guidance would need to be developed for operators granting approvals to passengers wishing to place PEDs in checked baggage. It was also noted that by combining PEDs with other dangerous goods, an explosion (unrelated to gases emanating from the battery) could result before halon could be sufficiently discharged if in a Class C compartment whilst no protection would be provided in a Class D compartment for a similar event The consequences on airline operations as well as the impact on the airline business model would need to be assessed for various scenarios. It was noted that should fire resistant packaging be used, the compatibility of such products with constraints imposed by security should also be assessed.

3.3 The group believed that more comprehensive data is required in order to reassess cargo fire probability, noting that this might have an impact on maintenance programmes, the design of which was based on a certain probability of fires. It was suggested that design standards for cargo compartment fire protection might also need to be changed for new type certificated aircraft should this probability be significantly different. It was further noted that the firefighting principle used in Class D compartments (fire containment and oxygen consumption) might not be sufficient to control a fire involving PEDs whereas a similar fire in a Class C compartment could be expected to be controlled by halon. It was believed all data should be given to AIRP to assist the panel in its work on cargo compartment fire suppression provisions.

3.4 The group was informed that some operators were placing large numbers of fully charged PEDs in the cabin for passenger use, utilizing the provisions of the Technical Instructions for “Exceptions for Dangerous Goods of the Operator” which referred to items permitted to be carried by passengers rather than seeking airworthiness certification approval which referred to items installed on the aircraft. It was agreed that this issue should be referred to the AIRP, FLTOPSP and DGP for further consideration.

3.5 The group noted the work being done by the CSSG of the FLTOPSP and agreed that specific safety management expertise would be required in order for appropriate guidance material to be developed. It was suggested that realistic scenarios would need to be considered, recognizing the impact additional costs might have on the feasibility of some of those scenarios.

4. RECOMMENDATIONS

4.1 The Second CSG concluded by recommending the following:

a) that the DGP should amend the Technical Instructions so that PEDs may only be transported in carry-on baggage unless with the approval of the operator;

b) that the DGP review the items permitted to be carried by passengers in checked baggage and to establish if certain combinations should be forbidden;

c) that the DGP together with the battery manufacturing industry develop a clear definition of what was meant by PEDs;

d) that the AIRP, FLTOPSP and DGP review the issue of operators placing charged PEDs in the cabin for passenger use, utilizing the provisions of the Technical Instructions rather than seeking airworthiness certification approval;

e) that the battery manufacturing industry continue its research into lithium battery hazards and for this information to be provided to the AIRP and DGP;

f) that ICCAIA be asked to provide the assumptions used by aircraft manufacturers when calculating a fire probability of 1E-7 per flight hour and that this be provided to the AIRP;

g) that ICCAIA and the International Air Transport Association (IATA) be asked to provide data on the number of aircraft with Class D cargo compartments, and that States be asked to provide data on the number of such aircraft registered in their States and that this be provided to the AIRP;

h) that ICCAIA, IATA and States be asked to provide: i) data on the number of PEDs being transported; and ii) information on all accidents and incidents involving PEDs; and that this be provided to the SMP, DGP, AIRP and FLTOPSP-CSSG; and

i) that members of the SMP join CSSG so that appropriate expertise is provided to that group when developing guidance on risk assessments when transporting items in the aircraft hold.

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APPENDIX

LIST OF PARTICIPANTS

State/Organization	Name
J. Anton	Chair, AIRP (EASA)
C. Chanson	Co-Chair of SAE G-27 (RECHARGE)
P. de Gouttes	Member, AIRP (ICCAIA)
E. Fortunato	Advisor, FLTOPSP (ICCAIA) and Rapporteur, CSSG
R. Lobato Galeote	Observer, DGP (Spain)
J. Gardlin	Advisor, AIRP and DGP (United States)
I. Gilchrist	Member, AVSECP (Qatar)
H. Hallauer	Advisor, FALP (Switzerland)
S. Hifdi	Chair, AVSECP IED TF (France)
R. Hill	Safety Expert, FAA (United States)
V. Koh	Observer, DGP (Singapore)
Y. Mikuni	Member, SMP (Japan)
T. Ohnimus	Advisor, AIRP (EASA)
L. Osty	Advisor, ADOP (France)
J.-L. Pirat	Chair, ADOP (France)
K. Rooney	Chief, Cargo Safety Section (ICAO)
S. Schwartz	Member, DGP and CSSG (IFALPA)
P. Tatin	Member, DGP (France)
S. Yabe	Battery Association Japan
F. Zizi	Advisor, ADOP (France)

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