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[D-1.3.A: REPORT ON STAKEHOLDER CONSULTATION]

Detection of lithium batteries using security screening equipment

An Agency of the European Union

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SUMMARY

Problem area

Lithium batteries are becoming more and more ubiquitous in portable electronics devices. Their diverse form-factors and favourable energy storage characteristics make them a prime choice of batteries in many applications. Yet the high density of stored energy along with the combustion characteristics of lithium batteries can also constitute a safety hazard resulting in a thermal runaway fire. This hazard is particularly acute in the aviation field onboard the aircraft, and in particular the baggage and cargo hold, where fire hazards pose particularly severe safety risks to the aircraft.

For these reasons, the carriage of lithium batteries in checked baggage and cargo is tightly regulated and restricted by ICAO. Enforcement of this regulation would be aided by a means to detect the presence of lithium batteries. An opportunity lies with the use of imaging and detection equipment already deployed and required as part of aviation security infrastructure. With adaptations to its detection characteristics as well as operational adjustments, certain aviation security detection equipment can be made to also mitigate the specific safety risk posed by lithium batteries deemed non-compliant with the provisions for transport by air.

Description of work

In December 2022, EASA appointed a consortium to deliver this research study for the specific case of detecting lithium batteries in checked baggage. The consortium is led by Rapiscan Systems and supported by consortium partner UK CAA International. This project will consist of four technical tasks.

- Task 1: Review of state-of-the-art solutions, development of test plan and protocol and consultation with Stakeholders
- Task 2: Performance of tests, collection of data
- Task 3: Analysis of tests performed, consultation with Stakeholders
- Task 4: Conclusions and recommendations
- Task 5: Communication, dissemination, knowledge-sharing and stakeholder management

In addition to the technical tasks, this project includes a fifth workstream: ***'Communication, dissemination, knowledge-sharing and stakeholder management'.*** As per the tender specification, the objective of this workstream is to identify the target audience and their different needs and support EASA in the planning and organisation of the stakeholder events as well as in the preparation of briefings and presentations. The project includes several consultations with the main Stakeholders concerned with the detection of lithium batteries at aerodromes. Two workshops with Stakeholders need to be organised by the contractor during the project to present the results of Tasks 1, 2 & 3 of which one has already been conducted. The first workshop was held on the 18/10/2023, with the second scheduled for June 2024

Toward the end of the project, the dissemination of the research results is to be structured in a way that allows the contractor and EASA to identify the best communication formats and means to transfer the knowledge gained according to the identified dissemination goals. The dissemination goals range from ***raising awareness of the research project*** to the final goal of ***establishing a long-term impact of the project results on its target***

group. Such goals, as well as the audience to be reached will be identified jointly by the contractor and EASA and documented in the communication and dissemination plan. The plan shall also consider appropriate knowledge-sharing actions for the target group.

This report represents the deliverable for Task 1.3 – Report on Stakeholder Consultations.

Results and Application

The purpose of this overall study is to provide objective data and recommendations concerning the use of certain existing security screening equipment to detect lithium batteries in passenger checked baggage. By exploring this data, we will in turn assess the impact that detecting lithium batteries has on airport operations and screener performance. The results will be used to facilitate and underpin future discussions amongst stakeholders and regulators. At the time of writing, there is no plan to mandate the results of this study in European aviation regulation but to contribute to a discussion on a potential need to do so.

This part of task 1 will review the stakeholder consultation held for the first phase of the project.

The outcome of Task 1 will show the state-of-the-art solutions, development of test plan and protocol and consultation with Stakeholders. The results of this will be used to shape the subsequent project.

CONTENTS

ABBREVIATIONS

ACRONYM	DESCRIPTION
ACI	Aerodromes Council International
AvSec	Aviation Security
BHS	Baggage Handling System
CAA	Civil Aviation Authority
CONOPS	Concept of Operations
DG	Dangerous Goods
EASA	European Union Aviation Safety Agency
EDS	Explosives Detection System
ECAC	European Civil Aviation Conference
EU	European Union
FAA	Federal Aviation Administration
ICAO	International Civil Aviation Organisation
IED	Improvised Explosive Device
IT	Information Technology
Level 4	Level 4 is typically where passengers are reconciled with the aerodrome operator/air operator representative and their bag, should there be an issue. Level 1 is an x-ray scanner, Level 2 is a screener who views the scanner image should it be rejected, Level 3 is a screener with unlimited time to view a Level 2 reject
TIP	Threat Image Projection
Wh	Watt hours

1. Introduction

1.1 Scope and Objectives

The stakeholder consultation was conducted as part of this project aimed at enhancing safety measures regarding the transportation of lithium batteries in aviation, specifically in the holds of aircraft. Lithium batteries, while widely used in portable electronics, pose a safety hazard due to their high energy density and potential for thermal runaway fires. The International Civil Aviation Organisation (ICAO) tightly regulates and restricts the carriage of lithium batteries in checked baggage and cargo to mitigate these risks. These are outlined in ICAO Annex 18 and ICAO Doc 9284 Technical Instructions for the Safe Transport of Dangerous Goods by Air.

The stakeholder consultation plays a crucial role within this project. The focus was to explore what is currently being done to detect non-compliant lithium batteries and by who. The proposed solution involves adapting existing aviation security infrastructure, such as imaging and detection equipment, to address the specific safety risks associated with these batteries. By modifying detection characteristics and making operational adjustments, this equipment may be repurposed to cover a dual-purpose and mitigate the risks posed by non-compliant lithium batteries in aviation.

The consultation delves into pre-existing methods for the detection of non-compliant lithium batteries and explores possible adaptations to existing aviation security infrastructure. These adaptations are essential to detect and mitigate the specific safety risks associated with these batteries. Stakeholders' input will be instrumental in proving these adaptations.

The aim is to foster engagement with a wide array of stakeholders, encompassing regulators, air operators, manufacturers, security experts, and industry representatives. These stakeholders will contribute their insights, knowledge, and expertise on the subject matter.

The objectives of the stakeholder consultation are multifaceted and designed to guide the project towards a comprehensive and effective outcome. The consultation is designed to explore technical aspects of adapting existing aviation security equipment to effectively detect non-compliant lithium batteries. This involves researching and discussing potential modifications that can be made to the equipment to mitigate the risks associated with non-compliant Lithium batteries.

Stakeholder engagement is vital as we seek to facilitate collaboration among regulatory authorities, air operators, manufacturers, and security experts. Their collective insights and expertise are invaluable in ensuring a holistic and well-informed approach to addressing the issue of lithium battery safety in checked baggage.

Our aim is to understand the feasibility of detection of lithium batteries in hold baggage using existing screening technology. In addition, the testing conducted during this project will identify procedures for dealing with non-compliant lithium batteries. These procedures will cover their detection, reporting, and the necessary steps to be taken to ensure safety and regulatory compliance.

1.2 Executive Summary

To understand the current situation and the technologies used to detect lithium batteries, interviews were conducted with stakeholders. These included representatives from aerodrome operators, air operators, trade associations and regulators. This was supplemented with literature sourced from the Internet, IATA regulations and from experienced individuals at Rapiscan Systems (who have detection systems at many aerodromes around the world) as well as UK CAA International. This intelligence helped to identify the most suitable solution to the issue at hand. However, it also highlighted challenges that will need to be addressed and resolved.

Research undertaken for this report clearly shows that prohibited lithium batteries in checked baggage are making their way onto the aircraft. The potential dangers associated with lithium batteries are well documented and have been the cause of numerous in-flight fire incidents[1]. In June 2022, the International Air Transport Association (IATA) in order to address incidents with undeclared or mis-declared shipments of lithium batteries called on governments to further support their safe carriage by developing and implementing global standards for screening, fire-testing, and incident information sharing[2].

The consensus from the industry interviews was that passengers are often unaware of the risks posed by lithium batteries and ignorant to the fact that an item in their checked baggage contains a lithium battery. Even though the online and aerodrome check-in highlights prohibited lithium batteries, they are still being transported on board aircraft. The current system is based on trust in passengers' declaration with regard to compliance with safety rules prohibiting the carriage of certain types of lithium batteries but there is no subsequent verification mandated by aviation safety or security applicable rules. The current system is based on the passenger's ability to self-identify and declare any prohibited lithium batteries to comply with safety rules.

According to aviation security requirements all checked baggage is screened in order to detect prohibited articles from aviation security perspective. As lithium batteries are not considered as prohibited items for aviation security, there is no mandatory detection of lithium batteries at the moment.

Following baggage check-in or bag drop, the checked baggage undergoes security screening, typically using Explosives Detection System (EDS) equipment to screen for explosives. The EDS equipment typically raises alarms on 15-25% of scanned baggage, with the remainder going straight on to the aircraft. The X-ray images of these alarms must be reviewed by a human screener to ensure that the alarm does not correspond to an Improvised Explosive Device (IED). Most aerodrome operators interviewed stated that if the screener has sufficient time following the review of the explosives alarm, they will also look for Dangerous Goods (DG), including lithium batteries. It, therefore, follows that the vast majority of checked baggage are not inspected for lithium batteries.

None of the aerodrome operators that we interviewed, nor any Rapiscan customer is using dedicated automated detection systems to identify lithium batteries in one hundred percent of checked baggage. They are using the EDS equipment and the by-product of the explosives alarm image to identify if lithium batteries are present.

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[1] Lithium aircraft incidents on the rise - CBS News Report
Battery fire on board aircraft - ABC New Report
International Association of Fire and Rescue Services - News Report
Aircraft fire on board Cainiao - News Report
Bicycle battery fire - Sky News Report

[2] IATA - Government Support Needed to make Transport of Lithium Batteries Even Safer

If lithium batteries are found, the process used by those aerodrome operators interviewed differs widely. Some reconcile the bag with the passenger and airline, while at the other extreme they do not involve either, opting to open the baggage, remove the lithium battery, insert a note to advise the passenger, and load it in the aircraft cargo compartment. The lithium battery is then safely disposed of.
The aerodrome operators and air operators we interviewed agreed that the overall responsibility for ensuring prohibited lithium batteries are not contained in checked baggage, lies with the air operator 'It's a safety issue, not security'. This is likely why we are unaware of any aerodrome operator screening all checked baggage for lithium batteries. Whilst overall safety responsibility lies with the air operator, responsibility and management for prohibited lithium batteries screening, using X-ray equipment, is not clearly scoped in any regulatory framework. Both parties agreed on the need to work together and for regulations to drive any change, uniformly across Europe.

That said, the aerodrome operators that we contacted were reluctant to take on voluntarily additional responsibility for having to screen all checked baggage for lithium batteries and were of the mind that regulations may well be needed to drive change, uniformly across Europe. Afterall, today this is an airline responsibility.

If change was to occur, and all checked baggage screened, an automated system would certainly be necessary. The throughput at all but the smallest of aerodromes would be too great for the screening of all bags using image review. Fortunately, most aerodrome operators throughout Europe are using EDS equipment. Their primary purpose is to screen for explosives; however, these same systems could be used to screen for lithium batteries. EDS equipment has already demonstrated it can run additional algorithms to detect DG, firearms, narcotics, endangered animals etc. An algorithm to detect lithium batteries is feasible and its deployment relatively straightforward.

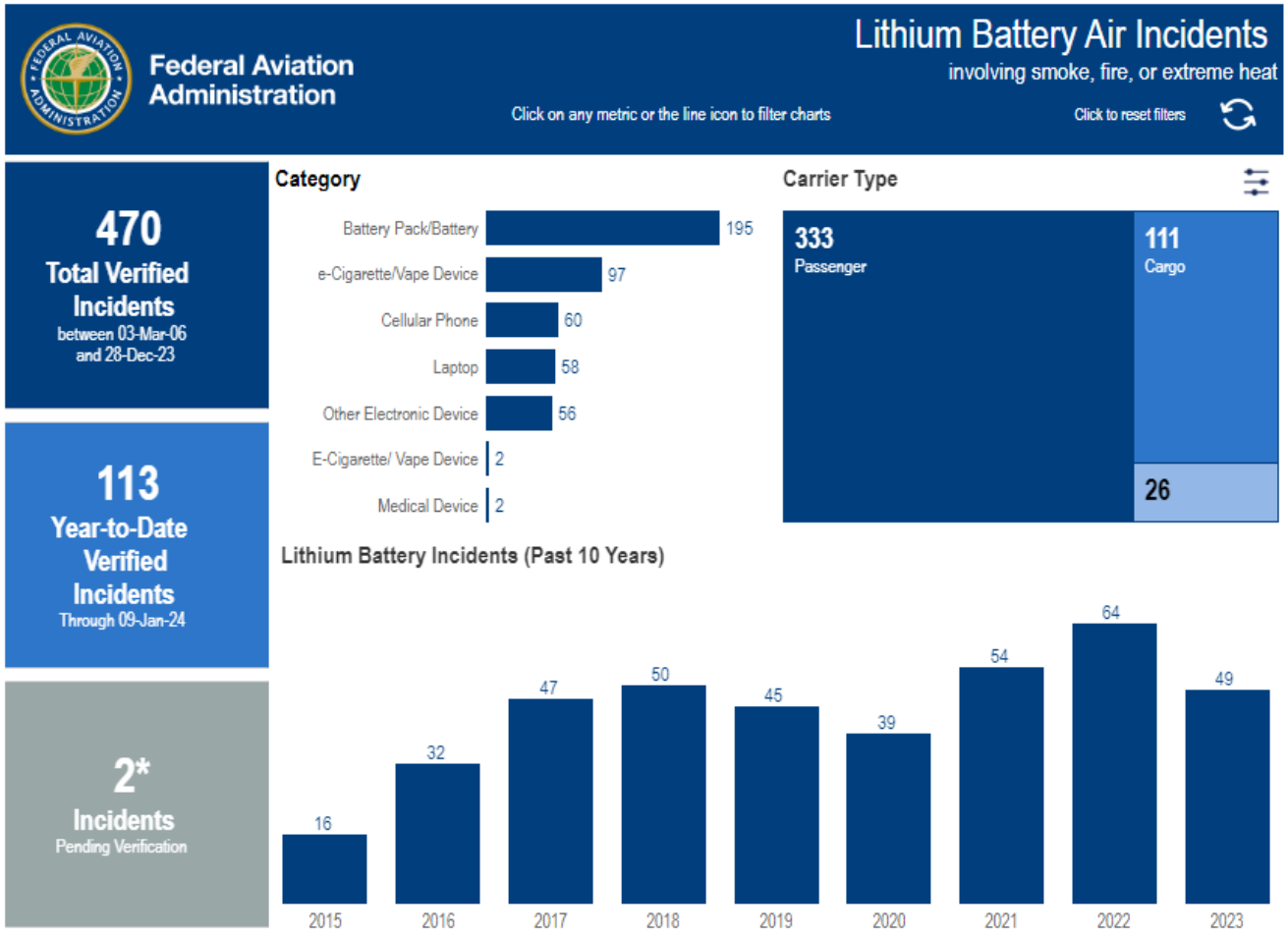
Lithium batteries pose a safety risk, checked baggage containing prohibited lithium batteries will make it onto the aircraft as most go unscreened by a human operator. Air operators, aerodrome operators and regulators from across the safety and security communities are acutely aware of the risks. What would be needed are actions and perhaps legislation to drive change. Fortunately, EDS equipment, already present in most EU aerodromes, can be adapted to provide a solution.

In conclusion, the insights from aviation industry stakeholders have illuminated the complex challenges of ensuring the safe transport of lithium batteries and DG. Collaboration is pivotal in addressing these issues, with a focus on the lack of standardised regulations, passenger awareness, and operational challenges. While stakeholders emphasise the need for clear responsibilities and operational models, they also underscore the persistence of these concerns beyond the project's scope. The potential implementation of detection systems and the subsequent operational impact necessitate further consideration. A significant public relations campaign and regulatory involvement would be crucial for successful implementation. Ultimately, cohesive regulations, education, and collaboration are essential for a safer approach to handling lithium batteries and DG, with a shared commitment to aviation safety.

1.3 Introduction

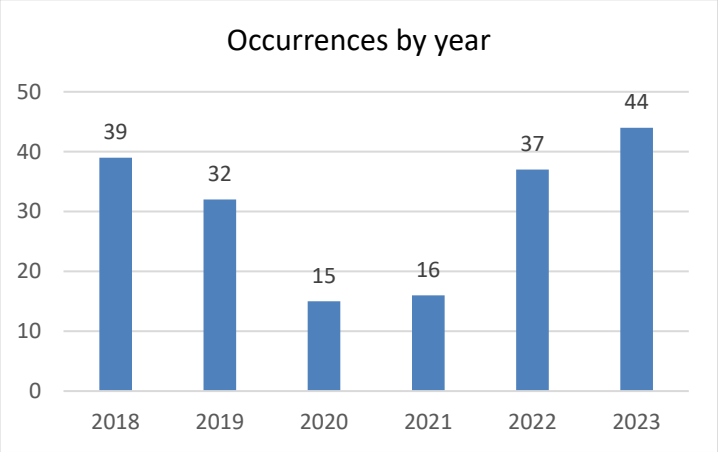
Lithium batteries are considered dangerous goods and regulations are in place on the carriage of such items by air. However, with the increased use of lithium batteries in everyday electronic devices it is inevitable that lithium batteries will end up being placed in checked luggage for carriage by air operators either by themselves or contained within a device.

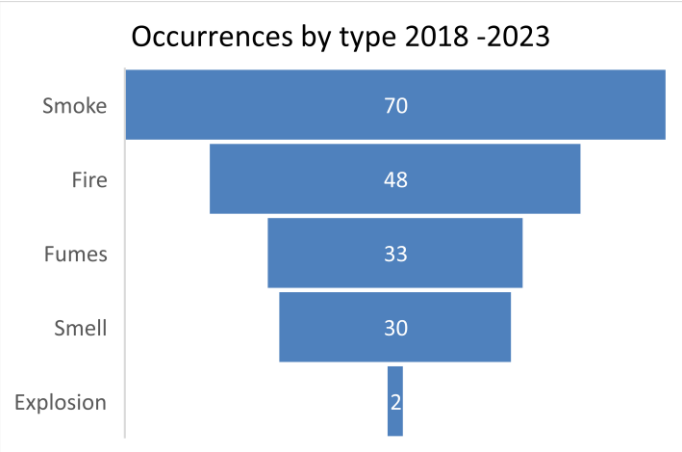
Forbes Magazine published an article in March 2023 (Forbes Magazine Lithium Battery Incidents) regarding the growing number of lithium battery incidents. The US Federal Aviation Administration (FAA) reported 64 lithium battery overheating incidents in 2022 compared to 54 the previous year. The article went on to state that in 2014, only 9 incidents were reported all year, highlighting the growing use of lithium batteries and the risk associated with them.
The FAA report shows after battery packs, e-cigarette and vape devices are the number two cause of air incidents involving smoke, fire or extreme heat (see diagram below).



Source: Federal Aviation Administration, Security and Hazardous Materials Safety

The data below is from European Central Repository for the period 2018-2022 and shows the number of lithium battery incidents.





Source: European Central Repository

Aviation safety regulators and air carriers through IATA have been advocating for additional actions but a workable solution is yet to be found.

Without extensive research across multiple aerodromes, it is impossible to know the extent of undetected prohibited lithium batteries making their way to the aircraft. However, during the industry interviews, one aerodrome operator conducted a study and found that just over 1% of checked baggage contained some form of prohibited lithium batteries. IATA report that, globally, there are ca. four billion items of checked baggage per year. Using 1%, this would equate to 40 million bags containing prohibited lithium batteries.

A recent fire on the vehicle transportation ship, Freemantle Highway, demonstrates the risk of lithium batteries. The ship had 3,000 vehicles on board, including twenty-five which were electric. It is believed that the fire started with one of the electric vehicles. The crew were unable to extinguish the fire and had to be rescued from the ship. Tragically, one of the crew members died. An interview with the Director of CEDRE (French agency specialising in accidental water pollution) suggested that the insurers will be quicker than the authorities to "put some order" in place for the transportation of lithium batteries (Freemantle Highway Ship Fire).

With this in mind, EASA launched this research project to understand the feasibility of detecting lithium batteries using current screening equipment, to help drive change and mitigate the risk associated with the transport of lithium batteries in checked baggage and the number of in-flight incidents.

This report looks at the stakeholder consultations held during phase 1 of the project and their responses.

1.4 Methodology

To establish background information for this project a stakeholder management plan has been created and is being followed throughout the project. This management plan focuses on defining and understanding the different stakeholder groups affected by this project. It also sets out a list of actions to help manage stakeholder participation, expectations, and involvement throughout the study. The stakeholder management plan covers stakeholder identification, stakeholder prioritisation and stakeholder communication. Different communication channels will be used in line with this plan.

Stakeholders were plotted based on whether they have low/high interest and low/high influence during the project lifetime. Each of the category's indicates a level of engagement and suggests how we manage each stakeholder group. The engagement levels using the Mendelow Matrix methodology are outlined below:

- **High influence, high interest (Manage Closely):** Aim to fully engage these organisations, making the greatest efforts to satisfy them.
- **High influence, low interest (Keep Satisfied):** Put enough work in with these organisations to keep them satisfied, but not so much that they become bored with your message.
- **Low influence, high interest (Keep Informed):** Adequately inform these organisations and talk to them to ensure no major issues are arising. These audiences can also help point out any areas that could be improved or overlooked.
- **Low influence, low interest (Monitor):** Don't bore these stakeholder groups with excessive communication. Keep an eye out to check if their levels of interest or power change.

1.5 Stakeholder Engagement

One to One Stakeholder Interviews

To better understand the current situation, interviews were conducted with people from the industry, States and regulatory bodies. It included those at aerodrome operators, air operators, trade associations and regulators. This was supplemented with literature sourced from the Internet, IATA guidelines and from experienced individuals at Rapiscan Systems and UK CAA International.

Telephone interviews were conducted with several key industry stakeholders from the following groups:

- Aerodrome operators
- Air operators
- Regulators
- Associations
- Cargo Agents

Consultation Webinar

A webinar was organised to introduce and present the key objectives of the EASA research project Detection of Lithium Batteries using existing security screening equipment. It provided attendees with an overview of the objectives of this project and how/when these will be achieved.

The Consortium provided an update on the progress to date in achieving the project's objectives and described the expected project outputs. This webinar also offered attendees the opportunity to ask questions about the project and provided an understanding of how they can engage and contribute to the research.

There will be a further workshop that will present the findings from the test data and analysis in June 2024.

Delegate Survey

Delegates who attended the webinar represented safety and security domains, including the EU Civil Aviation Authorities, air operators, airport operations and industry organisations. All delegates attending the webinar were sent a survey, the aim of which was to identify the effectiveness of communication about the project and gauge the desired level of involvement in this project from attendees.

Communication with Manufacturers

To understand whether lithium battery detection algorithms are already available or in development a questionnaire was sent to other manufacturers of screening equipment. This questionnaire was sent as part of a communications package, attaching communication from EASA as well as from the Project Delivery Team.

EASA Credentials

A letter from EASA was drafted to brief stakeholders about the project and formally introduce the consortium.. The aim of this letter was to help increase buy-in, support and trust from the primary stakeholders. The letter detailed how the study will engage their organisations and the opportunities they will have to share their feedback on the tests/trials. This EASA letter supported the request to manufacturers for information.

EASA Website

The research project webpage on the EASA website (link below) was shared in direct communications with stakeholders to gain trust and credibility with study subjects. Details concerning stakeholder workshops and the study's results during the dissemination phase will also be published on this webpage:

https://www.easa.europa.eu/en/research-projects/detection-lithium-batteries-using-security-screening-equipment

2. Results of Stakeholder Engagement

2.1 One to One Stakeholder Interviews

The overall summary from all respondents was as follows:

The absence of EU-wide rules for the detection of lithium batteries in checked baggage has led to a considerable variation in practices across different countries. As a result, approaches to this issue vary significantly. While all parties involved viewing lithium batteries as a safety concern rather than a security matter, there is a shared desire for a collaborative solution to be developed, provided it is operationally feasible.

In the EU, the responsibility for detecting lithium batteries and DG primarily rests with air operators. A few EU states share DG responsibilities between air operators and aerodrome operators, though this is less common. Air operators make concerted efforts to alert passengers to the presence of lithium batteries, as required by ICAO standard, both during online check-in and face-to-face interactions at the airport. However, they acknowledge that passengers may not always be diligent or fully grasp the regulations, for example devices don't always clearly display Watt Hours of their batteries potentially leading to unauthorised lithium batteries in checked baggage.

Aerodromes are currently making "best endeavours" to detect and prevent non-compliant lithium batteries, but this largely occurs as a by-product of explosive detection screening. The consensus is that existing systems and processes do not catch all lithium batteries that should be removed. Based on the study mentioned previously, 1% of baggage containing prohibited lithium batteries represents a significant number of bags. Even after reminders from air operator staff during the check-in process, few passengers actually remove them from their checked baggage.

While all aerodrome operators claim to search for DG and lithium batteries during explosives alarm resolution (around 20% of all bags), security screeners only analyse bags for DG, with lithium battery analysis if they have sufficient time before the image times out and becomes an automatic reject. A significant percentage of checked baggage—around 70-85%— do not generate an explosives alarm and are consequently not being screened for lithium batteries or other DG. Training for screeners in detecting DG is inconsistent, and screeners are not regularly assessed for detection accuracy, such as through Threat Image Projection (TIP) for explosives.

Air operators and aerodromes acknowledge the safety risk posed by lithium batteries. However, they assert that without appropriate legislation, the pace of change will remain slow, leading to inconsistent and fragmented practices. There are notable differences across countries in the processes undertaken once unauthorised lithium batteries are found in checked baggage. Some consider it a joint action and involve the air operator in resolving the issue, in other cases the aerodrome operator independently handles it. Most countries do not impose fines for unauthorised lithium batteries, although there are a few that do.

An interesting observation is that one aerodrome operator opened 1,000 checked bags to gauge the prevalence of unauthorised lithium batteries in checked baggage. They found that 1.1% of these bags contained unauthorised lithium batteries. With billions of checked bags processed annually, this percentage could translate into a significant number, potentially millions of bags containing unauthorised lithium batteries. All stakeholders anticipate a substantial increase in the quantity of lithium batteries carried in both checked and carry-on baggage, which further amplifies the importance of effective detection.

Aerodrome operators express concerns about the financial implications if all checked baggage need to be screened for lithium batteries. This would require additional screeners, potential infrastructure changes, new IT equipment, perhaps adjustments to baggage handling systems, and additional personnel to resolve issues with passengers. Repurposing existing Explosive Detection System (EDS) scanners is considered a logical approach to address this challenge.

Summary of Aerodrome Operator Responses

Aerodromes generally consider lithium batteries and DG to be the responsibility of air operators. However, they recognise the challenges faced by air operators in persuading passengers to declare lithium batteries and other DG during the check-in process. In addition to resolving explosives alarms, aerodrome security screeners also look for lithium batteries and DG. However, this means that only a small percentage, around 25%, of checked baggage is inspected. Most bags are screened by automated Explosive Detection Systems that only present bags with potential explosive threats to operators. Consequently, most bags proceed to aircraft without scrutiny for lithium batteries or DG.

The consensus is that lithium batteries are primarily viewed as a safety issue rather than a security concern by aerodromes. Different processes are employed when unauthorised lithium batteries are identified in checked bags. Some aerodrome operators remove the batteries and send the baggage on its way without involving the air operator or passenger. A note is left in the bag indicating that the lithium battery has been removed and disposed of. Others reconcile the issue with the air operator and passenger, while some directly manage it with the passenger. There is a belief that EU regulation 300/2008 allows for such actions, although this regulation pertains to security, not safety.

There is variation in the priority placed on screener training programmes and proficiency assessment, such as using Threat Image Projection (TIP) images to track performance. Data on the quantity of lithium batteries detected and removed from checked baggage is limited. There are concerns regarding the financial burden if all bags were to be screened for lithium batteries. Aerodrome operators would potentially need to increase staffing levels and possibly make alterations to the Baggage Handling System (BHS).

Some aerodrome operators suggest that air operators should take a more active role in educating passengers about the dangers of lithium batteries. Identifying lithium batteries in cabin baggage at security checkpoints is considered more reliable, as all bags are viewed and screened. In contrast, with checked bags, only 15-25% are viewed. However, there is uncertainty about whether all rejected checked baggage is analysed for lithium batteries and to what quality level.

Aerodrome operators anticipate the introduction of more lithium battery regulations in the future, as the number of lithium batteries carried in both carry-on and checked baggage continues to increase. They advocate for a joint initiative between EC/EASA/ICAO to ensure consistent regulations and guidelines, at least across the EU although ideally worldwide. The response to the consistency of regulations and guidelines across the EU varies. Some stakeholders find them clear and consistent, while others perceive them as ambiguous and subject to country interpretations.

There is diversity in the training approaches for screeners in detecting lithium batteries, with some aerodrome operators utilising external companies for training, while others rely on on-the-job learning and knowledge sharing among colleagues. There are significant differences in the quantities of lithium batteries and DG found across aerodrome operators. For instance, one operator stated that 1.1% of all checked bags contained unauthorised lithium batteries, while another reported only 0.008%. These variations likely reflect the inconsistent "best endeavours" approaches used currently.

In one notable case, a large aerodrome operator reported that in May 2023, 51 bags were rejected to Level 4 for passenger reconciliation due to the presence of lithium batteries. Some concerns are raised about the ability of the (BHS) to cope with 100% checked baggage inspection, should it be required in the future.

Summary of Air Operator Responses

Currently, the responsibility for addressing the issue of DG, including lithium batteries, falls primarily on the air operators. They take a proactive role in dealing with this challenge. Ensuring that DG, particularly lithium batteries, are not packed in checked baggage presents a considerable challenge. The consensus is that many passengers are not adhering to the guidelines and regulations in place.

Despite active efforts, such as pre-check-in questionnaires and multilingual signs posted throughout the self-check-in, check-in desk, and bag drop areas, unauthorised lithium batteries continue to find their way onto aircraft. In some cases, this occurs daily. There is a prevailing feeling that the potential dangers of lithium batteries are inadequately communicated uniformly and understood by passengers and to some extent, airline staff.

Air operators anticipate a future emphasis on detection and enforcement in addressing the issue of unauthorised lithium batteries. Some respondents view fines imposed by safety regulators for discovering unauthorised lithium batteries after check-in as merely a cost of doing business.

To address the problem, certain air operators have taken measures to ensure staff adherence to guidelines. These actions include conducting covert DG validation to verify check-in staff's adherence to the process and providing training to staff on the importance of checking for lithium batteries.

Most air operators assert that a comprehensive solution can only be achieved through the establishment of clear regulations and the concerted efforts of both aerodrome operators and air operators working in harmony. They recommend that the European Union Aviation Safety Agency (EASA) collaborate with the International Civil Aviation Organisation (ICAO) to define appropriate and universal regulations and enforcement measures. One air operator suggests that lithium-based products that are unsafe for air travel should be clearly labelled as such. This would provide passengers with clear information about the products. Another air operator proposes the idea of imposing infringement fines on passengers who falsely declare that they have not packed any DG. Such a measure, although potentially stringent, may be necessary to bring about a significant change in the current situation.

Summary of Regulator Responses

Regulators emphasise that lithium batteries pose a significant safety concern within aviation operations. They view the issue a safety concern rather than a security threat, noting that regulations primarily apply to airlines rather than airports. The issue is compounded by the lack of coordination between airlines and airports. Improvements will need all parties to work together on the solution.

The regulators highlight the challenge of accidental carriage of lithium batteries by passengers, particularly in checked baggage. They stress the need for heightened public awareness to address this issue, acknowledging that some passengers may even knowingly ignore guidelines and be unaware of the safety risks. Furthermore, they point out that security screeners only view a small percentage of passenger baggage, leading to unscreened items making their way onto aircraft.

Regarding solutions, regulators mention the potential use of dogs to detect lithium batteries, albeit not as a mass screening option due to practical limitations and the possibility of improving the resilience of aircraft or cargo vessels against lithium batteries. They also cite the necessity of new regulations to incentivise and expedite necessary changes, as voluntary measures have been slow to yield significant results. Additionally, they note the substantial manufacturing volume of lithium batteries, highlighting the global scale of the challenge.

They stressed the importance of ICAO and IATA in setting the framework for handling dangerous goods, including lithium batteries. However, the challenges in passenger compliance and variability in staff competency will need to be overcome, advocating for standardised messaging and continuation of enhanced staff training.

A multi-faceted approach to address the lithium battery issue is favoured, including awareness campaigns, standardising information dissemination and improving training for staff. There is an emphasis on the need for collaboration across industry to ensure effective implementation of regulations and procedures. Additionally, they highlighted the successful efforts in the cargo sector as a model for addressing lithium battery concerns, where operators actively scan and identify prohibited batteries, passing the associated costs to customers.

Overall, regulators underline the importance of addressing the lithium battery issue through a combination of regulatory measures, public awareness campaigns, and industry collaboration. They acknowledge the complexity of the challenge and advocate for a coordinated effort to ensure the safety and security of aviation operations.

Summary of Association Responses

The rules and guidelines for handling DG, including lithium batteries, depend to some extent on national legislation and, until the EASA GH Regulations enter into force, there are no consistent EU-wide rules in place. This legislative diversity has led to variations in practices across different regions.

In accordance with International Civil Aviation Organisation (ICAO) rules, aerodrome operators are required to provide training to security screeners on identifying and understanding the importance of checking for DG. However, in many states, there are no additional requirements beyond this initial training. The primary responsibility for identifying DG falls on air operators. In some states, DG responsibilities are shared between air operators and aerodrome operators, a practice viewed positively, although it is not a common arrangement.

The European Union Aviation Security (AvSec) legislation contains ambiguity regarding the prohibited items list and what constitutes a threat to the safety of the aircraft. To mitigate the risk associated with lithium batteries and DG, a more integrated approach that combines both security and safety aspects is deemed necessary. Lithium batteries are considered a safety issue at present.

Implementing 100% screening for lithium batteries would be a challenge and could lead to operational complications. Instead, an effective approach is seen as lying between passenger declarations and a certain percentage of bags being subjected to screening. Data collected from the latter would inform the necessary percentage of bags that require checking.

It is suggested that aerodrome operators should make their baggage screening equipment available for the detection of lithium batteries, improving the overall capability to identify and manage this issue. Associations emphasise that any changes in legislation, guidelines, or rules related to lithium batteries should be the

outcome of a collaborative effort involving the entire aviation industry. This ensures that all relevant parties have an opportunity to contribute to the decision-making process.

Summary of Regulated Agents Responses

Regulated Agents actively engage in the search for undeclared DG, including lithium batteries. This proactive approach involves scrutinising x-ray images and inspecting the manifest, ensuring a comprehensive screening process. They diligently follow the International Air Transport Association's (IATA) Dangerous Goods manual which is in line with ICAO Doc 9284 to ensure that DG, including lithium batteries, are handled and transported in compliance with industry standards.

A heightened level of vigilance is applied to some countries where the quality of lithium batteries can be subpar, necessitating increased scrutiny. They have established agreements with third-party screening companies to conduct additional checks for all DG, including lithium batteries, following the resolution of explosives alarms. This supplementary screening process ensures comprehensive detection.

A significant priority is the education of shippers regarding the potential dangers of shipping DG. Cargo agents believe that the issues encountered are largely due to a lack of awareness rather than deliberate intent. Efforts are aimed at enhancing awareness and understanding of the risks associated with DG, particularly lithium batteries. In cases where undeclared DG are identified, they take action to remove them from the shipment without involving the shipper. This prompt and appropriate response ensures safety and compliance.

As part of their safety measures, they suggest the use of videos that convey the dangers of carrying lithium batteries in checked baggage.

2.2 Consultation Webinar

The webinar was hosted on the 18th October 2023 via Microsoft Teams. In the lead up to the event 259 people viewed the registration page and 187 registered to attend. On the day 138 people participated in the event. This demonstrates a huge interest in this project as 73.8% of registrations attended.

The webinar consisted of a presentation from EASA to introduce the objectives of the project then the consortium provided updates on the progress to date. A question and answer session was facilitated at the end of the presentations with the ability to ask questions and make comments to those in attendance. All questions that were not answered during the live session were recorded and addressed via the Questions and Answers Log.

The following summary of these questions and answers offers a comprehensive overview of the discussion pertaining to the detection of prohibited lithium batteries in cabin baggage, reflecting the engagement between participants and the project team. This encapsulates a wide array of topics, including the challenges and complexities of battery detection, the need for stakeholder involvement and cost considerations, data breakdown and reporting, the operational impacts, and regulatory implications.

Summary of Questions and Answers

The project's primary focus is on the detection of prohibited lithium batteries in checked baggage. It aims to assess the technical, operational, and regulatory possibilities for detecting such batteries against existing requirements. The trial is due to commence in April 2024 and the performance statistics from the trial will be

made public. The project does not cover cabin baggage and is not concerned with containers or procedures for handling lithium batteries in flight. Its primary objective is to prevent prohibited lithium batteries from making it onto the aircraft in the first place. The project is also looking at the impact of any additional regulations on existing Explosive Detection Systems (EDS) algorithms and aims to assess whether existing EDS systems can be used to detect lithium batteries. The trial will provide insights into the impact of the additional algorithm on screener viewing times, and the final recommendations and regulatory framework will be determined based on the outcomes of the market assessment and airport trial. Whether the detection algorithm should be regulated or not will be a subject of discussion.

The scope of the project is limited to checked baggage. At the initial stage cargo operators were also consulted and interviewed to enable better understanding of current best practice in this area and approach taken by cargo operators however there are no plans to extend it to cargo. The project will not address issues related to the ownership of removed batteries or air operators Conditions of Carriage. The feasibility of implementing the algorithm on current screening equipment will depend on the algorithm's development and performance, which is currently being worked on to ensure the accurate detection of prohibited lithium batteries based on their specifications.

Summary of Comments

The discussions have highlighted various challenges and considerations in the project. The vast majority of EU aerodromes are using EDS machines, but there are still some using more basic X-ray screening machines for cabin baggage screening, emphasising the variability in screening equipment across aerodromes. The complexities of communicating DG training, particularly regarding batteries, have been recognised as a challenge, underscoring the importance of effective training and awareness programmes. The project acknowledges the role of air operators in bearing the cost of screening and the need for their full cooperation, emphasising the importance of engaging stakeholders and inviting their feedback. Reuniting passengers with their luggage has been acknowledged as a challenge, appreciating the insight into operational considerations.

Furthermore, there have been suggestions to reach out to the FAA for a more detailed breakdown of lithium battery incident data, emphasising the need for accurate data collection through the trial at an aerodrome operator. While it's noted that incidents in Europe have declined slightly, no additional detailed data is available. Comments have touched on the responsibility of carriers for the removal and disposal of prohibited items in line with Annex 18. The considerations about lithium AA and AAA batteries and their regulatory views have been mentioned, with the project reiterating its scope and the consideration of regulations in later stages. The effectiveness of in-person sessions for two-way discussions has been suggested. Concerns about the labelling challenge and its impact on carrier operations have been raised, this will be investigated during practical implementation challenges in later stages.

Overall Summary

The engagement highlights the importance of understanding the practical implementation and potential impacts on carrier operations, emphasising the need for clear communication and collaboration among air operators, airports, and regulatory bodies. The questions, answers and comments provide insights into the ongoing efforts to enhance safety within the aviation industry by addressing the issues related to lithium batteries in baggage. The responses acknowledged the comments and highlighted the project's focus on examining the use of existing EDS systems for lithium battery detection, understanding the operational impact through trials, and considering regulatory aspects at later stages. The trial is expected to provide valuable data and insights for addressing the issues raised by participants.

2.3 Delegate Survey

Following attendance at a recent webinar, participants were asked to provide feedback on various aspects of the event. There were 22 respondents to the survey. The survey responses indicate a diverse range of opinions regarding the webinar, with some participants expressing satisfaction and others providing valuable feedback for improvement. The overall interest in receiving future notifications demonstrates a continued interest in the research project.

The following summarises the responses of the delegate Survey:

Participants were asked to rate the webinar, and the responses varied. 18.18% of respondents rated it as "Excellent," while 70.73% found it "Good," and 4.55% considered it "Average."

Regarding whether the webinar met their expectations, half of participants (50.00%) responded with a "Yes." Some (40.91%) felt it somewhat met their expectations, while a small percentage (9.09%) indicated "No."

When asked if they found the content interesting and relevant to their work, 60.64% of respondents answered "Yes," while 31.82% responded with "Somewhat." Only 4.55% said "No."

Feedback on pre-webinar organisation and communication was primarily positive, with 11 respondents rating it as "Excellent."

Thirteen respondents provided feedback for improving future webinars. Suggestions included sending presentation slides via email, involving more speakers, improving the Q&A session, providing practical information, and monitoring the chat function more closely. All these comments are being considered for future webinar events.

When gathering feedback regarding the project some delegates expressed the critical importance of this topic for safety and security. Others had specific requests, such as receiving presentation slides and statistics via email. Some participants expected more specific and practical information, while others felt the content was lacking in relevance. There were also concerns about the project's implications and a call to broaden its scope to include cargo screening and smaller batteries.

21 of 22 respondents expressed interest in receiving email notifications to stay informed about future events and updates related to the research project. Those who have expressed an interest will certainly be approached in the future.

2.4 Communication with Manufacturers

Due to the highly commercial sensitivity of the topic, it is important to note that of the manufacturers surveyed, only two responded to the inquiries regarding their lithium battery detection algorithm for checked baggage. One response came with the caveat that we are not to publish customer references on the public domain due to concerns related to data privacy. This underscores the confidential nature of the information surrounding such security technologies and the need for discretion when discussing specific customers and deployments in this field.

The following information provides an overview of the response to the questionnaire to manufacturers. There are lithium battery detection algorithms that are available from different manufacturers. These algorithms are commercially available for use on specific equipment.. They can be implemented through a software upgrade and operate in parallel with certified Explosive Detection System (EDS) algorithms.

Lithium detection algorithms are operational in very few airports, three in Europe and six internationally. They can detect various types of lithium batteries including, 18650 lithium battery, polymer lithium battery, ternary lithium battery, 26650 lithium battery, nickel hydrogen battery, flat batteries, cylindrical batteries, and batteries from devices such as laptops, power banks, mobile phones, AA batteries, and cordless screwdrivers.

The false alarm rate for the algorithms is reported to be less than 5%, based on aerodrome-driven evaluation. The detection rate for algorithm ranges from 80% to over 90%, depending on the type of battery and stream of commerce.

The manufacturers report that implementing the lithium battery detection algorithm in existing baggage screening systems is challenging. It depends on the willingness of air operators to adopt the necessary processes and regulatory bodies setting thresholds for the allowable quantity of lithium battery mass in checked baggage. The process does not affect normal inspection for explosives. It is possible to use EDS baggage screening equipment to detect lithium batteries, but there are possible impediments to implementing this into the baggage handling system (BHS) process.

Some national civil aviation authorities have already implemented restrictions on lithium batteries in hold baggage and deployed the corresponding detection system together with EDS. This has received positive feedback from the operation. Lithium batteries are widely used and limited control over the quality and volume may bring potential risks to civil aviation.

One manufacture offers a Fast Parcel dangerous goods algorithm (lithium batteries, flammable liquids and compressed gases) and is in use on nearly forty of its EDS machines around the globe. Safety concerns over DG, including lithium batteries, are particularly heightened in this industry as many of the companies own their aircraft fleet. Screeners review images for both explosives and DG, with image review times consistent with many aerodromes even though they potential review an additional alarm.

There are other non-regulated algorithms including firearms, wildlife trafficking and bio-security. Bio-security demonstrates the art of the possible and what can be achieved with EDS machines. In addition to a wide range of meat, fish and seafood, vegetable and plant foods, the algorithm detects fruit, including apples, avocado, banana, blueberry, grape, kiwifruit, lemon, lychee, mandarin, mango, orange, plum, strawberry and tomato. This algorithm has been used in Australia and New Zealand to safeguard its animals, plants, farms and the environment from pests, diseases, and weeds. Australia and New Zealand take bio-security very seriously and rely on these algorithms combined with EDS to help police its borders. This is a good example of a governmental requirement driving an EDS manufacturer algorithm development and successful deployment into aerodromes.

The additional algorithm can be either loaded onto the EDS machine as it leaves the factory or installed post installation at the aerodrome, loading the algorithm onto the machine is a short process. Customers consider whether they precure a one-off algorithm or to work with the manufacturer and optimise it over time to their stream of commerce. Where throughputs are high, even a small reduction in false alarm rate can represent a considerable reduction in screener resource (costs).

In summary, lithium battery detection algorithms are available but operational in only three European airports for checked baggage. They can detect various types of lithium batteries with a low false alarm rate. Challenges will exist in implementing the algorithm into existing baggage screening processes and making it simple to follow the regulatory thresholds set for lithium batteries. The use of EDS equipment for this purpose is possible but faces implementation challenges.

2.5 Conclusion

In conclusion, although the insights gathered from various stakeholders within the aviation industry come from a relatively small pool of respondents, their feedback was remarkably consistent. Stakeholders illuminated the multifaceted challenges and complexities associated with the safe transport of lithium batteries and DG. With the webinar confirming our findings from previous consultations it is abundantly clear that a collaborative approach is imperative to address this issue effectively, taking into account several critical considerations.

Stakeholders have provided data that underscores the existence of a significant issue concerning the handling of lithium batteries within the aviation industry. Incidents of unauthorised lithium batteries finding their way into checked baggage are a cause for concern, highlighting the importance of developing robust solutions.

A prominent issue is the ambiguity in rules and guidelines across different regions. This lack of harmonisation poses challenges and calls for a need to establish more consistent standards at the international and regional levels. Stakeholders highlighted the importance of collaboration between aerodrome operators and air operators, especially in the context of DG identification. Clear regulations and guidelines which are easy to implement are seen as necessary to facilitate a unified approach to addressing these safety concerns.

However, it is essential to note that stakeholders emphasise that their support for initiatives aimed at addressing this issue is contingent upon the resolution of operational challenges that extend beyond the range of the current project. These operational issues, while not directly within the project's scope, are fundamental to ensuring the successful implementation of any safety measures.

The central issue at hand, as emphasised by stakeholders, revolves around determining the allocation of responsibility and defining the operational model that would effectively manage the transportation of lithium batteries. While the capability to detect these items is an interesting topic, stakeholders are primarily interested in ascertaining who holds responsibility and how the operating model will be structured to ensure safety and compliance.

Crucially, the concerns and issues raised by stakeholders persist, regardless of the project's specific scope. These are the core topics that stakeholders are keen to discuss and address, underlining the urgency and importance of these matters within the aviation industry.

Additionally, cost considerations play a significant role in shaping the way forward. The financial implications associated with implementing new safety measures, such as 100% screening for lithium batteries, require careful consideration to strike a balance between safety and operational efficiency.

The responses underscore a general lack of passenger awareness regarding the dangers of carrying lithium batteries in checked baggage. Measures such as education through videos were suggested as a means to bridge this knowledge gap and promote safer practices. Stakeholders recognise that many issues related to DG compliance are rooted in a lack of awareness rather than deliberate non-compliance. Educating passengers about the dangers of having prohibited lithium batteries in their baggage is considered an important preventative measure.

Furthermore, stakeholders have raised the potential implementation of detection systems that, when lithium batteries are discovered, would require a percentage of customers to present themselves at security to open their baggage. This approach demands an increased number of security staff, along with regular and frequent

calls over the public announcement system to request customers' return to security. The lack of such frequent calls at present suggests that airports may not be adequately screening for lithium batteries.

The primary challenge, as echoed in conversations with stakeholders during the webinar, appears to be the operational implementation and impact of such detection systems. An operational trial is expected to provide an estimated number of prohibited lithium battery instances in checked baggage and an understanding of their impact on the current operation.

To implement such a system, there would be a need for a significant public relations campaign from regulators such as EASA and National Authorities to explain the potential new rules and their potential consequences.

In summary, the consultation with aviation industry stakeholders and regulatory bodies highlights the need for cohesive regulations, comprehensive education, and collaborative efforts to mitigate the safety risks associated with lithium batteries and DG. It is evident that stakeholders are seeking clarity on responsibilities and the operating model, and their support hinges on addressing operational challenges. By working together to resolve these issues, the industry can strive for a safer and more consistent approach to handling DG and lithium batteries, ultimately ensuring the well-being of passengers, crews, and the integrity of air travel. The urgency of addressing these issues is underscored by the burning questions and concerns voiced by stakeholders, making it clear that a "proof of concept" approach alone may not be sufficient to address the significant issues at hand.

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