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How to optimize air cargo operations and communication at Challenge Group?

Challenge Group
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1 Introduction

We are on July 20, 1969, at 8:17:40 p.m. UTC, and Neil Armstrong sets foot on the Moon. The Apollo 11 mission is a success. It marked a major turning point in aerospace, leading to a flood of scientific discoveries and igniting fascination among past and future generations, including myself.

I have always dreamt of being part of this world, first as an engineer and later as a logistician. After initially starting my studies in International Business, I was introduced to the marvelous field of transportation, particularly through the class taught by Mrs. Soyer, my promoter. It only reinforced my desire to pursue a career related to transportation and aviation.

Naturally, I turned to one of the flagships of our region: Challenge Handling, part of Challenge Group. With a thirst for learning, travel, and exploration, I inquired if it were possible to do my internship at one of their offices in the United States. After a long journey, I eventually managed to secure a position at the JFK station in New York. By doing so, I achieved two of my biggest dreams: working in aviation and experiencing an extended stay on American soil.

On-site, the approach to the internship was different from what I expected. Saar, the Operations Manager, had a very practical vision for this learning period. The goal was to use these fifteen weeks as if I were a new employee at the station, observing and deeply understanding their operational approach and each role. It was my responsibility to reconcile this vision with the requirements of HELMo, and that is what I did.

In this thesis, I will start with a theoretical section, describing the world of air freight transportation and Challenge Group as a whole. This section will include, among others, statistical information, various definitions, and facts that provide context for this work. Then, I will move on to a practical part that reflects the work accomplished at JFK, my observations on the station's functioning, and some leads to explore for improving communication and operations. Finally, I will conclude the work by summarizing all the elements discussed.

With that being said, I wish you an enjoyable read.

Theoretical part

As I told you, I will start this thesis with a brief introduction to air freight industry and Challenge. Let us begin with air freight industry.

2 Air freight industry presentation

2.1 Overview

Air freight refers to the transportation of goods via aircraft, rather than by sea or land. It is a fast and efficient way to move merchandise, especially for long distances or for perishable items that need to be delivered quickly.

There are two main types of air cargo:

1. Passenger cargo that is shipped on commercial passenger flights. It is typically less expensive than other types of air cargo, but it is also less reliable and can be subject to delays due to the constraints of the passenger flight schedule. We talk about **belly cargo (1)**.
2. Freighter cargo that is sent on dedicated cargo planes, which are specifically designed to transport goods. Freighter cargo is generally more expensive than passenger cargo, but it is also more reliable and offers a wider range of services such as temperature-controlled shipping and handling of hazardous materials.

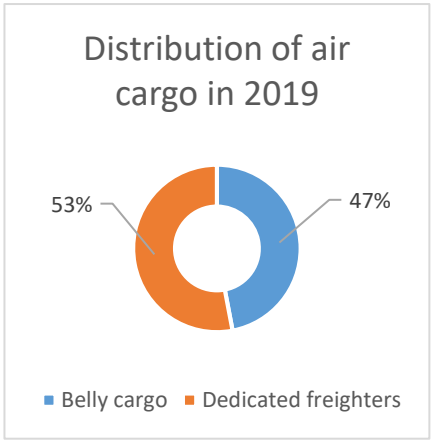


Chart 1 - Distribution of air cargo - Source: Statista

Air freight is a significant contributor to the global economy as it allows the quick and efficient transportation of goods around the world. According to the **International Air Transport Association (2)**, the air cargo industry generates approximately $6.8 trillion in economic activity and supports over 68 million jobs worldwide (*Cargo*, n.d.).

2.2 Regulation

There are many governing bodies and regulations ruling the transport of air freight around the world and in the United States. Here are the ones that interest us the most in the context of this work: the **International Air Transport Association (2)** that represents airlines and the **International Civil Aviation Organization (3)** that speaks for aviation authorities. Please see the glossary for more details.

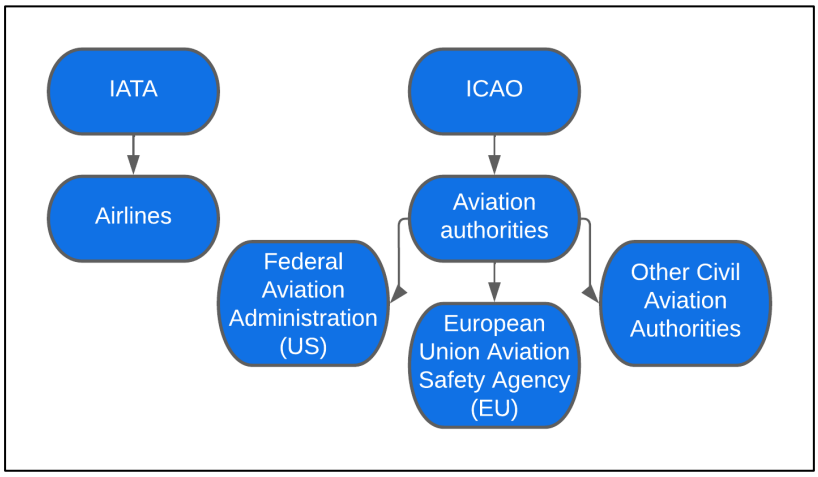


Figure 1 - Aviation governing bodies - Source: internal

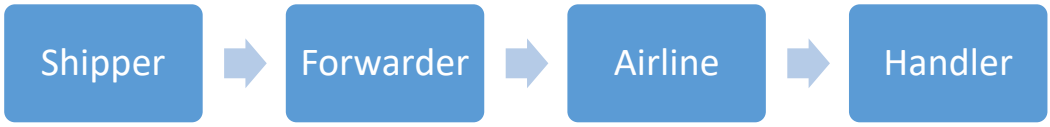
2.3 Documents

The Airway Bill, shortened AWB, is a non-negotiable legal document that serves as a contract between the shipper and the carrier. It contains premier information such as the type of goods, the weight, the dimensions, the origin/destination airports, and the terms and conditions of the shipment. In case of **consolidation (4)**, we also talk about **Master Airway Bill (5)** and **House Airway Bill (6)**, respectively shortened **MAWB** and **HAWB**. The **MAWB (5)** is the main contract of carriage between the airline and the shipper, while the **HAWB (6)** is a subsidiary document that is used to **consolidate (4)** multiple shipments into a single shipment. Both documents are important for tracking air cargo throughout the transportation process.

In addition to these two types of AWBs, there are also electronic Airway Bills (e-AWBs), which are becoming increasingly popular in the air cargo industry. E-AWBs, electronic versions of the traditional paper AWBs, are created and transmitted electronically between the parties involved in the shipment. We will discuss this particular aspect in more details further in the thesis.

2.4 Different players

Here is the typical export cargo process:



Firstly, the shipper is the owner, the person, or the company that sends the goods and is responsible for preparing and packing the shipment. Secondly, the forwarder is a third-party logistics provider who arranges the transportation of the cargo from the shipper to the airline or carrier. Afterwards, the airline is the company that operates the aircraft and is responsible for transporting the cargo to its destination. Finally, the handler is responsible for the ground handling of the cargo, including loading and unloading as well as other activities such as cargo screening and storage.

The US ground operations team, with which I worked for fifteen weeks, is part of this handling process. At JFK, they work together with Lufthansa because Challenge Handling, the handling subsidiary of the group, is not established at this airport. Their responsibilities include managing company operations and logistics, ensuring that safety and security measures are designed and updated, implementing company policies, complying with regulations and standards, auditing and inspecting employees and suppliers, accepting and dispatching cargo efficiently and safely, handling special cargo, maximizing aircraft capacity, facilitating information flow among team members and conducting operational meetings and safety conferences. We will expand on this experience in more details in the following chapters.

2.5 Pros and cons of air freight transport

Pros	Cons
Speed Reliability Accessibility Reduced transit time Security	Cost Capacity Potential delays or disruptions Environmental impact Limited cargo options

2.6 Current trends worldwide and in the US

On the chart below, we can see air freight has grown globally over the last few years, going from 40.9 million metric tons in 2004 to 68.4 in 2022, or an increase of 67.24% in 18 years. We can notice a slight decline of 4.1 million metric tons in 2009 following the **subprime mortgage crisis (7)**. The period between 2010 and 2012 corresponds to the time during which the price of kerosene reached peaks, leading to a decrease in sector performance (Bodson, n.d.) (*Worldwide air cargo traffic*, 2023).

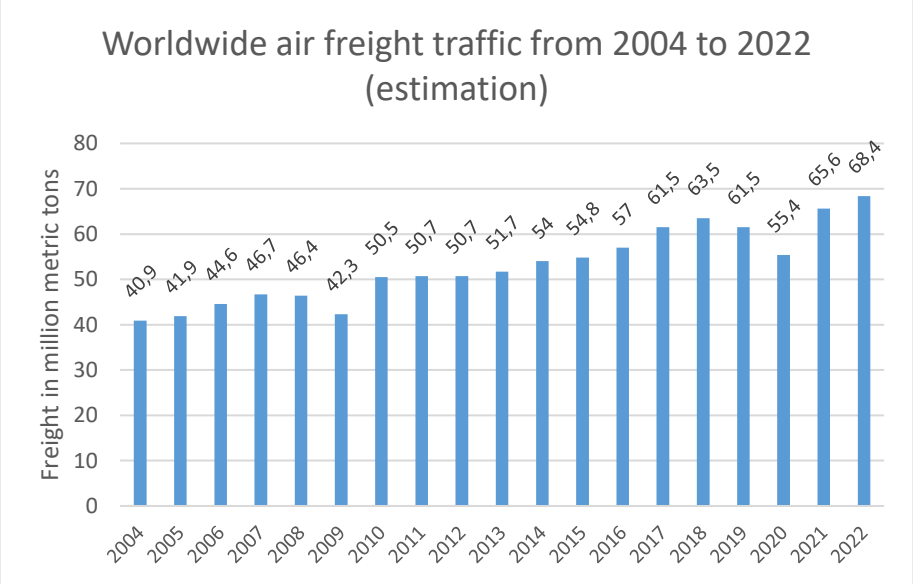


Chart 2 - Worldwide air freight traffic - Source: Statista

On the other hand, this other chart shows air cargo industry bounced back in 2016 when airline fuel prices fell to a low point (*US airline fuel cost 2004 - 2021*, 2023).

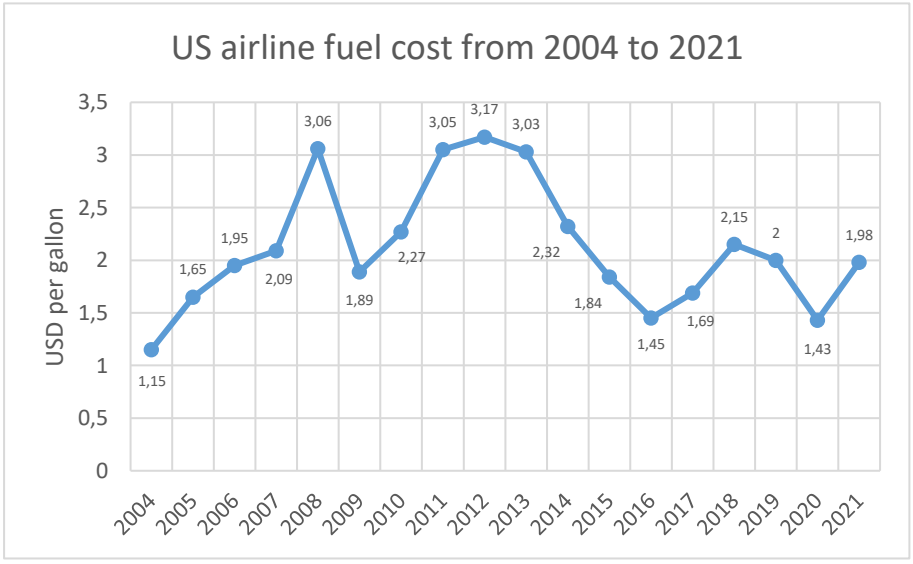


Chart 3 - US airline fuel cost - Source: Bureau of Transportation Statistics

In recent years, the sector has been a bit disturbed by two major factors: the pandemic and the rise of e-commerce.

In 2020, when Covid hit, air freight traffic dropped because passenger flights, which hold cargo in their bellies, almost fell to zero. As a reminder, before the pandemic in 2019, belly freight accounted for 47% of the total air cargo transported in the world. Nevertheless, airlines had to find a solution, so they began to fly only cargo in their **wide-bodies (8)**, reason why the traffic revived so quickly (CNBC, 2022).

Another reason explaining the cargo boom is the rise of e-commerce (15% of air cargo volume in 2019 according to the **International Air Transport Association (2)**). Already popular before the pandemic, it soared during the various lockdowns. Multiple sources state that Covid accelerated the e-commerce industry by two, three, five, and even ten years depending on the region on the globe. For instance, Amazon saw an increase of 44% in sales during the first quarter of 2021 compared to the same period in the previous year. Meanwhile, US e-commerce experienced a growth of 32% from 2019 to 2020, and then an additional growth of 16% in 2021 (*E-Commerce & Logistics*, n. d.) (Baron, n. d.) (Palmer, 2021).

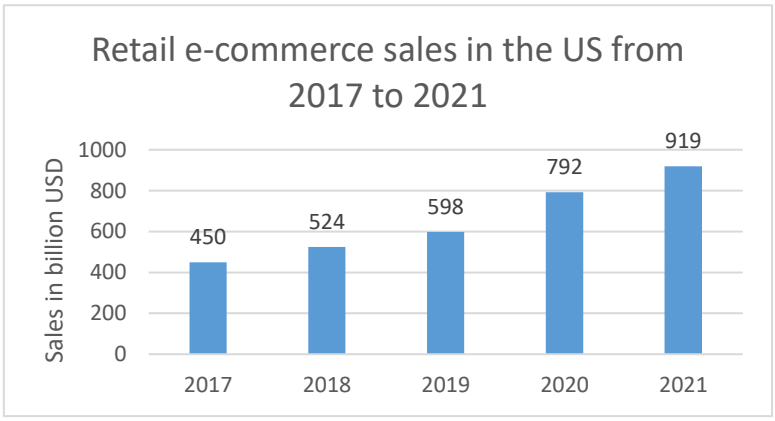


Chart 4 - Retail e-commerce sales in the US - Source: Statista

Nowadays, even if near-term problems were to occur like a slowing economy, the rising inflation, the Russia – Ukraine war or the issues in China, where anti-Covid measures continue to negatively impact the economy, experts say air cargo transportation is going to thrive in the near future, so much so that Boeing has projected the global freighter fleet will increase by 80% over the next 20 years, namely because older Boeing 747s are becoming increasingly obsolete worldwide (CNBC, 2022) (Jeffrey, 2022).

We now have more information about air freight industry. Let us move on to the next point, the presentation of Challenge Group.

3 Challenge Group presentation

3.1 Overview

Challenge is an international group that deals with non-standard cargo, as they like to say: "Your non-standard is our standard." Therefore, they tend to focus on commodities such as:

- Dangerous goods (flammable, explosive, radioactive…).
- Pharmaceuticals.
- Oversized items.
- Perishables.
- Living animals.
- Aircraft engines.
- Valuables.

In 2022, they completed 230 **charters (13)**, 2,402 rides (what they call **legs (9)** internally) and transported 167,793 tons of cargo across four continents and nine scheduled destinations. The organization employs 900 people worldwide and has a fleet of four Boeing 747s. In 2022, they generated over $500 million in revenue and their aircraft accumulated 13,695 flight hours (Challenge Group, n.d.).

3.2 One group, eight companies

Challenge Group is split into eight different companies, including three airlines. Each of them specializes in a particular aspect of the supply chain, running from transport to handling.

3.2.1 Challenge Airlines Israel, Belgium, and Malta

Challenge Airlines is the spearhead of the group since it is the carrier. It is divided into three different subsidiaries, namely Challenge Airlines Israel, Challenge Airlines Belgium, and the newest one Challenge Airlines Malta that got its **Air Operator Certificate (10)**, i.e., its authorization to transport cargo, in November 2022. A fleet of four Boeing 747s allows them to fly more than 300,000 tons of cargo per year. They aim to handle 500,000 tons by the end of 2023.

3.2.2 Challenge Handling

Together with the former CAL Cargo Airlines (now rebranded Challenge Airlines Israel), Challenge Handling is one of the pillars of the group. Previously named Liege Airport Cargo Handling Services (LACHS), they deal with the physical aspect of logistics. Challenge Handling, located at Liege Airport in Belgium, is ideally situated to handle "flexport" cargo without interruption, as the airport's priority is 24-hour service without interruption. Liege Airport is open throughout the entire year and is conveniently situated within the Paris-Amsterdam-Frankfurt triangle, providing operators with straightforward and swift access to all major European commercial **hubs (11)**.

3.2.3 Challenge Air Cargo

This is the commercial arm of the company. Founded in 2018, it aims to increase the group's sales force by handling all the commercial paperwork, arrange air cargo bookings, and provide tailored, door-to-door solutions for any urgent or complicated shipments.

3.2.4 Challenge Aviation

Challenge Aviation is the leasing branch of Challenge. It has a fleet of eight **wide-body (8)** aircraft and five spare engines that it leases out to the group's three airlines as well as to other external airlines.

3.2.5 Challenge Logistics

This part of the group deals with truck transportation as they provide **Road Feeder Services (12)** in Europe and in the United States. They are also based in Liege. Challenge does not own its own trucks, they go through more than forty different subcontractors in Europe, such as Jost[1], and three in the United States. Thanks to this service, Challenge is able to send freight in most European destinations within twelve hours once the goods arrive at the airport.

[1] Transport and logistics company.

3.2.6 Challenge Technic

Formerly JetMX, Challenge Technic was acquired by the group in 2021. It is a full-service aviation maintenance company providing certified, compliant regulatory services to a variety of aircraft, including many Boeing or Airbus variants. Their team of certified technicians and mechanics is always available to help with a range of maintenance services such as daily and weekly checks, engine washing and changing, and fixing problems with the cabin. They can also provide urgent support if a plane experiences unexpected issues while flying. Their headquarters are based in Iceland and they operate in Belgium (Liege), Germany (Leipzig, Koln/Bonn, Hannover), and Cabo Verde. They handle the maintenance of both the Challenge Group fleet and those of other airlines.

3.2.7 Visual summary of Challenge Group

Note: all of these companies are part of the holding "Challenge Aviation Holding Limited", a Maltese limited liability company (*Malta Business Registry*, n. d.).

Figure 2 - Challenge Group visual summary - Source: internal

3.3 Network

Figure 3 - Challenge network - Source: internal

Liege Airport is the group's main **hub (11)**, where everything starts. They can transport cargo to most continents, including Europe, America, Asia, and Africa. For instance, there are eight regular flights per week to the United States (five to New York, two to Atlanta, and one to Houston). In addition, there are some **charters (13)** now and then from Miami and Greenville-Spartanburg, where there is a BMW[2] factory. The group plans to add new destinations to its network in the coming years as part of its fleet expansion. Indeed, short flights with long-haul aircraft like Boeing 747s are not profitable, while small planes save money to make shorter jumps, such as to Africa or India. In the future, Mumbai airport will be connected to Liege with Boeing 767s.

Challenge also has **interline agreements (14)** with other airlines, allowing them to operate flights to other destinations in Africa. Therefore, there are many companies at Liege Airport working together with Challenge that fly to Africa. Challenge brings goods from the United States to Liege and another company takes them elsewhere. These are global flights with two or more different operators where everyone does its part of the journey.

[2] German car manufacturer.

3.3.1 Focus on Liege Airport (LGG)

Liege Airport is the main **hub (11)** of the group with twenty flights per week and the headquarters of Challenge Handling. Their facilities cater specifically to special cargo needs with a warehouse including 30,000 m^2 of online warehouse (for e-commerce fulfillment and individual customer orders), 11,000 m^2 of offline warehouse (for restocking needs of physical retail stores) and 400 m^2 of temperature-controlled storage as well as 5,000 m^2 of office space. It boasts the largest capacity high loader[3] in Europe (52 tons), an automated roller system for **Unit Load Devices (15)** (including **Elevating Transfer Vehicles (16)**) for quick and efficient handling of cargo, and a high level of security clearance.

3.3.2 Focus on John F. Kennedy International Airport (JFK)

Operating five flights a week, JFK is the biggest station in North America, and therefore another important **hub (11)** for the group. Nevertheless, unlike Liege, they do not have their own handling facilities (i.e., Challenge Handling). Therefore, they use Lufthansa for physical operations. Their main warehouse features:

- Landside docks for trucks.
- Airside parking areas for up to four **Aircraft Design Group V (17)** aircraft with **Ground Power Units (18).**
- **Ground Support Equipment (19)** facilities.
- A 330-pallet position automated **Unit Load Device/Transfer Vehicle (15, 16)** structure.
- A dedicated drive-in vault for the transfer of valuables.

(*AIRIS*, n.d.)

3.4 Fleet expansion

Currently, Challenge operates a fleet of four Boeing 747s: one **747 Freighter (20)**, one **747 Converted Freighter (21)** and two **747 Extended Range Freighters (22)**. These planes are able to carry up to 120 tons. For information, the main differences between a classic freighter and a conversion are the openable nose and the windows (there are bound to be more portholes on the fuselage of a conversion).

[3] Specialized piece of equipment used in air cargo handling to load and unload freight from an aircraft (please find a picture in the appendices).

Recently, four Boeing 767s were purchased and are expected to be converted into freighters by 2023. They will be assigned to Challenge Airlines Malta. Thanks to a pool of ten pilots based in their headquarters in Malta, they will be able to operate regular flights from and to Liege, Tel Aviv, Sharjah, New York, and Mumbai that will be a new destination. The items that are expected to be transported on these aircraft will probably include a combination of perishable goods, medicines, and shipments that involve moving goods from sea to air in the short-term. As time goes on, the range of items transported will expand to include high-value long-distance shipments such as online purchases, as well as the group's specialties: horses, cars, and engines.

Nowadays, Challenge Aviation (the leasing division) is in the process of acquiring four Boeing 777s, which will then be passed on for **conversion (23)** to Israel Aerospace Industries, a major Israeli aerospace and defense company. All new aircraft will be **conversions (23)** due to the **conversion (23)** boom following the pandemic. Thus, the Challenge fleet is destined to triple by 2026. Eventually, Challenge Airlines Belgium will have the Boeing 747s, the Maltese branch the 767s and the Israeli division will own the 777s. It is most important to renew the fleet since the 747s are doomed to disappear due to the different European and Belgian regulations (cf. "Current events and perspectives" section). What's more, Boeing even stopped its production earlier this year (Insinna, 2023).

Figure 4 - One of Challenge future Boeing 767s - Source: Mario Caruana (MAviO News)

3.5 Customers

Here are some of Challenge customers at JFK.

ASML, whose HQs are located in the Netherlands, is Challenge main customer at JFK. It is a leading global supplier of semiconductor manufacturing equipment and technology that uses the air cargo industry for efficient product delivery.

Teva Pharmaceuticals is a multinational pharmaceutical company based in Israel. It was founded in 1901 as a small wholesale drug business and has since grown to become the world leader in generic drugs. Challenge charters a plane just for them once a week at JFK.

American logistics company that provides art logistics and shipping services to museums, galleries, and private collectors worldwide. They specialize in handling fine art, antiques, and other high-value items.

Division of DSV, a global transport and logistics company headquartered in Denmark, which specializes in air and sea freight forwarding services.

3.6 Current events and perspectives

Lately, a decision by the Walloon government in Belgium almost put the group in a difficult situation. In fact, in August 2022, it granted Liege Airport (as a company) a unique permit[4] for the operation of the airfield over the next twenty years. The problem is, this authorization was the subject of numerous legal appeals following the dissatisfaction of certain parties (mainly residents and environmentalists), to the point that it had to be amended. Initially, it limited the number of flights to 50,000 per year, and then the government eventually agreed on 55,000 flights. Following this decision, Challenge Handling announced the creation of 700 additional jobs in the short and medium term (Belga, 2023) (SudinfoBe, 2023) (RTC Liège, n.d.) (Xavier, 2023).

In addition, the organization received its **Center of Excellence for Independent Validators (CEIV) (24)** Live certification from the **International Air Transport Association (2)** in 2022. **CEIV (24)** is a globally recognized certification program for air cargo handling focused on live animals and other sensitive goods. It provides a standard for companies to ensure that their processes and facilities meet the requirements for the safe and secure handling of these products and helps improve the quality and reliability of air cargo handling for these sensitive products. This is already the second **CEIV (24)** for Challenge, which also holds the **CEIV (24)** Pharma certification (Xavier, 2023).

Finally, in February 2023, the group was awarded the Highly Acclaimed All Cargo Carrier of the Year award at the International Air Cargo Excellence Awards organized by STAT Times[5]. This award is extremely regarded in air freight industry and is considered a prestigious honor. Winning the award can help a carrier enhance its reputation, increase its customer base, and attract new business opportunities (*STAT Times International Award for Excellence in Air Cargo*, n. d.).

This last comment on Challenge perspectives closes this first theoretical part. Now we know more about the industry and the company, it is time to move on to the practical part of the thesis.

[4] Combination of a planning permission and an environmental permit.
[5] Renowned international air cargo news and media publication.

Practical part

In this part, divided into two sub-parts, I will expand on my experience in the ground operations team at JFK, which works closely with the commercial team occupying neighboring offices. At first, this is more of a description than an analysis strictly speaking because the objective was to act as if I were truly a new employee within the group, but I will continue with the analysis later. Let us cut to the chase.

4 JFK station mode of operation

As I mentioned before, the JFK team only handles the administrative part of the operations because Challenge does not have its own handling facilities overseas. Therefore, they rely on Lufthansa for the physical operations. JFK plays an important role within the group with five scheduled flights per week from and to Liege, with inbound flights landing at 9:00 a.m. and departing at 1:00 p.m. Eastern Time Zone, i.e., a four-hour turnaround. For reasons of efficiency, the staff always arrives three hours prior to the arrival of the flight, that is at 6:00 a.m.

The first two weeks of my internship allowed me to get accustomed to the company, its various procedures, aviation jargon, and life in New York in general. It was then agreed that I would participate in the different possible shifts at the station, namely:

- Data entry.
- Screening.
- Build-up/manifesting.
- Ramp Safety Supervisor.
- Turnaround Coordinator/Air Carrier Management Representative.

These shifts are split into three possible schedules: from 7:00 a.m. to 3:00 p.m., from 3:00 p.m. to 11:00 p.m., and from 11:00 p.m. to 7:00 a.m. Let us see in detail what these various tasks consist of by analyzing the cargo flow.

4.1 Cargo flow

To better understand the operating mode of the station, it is necessary to grasp the cargo flow, which is summarized in the following diagram.

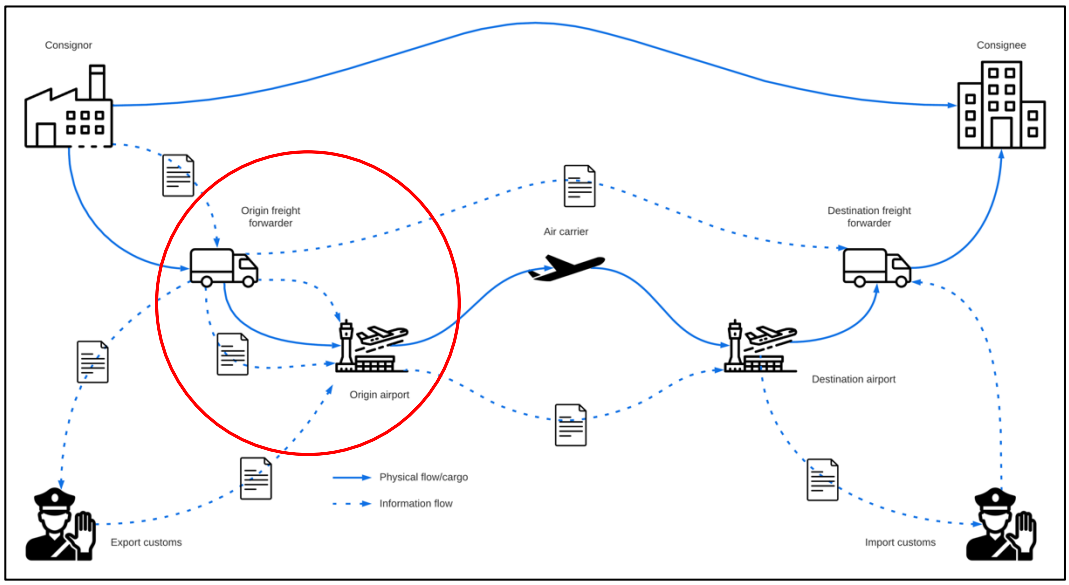


Figure 5 - Cargo flow overview - Source: International Civil Aviation Organization

Therefore, here is a general overview of the flow of goods and information between the different stakeholders involved in the supply chain (e.g., Challenge, its customers, and Lufthansa). In the context of this internship and this thesis, we will focus on the red circle that depicts the cargo acceptance and the work achieved by the ground operations team when it comes to exporting goods (from New York to Liege).

4.1.1 Cargo acceptance

Cargo acceptance is the step during which the truck arrives at the Lufthansa warehouse. At this stage, the company needs the following documents:

- Driver's license.
- **Master Airway Bill (5)**, which, as a reminder, serves as the main contract of carriage in air freight industry.
- **House Manifest (25)**, a comprehensive record containing all the details related to the **House Airway Bills (6)** associated with a consolidated shipment.
- **Transportation Security Administration (26)** letter.
- **Dangerous goods (DG) (27)** declaration.

With these, Lufthansa creates a file that will follow the cargo until take-off. Once accepted, the goods are handed over to the handling team where the different shifts begin.

However, before we move on to the other roles, it is most important to mention data entry. This key process is carried out in real time since it is a guarantee of quality. It consists in entering all the data included in the Airway Bills encompassed in the files created by Lufthansa: names and addresses of the consignor and the consignee, description of the goods, number of pieces, weight of pieces, potential **DG (27)** data, and **consolidation (4)** information.

4.1.2 Security checks

This is what we call "screening", i.e., check the cargo to make sure it matches the **Transportation Security Administration (26)** requirements. They use three different methods at JFK:

- Sniffer dogs, or K9, that is dogs trained to detect hazardous materials.
- Explosive Trace Detection or use of swabs just like when you go through security checks and they sample your fingers for a commercial flight.
- Physical search in the last resort.

Furthermore, the process varies depending on whether it is general cargo or **dangerous goods (27)**.

4.1.3 Consolidation

This step involves two shifts: build-up and manifesting. While the first one is mainly performed by a build agent, the second one is completed by one of the ground operations team members. The build agent is an individual responsible for **consolidating** or **deconsolidating (4)** shipments at an air cargo terminal. On the other hand, the manifesting process refers to encoding the unique reference number of a pallet in the **ERP Priority (28)** for a given flight to get an accurate idea of the goods flying and to keep a record.

4.1.4 Loading

The last step of the process is the loading of the cargo onto the aircraft. This involves three different positions:

1. Ramp Safety Supervisor (RSS): employee ensuring that all ground activities are conducted smoothly and safely. This includes ensuring the safe movement of employees, avoiding proximity to aircraft wings and engines, and ensuring proper usage of forklifts and other equipment.
2. Turn Around Coordinator (TAC): person who makes sure that everything is ready for the import and export flights. That person also determines if any special handling or extra ground time is needed.
3. Air Carrier Management Representative (ACMR): individual designated by an air carrier who serves as the primary point of contact with **Transport Security Administration (26)** for security-related matters.

4.1.5 Visual summary of the cargo flow

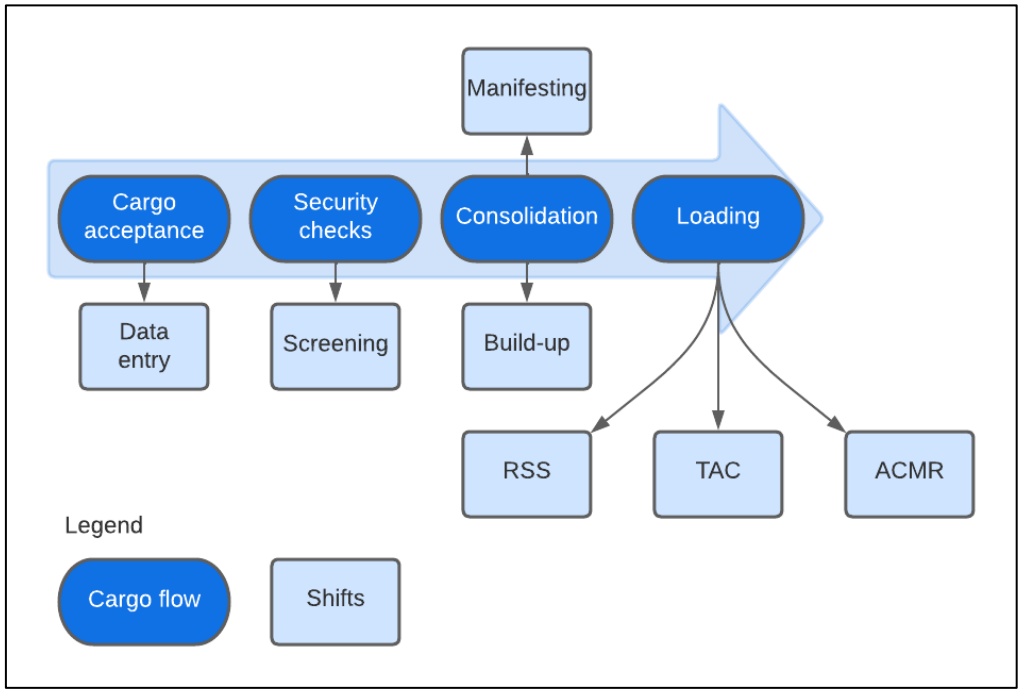


Figure 6 - Visual summary of the operations at JFK - Source: internal

You are now well versed in the flow of goods concerning the exports at JFK. Now, I need to make the connection with the topic of my thesis, which is the search for solutions to optimize communication and operations. Therefore, let us first see where the problem lies at various levels by identifying them.

4.2 Problem identification

After observing the functioning of the JFK station, I would like to discuss specific aspects of the shifts that, in my view, present challenges or have room for improvement. The primary focus is on communication.

Firstly, I will discuss how Challenge and Lufthansa communicate. Currently, everything is done through emails, phone calls, or text messages. As for the transmission of cargo-related documents, it is done physically, i.e., the acceptance file constantly goes from the warehouse to the office in its paper form and vice versa. However, nowadays, there are methods available to digitize almost all of the documents used, if not all. I will address this in the "Communication improvement" section.

Next, we will discuss the issue of **consolidation (4)**. As indicated in the glossary, this refers to the construction of pallets intended to be loaded onto the aircraft. Once again, I believe that communication can be improved, as well as the tools used by both Challenge and Lufthansa. Thus, we will explore two potential solutions in the "Build-up improvement" section.

Lastly, the new European customs system, known as Import Control System 2, presents another matter that needs to be resolved. This system aims to enhance the security of imports and transits within the European Union. However, it introduces a series of new requirements that have consequences for all stakeholders, particularly the airlines. We will elaborate on this sensitive topic in the section simply titled "Import Control System 2".

These paragraphs lay the groundwork for my actual thesis, which I will develop in the following pages. Unlike the previous pages, we now enter a more analytical part where I report on elements that could be improved. With that established, let us get down to the heart of the matter.

5 Communication improvement

The very first concern I had lies in communication. As we have observed previously, this is done the old way, while current means allow a transition to digital. Thus, we will see two alternatives in the coming pages.

5.1 E-freight

One way to improve communication between Challenge and Lufthansa would be to move to e-freight, which includes the electronic Airway Bill we have discussed in the first part. Nevertheless, what is it all about in the end? Let us take a look.

5.1.1 Definition

E-freight is an initiative of the **International Air Transport Association (2)** to digitize and streamline the entire supply chain in the air cargo industry. The program was launched in 2006 and has since evolved significantly. Actually, Lufthansa, with whom Challenge works, was the first airline to send fully digitized air cargo from Germany in 2008 (*Facts & Figures - Lufthansa Cargo*, n. d.).

5.1.2 Difference between e-freight and the e-AWB

In fact, the electronic Airway Bill (identified below as "XML Waybill") is just one of many documents that are included in e-freight. Indeed, this arrangement is very comprehensive and allows for the digitization of no less than twenty formerly paper-based documents. Here is an overview:

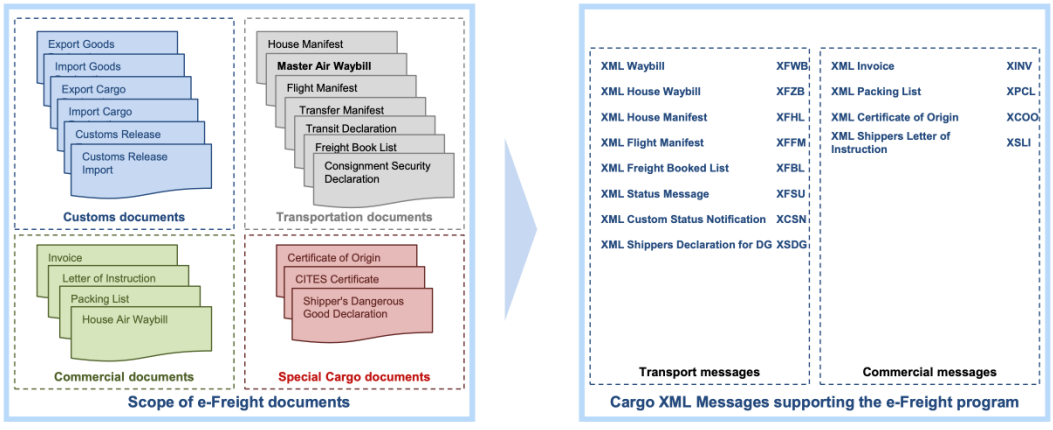


Figure 7 - Cargo-XML messages - Source: International Air Transport Association

Among the documents digitized are the **Master Airway Bill (5)**, the **House Airway Bill (6)/House Manifest (25),** and the **dangerous goods (27)** declaration, all three of which are part of the file created by Lufthansa when the cargo is accepted in their warehouse.

5.1.3 E-AWB deployment

5.1.3.1 Overview

Now we know what it is in broad outline, let us see where the implementation of the electronic Airway Bill (e-AWB) is, whose performance is to be qualified. Below is a table showing the penetration rate of the e-AWB in the world.

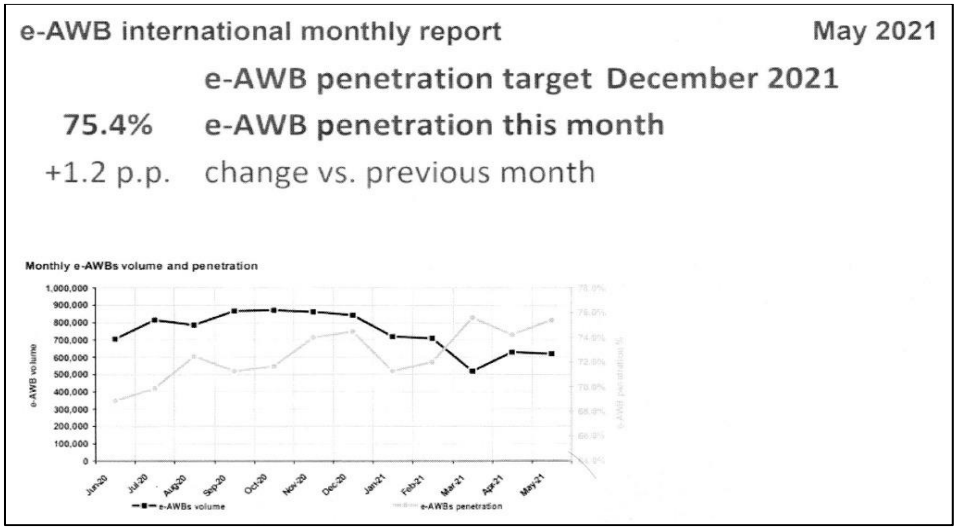


Figure 8 - e-AWB penetration rate - Source: International Air Transport Association

First of all, we can notice the data is from May 2021. This is taken from a transport course book at HELMo (Bodson & Flechet, n.d.). I unsuccessfully tried to find more recent data. On the contrary, the last monthly report from the **International Air Transport Association (2)** on their website is from September 2020. Still, at that time, the penetration rate was 75.4%. This penetration rate is obtained according to the following formula:

$$\frac{Total\ number\ of\ eAWBs}{Total\ number\ of\ eAWBs + total\ number\ of\ paper\ AWBs}\ x\ 100$$

In fact, this is very good, but it should be taken with caution because it is based on the feedback of major airlines, handlers, and freight forwarders. Thus, it does not consider the many smaller forwarders who are small and medium-sized companies that do not necessarily have the financial or IT means to switch to e-freight (*The e-AWB Fairy Tale - a Freight Forwarder's Point of View - Part 1*, 2020).

Now let us see where the implementation is in the world and in companies.

5.1.3.2 Situation in the US

Top-10 countries of origin (ranking by e-AWB volume)

Rank (previous)	Country	e-AWB penetration (previous)	e-AWB penetration (current)
1 (1)	CN - People's Republic of China	76.1%	75.0%
2 (2)	US - United States of America	59.2%	59.4%
3 (3)	HK - Hong Kong (SAR), China	75.4%	76.1%
4 (4)	DE - Germany	74.6%	74.9%
5 (5)	KR - Korea (South)	84.0%	83.9%
6 (6)	TW - Chinese Taipei	81.6%	83.7%
7 (7)	IN - India	76.3%	72.1%
8 (8)	JP - Japan	55.2%	51.9%
9 (9)	SG - Singapore	82.8%	85.1%
10 (10)	NL - Netherlands	72.1%	72.3%

Figure 9 - Top-10 countries of origin - Source: International Air Transport Association

According to the previous report of the **International Air Transport Administration (2)** (September 2020), the United States is the second most e-AWB-issuing country in terms of volume, with 85,513 e-AWBs issued, behind China (148,756), but ahead of Hong Kong (66,698). This means that e-AWBs are already widely adopted at the national level (Sauv, 2022).

e-AWB international monthly report **September 2020**

100 priority e-airports of origin for eAWB360 (ranked by e-AWB volume over the past 12 months)

Airport	Rank	Sep 19	Oct 19	Nov 19	Dec 19	Jan 20	Feb 20	Mar 20	Apr 20	May 20	Jun 20	Jul 20	Aug 20	Sep 20
PVG - PuDong, Shanghai, CN	1	63.3%	64.8%	66.0%	68.2%	69.2%	71.8%	71.1%	71.8%	72.3%	72.3%	73.7%	76.6%	75.2%
HKG - Hong Kong Int'l, Hong Kong, HK	2	73.1%	72.7%	73.4%	73.0%	74.0%	78.6%	72.9%	70.5%	69.5%	72.2%	72.2%	75.4%	70.1%
ICN - Incheon International, Seoul, KR	3	78.4%	74.1%	74.0%	78.1%	79.3%	75.3%	76.7%	79.4%	78.7%	83.1%	79.6%	84.0%	83.8%
FRA - Frankfurt Int'l, Frankfurt, DE	4	66.4%	66.6%	68.2%	67.7%	70.6%	68.7%	67.3%	63.9%	66.5%	65.7%	67.8%	72.3%	73.3%
TPE - Taoyuan, Taipei, TW	5	76.7%	75.5%	76.4%	77.8%	75.9%	76.1%	77.5%	77.3%	75.7%	76.3%	79.4%	80.6%	82.7%
SIN - Changi, Singapore, SG	6	88.1%	83.5%	84.2%	83.0%	84.2%	86.1%	84.2%	78.9%	79.4%	80.6%	81.9%	82.8%	85.1%
AMS - Schiphol Airport, Amsterdam, NL	7	67.9%	68.3%	69.6%	68.8%	71.2%	69.6%	67.4%	67.0%	67.0%	67.3%	70.1%	72.2%	72.6%
NRT - Narita, Tokyo, JP	8	53.2%	53.1%	56.7%	56.3%	58.1%	56.7%	54.4%	55.8%	50.6%	45.1%	50.6%	56.5%	51.9%
CAN - Baiyun, Guangzhou, CN	9	71.4%	69.4%	69.3%	67.2%	67.9%	67.5%	71.3%	64.7%	72.6%	77.9%	77.0%	75.9%	77.7%
LHR - Heathrow, London, GB	10	47.8%	47.8%	49.3%	49.7%	51.3%	52.2%	49.6%	51.9%	49.0%	50.6%	51.4%	50.9%	52.5%
ORD - O'Hare International, Chicago, US	11	57.1%	57.1%	58.3%	57.6%	59.9%	58.2%	56.9%	59.6%	56.6%	58.0%	57.5%	59.1%	59.3%
LAX - Los Angeles Int'l, Los Angeles, US	12	51.8%	48.8%	51.6%	50.5%	52.4%	52.4%	51.3%	54.6%	52.4%	53.6%	54.8%	58.7%	58.4%
CDG - Charles De Gaulle, Paris, FR	13	60.9%	60.0%	62.0%	61.3%	65.8%	62.5%	63.2%	61.9%	60.2%	59.6%	62.8%	64.1%	65.6%
PEK - Capital, Beijing, CN	14	73.3%	69.8%	74.3%	74.1%	75.8%	69.8%	75.5%	78.6%	77.5%	78.0%	77.6%	82.4%	82.8%
DXB - Dubai, Dubai, AE	15	93.2%	93.4%	94.0%	93.2%	93.7%	94.1%	93.0%	94.3%	94.2%	95.5%	97.3%	95.7%	96.8%
JFK - John F Kennedy Int'l, New York, US	16	53.3%	53.1%	52.3%	54.0%	56.2%	55.2%	54.1%	58.2%	54.9%	55.7%	55.0%	57.3%	58.0%

Figure 10 - 100 priority airports of origin for e-AWB - Source: International Air Transport Association

The table above shows the airports with the highest e-AWB emissions in terms of volume. The percentage is obtained using the formula on the previous page. We can observe that JFK is the third US airport on the list, after Chicago, and Los Angeles. This validates the extensive digitization on a nationwide scale (Sauv, 2022).

Let us now turn to the situation in the companies.

5.1.3.3 Situation at competing companies

Top-10 airlines (ranking by e-AWB volume)

Rank (previous)		Airline	e-AWB penetration (previous)	e-AWB penetration (current)
1	(2)	LH - Lufthansa Cargo	81.6%	80.5%
2	(1)	CXG - Cathay Pacific Group	92.8%	93.5%
3	(4)	AKG - Air France - KLM Group	85.7%	85.4%
4	(3)	QR - Qatar Airways	84.5%	84.7%
5	(5)	KE - Korean Air	77.6%	79.4%
6	(6)	CI - China Airlines	79.0%	78.6%
7	(7)	TK - THY - Turkish Airlines	70.6%	69.6%
8	(8)	SQ - Singapore Airlines	92.4%	94.3%
9	(16)	EK - Emirates	38.5%	39.9%
10	(11)	MUG - China Eastern Airlines Group	65.0%	65.5%

Figure 11 - Top-10 airlines - Source: International Air Transport Association

The table on the left shows the airlines that use the e-AWBs the most. In the top three are Lufthansa, Cathay Pacific, and Air France/KLM. The interesting point here is to compare this ranking with the airlines operating at JFK. It appears that all of them are included. Therefore, it is essential that Challenge improves its ranking as soon as possible in order to avoid falling behind. On the other hand, it is interesting to notice that Lufthansa is the first in the ranking, which seems logical since they are pioneers in the e-freight initiative (Sauv, 2022) (*Port Authority of New York and New Jersey Air Cargo Facilities at JFK International Airport*, n.d.).

During a meeting with Tracey Boothe, Project Manager at Lufthansa in New York, I learned that the e-AWB was indeed massively used on their side, to the point that they are able to digitize almost their entire file. The only obstacles they are currently encountering are:

- The **Transport Security Administration (26)** letter because it is not yet available in electronic format (a paper version is still required).
- The **dangerous goods (27)** declaration, which is currently only used experimentally in Chicago.
- Some customers who have not yet gone digital (such as Challenge).

5.1.3.4 Situation at Challenge

I contacted one of the members of the IT team at Challenge Handling to find out where e-freight and the e-AWB stand within the group. It turns out that although they are planned for the near future, they are still not effective. In fact, the **ERP Priority (28)** is simply not compatible because it still uses **Cargo-IMP (29)**, an old email format in air cargo industry, that is why it needs to be upgraded (even if the use of e-AWB is possible with this format, it is harder).

As we now know more about setting up the e-AWB, let us move on to how one can deploy it.

5.1.4 How to implement the electronic Airway Bill?

To be able to use the electronic Airway Bill (e-AWB), it is first necessary to ensure that the respective countries of the consignor and the consignee have signed the same treaty, namely the Montreal Protocol #4 of 1975 or the Montreal Convention of 1999. These two treaties aim to amend the Warsaw Convention of 1929, an international agreement that establishes the fundamental rules of the liability of air carriers in case of damage related to international air transport. It is considered the first major international convention governing air transport. Besides, it must be ensured that these countries recognize the e-AWB as a contract of carriage. Once this is done, there are basically five steps:

- Step #1: become a member of the **International Air Transport Association (IATA) (2)** e-AWB multilateral agreement, Resolution 672[6].
- Step #2: make sure that the system used by Challenge supports the e-AWB, i.e., **Cargo-IMP (29)** or **Cargo-XML (30)** (more convenient according to the **IATA (2)**).
- Step #3: check the relevance of the messages sent by correcting in particular missing or wrong data, syntax errors, a poorly configured cargo system, or a message sent late.
- Step #4: update the partners to let them know that Challenge has moved to the e-AWB and explain what it means to them.
- Step #5: launch the e-AWB.

(Sauv, n.d.)

5.1.5 Pros and cons

Pros	Cons
Improved efficiency Enhanced security Increased transparency Better environmental impact	Implementation cost Dependence on technology Legal and regulatory challenges Resistance to change

Now we know more about the electronic Airway Bill, let us focus on concrete solutions to implement it.

[6] Agreement among participating airlines to use the electronic Airway Bill as the preferred method of issuing and transmitting Airway Bill data electronically.

5.1.6 Potential solutions and cost

E-freight and the e-AWB are one thing, how they can be exploited is another. Therefore, we will now see solutions to migrate to this new system.

Right away, I see two potential options: either IT team upgrades the **ERP Priority (28)** or Challenge uses a third party to get a complete package, at least temporarily. To find out what the best solution is, I did extensive research into Challenge itself but also with external companies to know a bit more about their software, how they work, and what it would cost in terms of time and money to implement them within the group. Nevertheless, it is difficult to accurately assess the cost of such an undertaking since it can vary significantly depending on a number of factors including the size of the company, the scope of the implementation, and the existing technology infrastructure. Still, I did my best to get an overview that is as precise as possible. Here are the results of my research.

5.1.6.1 Upgrade of the ERP Priority

The first solution considered would be to upgrade the **ERP Priority (28)**. To learn more about it, I contacted Hossaine El Bouayadi, IT Applications Manager at Challenge Handling in Liege, who worked specifically on the implementation of the electronic Airway Bill.

According to him, the development would take approximately eight days per message. The first one will obviously take longer to develop, as they would need to start from scratch. However, subsequent messages will be easier to code since they will follow the basic structure of the previous message and so on. Here are the primary messages:

- **Master Airway Bill (5).**
- **House Airway Bill (6).**
- Flight Manifest, which contains a comprehensive list of all cargo and passengers on board an aircraft for a particular flight.
- Freight Booked List, that is a compilation of goods currently present on an aircraft that is expected to reach a designated airport.
- Certain status messages like “Received from Shipper” or “Freight on Hand” that we will parse out further in the “Freight Status Update messages” section.

Considering these main messages, this would represent a development time of at least 48 days. In addition to the development time, there would also be a financial investment to consider: more or less €800 per day, or €38,400 in total for the six messages we have just discussed.

5.1.6.2 MercuryGate

Besides the in-house development, Challenge can also consider using third-party suppliers whose names are given below. Each of these solutions has its pros and cons. Let us see what they are.

The first company that replied to my emails is MercuryGate, which is a technology company that provides **Transportation Management System (TMS) (31)** solutions for shippers, freight brokers, and carriers. Their cloud-based **TMS (31)** platform is designed to help customers optimize their supply chain operations and improve visibility, efficiency, and cost effectiveness.

I had a call with Alex Hollingsbee, Strategic Account Director. He told me they do the **TMS (31)** globally, which means they take data from the company's system, optimize it, allocate it, route it to a foreign system, retrieve the information, and then execute it to the carrier.

Good point here, Lufthansa is one of their customers and this is exactly what they do for them. On that, he told me the best solution would be to get in touch directly with Lufthansa. If Challenge had access to their tool, they would have the information right there and would be able to send it to their own system, but there would be charges involved that Challenge would need to face. Unfortunately, I cannot quantify them.

In terms of cost, Alex told me an out of the box implementation giving Challenge the ability to plan in the system, communicate with the stakeholders, process to dock scheduling to get visibility in the warehouse… would be around $100,000 for the implementation, then $5,000 a month for the membership.

Finally, he told me he would need to know more about Challenge to make a more precise quotation. Normally, he would come on the spot to look for an opportunity to buy the **TMS (31)** and to get an overview of the company with some slides and accurate data. This kind of mapping costs between $5,000 and $10,000 depending on companies.

5.1.6.3 Kale

Another external provider to consider is Kale. Kale Logistics Solutions is a software provider for the global logistics and supply chain industry. They offer a range of technology solutions and services to enhance the operational efficiency and visibility of logistics processes.

I had a meeting with Latoya Boose, Sales Director, and Sheereedah Copening, Account Manager. They introduced me to the company and explained to me to what extent they can help Challenge improve its communication. Among the many pieces of information they provided me, I particularly remember two:

- Airport Community System (ACS): software solution for the air cargo industry, connecting stakeholders within an airport community. It eases digital connectivity among airlines, freight forwarders, ground handlers, customs authorities, and other relevant parties involved in the air cargo supply chain.
- Paperless INteGration (PING): conversion tool whose purpose is to digitize and streamline the switch of paper documents such as Airway Bills into electronic data for seamless data transfer and integration within the air cargo supply chain.

My primary goal being to find ways to improve communication, I sought to determine how this software could be useful to Challenge, and I was not disappointed:

- Elimination of constant phone calls, emails, and back-and-forth through real-time visibility of cargo movement and documents within the system.
- Integration with any software.
- No need to upgrade the **ERP Priority (28)**.
- Ability to scan all the documents in the file created by Lufthansa (**Master Airway Bill (5)**, **House Airway Bill (6)/House Manifest (25)**, **Transport Security Administration (26)** letter, and **dangerous goods (27)** declaration).
- Artificial intelligence and human verification ensuring 99.4% data accuracy.

(*Addressing congestion and inefficiencies at USA airports using Cargo Community Systems*, 2022)

Regarding the implementation and the cost, a small-scale rollout is usually what they recommend, and they suggest a **Proof of Concept (POC) (32)**, i.e., a testing period, that can span from 30 to 60 days. Initially, a **POC (32)** for their tools would cost about $20,000. It involves namely training, data gathering, and system analysis to see what kind of interface would need to be done. Concerning other potential costs, they apply a decreasing rate for the volume of Airway Bills (AWBs) (and other documents) processed. Here it is:

# of AWBs	1 - 2,000	2,000 - 10,000	10,000 - 20,000	20,000 - 40,000
Cost/AWB	$2	$1	$0.60	$0.40

To find out the situation on a JFK scale, I asked Mrs. Lamdan, North America & Mexico Commercial Manager at Challenge in New York, for a record of the AWBs processed at JFK in recent years. She provided me with the details from January 2020 to May 2023, period during which Challenge processed 47,854 AWBs, which averages to roughly 1,167 AWBs per month if we round to the unit. If we apply Kale's rate, it amounts to an average of $1,167 per month for AWBs alone.

5.1.6.4 SAP

The last option is SAP, or Systems, Applications, and Products in Data Processing, a leading provider of enterprise software solutions. SAP offers a wide range of software applications, which help businesses automate and manage various aspects of their operations, including finance, human resources, supply chain, and more.

Just like MercuryGate, they offer a **Transportation Management System (31)** to improve the supply chain. I tried to learn more by scheduling a call with Alicia Griffith, Customer Advocacy Lead. However, due to the resignation of the sales representative for the North American region, the meeting never took place.

Now, I would like to switch to a completely different way to improve data transmission within the group and with the different partners. Let us find this out.

5.2 Freight Status Update messages

Thus, another way to improve communication, especially between Challenge and Lufthansa, is to execute Freight Status Update messages, or status messages.

5.2.1 Definition

In air freight industry, status messages are used to provide timely updates and information about the situation of a particular flight carrying cargo or the cargo itself. Status messages are an essential part of the communication process between various stakeholders involved in air freight operations, including airlines, freight forwarders, ground handling agents, and customs authorities.

5.2.2 Types of messages

There are many status messages in air freight industry, but seven are particularly interesting for us. Here is a brief overview:

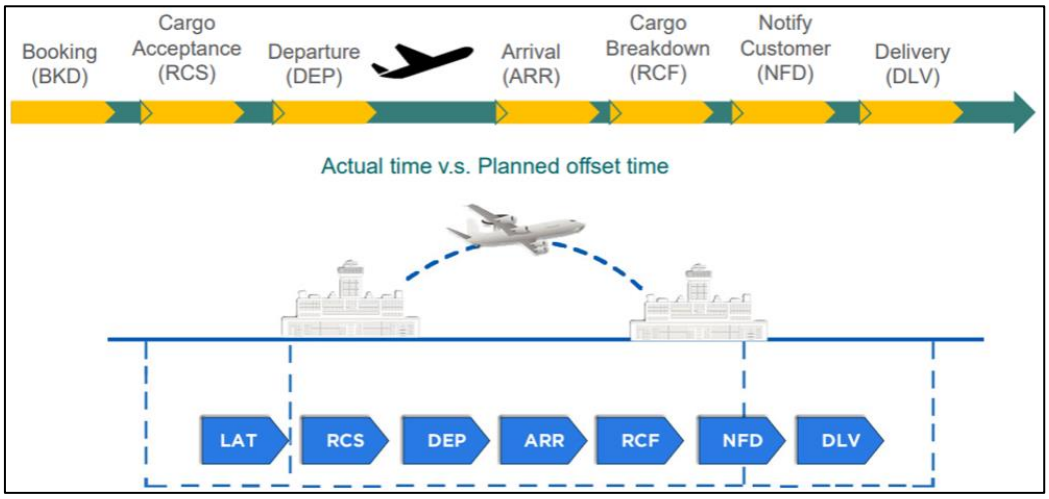


Figure 12 - Freight Status Update messages milestones - Source: internal

- Booked (BKD) refers to the status of a shipment or a booking indicating that it has been confirmed and reserved. When a shipment is booked, it means that space has been allocated on a specific flight for the cargo.
- Received from Shipper (RCS) indicates that the cargo or shipment has been received from the shipper or the party responsible for sending the goods. It signifies the point at which the airline or the handling agent takes possession of the cargo.

- Departure (DEP) represents the departure of a flight from its origin airport. When the flight takes off and leaves the departure airport, it is considered to have departed.
- Arrival (ARR) indicates the arrival of a flight at its destination airport. When the flight lands and reaches the destination airport, it is considered to have arrived.
- Received from Flight (RCF) signifies that the cargo or shipment has been received from the flight or aircraft upon arrival at the destination airport. It indicates that the cargo has been offloaded from the aircraft and is in the possession of the handling agent or the consignee.
- Notified for Delivery (NFD) means that the consignee of the cargo has been notified that their shipment has arrived and is ready for delivery. It indicates that the handling agent or the delivery service provider has informed the consignee about the availability of the cargo and its readiness for pickup or delivery.
- Delivery (DLV) represents the final stage of the shipment process, indicating that the cargo has been delivered to the consignee. It signifies the successful completion of the transportation and handover of the goods to the intended consignee.

Please note that this list is not exhaustive as it only includes the main messages. Also, note that some messages are supposed to be mandatory, especially for export. This is the case with the message “Received from Shipper”, which signifies the transfer of liability from the freight forwarder to the ground handler when sent either by the forwarder delivering the goods or by the handler receiving them. The same applies when the cargo is transferred from the ground handler to the airline carrier. Nevertheless, from my observations, these are only rarely sent (if ever). I already mentioned this message in the comment about the upgrade of the **ERP Priority (28)** (cf. “Upgrade of the ERP Priority” section).

5.2.3 How do Freight Status Update messages work?

Challenge is already able to send and receive status messages. So, let us see how they work in a practical way using the **ERP Priority (28)**.

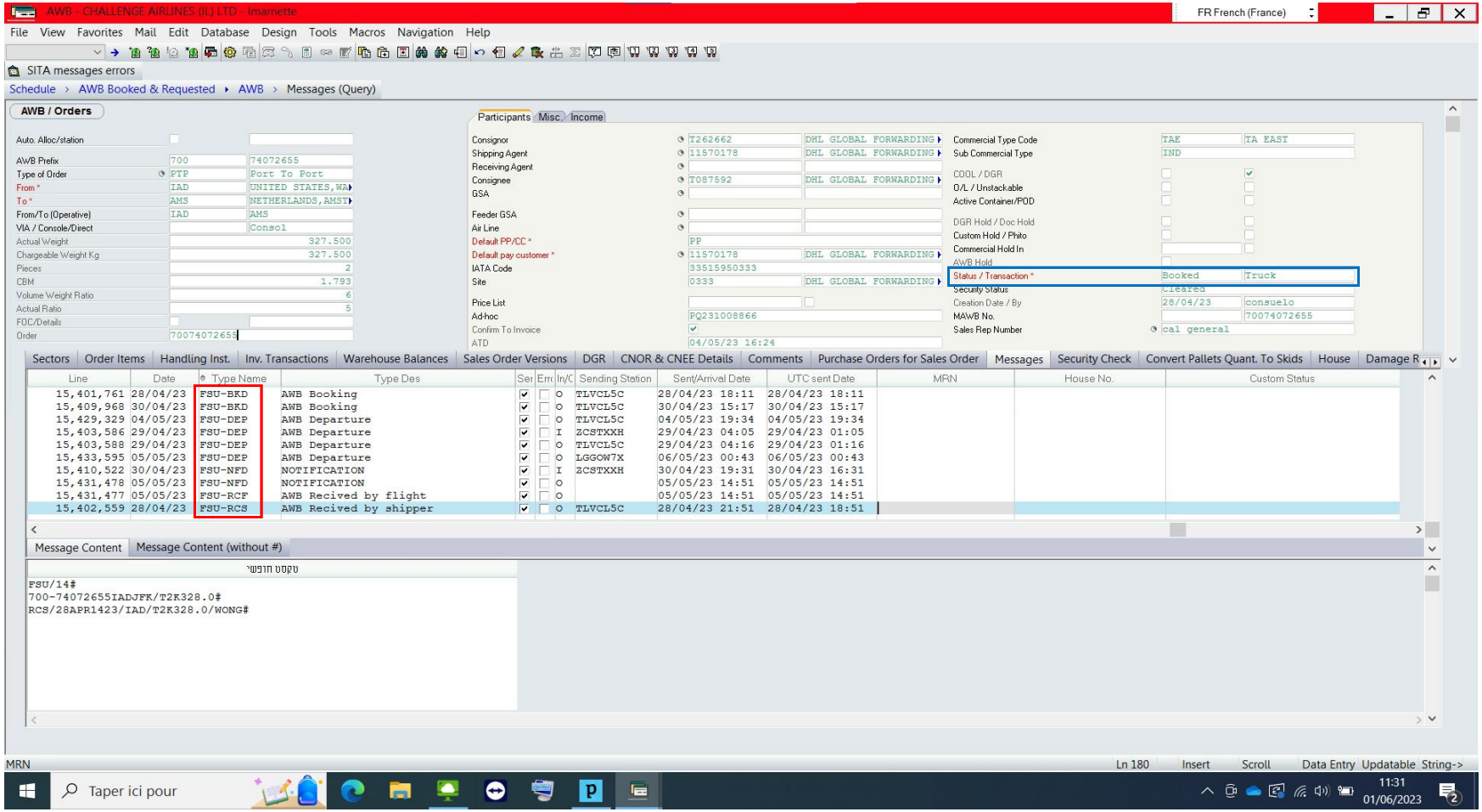


Figure 13 - Freight Status Update messages in the ERP Priority - Source: internal

You will find highlighted in red the status messages sent and received for a given Airway Bill (AWB). For the sake of convenience and clarity, I have sorted the messages to display only those that are relevant to the thesis. Here we can see five out of the seven messages we have previously seen. Thus, depending on the flow of goods, the different parties can send a message corresponding to the various stages of the delivery.

That being said, let us talk about the blue box in the upper right part of the screenshot. This concerns the "sector" status and "transaction" status:

- "Sector" status refers to the booking of a **leg (9),** the internal group reference number corresponding to transport by plane or truck that can be either reserved, pending, or canceled.
- "Transaction" status denotes the physical flow of the merchandise. In this case, there are several options available based on the location of the goods: arrival, build-up, delivery, departure, receipt, and truck.

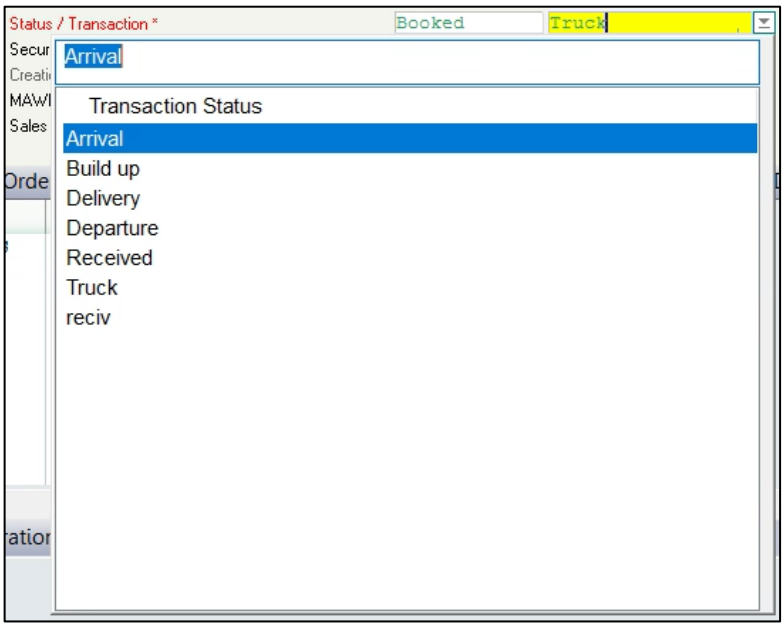


Figure 14 - Transaction status in the ERP Priority - Source: internal

Typically, this data is manually encoded into the system. This allows Challenge to keep track of the merchandise's location at a given moment and inform other stakeholders about its whereabouts for each AWB within the supply chain. In fact, simply encoding these basic pieces of information with the correct nomenclature in the system automatically upgrades the status for all parties involved through status messages.

5.2.4 How to implement Freight Status Update messages?

So, Challenge already uses status messages. Therefore, why are they a problem? To find out, we need first to understand how to implement them and, secondly, what the situation is at Lufthansa. That is what we will do in this subsection.

During my training, I was told that Lufthansa barely uses status messages, at least at JFK. Therefore, I wanted to make sure they were able to send and receive them. To do so, they need to be part of the SITA network. SITA (Société Internationale de Télécommunications Aéronautiques) is a multinational information technology company that specializes in providing communication and IT solutions to the air transport industry. While SITA is primarily known for its work in airline passenger services, it also offers a range of solutions for air freight operations.

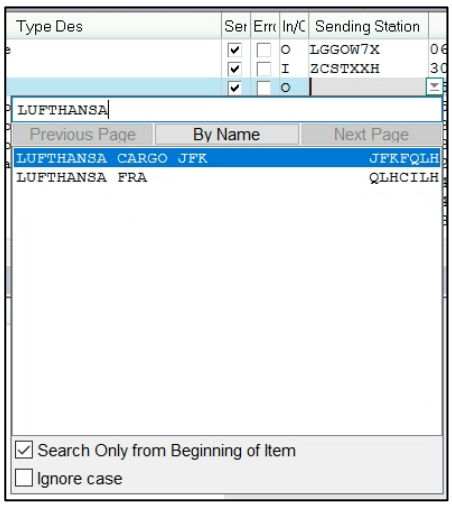


Figure 15 - SITA addresses - Source: internal

To find out this information, I went to look for into Challenge database using the query mode. To this end, I just searched the first thing that came to my mind: "Lufthansa." And here is the result, they do have a SITA address named "JFKFQLH".

The point now is to discover why they do not use them, at least with Challenge. This questioning was one of the points discussed during my meeting with Mrs. Boothe, Lufthansa Project Manager in New York. She told me they did a few test Airway Bills and the transmissions are fine. The only difficulty is the **Unit Load Device (ULD) (15)** Manifest, an uncommon status message that provides information about the cargo loaded onto a given **ULD (15)** and specifically required by Challenge. She has been in contact with their IT team in Frankfurt and they have already activated them exclusively for Challenge. But, for some reason, it is not transmitting. In general, they are not sending the **ULD (15)** Manifest to anybody at all, even them. The point is, once this transmission problem is resolved, the situation should normalize, making better communication possible via this channel.

5.3 Intermediate conclusion

So, to wrap up, we have analyzed two potential solutions to improve communication as such, that is the transmission of pure data. The first one is e-freight and the second one concerns Freight Status Messages. Each of them has its own pros and cons. However, ideally, both should be adopted.

Firstly, e-freight and the electronic Airway Bill are very comprehensive. Switching to e-freight means adopting a new format, **Cargo-XML (30)**. This format allows for a range of tasks that cannot be implemented with the current outdated system, including comprehensive document digitization, better data transmission, supply chain optimization, cost reduction, and more. However, there are still some gray areas. Some companies simply cannot make the transition, either due to financial or technical reasons, or simply because they are not interested. Additionally, there are legal constraints, particularly regarding **Transportation Security Administration (TSA) (26)**, which still requires a paper version of the **TSA (26)** letter. This is more of a regulatory issue. Nevertheless, I believe the transition will be inevitable, as the **International Air Transport Association (2)** has not upgraded the old messaging format (**Cargo-IMP (29)**) since 2014 (Sauv, n.d.).

Secondly, we discussed the Freight Status Update messages. These will be easier to implement as Challenge already uses them. The dare lies more with Lufthansa. As we have observed, they are unable to transmit a specific message, the **Unit Load Device (15)** Manifest. Once they find a solution to this problem, I am confident that communication will be greatly improved.

Now, it is time to move on to the second issue in this thesis: the build-up. Once again, we will explore certain tools to improve this shift. See you in the next pages.

6 Build-up improvement

Regarding the build-up, I realized during my training that there are two potential ways to improve the process through better communication. Let us explore them.

6.1 Zoom on build-up

We have briefly discussed this shift when describing the operating mode of the JFK station. Build-up refers to the process of assembling and preparing **Unit Load Devices (ULDs) (15)** before loading them onto the aircraft.

To do this, the build agents receive the Lufthansa file of the cargo that has just been approved by Challenge security team. It includes an unloading order, a paper document that specifies the number of pieces, their weight, and their location in the warehouse. With this information, the supervisor knows exactly where to send the Lufthansa build agents to construct the **ULDs (15)**.

Once the **ULDs (15)**, or assembled pallets, are built, the build agents write their unique serial numbers on the unloading order, which is then placed in baskets at a dedicated Challenge workstation (of which you will find a photo taken by me below).

Figure 16 - Challenge workstation in the Lufthansa warehouse - Source: internal

Finally, the Lufthansa supervisor records the pallet number and the number of pieces it contains on the pallet sheet, which is a register of the **ULDs (15)** for a given flight. This pallet sheet is then handed over to the Lufthansa loadmaster, who is responsible for load distribution in the aircraft.

6.2 Problem identification

Now we have seen this shift in more detail, I would like to address the problems related to it.

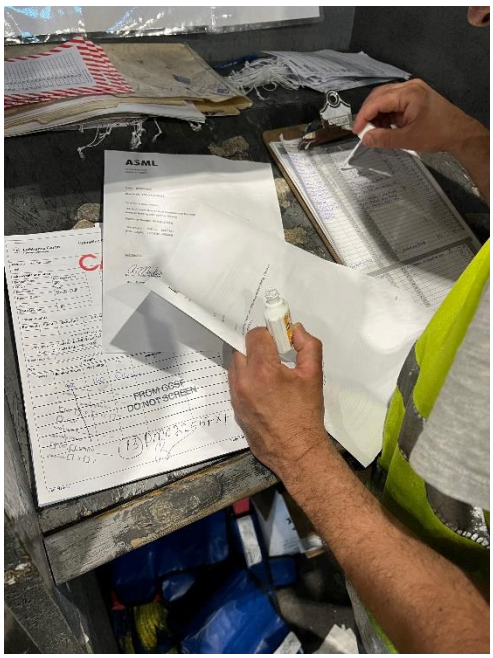


Figure 17 - Old-fashioned fix - Source: internal

The first issue concerns the documents used: the pallet sheet and the load plan. Why? Firstly, the pallet sheet needs to be printed for each flight. So, when an error is made on it, it has to be corrected the old-fashioned way, with Tipp-Ex for instance (please see the picture on the left). Moreover, as we have seen before, Challenge is supposed to manifest the **Unit Load Devices (15)** listed on the pallet sheet in the **ERP Priority (28)**. Normally, they have to wait for the supervisor to complete it with the unloading order data before being able to bring that order back to the office to encode the pallet number into the system. It is a huge amount of time since there is literally an entire eight-hour shift of data entry and manifesting. Secondly, Challenge does not have access to the load plan. They only receive it via email at the end of the process. Consequently, in case of an error or a modification to be made in the arrangement of the pallets in the aircraft, Challenge has to send a request by email to Lufthansa loadmaster, or the amended document.

The second issue that I noticed during my internship relates to the manifesting of pallet numbers in the **ERP Priority (28)**. Normally, it is necessary to retrieve the unloading orders and take them to the office for encoding, and then bring them back to the warehouse. I think this process can be avoided with a connected pallet sheet or through another solution that we will now explore. Let us continue, shall we?

6.3 Potential solutions and cost

6.3.1 A shared Excel spreadsheet

It may seem simple, but it would work. As far as I know, this is how they work at Challenge Handling in Liege and this is also how Lufthansa loadmaster work to draw his load plan. Let us take a practical example.

As you can see in the appendices, there is already an Excel-format pallet sheet. Indeed, it is the best way to build it so far. However, as I have already mentioned, it is not shared among the different parties. The Challenge supervisor has to prefill it at the office, print it, and take it to the warehouse to complete it. The modifications are only made at that time.

Therefore, we could consider integrating the aforementioned pallet sheet into a connected database like OneDrive, accessible to both the Challenge and Lufthansa teams, while planning to make regular backups to avoid any discrepancies. The operations and export offices already have the terminals for it. It would be just a matter of adding one to the Challenge workstation in the warehouse and it is done.

We could even go further and develop a connected load plan that incorporates the pallet sheet and any information regarding special goods such as horses, engines, or oversized items. The loadmaster would then provide real-time loading instructions to the workers for these special goods.

FLT			DEST			REG	OO-ACE			DATE			PLANNER			
		Target Weight	kgs			Flight planning										
		Target CBM	m3													
	160	180	M/D 2.20 HIGHT			H/D 3.0 HIGHT										
	A/1	A/2	B/2	CR/3	DR/4	ER/5	FR/6	GR/7	HR/8	JR/9	KR/10	LR/11	MR/12	PR/13	QR	RR/14	SR/15	T/29
ULD NR																		
BUILD GROUP																		
HGT/MISC																		
Est. WEIGHT																		
Fnl. WEIGHT																		
AWB/GRP																		
AWB/GRP																		
REMARKS																		

Un-Calculated / ULD Stack		M/D 2.20 HIGHT			H/D 3.0 HIGHT											
		CL/3	DL/4	EL/5	FL/6	GL/7	HL/8	JL/9	KL/10	LL/11	ML/12	PL/13	QL	RL/14	SL/15	
ULD NR																ULD NR
BUILD GROUP																BUILD GROUP
HGT/MISC																HGT/MISC
Est. WEIGHT																Est. WEIGHT
Fnl. WEIGHT																Fnl. WEIGHT
AWB/GRP																AWB/GRP
AWB/GRP																AWB/GRP
REMARKS																REMARKS

L/D PALLET

6*RKN CONFIGURATION		L/D 1.60 HIGHT								L/D 1.60 HIGHT						
Number	Weight	11P/RKN	12P/RKN	21P	22P	23P		Total	A/C Destination	31P	32P	41P	42P	PXY	PKC	BULK
ULD NR																
BUILD GROUP							Est Max payload	#N/A								
HGT/MISC							Est. Weight	-	Pax							
Est. WEIGHT							Fnl. Weight	-								
Fnl. WEIGHT							Pax	-	FAK							
AWB/GRP									725							
AWB/GRP							Left To Build	#N/A								
Total	0						Payload	-								

Figure 18 - Boeing 747 Converted Freighter load plan - Source: internal

Here is a template of a load plan for a **Boeing 747 Converted Freighter (21)**. It makes it possible to indicate in particular the pallet number, the build group (i.e., the commodity category: horse, engine, car…), and certain remarks concerning the way of laying out the cargo. One could then imagine the creation of a pallet sheet linked to this one, which would be filled progressively according to the data entered in the load plan. This data would be visible on the fly and modifiable at any time.

Non-Standard Flight Details									
Amount	Limit	Type	AWB#	ULD# or ULD Type	Gross Weight (Kg)	Dimensions (LxWxH in cm)	Final DEST	Details/Comments	Chief LM Comments
0	> 0	Centerload/Floating							
0	> 3	Crossloaded 16ft PRA/P4M							
0	> 0	Crossload 16ft PRA/P4M >7000KG							
0	> 0	Connected PMC / 16ft / 20ft with OHG							
0	> 0	Connected heavy duty (40ft)							
	> 0	Size Code A/M >6804KG							
	> 0	Size Code R >11340KG							
	> 0	Size Code G >13608KG							
0	> 2	Engines on 16/20ft							
	> 0	ULD with straps as only restraint (no net), except engines							
0	> 0	OTHER							

Figure 19 - Non-standard flight details template - Source: internal

Alongside the load plan, we could consider implementing a document displaying the details for non-standard flights. Here is a sketch of how it would work:

1. The load plan is completed by the loadmaster. As it is filled in, appropriate formulas identify whether it involves non-standard cargo listed in columns one to three (amount, unit, and type).
2. We manually input data related to Airway Bill, **Unit Load Device (15)**, and dimensions.
3. Finally, the build agents and loadmaster can add any necessary remarks to facilitate operations during loading and unloading on departure or arrival.

In summary, we would have three interconnected documents in the same Excel workbook: the load plan, the non-standard flight details, and the pallet sheet. Each of these documents would save a lot of trouble for Challenge employees during shifts, such as preparation and execution.

Financially speaking, I only see two costs associated with this project: the one related to the Office 365 license and the one linked to purchasing a computer. Fortunately, Challenge, just like Lufthansa, already has a professional Office 365 license. So, all that is left is to invest in a computer and install it in the warehouse.

For instance, Challenge could invest in a Dell[7] OptiPlex series. Dell provides some computers that are well suited for warehouse environments. Models like OptiPlex 5000 or OptiPlex 7000 offer reliable performance, durability, and customizable configurations to meet specific requirements.

Let us consider the OptiPlex 5000. In its "Small Form Factor" version (meaning the miniature version), the investment would be $1,833.71 (as of May 23, 2023). According to the Internal Revenue Service[8], computers are to be depreciated over five years in the United States. The expense would amount to $366.74 per year over five years as indicated in the depreciation schedule below (*Depreciation & Recapture | Internal Revenue Service*, n.d.).

Year	Value to amortize	Annuity	Cumulation	Residual value
N	$1,833.71	$366.74	$366.74	$1,466.97
N+1	$1,833.71	$366.74	$733.48	$1,100.23
N+2	$1,833.71	$366.74	$1,100.74	$733.49
N+3	$1,833.71	$366.74	$1,466.96	$366.75
N+4	$1,833.71	$366.75	$1,833.71	$0

Although simplistic, Excel is therefore a primary tool for enhancing build-up through improved communication. Now, let us move on to the second instrument for which we will once again analyze intrinsic and extrinsic solutions for Challenge.

[7] Multinational technology company that specializes in the development, manufacturing, and sale of computer hardware and related services.
[8] Revenue service of the United States federal government. It is responsible for the administration and enforcement of the Internal Revenue Code, which encompasses the federal tax laws of the country.

6.3.2 A handheld barcode scanner

Figure 20 - Airway Bill label template - Source: SATO

The idea came to me while I was grocery shopping: why not use a barcode scanner to manifest the pallets directly in the **ERP Priority (28)**? The idea would be to use the labels of the Airway Bills attached to the goods since they contain all the necessary information. It would only be a matter of typing the pallet's reference number when scanning and we are good to go. The only drawback is that Challenge would need to find a way to integrate the **ERP Priority (28)** with the scanner for it to work.

The barcode scanners were discussed during my meetings with Hossaine El Bouayadi and Tracey Boothe. Both of them provided me with some clarifications on this matter whether it was from Challenge or Lufthansa perspective. In an attempt to learn more and gain a clearer understanding of this topic, I also followed the same modus operandi as software providers for e-freight by creating a list of companies that I subsequently contacted, and the answers were not long in coming. I received numerous emails the very next day. Let us examine these various outcomes.

6.3.2.1 In-house application

Like with e-freight and the electronic Airway Bill, it is entirely feasible to develop an in-house solution to integrate it with barcode scanners. Let us explore it more thoroughly.

This point was one of my questions during my meeting with Hossaine El Bouayadi, IT Applications Manager at Challenge Handling in Liege. He explained to me that they already use scanners at Liege Airport. However, it is not possible to "export" their processes as they are to JFK because the environment and the way the scanners will be used need to be evaluated first. Additionally, the second challenge is to create a suitable interface.

Therefore, we should expect a minimum of twelve months for in-house development, including mapping, testing, and deployment. In addition, there will be a financial cost of approximately €250,000 to design the web application and adapt the **ERP Priority (28)**. Finally, we need to account for the purchase of the scanners themselves, approximately €2,000 per scanner. If we consider the purchase of ten scanners, the total would amount to €270,000.

6.3.2.2 Use of Lufthansa resources

The second semi-internal option to facilitate the process would be to use Lufthansa resources. In fact, they already have barcode scanners. However, these are not being used properly as the employees use them in the export office instead of in the warehouse. By relocating the devices, they could among others:

- Trigger the Freight Status Update messages we saw earlier, e.g., to notify the different stakeholders that the cargo has moved from the handler to the airline.
- Manifest the **Unit Load Devices (15)** in real time, that is encoding their reference in the IT system.

During my meeting with Tracey Boothe, I learned that a collaborative project is already underway, but it has not yet truly materialized. Lufthansa is considering directly manifesting Challenge flights within their **ERP (28)** system. The information will then be transmitted from Lufthansa system to Challenge **Priority ERP system (28)**. Unfortunately, I am not able to assess the cost of such an initiative.

Previously, I have told you about extrinsic solutions. Let us now see what it entails.

6.3.2.3 CipherLab

The first of these third-party options is CipherLab, a company that specializes in the development and manufacturing of barcode scanners and mobile computing devices. They provide a range of solutions for various industries, including logistics and transportation. CipherLab products include handheld barcode scanners, mobile computers, **Radio Frequency Identification (33)** readers, and other related accessories.

On May 25, I had a discussion with Rocco Floccari, Northeast Regional Sales Manager. He told me about the scanning industry and CipherLab. Concerning their products, there are basically two formats: the "cellphone" and the "brick." He showed me an example for each, which you will find hereunder.

RS35 Series: rugged mobile computers with a 4.7-inch touch screen, built-in barcode scanner, and wireless connectivity. Ideal for warehousing, logistics, and field service applications.

RK95 Series: rugged mobile computers featuring a 4-inch touch screen, full QWERTY keyboard, built-in barcode scanner, and wireless connectivity. Designed for intensive data entry tasks in industrial environments.

At the time, I only had two concerns:

- Would the scanners be compatible with the **ERP Priority (28)**?
- Would Challenge be able to enter the pallet reference directly in the device?

On that, Rocco immediately reassured me. Indeed, both of them are highly customizable and would perfectly fit Challenge needs since they can easily interact with the **ERP Priority (28)**. We could send the data whether at the end of the day or directly via Wi-Fi or any other seamless process. Rocco also told me Challenge can fit the data directly into an Excel spreadsheet (ideal for the shared spreadsheet) or into a cloud-based system (ideal for e-freight). Therefore, they could eliminate many mistakes, both writing and reading errors for instance (some people write really badly…).

In terms of cost, I asked him how much it would be in ballpark figures knowing the field in which Challenge is active. Here they are:

- RS35 Series: $1,071.00/unit (precise wholesale price).
- RK95 Series: $2,000.00 - $2,500.00/unit (or even more, depending on the features).
- A 30-day free trial to test the products, which provides insight, tutorials, and training.

It is important to note that the prices depend on the needs of Challenge. Since the devices are customizable (range, pistol grip, battery…), it may vary from one version to another. But, again, based on his experience, the former figures are quite accurate.

6.3.2.4 Unitech

The second option is Unitech, a global provider of Automatic Identification and Data Capture[9] solutions. Unitech dedicates itself to manufacturing and distributing a wide range of products and solutions that include barcode scanners, mobile computers, **Radio Frequency Identification (33)** readers, rugged tablets, and other related devices.

The International Key Account Manager BeNeLux and Nordics, Rik Heirman, told me that Unitech is only a hardware manufacturer, which means that they do not provide complete solutions. Therefore, he suggested three ideas for the software part:

1. Challenge IT department develops software itself. We saw that it would cost around €270,000 (cf. “In-house application” section for more details).
2. We call on a local integrator in New York (in case of a small-scale implementation).
3. We rely on a Belgian integrator (in case of a large-scale implementation).

[9] Set of technologies used to automatically collect data from objects or entities without the need for manual data entry.

As it would rather be a limited rollout at the JFK station, he recommended me going for the high-end product, the PA768. It is a heavy-duty mobile computer (like the previous CipherLab RS35 Series) designed for connectivity and tough environments. This one costs €1,400.00/unit, i.e., roughly $1,500.00 at the exchange rate of May 29, 2023. The software part, on the other hand, depends on many factors and is difficult to assess.

6.4 Intermediate conclusion

To summarize, once again, we have a theme and two improvement tracks. This time, the focus is on improving operations through better communication, specifically by using a shared Excel spreadsheet and/or barcode scanners.

On the one hand, the shared Excel spreadsheet would centralize essential information such as pallet numbers and package dimensions. It would facilitate coordination between Challenge and Lufthansa, as well as the various stakeholders involved in the build-up process, such as supervisors and build agents.

On the other hand, barcode scanners would help automate data entry while reducing human errors. By scanning the barcodes on the Airway Bills, the build agents could associate them with pallet numbers in real time, thus reducing the time spent on manual encoding during shifts like data entry and manifesting.

This second interim conclusion marks the transition to the next and final part: Import Control System 2. This is not a problem related to Challenge but rather a dare for Challenge. I am going to explain it further in the following paragraphs.

7 Import Control System 2

The last issue that I observed concerns ICS2, or “Import Control System” second version. This is the new system for advance information on goods for European customs, whose implementation coincides with the period of my internship. It involves a plethora of changes for a series of economic operators within the supply chain, especially for carriers such as airlines. Unlike the other two points we have discussed, ICS2 is not so much an internal issue within the company but rather an external concern of a legal nature that needs an adapted communication strategy. Therefore, we will explore how it is related to communication, to e-freight, and why it deserves its place in this thesis. Let us take a closer look at what this entails.

7.1 Definition

Import Control System 2 is an electronic system developed by the European Union to facilitate the management of customs and security controls on goods entering the EU's customs territory. It is part of the EU's overall strategy to ensure the security of the global supply chain and prevent the entry of **dangerous goods (27)** that have the potential to pose a risk to health, safety, property, or the environment (*Import Control System 2 (ICS2)*, n.d.).

7.2 Timeline

Figure 21 - Import Control System 2 timeline - Source: European Union

Import Control System 2 is a three-phase project, the first of which came into effect on March 15, 2021. At the time, only express air carriers[10] and air postal carriers[11] were impacted. In the next phase, all types of air carriers will be affected. Its launch was scheduled for March 1, 2023, but has been postponed to July 1, 2023, due to the low involvement of the various actors.

[10] Company that offers expedited shipping services for time-sensitive and high-value shipments.
[11] Entity responsible for the transportation of mail and postal packages by air.

We will address this topic in the section “What is the situation at Challenge?” For information, the last step will supposedly apply on March 1, 2024 and will affect other means of transport such as maritime, road, and rail transport companies.

7.3 Implications

7.3.1 Overview

But concretely, what does it imply? Different economic operators will now have to transmit a series of information to European customs prior to the arrival of goods in Europe. This includes:

- Pre-loading: Import Control System 2 introduces the concept of “pre-loading advance cargo information”, which is a procedure specific to air freight industry. It will now be the responsibility of the air carrier to ensure that customs receives certain information before the aircraft is loaded, as early as possible. The aircraft can only be loaded with customs approval.
- Pre-arrival: as with Import Control System 1, the carrier must inform customs at least four hours prior to aircraft scheduled arrival on European ground in the form of an Entry Summary Declaration, a document that provides advance information about goods being imported into the European Union by air.

(CHAMP Cargosystems Marketing, 2022)

Now let us see which information it is.

7.3.2 Goods description code

Harmonized Commodity Codes, also known as Harmonized System Codes, are internationally standardized 6-digit codes that identify and classify goods traded across borders. They are used by customs authorities worldwide to facilitate the collection of trade statistics, the assessment of tariffs, and the monitoring of goods subject to import and export controls. These codes were developed by the World Customs Organization[12] and were first implemented in 1988. For the sake of clarity, I will refer to them by writing “description codes”.

[12] Intergovernmental organization of the United Nations that aims to improve the effectiveness and efficiency of customs administrations worldwide.

The thing is, if description codes are not provided under Import Control System 2 (ICS2), it will cause disruptions in the movement of goods. There are two primary challenges to address:

1. Ensuring that description codes become a standard piece of information in trade messages in the future. As I am writing to you, more than half of the messages Challenge receives do not include even a single code.
2. The system requires codes at a commodity level, i.e., on **House Airway Bill (HAWB) (6)** level. As a **Master Airway Bill (5)** can contain several tens of **HAWBs (6)**, the amount of data to encode and process will be greater. Hence, the interest in switching to a more efficient system such as e-freight and **Cargo-XML (30)** which we have discussed in the part on e-freight.

(CHAMP Cargosystems Marketing, 2022)

Here is a practical example. Let us say a **HAWB (6)** contains aircraft parts, this would be the situation:

- **HAWB (6)**: aircraft parts.
- Commodity #1: engine => description code needed.
- Commodity #2: wheel => description code needed.
- Commodity #3: landing gear => code description code needed.

7.3.3 Consignee's identification number

The Economic Operators Registration and Identification (EORI) number is a unique identification number used in the European Union to track and monitor businesses engaged in import and export activities. It a 17-character alphanumeric code that identifies individual businesses and that is used by customs authorities to manage the movement of goods across borders. As for the goods description previously, I will say "identification number" for the sake of clarity.

Now we know more about these new requirements, let us see where Challenge stands with its customers.

7.4 What is the situation at Challenge?

During my preliminary sessions at Challenge Handling in Liege, I was asked to carry out a study of the customers who provide the description codes and the identification numbers in order to establish an appropriate strategy in the event of non-compliance. To do so, I compiled an Excel database of export flights from JFK to Liege Airport. In all, I analyzed one by one 353 Airway Bills spread over ten flights by going to the messages they contained.

7.4.1 At Master Airway Bills level

First, I had to determine which customers were sending a **Master Airway Bill (MAWB) (5)** to Challenge. This message contains the same information as the paper format Airway Bill (AWB) (note that unlike the e-AWB, it does not serve as a transport contract). It is in this message that we find the information related to the goods and the consignee. However, according to my calculations, only 62.61% of consignors provide Challenge with this **MAWB (5)** as can be seen in the graph below. This is not only a waste of time and money as the data then needs to be manually encoded in the **ERP Priority (28)**, but it is also a problem in the context of Import Control System 2 (ICS2) as it can have serious repercussions for Challenge.

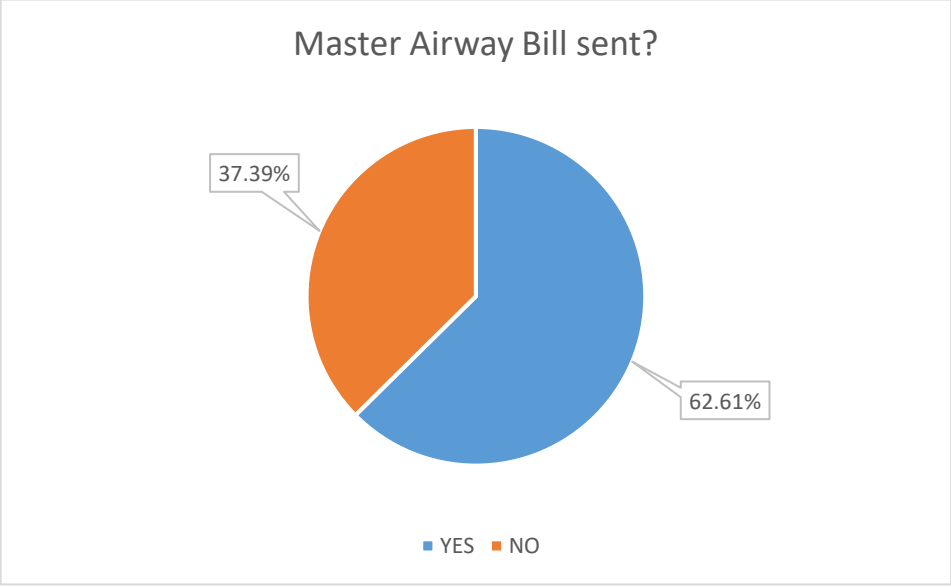


Chart 5 - Master Airway Bill percentage - Source: internal

```
FWB/16
700-74052521YULLGG/T2K6078
FLT/5C001/31/5C542/02
RTG/JFK5C/LGG5C
SHP
/DHL GLOBAL FORWARDING CANADA INC
/555 MONTEE DE LIESSE
/ST. LAURENT/QC
/CA/H4T 1P5/TE/15143443447
CNE
/DHL GLOBAL FORWARDING FRANCE SAS
/27 RUE DE LA BELLE BORNE ZONE CARGO
/TREMBLAY-EN-FRANC/93
/FR/93290/TE/33182711340
AGT//6010013/0016
/DHL GLOBAL FORWARDING CANADA INC.
/MONTREAL
CVD/CAD/PP/PP/NVD/NCV/XXX
RTD/1/P2/K6078/CQ/W10000/R3/T30000
/NC/CONSOLIDATION AS PER
/2/NC/ATTACHED LIST
/3/NG/NOT RESTRICTED AS PE
/4/NG/R SPECIAL PROVISION
/5/NG/A70
/6/ND//CMT587-196-245/1
/7/ND//CMT587-196-245/1
/8/NH/841122
/9/NS/2
OTH/P/XBC2000
/P/MYC3000
PPD/WT30000
/OC5000/CT35000
CER/REINELDA LUCAS
ISU/31MAR23/ST. LAURENT/DHL GLOBAL FORWARDIN
OSI/CA RA EORI 34430738400570
REF//C2300632582/FFW/CWIDDFOCA0PRO/YUL
SPH/NSC
OCI///ST/DHL GLOBAL FORWARDING CANADA INC.
///ST/HAS REVIEWED ALL AVAILABLE
///ST/DOCUMENTATION AND HAS DETERMINED
///ST/THAT NONE OF THE CARGO BEING
///ST/OFFERED IN THIS CONSIGNMENT OR
///ST/CONSOLIDATION HAS EITHER
///ST/ORIGINATED IN TRANSFERRED FROM OR
///ST/TRANSITED THROUGH ANY POINT IN
///ST/EGYPT SOMALIA SYRIAN ARAB REPUBLIC
///ST/YEMEN.
/CA/SHP/CT/15143443447
/FR/CNE/T/FR34430738400570
/FR/CNE/CT/33182711340
```

Figure 22 - Master Airway Bill excerpt - Source: internal

Once this is established, we have to dive even deeper and determine if the information that interests us is there. This is an **MAWB (5)** from DHL Global Forwarding taken from the **ERP Priority (28)**. We can find the description code in the goods description section highlighted in red. The identification number, on the other hand, is located in the miscellaneous customs information part highlighted in blue. In this case, the shipper provides all the necessary information for the smooth running of things within the framework of ICS2. But this is not always the case.

Indeed, as we have previously noted, almost a third of consignors do not even provide an **MAWB (5)**. But what about description codes and identification numbers? Based on my analysis, Challenge only receives 44.76% of codes and the percentage drops to 26.91% for the identifiers. It is safe to say that this is a catastrophe.

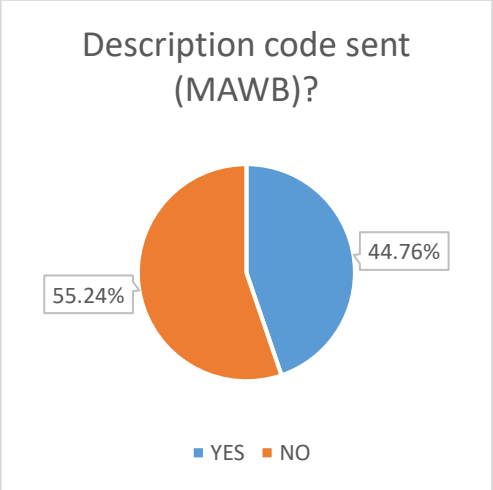


Chart 6 - Description code percentage (MAWB) - Source: internal

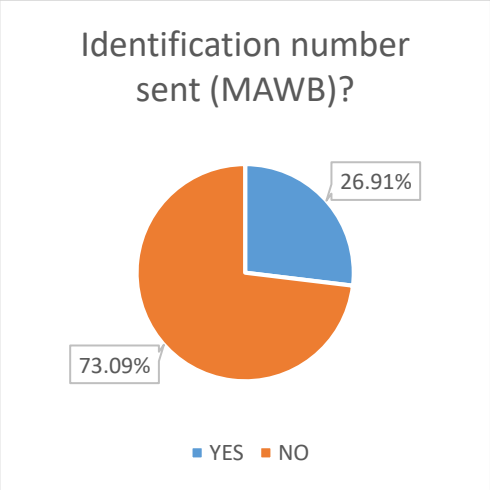


Chart 7 - Identification number percentage (MAWB) - Source: internal

In order not to get erroneous results, I carried out a double check via the following tools:

- Integrated Community Tariff (Taric): European database containing the description codes and providing the appropriate customs information. By entering the description code appearing in the **MAWB (5)**, e.g., 841122, this is what we get. It is therefore consistent with the description of the goods in the AWB.

Figure 23 - Taric - Source: European Union

- EORI database: depending on whether it is a European or British number, you must go to the appropriate database. Here it is a French number (FR34430738400570). Again, nothing to report.

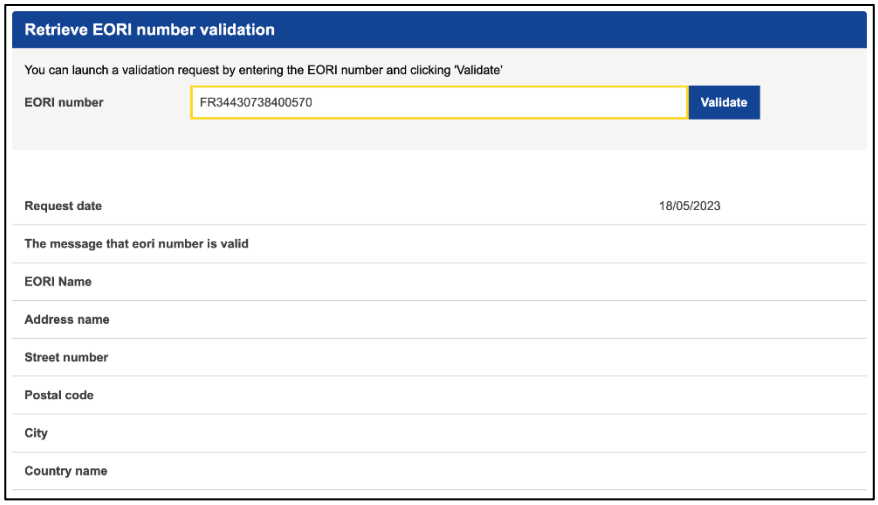


Figure 24 - EORI database - Source: European Union

However, I also noticed that the results need to be nuanced based on the consignors and the consignees. Indeed, some are very good performers, and this is particularly the case with big names such as Kuehne + Nagel, DSV Air & Sea, or DHL Global Forwarding for which Challenge almost always gets codes and identifiers. Additionally, it is also important to note that these pieces of information are sometimes included in the message but can be incorrect, especially for the identification number, either because it is invalid or because it is improperly encoded in the system. In either case, Challenge cannot accept this deviation because the European customs authorities would also reject it.

7.4.2 At House Airway Bills level

We can perform the same analysis with **House Airway Bills (HAWBs) (6)**. Here, we are almost at 50/50, which, once again, is not really a good thing.

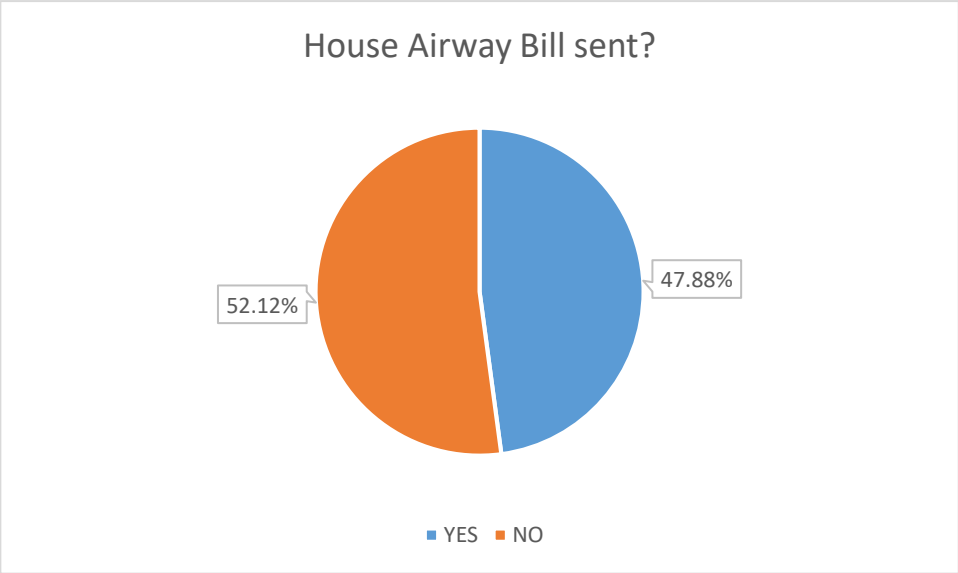


Chart 8 - House Airway Bill percentage - Source: internal

```
FHL/4
MBI/700-74067265JFKEIN/T14K1470
HBS/L9X0002980/JFKEIN/14/K1470//PART FOR WAFERS
/NSC
TXT/PART FOR WAFERSTEPPER SL PRIORITY DN 80289984
/04 80289788 80289983 80289983 INCOTERM DAP WILTON
HTS/9013200000
/7616995190
/8108903060
/761995190
/8419899585
/8538908180
OCI/NL/CNE/T/NL007051104
SHP/ASML US LLC
/77 DANBURY ROAD
/WILTON/CT
/US/06897
CNE/ASML BUILDING 5L
/DE RUN 7190
/VELDHOVEN
/NL/5504 DR
CVD/USD/PP/NVD/NCV/XXX
```

Figure 25 - House Airway Bill excerpt - Source: internal

On the left is a **HAWB (6)** extracted from the **ERP Priority (28)**. This time, the consignor is ASML US LLC (Connecticut) and the consignee is the ASML headquarters in Veldhoven, the Netherlands. Here, the description codes are located in the block highlighted in red. Operators can enter up to nine codes per block. The identifier, for its part, is still in the miscellaneous customs information part emphasized in the blue box.

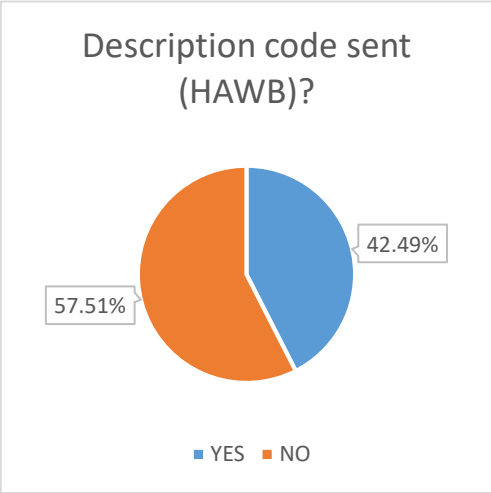


Chart 10 - Description code percentage (HAWB) - Source: internal

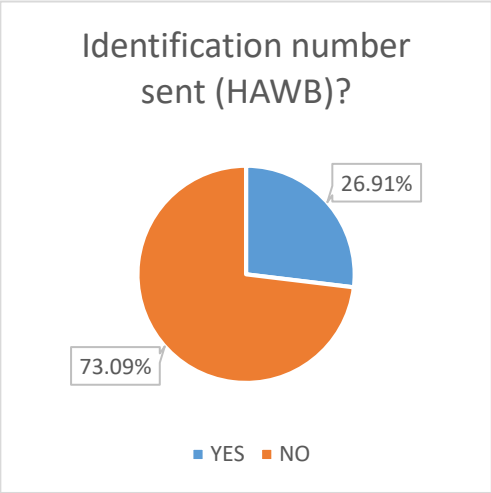


Chart 9 - Identification number percentage (HAWB) - Source: internal

Again, if we look closer at the data provided in the charts above, we can see that the figures are substantially the same as those for the **MAWB (5)**, which means they are not good either.

7.5 What if Challenge does not comply?

The question now is: what if the situation remains the same? Non-compliance may have the following impact:

- Sanctions on carriers, including financial penalties or suspension of **Air Operator Certificate (10)**.
- Cargo will be stopped at the border.
- No customs clearance of goods.
- Unnecessary interventions.
- Rejection of poor-quality declarations.

This may result in additional costs for Challenge since the carrier is responsible for providing the data. For instance, the fine imposed by European customs authorities is $100 per **Master Airway Bill (5)** and per **House Airway Bill (6)**. Let us do a quick calculation based on the number of Airway Bills (AWBs) processed at JFK. As a reminder, the average is approximately 1,167 AWBs per month. Let us also consider that 73.09% of them are not valid (cf. identification number chart). This gives us 853 invalid AWBs, resulting in a total fine of $85,300 per month.

Another example of an extra cost is that Lufthansa applies export storage fees if the goods arrive more than 48 hours before the scheduled arrival time or if they remain more than 48 hours after the scheduled departure time. These costs amount to $0.80 per day per kilogram at JFK with a minimum of $100 per shipment (see the table below for more details) (Lufthansa Cargo, 2023). It is not so much a problem for Challenge but rather for their customers as the financial burden will ultimately be passed on to them. Nevertheless, a slowdown in their clientele's activity will inevitably be detrimental to them.

		Weight				
		1 ton	2 tons	3 tons	4 tons	5 tons
Span	1 day	$800	$1,600	$2,400	$3,200	$4,000
	2 days	$1,600	$3,200	$4,800	$6,400	$8,000
	3 days	$2,400	$4,800	$7,200	$9,600	$12,000
	4 days	$3,200	$6,400	$9,600	$12,800	$16,000
	5 days	$4,000	$8,000	$12,000	$16,000	$20,000

7.6 Potential solutions and cost

Well, one may wonder why I am talking about this in my thesis and what it has to do with communication. In fact, it is a communication problem, because the only way to remedy the situation is to discuss it with the customers. Ideally, Challenge should set up an exchange strategy to make them aware of the situation, emphasizing the implications for them (and for Challenge as a side effect) in case of non-compliance with the new standards. However, it is important to strike a delicate balance: a punitive policy could drive customers away to the competition.

7.6.1 Preliminary step: understand Air Cargo Advance Screening

To better understand how to approach the implementation of Import Control System 2 (ICS2), we could take the example of the measures that were taken by Liege when Air Cargo Advance Screening (ACAS), a program equivalent to ICS2 for imports in the United States, was implemented.

ACAS was rolled out in June 2018 by the United States Customs and Border Protection[13] to enhance air cargo security. It requires the submission of advanced cargo data for all shipments entering or transiting through the United States by air. Both ACAS and ICS2 share common points. Here are some key similarities:

- Pre-arrival data submission.
- Risk assessment and targeting.
- Security enhancement.
- Stakeholder collaboration.

In order to understand how Challenge approached the implementation of ACAS, I reached out to Roi Kaplan, Europe Logistics Manager and Deputy Security Director. Needless to say, the situation is far from reassuring, although I have learned a lot from it. The two systems have two major differences. Let us take a closer look.

Firstly, ACAS only requires basic information in the form of text: consignor and consignee's name and address, description of the goods, number of pieces, weight, dimensions, etc.

Secondly, ACAS is based on the **Cargo-IMP (29)** format, which has been in existence for years. Therefore, it did not require any system upgrade or change of procedures for the operators. On the other hand, as we have seen, ICS2 is not easily deployable without some minimum upgrades to provide description codes and identification numbers.

For these two reasons, Challenge European sales teams did not encounter any of the problems the American team is currently facing in the United States. They did not have to implement any particular strategies to ensure customers' cooperation. However, Roi mentioned communication was the best way to meet the new requirements. He also added that, in any case, it does not make much difference for Challenge. Even if the goods do not take off, the customer will still have to pay for the slot on the plane. Moreover, Challenge could apply a surcharge in the event of any fine or penalty. So, I have not really made much progress from this perspective.

That being said, I would like us to move on to the more concrete solutions to be provided before concluding this thesis.

[13] Agency within the Department of Homeland Security of the United States responsible for enforcing various federal laws and regulations at US borders and ports of entry.

7.6.2 Internal solution

The first solution would consist in implementing a meticulous and rigorous communication strategy as recommended by Mr. Kaplan. If a customer fails to provide the description codes and the identification number required for customs clearance, several steps can be taken to tackle the problem and minimize the impact on operations. Here is an example of an action plan:

1. Communicate with the customer.
2. Request the necessary information.
3. Follow up with the customer.
4. Consider alternative solutions.
5. Implement compliance programs.

Regarding the fourth step, I had considered a penalty system, but it did not make sense because in that case, the customer would simply go elsewhere. So, I thought of an incentive system instead, granting a possible discount on the shipping cost, which is risky since it opens the door to a price renegotiation. To this end, I asked for the sales revenue of the JFK station to calculate the impact of such a policy. Anyway, I was told that I was not authorized to access them. Therefore, the project was aborted.

Once again, Import Control System 2 was one of the points we discussed with Lufthansa. I wanted to know what their situation was and what strategy they were implementing with their own customers. Just like Challenge customers, a large portion of Lufthansa clientele do not provide the description codes nor the identification numbers. This is again a problem because if the airline fills in this information itself and there is any inconsistency, the responsibility falls on them. Mrs. Boothe believes that it is therefore necessary to educate the customers. As a result, she sent a communication to her sales team to inform them of what they should say to the customers. She also asked the handling team to check the Airway Bills in the warehouse and notify her of any anomalies for double check.

7.6.3 External solution

The second ideal solution would be for JFK airport to take the lead and require all operators to provide relevant information even before the implementation of Import Control System 2. According to Ruth Lamdan, North America & Mexico Commercial Manager of the group, this is what Houston airport in Texas does. If stakeholders do not cooperate, it immobilizes the cargo destined for Europe until the departure conditions are met. However, this is an element beyond the control of Challenge, and JFK may not want to go that far.

7.7 Intermediate conclusion

As we have observed, the context is quite unique and unprecedented. The best solution would be to instruct the sales teams to communicate the procedural changes to the customers, explain what it entails for them (and for Challenge) and make them understand that the situation will be the same for everyone. At present, it is impossible to quantify the cost associated with the implementation of Import Control System 2 due to the numerous factors involved. However, it is certain that any non-compliance will have detrimental repercussions for the group, which is why Challenge needs to tackle the problem now before it is too late.

In addition, due to the complexity of the system, an upgrade to the **ERP Priority (28)** will be necessary eventually. Therefore, it would be wise to consider transitioning to e-freight, which we discussed earlier. Indeed, **Cargo-XML (30)**, the new messaging format that supports such an initiative, is much more comprehensive and allows for a higher level of encoding and customization. However, as we have also seen, it is not impossible to work without an upgrade. Hence, this decision lies with the management of Challenge.

8 Main conclusion

It is now time to conclude this thesis. To do so, I would like to recap the elements we have discussed. Firstly, we began with a more theoretical approach to the internship by defining certain fundamental concepts essential for understanding it. I described the world of air freight transportation and provided an overview of Challenge Group, not just the JFK station, in order to have a comprehensive understanding of the various subsidiaries.

Next, I delved into a more practical part of the thesis. As a reminder, the primary goal of my internship was to find ways to improve operations and communication within the group and with its various partners such as Lufthansa. Thus, I focused on a series of issues and solutions that I identified during my training. Here they are.

8.1 Communication improvement

The first issue was the overall improvement of communication. I discussed two potential solutions. Firstly, the implementation of e-freight and the electronic Airway Bill. Secondly, the use of Freight Status Update messages.

To implement e-freight, I discussed internal and external strategies, each with their own pros and cons. In summary, an implementation by Challenge IT team would be slower but less expensive. On the other hand, third-party implementation would be faster but less affordable. Other factors also need to be considered, such as legal aspects, adoption by partners, and the group's priorities.

Regarding Freight Status Update messages, Challenge is on the verge of executing them. During my internship, test messages were exchanged between Challenge and Lufthansa and the result is promising. This is a positive development. Once fully implemented, they will undoubtedly streamline operations. The last obstacle lies with Lufthansa. When they resolve it, operations will be ready to move forward. Once this step is taken, they may even consider developing other types of messages, each with a specific meaning. The possibilities are numerous.

8.2 Build-up improvement

The second topic focused on build-up. Challenge and Lufthansa primarily use paper documents to build the pallets. However, I suggested two potential solutions to improve this process: a shared Excel spreadsheet and barcode scanners. Towards the end of my internship, I realized that such an initiative was already being planned. Lufthansa intends to scan Challenge Airway Bills (AWBs) and pallets to include them in their own system. However, two issues have emerged.

Firstly, the scanners are not being used in the appropriate location, i.e., in the export office instead of the warehouse. Secondly, warehouse workers are expected to manifest the AWB once they have loaded the cargo onto the pallet. However, they currently sign the files to indicate where the cargo is loaded, provide the pallet number, and specify the number of pieces loaded on that pallet.

Then, the export office manifests the AWB. The correct procedure would be for the warehouse workers to load the piece and immediately manifest it, ensuring that everything is done in real time. They now understand the source of the problem and have a plan to address it.

8.3 Import Control System 2

The last challenge concerns Import Control System 2 (ICS2). It is still an obstacle for Challenge. As I am writing these lines, the deadline for the second phase of the ICS2 rollout is June 30, and it is unlikely to be met, as many customers still do not provide the description codes of the goods nor the identification number. My idea was to engage in fair and effective negotiations with the customers, which was confirmed during my meeting with Lufthansa: this is also what they do. Unfortunately, there is not much else to be done. I just hope the addition of a legal framework will change the situation.

8.4 On a personal note

I would like to conclude this thesis with a more personal note. These past few months have been amazing and extremely enriching, both personally and professionally. I have made extraordinary connections and visited wonderful places that have changed me forever. This internship is, in a way, the icing on the cake, the culmination of a really long-term project. Thanks to all of this, I now feel ready for the new challenge that is the active life. And to that, I say challenge accepted! Thank you for reading.

9 Glossary

10: Air Operator Certificate (AOC): certificate issued by a national aviation authority to an aircraft operator, certifying that the said operator meets the requirements to provide aviation services.

17: Aircraft Design Group (ADG): classification system used by aviation regulatory authorities to categorize aircraft based on their physical characteristics and operational capabilities. The ADG system is used to determine the type of airport facilities, equipment, and services needed to accommodate different types of aircraft. It is based on a scale of six design groups, running from ADG I to ADG VI, with ADG I being the smallest and ADG VI being the largest.

Airway Bill (AWB): basic transport contract in air freight, subdivided into:

- 5: Master Airway Bill (MAWB): transportation document issued by the carrier or the freight forwarder and covering the entire shipment from the point of origin to the final destination.
- 6: House Airway Bill (HAWB): transportation document issued by the freight forwarder or the consolidator and covering the shipment of a single consignment or a portion of a **consolidated shipment (4)**.

1: Belly cargo: term referring to the cargo that is carried in the belly or lower compartment of a passenger airplane.

Boeing 747: **wide-body (8)** airliner that has been produced in various models, including cargo variants. The 747 Freighter, 747 Converted Freighter, and 747 Extended Range Freighter are all cargo variants of the 747, but they differ in terms of their specifications and capabilities:

- 20: Boeing 747 Freighter: standard freighter variant of the 747. It has a large cargo door on the main deck, allowing for the loading and unloading of palletized cargo. The 747 Freighter has a maximum payload capacity of around 124,330 kg and a range of 4,455 nautical miles (8,250 km) (with maximum payload, General Electric engines).
- 21: Boeing 747 Converted Freighter: converted passenger variant of the 747. It is converted from used passenger aircraft to cargo aircraft by removing the passenger cabin and installing a large cargo door on the main deck.

- 22: Boeing 747 Extended Range Freighter: a long-range variant of the 747. It has a larger fuel capacity and strengthened wings to allow for longer flights. The 747 Extended Range Freighter has a maximum payload capacity of around 124,012 kg and a range of 4,985 nautical miles (9,230 km) (with maximum payload, Pratt & Whitney engines).

Cargo-IMP/XML: two electronic messaging standards used in air freight industry for exchanging information related to the movement of cargo:

- 29: Cargo-IMP: older, reliable language that has been used in air cargo industry for a long time. It is structured and helps companies share information about the shipment, like booking requests, customs data, and flight details.
- 30: Cargo-XML: modern and flexible language, making it easier to understand and work with. It can handle all kinds of cargo-related information, and it is very adaptable to future changes and improvements.

24: Center of Excellence for Independent Validators (CEIV): certification program developed by the **International Air Transport Association (2)** to establish globally recognized standards for the handling, transportation, and storage of non-standard goods. There are currently several different CEIV programs:

- CEIV Pharma.
- CEIV Fresh.
- CEIV Live Animals.
- CEIV Dangerous Goods.
- CEIV Valuable CARGO.

13: Charter: customized and dedicated flight service that is arranged between an airline or a charter company and a specific customer or group of customers.

4: Consolidation: practice of combining multiple smaller shipments from different shippers into a single larger shipment.

23: Conversion: process referring to a series of modifications and alterations made to an existing passenger aircraft to transform it into a cargo-carrying aircraft. In the case of Challenge, the conversion is carried out by Israel Aerospace Industries, a major Israeli aerospace and defense company that offers a diverse portfolio of products and services, including aircraft conversions.

27: Dangerous goods (DG): also known as hazardous materials, or hazardous goods, they refer to substances or articles that pose a risk to health, safety, property, or the environment when transported by air. They are two types of DG:

- Regulated: they need a DG declaration and DG security checks.
- Non-regulated: they only need DG security checks.

28: Enterprise Resource Planning (ERP): software system that integrates and manages various core business processes within an organization. At Challenge, it is called "Priority."

16: Elevating Transfer Vehicle (ETV): specialized type of **Ground Support Equipment (19)** used in air freight industry to transfer **Unit Load Devices (15)** between different levels of an airport cargo terminal.

18: Ground Power Unit (GPU): mobile device used at airports to supply electrical power to parked aircraft, allowing them to operate onboard systems, such as air conditioning, lighting, and avionics, without the need to use the plane's own power generators or engines.

19: Ground Support Equipment (GSE): wide range of vehicles, machinery, and equipment used at airports to support aircraft operations on the ground.

25: House Manifest: document providing an overview of all the consolidated shipments (**House Airway Bills (6)**).

11: Hub: central airport or facility that serves as a focal point for the **consolidation (4)**, distribution, and transfer of cargo between various flights and destinations.

2: International Air Transport Association (IATA): global trade association that represents 300 airlines from 120 countries, accounting for 83% of all scheduled traffic worldwide. Its scope of support covers various aspects of aviation, and it contributes to the development of industry policies concerning crucial aviation matters.

3: International Civil Aviation Organization (ICAO): international organization financed and governed by 193 national governments. Its main purpose is to assist these member states in their diplomatic and cooperative efforts related to air transport, as they are all signatories to the Chicago Convention of 1944[14].

[14] Treaty setting out the fundamental principles and regulations governing international civil aviation.

ICAO's work involves establishing regulations that promote aviation safety, security, efficiency, and regularity, as well as environmental sustainability.

14: Interline agreement: contractual agreement between two or more airlines that allows them to cooperate and handle each other's cargo on certain routes.

9: Leg: Challenge Group internal reference number for flights and trucking.

32: Proof of Concept (POC): demonstration or prototype that validates the feasibility and potential of a concept or idea.

33: Radio Frequency Identification (RFID): technology that employs radio waves for the purpose of automatically identifying and tracking objects or individuals.

12: Road Feeder Services (RFS): transportation of cargo or freight from the airport to the final destination via road or land-based transport.

7: Subprime mortgage crisis: financial crisis that affected the mortgage industry in the late 2000s.

26: Transport Security Administration (TSA): agency of the United States Department of Homeland Security[15] responsible for ensuring the security of the traveling public within the United States, primarily in the area of civil aviation. The TSA's focus is to protect the nation's transportation systems, including airports, aircraft, and air cargo from threats such as terrorism and other criminal activities.

31: Transportation Management Software (TMS): software solution that helps organizations efficiently manage and optimize their transportation and logistics operations.

15: Unit Load Device (ULD): standardized container or pallet used to carry air freight on aircraft. ULDs come in different shapes and sizes to accommodate various types of cargo.

8: Wide-body: airplane that has two aisles or more to put cargo or passengers. Its opposite is the narrow-body.

[15] Federal executive department responsible for safeguarding the United States from various threats, both domestic and international.

10 References

List of websites, books, and other works consulted to write my thesis.

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11 Appendices

11.1 Pallet sheet

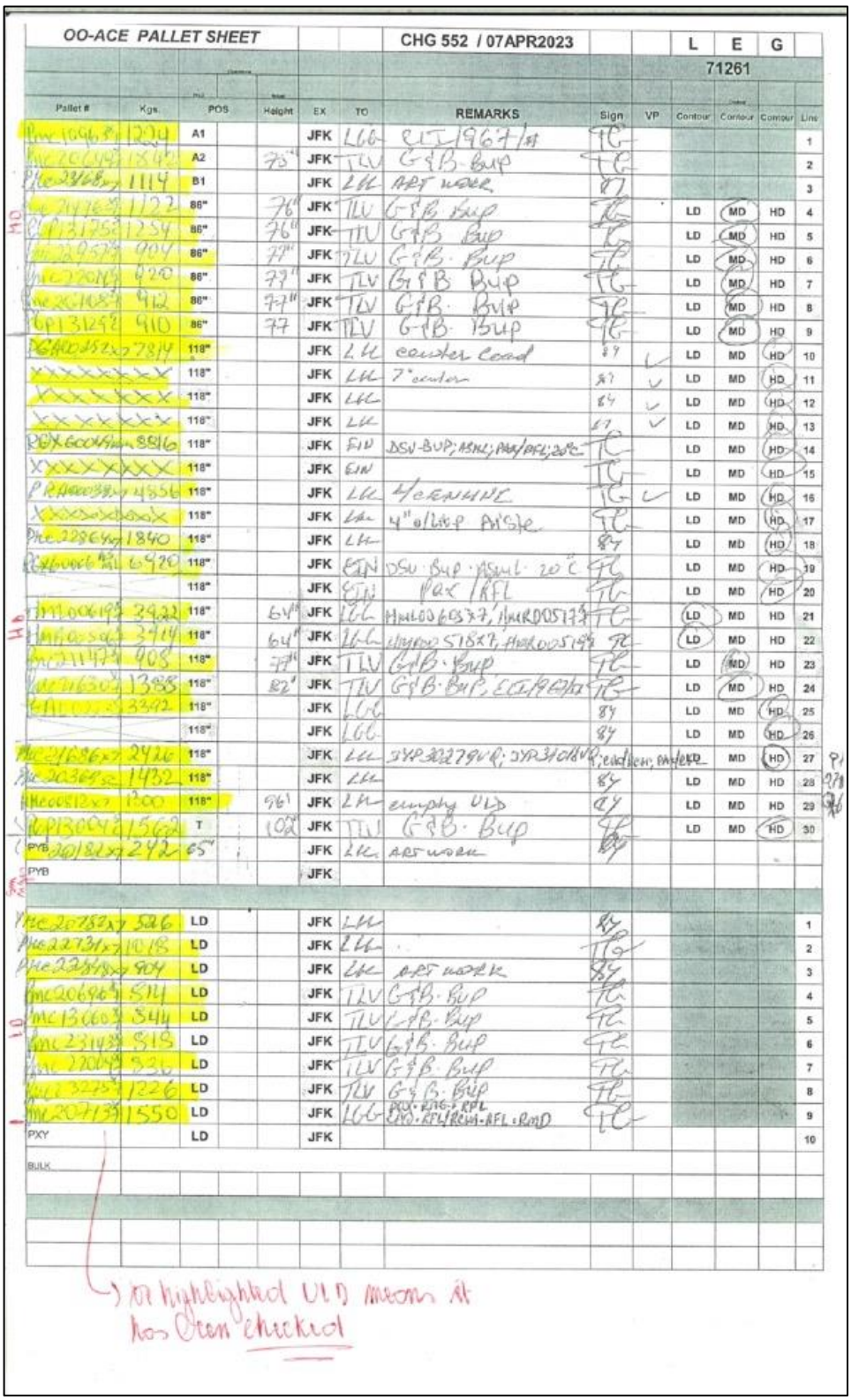
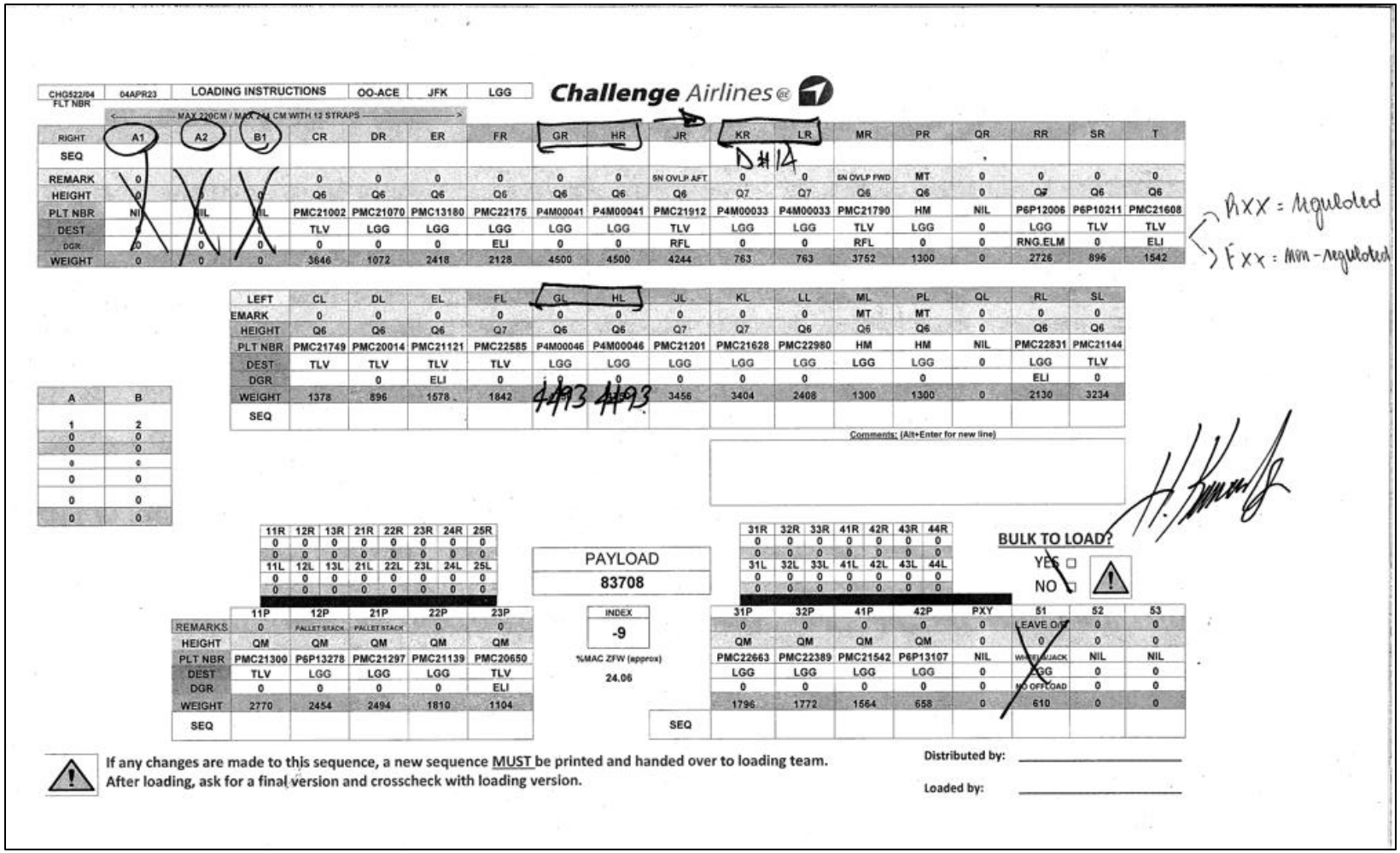


Figure 26 - Example of a pallet sheet - Source: internal

11.2 Load plan



CHG522/04 FLT NBR	04APR23	LOADING INSTRUCTIONS	OO-ACE	JFK	LGG

Challenge Airlines

MAX 220CM / MAX 244 CM WITH 12 STRAPS

RIGHT	A1	A2	B1	CR	DR	ER	FR	GR	HR	JR	KR	LR	MR	PR	QR	RR	SR	T
SEQ																		
REMARK	0	0	0	0	0	0	0	0	0	5N OVLP AFT	0	0	8N OVLP FWD	MT	0	0	0	0
HEIGHT	0	0	0	Q6	Q6	Q6	Q6	Q6	Q6	Q6	Q7	Q7	Q6	Q6	0	Q7	Q6	Q6
PLT NBR	NIL	NIL	NIL	PMC21002	PMC21070	PMC13180	PMC22175	P4M00041	P4M00041	PMC21912	P4M00033	P4M00033	PMC21790	HM	NIL	P6P12006	P6P10211	PMC21608
DEST	0	0	0	TLV	LGG	LGG	LGG	LGG	LGG	TLV	LGG	LGG	TLV	LGG	0	LGG	TLV	TLV
DGR	0	0	0	0	0	0	ELI	0	0	RFL	0	0	RFL	0	0	RNG.ELM	0	ELI
WEIGHT	0	0	0	3646	1072	2418	2128	4500	4500	4244	763	763	3752	1300	0	2726	896	1542

RXX = regulated

FXX = non-regulated

LEFT	CL	DL	EL	FL	GL	HL	JL	KL	LL	ML	PL	QL	RL	SL
REMARK	0	0	0	0	0	0	0	0	0	MT	MT	0	0	0
HEIGHT	Q6	Q6	Q6	Q7	Q6	Q6	Q7	Q7	Q6	Q6	Q6	0	Q6	Q6
PLT NBR	PMC21749	PMC20014	PMC21121	PMC22585	P4M00046	P4M00046	PMC21201	PMC21628	PMC22980	HM	HM	NIL	PMC22831	PMC21144
DEST	TLV	TLV	TLV	TLV	LGG	LGG	LGG	LGG	LGG	LGG	LGG	0	LGG	TLV
DGR		0	ELI	0	0	0	0	0	0		0		ELI	0
WEIGHT	1378	896	1578	1842	4493	4493	3456	3404	2408	1300	1300	0	2130	3234
SEQ														

A	B
1	2
0	0
0	0
0	0
0	0
0	0
0	0

Comments: (Alt+Enter for new line)

11R	12R	13R	21R	22R	23R	24R	25R
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
11L	12L	13L	21L	22L	23L	24L	25L
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

31R	32R	33R	41R	42R	43R	44R
0	0	0	0	0	0	0
0	0	0	0	0	0	0
31L	32L	33L	41L	42L	43L	44L
0	0	0	0	0	0	0
0	0	0	0	0	0	0

PAYLOAD
83708

INDEX
-9

%MAC ZFW (approx)
24.06

BULK TO LOAD?
YES ☐
NO ☐

	11P	12P	21P	22P	23P
REMARKS	0	PALLET STACK	PALLET STACK	0	0
HEIGHT	QM	QM	QM	QM	QM
PLT NBR	PMC21300	P6P13278	PMC21297	PMC21139	PMC20650
DEST	TLV	LGG	LGG	LGG	TLV
DGR	0	0	0	0	ELI
WEIGHT	2770	2454	2494	1810	1104
SEQ					

	31P	32P	41P	42P	PXY	51	52	53
	0	0	0	0	0	LEAVE O/T	0	0
	QM	QM	QM	QM	0	0	0	0
	PMC22663	PMC22389	PMC21542	P6P13107	NIL	WHITE JACK	NIL	NIL
	LGG	LGG	LGG	LGG	0	LGG	0	0
	0	0	0	0	0	NO OFFLOAD	0	0
	1796	1772	1564	658	0	610	0	0
SEQ								

If any changes are made to this sequence, a new sequence MUST be printed and handed over to loading team.
After loading, ask for a final version and crosscheck with loading version.

Distributed by: _____

Loaded by: _____

Figure 27 - Example of a load plan - Source: internal

11.3 Positions in a Boeing 747

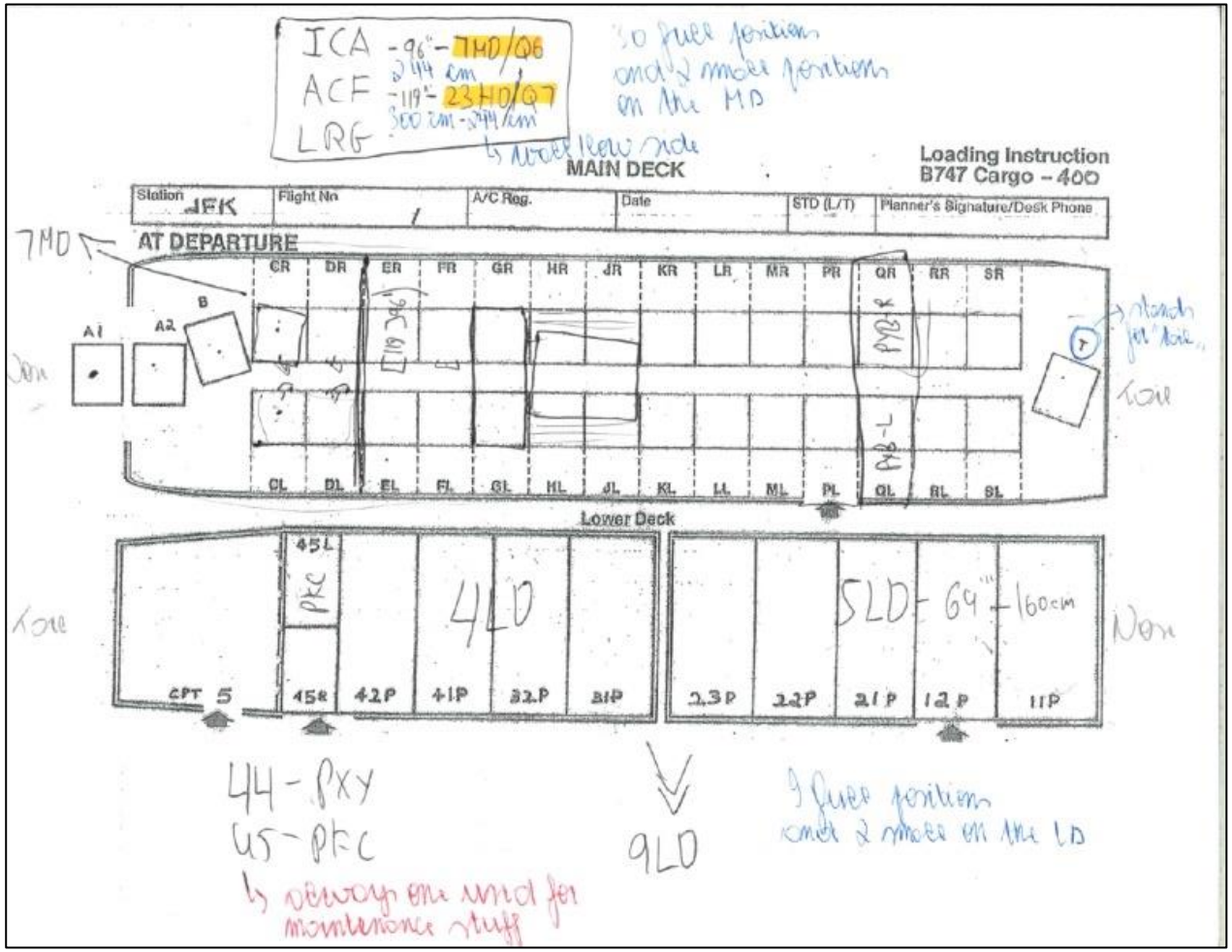


Figure 28 - Positions in an airplane - Source: internal

DECK TYPE:

A1

A2

PLD - aka LD

PWG - LD with overhang

X8 - 65" - 86"

Q6 - aka MD 87" - 96"

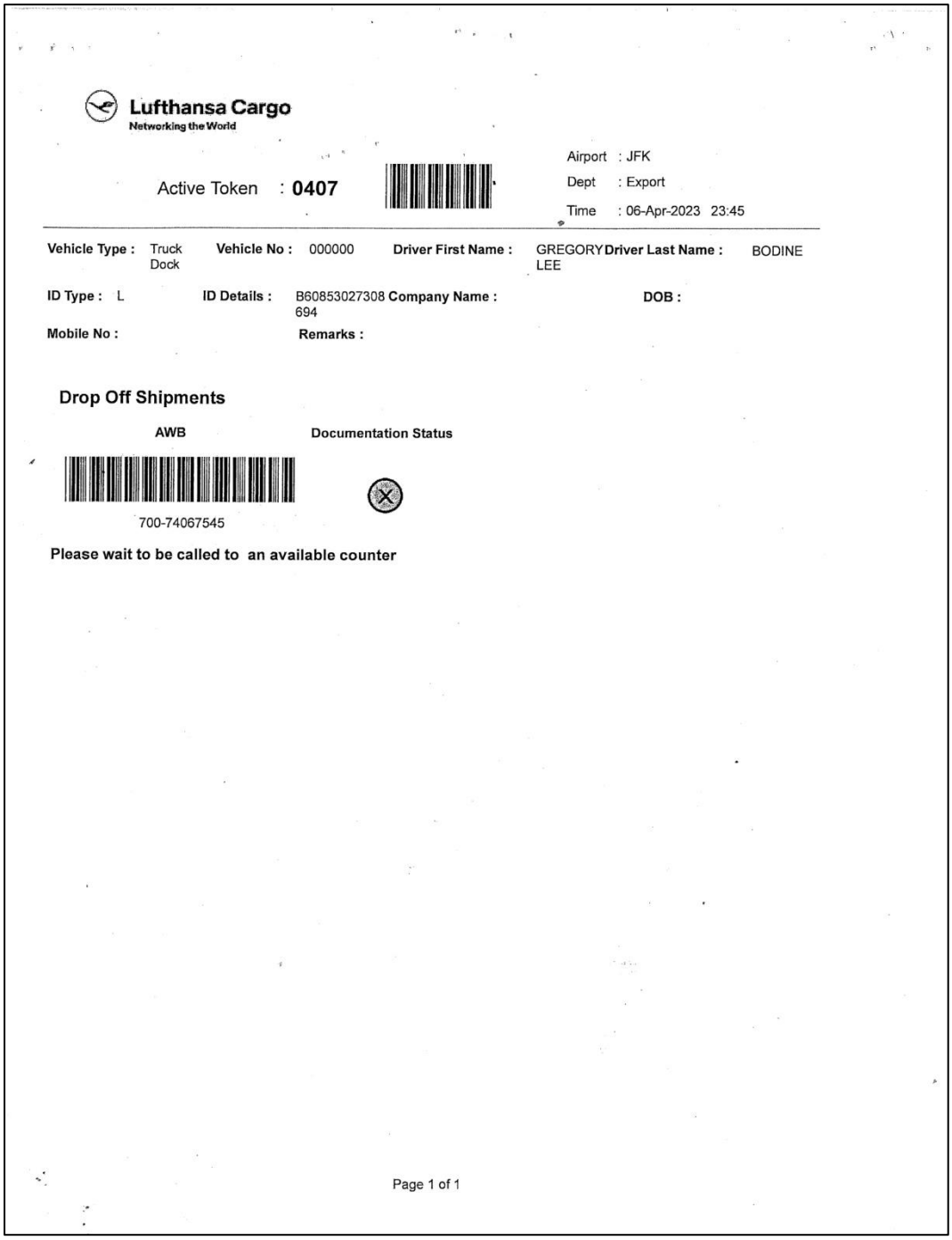
Q7D - aka HD 97" - 112"

Q7 - 113" and above

At these positions will be arranged pallets whose contours are found above. The contours are standardized dimensions used to construct the pallets during build-up.

11.4 Lufthansa file

Made of the following seven documents, among others.



Lufthansa Cargo
Networking the World

Active Token : **0407**

Airport : JFK
Dept : Export
Time : 06-Apr-2023 23:45

Vehicle Type : Truck Dock **Vehicle No :** 000000 **Driver First Name :** GREGORY **Driver Last Name :** BODINE LEE

ID Type : L **ID Details :** B60853027308 694 **Company Name :** **DOB :**

Mobile No : **Remarks :**

Drop Off Shipments

AWB **Documentation Status**

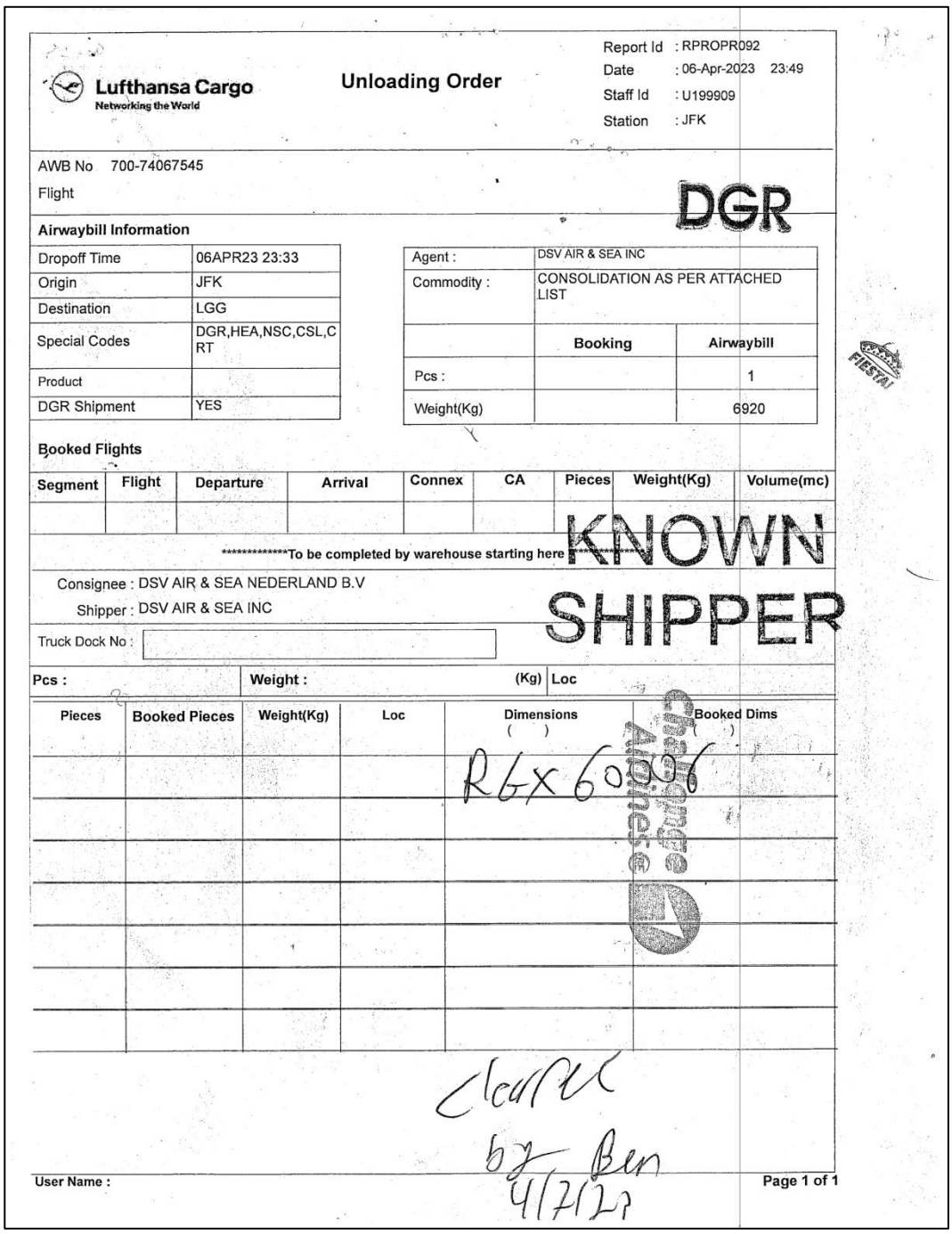
700-74067545

Please wait to be called to an available counter

Page 1 of 1

Figure 29 - File token - Source: Lufthansa/internal

File token the trucker gets when he or she shows up at the export counter to deliver the cargo. It shows various data including the Airway Bill number(s) of the shipment.



Lufthansa Cargo
Networking the World

Unloading Order

Report Id : RPROPR092
Date : 06-Apr-2023 23:49
Staff Id : U199909
Station : JFK

AWB No 700-74067545
Flight

DGR

Airwaybill Information

Dropoff Time	06APR23 23:33
Origin	JFK
Destination	LGG
Special Codes	DGR,HEA,NSC,CSL,CRT
Product	
DGR Shipment	YES

Agent :	DSV AIR & SEA INC	
Commodity :	CONSOLIDATION AS PER ATTACHED LIST	
	Booking	**Airwaybill**
Pcs :		1
Weight(Kg)		6920

FIESTA!

Booked Flights

Segment	Flight	Departure	Arrival	Connex	CA	Pieces	Weight(Kg)	Volume(mc)

**********To be completed by warehouse starting here

KNOWN SHIPPER

Consignee : DSV AIR & SEA NEDERLAND B.V
Shipper : DSV AIR & SEA INC

Truck Dock No :

Pcs : Weight : (Kg) Loc

Pieces	Booked Pieces	Weight(Kg)	Loc	Dimensions ( )	Booked Dims ( )
				RGX 60006	

Challenge Airlines

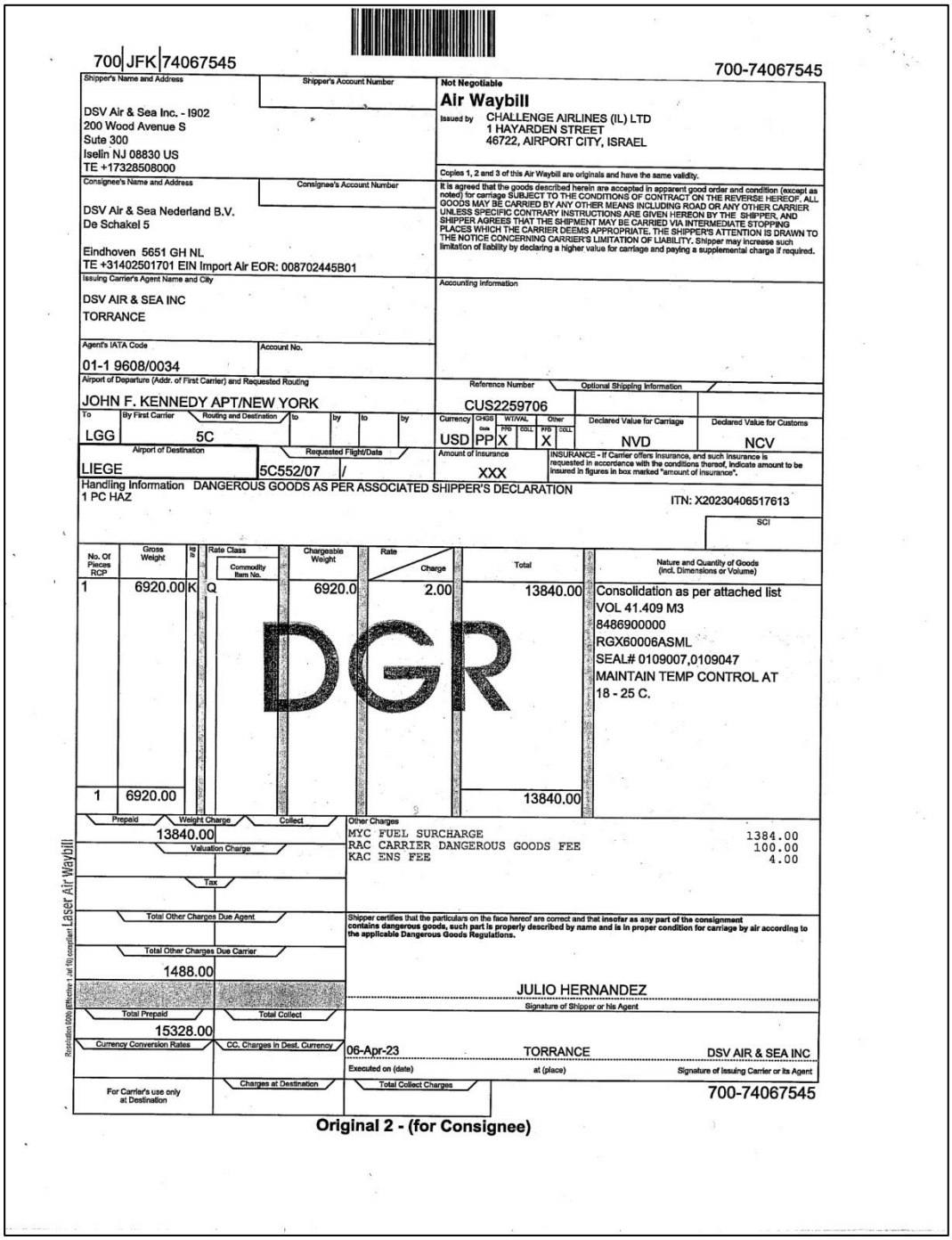
Cleared by Ben 4/7/23

User Name :

Page 1 of 1

Figure 30 - Unloading order - Source: Lufthansa/internal

Unloading order namely showing the location of the cargo in the warehouse. The "Challenge Airlines" stamp indicates the cargo has been cleared by the security team, and the "fiesta" stamp states it has been manifested in the **ERP Priority (28)**.



700 JFK 74067545

700-74067545

Shipper's Name and Address

DSV Air & Sea Inc. - I902
200 Wood Avenue S
Sute 300
Iselin NJ 08830 US
TE +17328508000

Shipper's Account Number

Not Negotiable

Air Waybill

Issued by CHALLENGE AIRLINES (IL) LTD
1 HAYARDEN STREET
46722, AIRPORT CITY, ISRAEL

Copies 1, 2 and 3 of this Air Waybill are originals and have the same validity.

It is agreed that the goods described herein are accepted in apparent good order and condition (except as noted) for carriage SUBJECT TO THE CONDITIONS OF CONTRACT ON THE REVERSE HEREOF. ALL GOODS MAY BE CARRIED BY ANY OTHER MEANS INCLUDING ROAD OR ANY OTHER CARRIER UNLESS SPECIFIC CONTRARY INSTRUCTIONS ARE GIVEN HEREON BY THE SHIPPER, AND SHIPPER AGREES THAT THE SHIPMENT MAY BE CARRIED VIA INTERMEDIATE STOPPING PLACES WHICH THE CARRIER DEEMS APPROPRIATE. THE SHIPPER'S ATTENTION IS DRAWN TO THE NOTICE CONCERNING CARRIER'S LIMITATION OF LIABILITY. Shipper may increase such limitation of liability by declaring a higher value for carriage and paying a supplemental charge if required.

Consignee's Name and Address

DSV Air & Sea Nederland B.V.
De Schakel 5

Eindhoven 5651 GH NL
TE +31402501701 EIN Import Air EOR: 008702445B01

Consignee's Account Number

Issuing Carrier's Agent Name and City

DSV AIR & SEA INC
TORRANCE

Accounting Information

Agent's IATA Code: 01-1 9608/0034

Account No.

Airport of Departure (Addr. of First Carrier) and Requested Routing: JOHN F. KENNEDY APT/NEW YORK

Reference Number: CUS2259706

Optional Shipping Information

To	By First Carrier	Routing and Destination	to	by	to	by
LGG		5C				

Currency	CHGS Code	WT/VAL PPD	WT/VAL COLL	Other PPD	Other COLL	Declared Value for Carriage	Declared Value for Customs
USD	PP	X		X		NVD	NCV

Airport of Destination: LIEGE

Requested Flight/Date: 5C552/07 /

Amount of Insurance: XXX

INSURANCE - If Carrier offers insurance, and such insurance is requested in accordance with the conditions thereof, indicate amount to be insured in figures in box marked "amount of insurance".

Handling Information DANGEROUS GOODS AS PER ASSOCIATED SHIPPER'S DECLARATION
1 PC HAZ

ITN: X20230406517613

SCI

No. Of Pieces RCP	Gross Weight	kg lb	Rate Class / Commodity Item No.	Chargeable Weight	Rate / Charge	Total	Nature and Quantity of Goods (incl. Dimensions or Volume)
1	6920.00	K	Q	6920.0	2.00	13840.00	Consolidation as per attached list VOL 41.409 M3 8486900000 RGX60006ASML SEAL# 0109007,0109047 MAINTAIN TEMP CONTROL AT 18 - 25 C.
1	6920.00					13840.00	

DGR

Prepaid / Weight Charge / Collect: 13840.00

Valuation Charge

Tax

Total Other Charges Due Agent

Total Other Charges Due Carrier: 1488.00

Total Prepaid: 15328.00

Total Collect

Currency Conversion Rates

CC. Charges in Dest. Currency

For Carrier's use only at Destination

Charges at Destination

Total Collect Charges

Other Charges

MYC FUEL SURCHARGE	1384.00
RAC CARRIER DANGEROUS GOODS FEE	100.00
KAC ENS FEE	4.00

Shipper certifies that the particulars on the face hereof are correct and that insofar as any part of the consignment contains dangerous goods, such part is properly described by name and is in proper condition for carriage by air according to the applicable Dangerous Goods Regulations.

JULIO HERNANDEZ
Signature of Shipper or his Agent

06-Apr-23 — Executed on (date)
TORRANCE — at (place)
DSV AIR & SEA INC — Signature of Issuing Carrier or its Agent

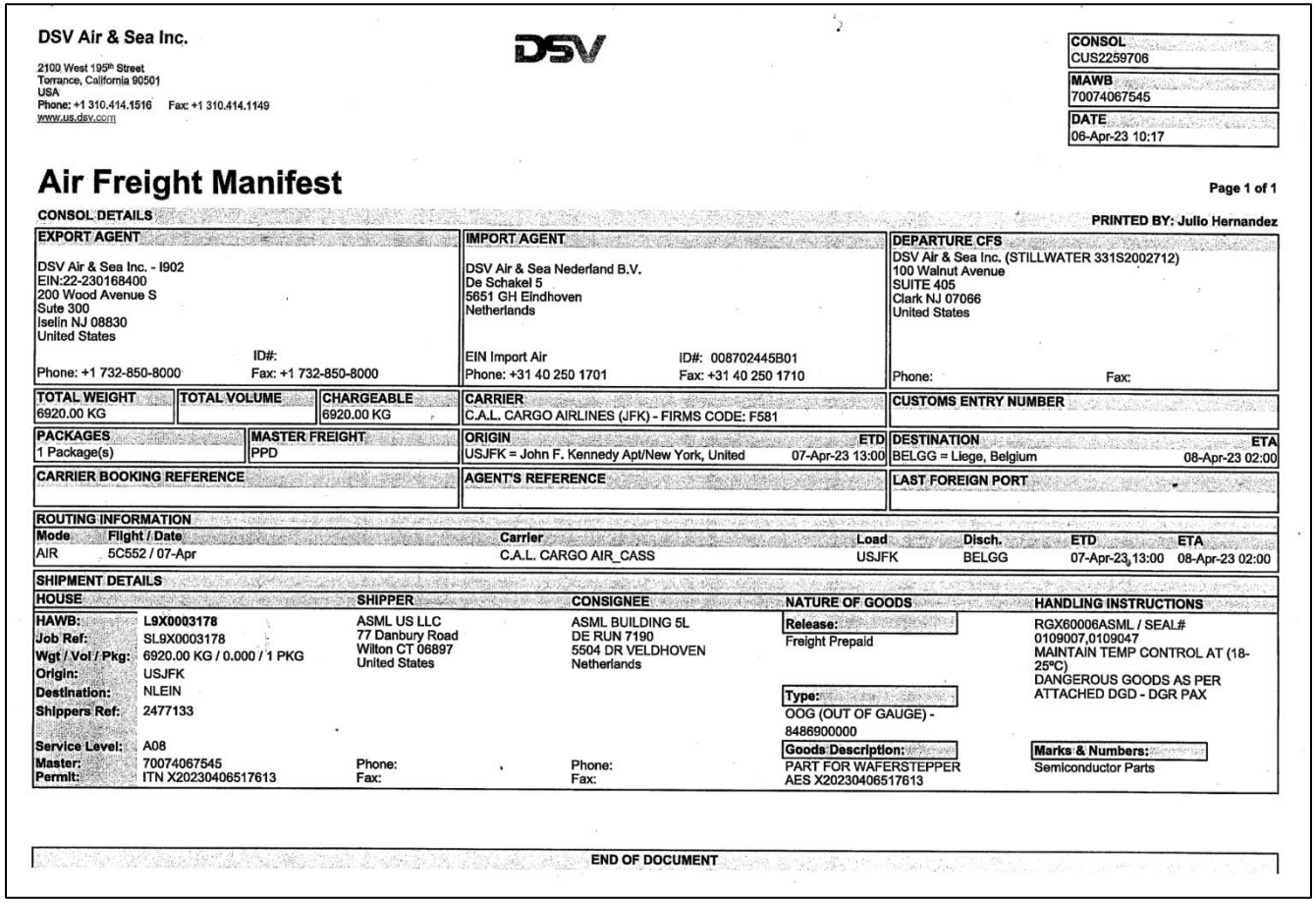
700-74067545

Original 2 - (for Consignee)

Laser Air Waybill

Figure 31 - Airway Bill - Source: Lufthansa/internal

Front side of an Airway Bill, premier document in air freight industry serving as a contract of carriage.



DSV Air & Sea Inc.

2100 West 195th Street
Torrance, California 90501
USA
Phone: +1 310.414.1516 Fax: +1 310.414.1149
www.us.dsv.com

CONSOL: CUS2259706
MAWB: 70074067545
DATE: 06-Apr-23 10:17

Air Freight Manifest

Page 1 of 1

CONSOL DETAILS

PRINTED BY: Julio Hernandez

EXPORT AGENT	IMPORT AGENT	DEPARTURE CFS
DSV Air & Sea Inc. - I902 EIN:22-230168400 200 Wood Avenue S Sute 300 Iselin NJ 08830 United States ID#: Phone: +1 732-850-8000 Fax: +1 732-850-8000	DSV Air & Sea Nederland B.V. De Schakel 5 5651 GH Eindhoven Netherlands EIN Import Air ID#: 008702445B01 Phone: +31 40 250 1701 Fax: +31 40 250 1710	DSV Air & Sea Inc. (STILLWATER 331S2002712) 100 Walnut Avenue SUITE 405 Clark NJ 07066 United States Phone: Fax:

TOTAL WEIGHT	TOTAL VOLUME	CHARGEABLE	CARRIER	CUSTOMS ENTRY NUMBER
6920.00 KG		6920.00 KG	C.A.L. CARGO AIRLINES (JFK) - FIRMS CODE: F581	

PACKAGES	MASTER FREIGHT	ORIGIN	ETD	DESTINATION	ETA
1 Package(s)	PPD	USJFK = John F. Kennedy Apt/New York, United	07-Apr-23 13:00	BELGG = Liege, Belgium	08-Apr-23 02:00

CARRIER BOOKING REFERENCE	AGENT'S REFERENCE	LAST FOREIGN PORT

ROUTING INFORMATION

Mode	Flight / Date	Carrier	Load	Disch.	ETD	ETA
AIR	5C552 / 07-Apr	C.A.L. CARGO AIR_CASS	USJFK	BELGG	07-Apr-23 13:00	08-Apr-23 02:00

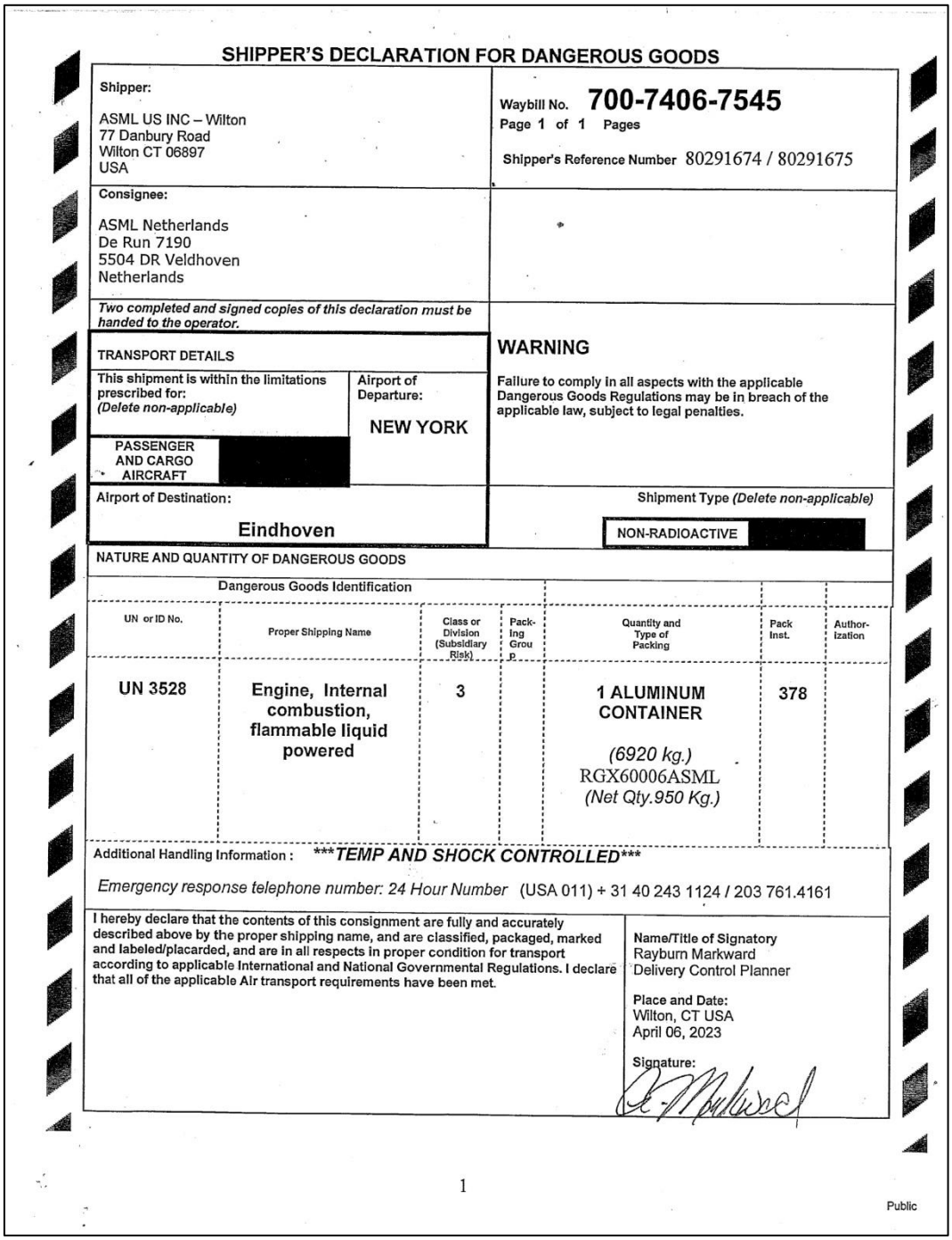
SHIPMENT DETAILS

HOUSE		SHIPPER	CONSIGNEE	NATURE OF GOODS	HANDLING INSTRUCTIONS
HAWB:	L9X0003178	ASML US LLC 77 Danbury Road Wilton CT 06897 United States	ASML BUILDING 5L DE RUN 7190 5504 DR VELDHOVEN Netherlands	Release: Freight Prepaid	RGX60006ASML / SEAL# 0109007,0109047 MAINTAIN TEMP CONTROL AT (18-25ºC) DANGEROUS GOODS AS PER ATTACHED DGD - DGR PAX
Job Ref:	SL9X0003178				
Wgt / Vol / Pkg:	6920.00 KG / 0.000 / 1 PKG			Type: OOG (OUT OF GAUGE) - 8486900000	
Origin:	USJFK				
Destination:	NLEIN				
Shippers Ref:	2477133				
Service Level:	A08			Goods Description: PART FOR WAFERSTEPPER AES X20230406517613	Marks & Numbers: Semiconductor Parts
Master:	70074067545	Phone:	Phone:		
Permit:	ITN X20230406517613	Fax:	Fax:		

END OF DOCUMENT

Figure 32 - House Manifest - Source: Lufthansa/internal

Air Freight Manifest, or Consolidation Manifest, or House Manifest, showing the **House Airway Bills (6)** that may be contained in a single shipment.



SHIPPER'S DECLARATION FOR DANGEROUS GOODS

Shipper:
ASML US INC – Wilton
77 Danbury Road
Wilton CT 06897
USA

Waybill No. 700-7406-7545
Page 1 of 1 Pages
Shipper's Reference Number 80291674 / 80291675

Consignee:
ASML Netherlands
De Run 7190
5504 DR Veldhoven
Netherlands

Two completed and signed copies of this declaration must be handed to the operator.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: *(Delete non-applicable)*
PASSENGER AND CARGO AIRCRAFT

Airport of Departure: NEW YORK

Airport of Destination: Eindhoven

WARNING
Failure to comply in all aspects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

Shipment Type *(Delete non-applicable)*
NON-RADIOACTIVE

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification						
UN or ID No.	Proper Shipping Name	Class or Division (Subsidiary Risk)	Packing Group	Quantity and Type of Packing	Pack Inst.	Author-ization
UN 3528	Engine, Internal combustion, flammable liquid powered	3		1 ALUMINUM CONTAINER (6920 kg.) RGX60006ASML (Net Qty.950 Kg.)	378	

Additional Handling Information : ***TEMP AND SHOCK CONTROLLED***

Emergency response telephone number: 24 Hour Number (USA 011) + 31 40 243 1124 / 203 761.4161

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations. I declare that all of the applicable Air transport requirements have been met.

Name/Title of Signatory
Rayburn Markward
Delivery Control Planner

Place and Date:
Wilton, CT USA
April 06, 2023

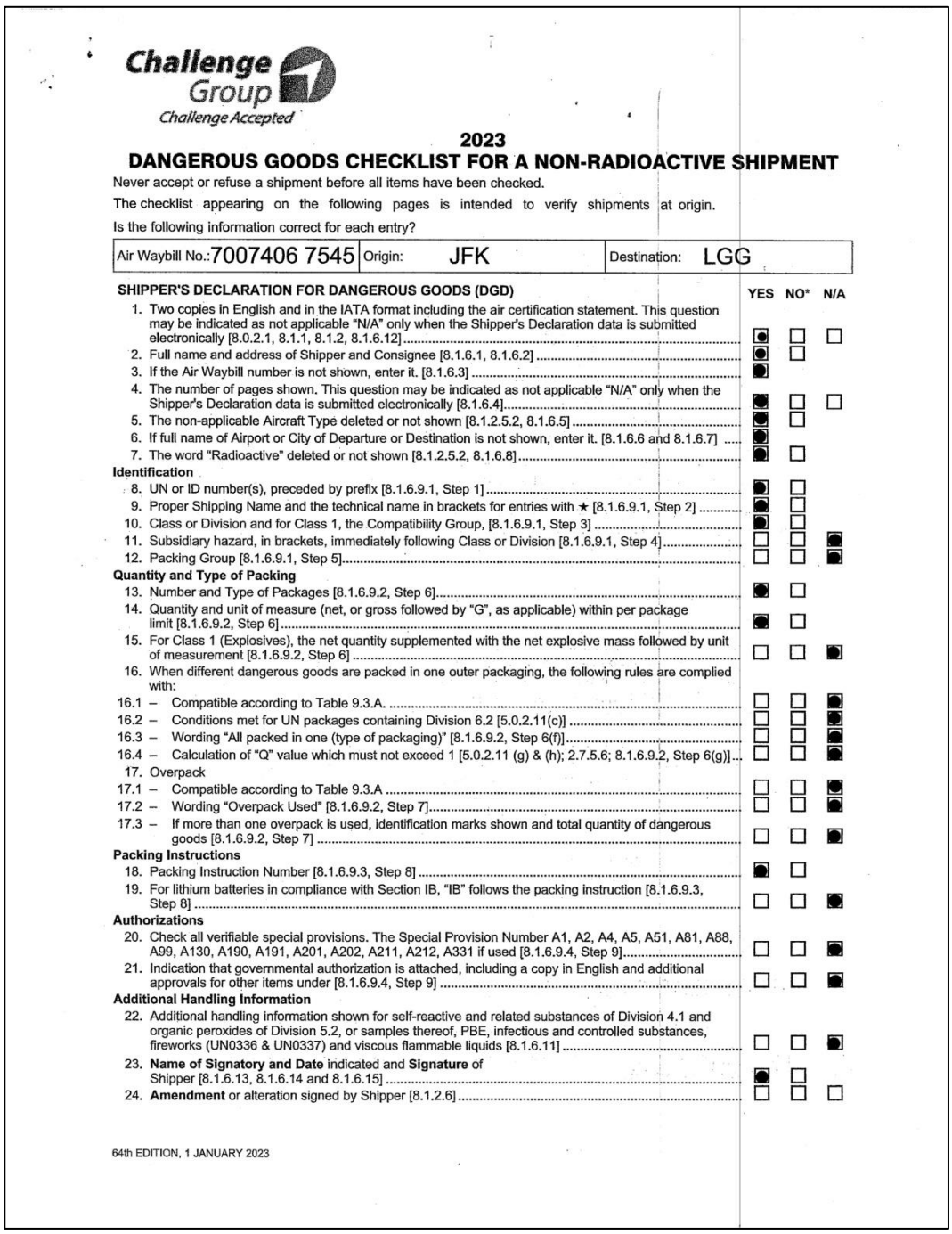
Signature:

1

Public

Figure 33 - Dangerous goods declaration - Source: Lufthansa/internal

Dangerous goods (DG) (27) declaration in case of hazardous materials. Note that only regulated **DG (27)** need such a declaration (please refer to the glossary for further explanation).



Challenge Group
Challenge Accepted

2023

DANGEROUS GOODS CHECKLIST FOR A NON-RADIOACTIVE SHIPMENT

Never accept or refuse a shipment before all items have been checked.

The checklist appearing on the following pages is intended to verify shipments at origin.

Is the following information correct for each entry?

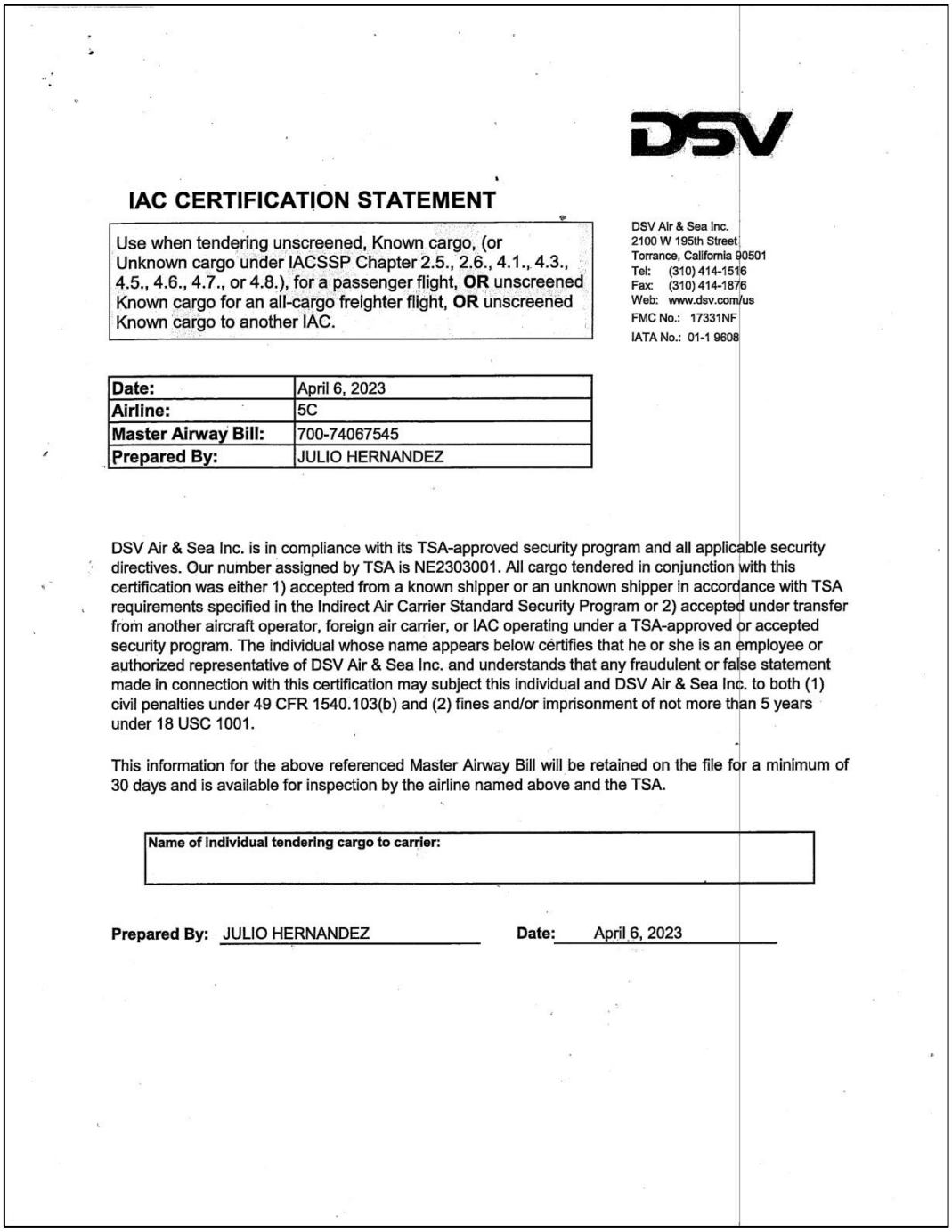
Air Waybill No.: 7007406 7545	Origin: JFK	Destination: LGG

SHIPPER'S DECLARATION FOR DANGEROUS GOODS (DGD)	YES	NO*	N/A
1. Two copies in English and in the IATA format including the air certification statement. This question may be indicated as not applicable "N/A" only when the Shipper's Declaration data is submitted electronically [8.0.2.1, 8.1.1, 8.1.2, 8.1.6.12]	●	☐	☐
2. Full name and address of Shipper and Consignee [8.1.6.1, 8.1.6.2]	●	☐	
3. If the Air Waybill number is not shown, enter it. [8.1.6.3]	●		
4. The number of pages shown. This question may be indicated as not applicable "N/A" only when the Shipper's Declaration data is submitted electronically [8.1.6.4]	●	☐	☐
5. The non-applicable Aircraft Type deleted or not shown [8.1.2.5.2, 8.1.6.5]	●	☐	
6. If full name of Airport or City of Departure or Destination is not shown, enter it. [8.1.6.6 and 8.1.6.7]	●		
7. The word "Radioactive" deleted or not shown [8.1.2.5.2, 8.1.6.8]	●	☐	
Identification			
8. UN or ID number(s), preceded by prefix [8.1.6.9.1, Step 1]	●	☐	
9. Proper Shipping Name and the technical name in brackets for entries with ★ [8.1.6.9.1, Step 2]	●	☐	
10. Class or Division and for Class 1, the Compatibility Group, [8.1.6.9.1, Step 3]	●	☐	
11. Subsidiary hazard, in brackets, immediately following Class or Division [8.1.6.9.1, Step 4]	☐	☐	●
12. Packing Group [8.1.6.9.1, Step 5]	☐	☐	●
Quantity and Type of Packing			
13. Number and Type of Packages [8.1.6.9.2, Step 6]	●	☐	
14. Quantity and unit of measure (net, or gross followed by "G", as applicable) within per package limit [8.1.6.9.2, Step 6]	●	☐	
15. For Class 1 (Explosives), the net quantity supplemented with the net explosive mass followed by unit of measurement [8.1.6.9.2, Step 6]	☐	☐	●
16. When different dangerous goods are packed in one outer packaging, the following rules are complied with:			
16.1 – Compatible according to Table 9.3.A.	☐	☐	●
16.2 – Conditions met for UN packages containing Division 6.2 [5.0.2.11(c)]	☐	☐	●
16.3 – Wording "All packed in one (type of packaging)" [8.1.6.9.2, Step 6(f)]	☐	☐	●
16.4 – Calculation of "Q" value which must not exceed 1 [5.0.2.11 (g) & (h); 2.7.5.6; 8.1.6.9.2, Step 6(g)]	☐	☐	●
17. Overpack			
17.1 – Compatible according to Table 9.3.A	☐	☐	●
17.2 – Wording "Overpack Used" [8.1.6.9.2, Step 7]	☐	☐	●
17.3 – If more than one overpack is used, identification marks shown and total quantity of dangerous goods [8.1.6.9.2, Step 7]	☐	☐	●
Packing Instructions			
18. Packing Instruction Number [8.1.6.9.3, Step 8]	●	☐	
19. For lithium batteries in compliance with Section IB, "IB" follows the packing instruction [8.1.6.9.3, Step 8]	☐	☐	●
Authorizations			
20. Check all verifiable special provisions. The Special Provision Number A1, A2, A4, A5, A51, A81, A88, A99, A130, A190, A191, A201, A202, A211, A212, A331 if used [8.1.6.9.4, Step 9]	☐	☐	●
21. Indication that governmental authorization is attached, including a copy in English and additional approvals for other items under [8.1.6.9.4, Step 9]	☐	☐	●
Additional Handling Information			
22. Additional handling information shown for self-reactive and related substances of Division 4.1 and organic peroxides of Division 5.2, or samples thereof, PBE, infectious and controlled substances, fireworks (UN0336 & UN0337) and viscous flammable liquids [8.1.6.11]	☐	☐	●
23. **Name of Signatory and Date** indicated and **Signature** of Shipper [8.1.6.13, 8.1.6.14 and 8.1.6.15]	●	☐	
24. **Amendment** or alteration signed by Shipper [8.1.2.6]	☐	☐	☐

64th EDITION, 1 JANUARY 2023

Figure 34 - Dangerous goods checklist - Source: Lufthansa/internal

Dangerous goods (DG) (27) checklist. All **DG (27)** need to go through these checks, even non-regulated **DG (27)**.



DSV

IAC CERTIFICATION STATEMENT

Use when tendering unscreened, Known cargo, (or Unknown cargo under IACSSP Chapter 2.5., 2.6., 4.1., 4.3., 4.5., 4.6., 4.7., or 4.8.), for a passenger flight, **OR** unscreened Known cargo for an all-cargo freighter flight, **OR** unscreened Known cargo to another IAC.

DSV Air & Sea Inc.
2100 W 195th Street
Torrance, California 90501
Tel: (310) 414-1516
Fax: (310) 414-1876
Web: www.dsv.com/us
FMC No.: 17331NF
IATA No.: 01-1 9608

Date:	April 6, 2023
Airline:	5C
Master Airway Bill:	700-74067545
Prepared By:	JULIO HERNANDEZ

DSV Air & Sea Inc. is in compliance with its TSA-approved security program and all applicable security directives. Our number assigned by TSA is NE2303001. All cargo tendered in conjunction with this certification was either 1) accepted from a known shipper or an unknown shipper in accordance with TSA requirements specified in the Indirect Air Carrier Standard Security Program or 2) accepted under transfer from another aircraft operator, foreign air carrier, or IAC operating under a TSA-approved or accepted security program. The individual whose name appears below certifies that he or she is an employee or authorized representative of DSV Air & Sea Inc. and understands that any fraudulent or false statement made in connection with this certification may subject this individual and DSV Air & Sea Inc. to both (1) civil penalties under 49 CFR 1540.103(b) and (2) fines and/or imprisonment of not more than 5 years under 18 USC 1001.

This information for the above referenced Master Airway Bill will be retained on the file for a minimum of 30 days and is available for inspection by the airline named above and the TSA.

Name of individual tendering cargo to carrier:

Prepared By: JULIO HERNANDEZ **Date:** April 6, 2023

Figure 35 - Transportation Security Administration letter - Source: Lufthansa/internal

Transportation Security Administration (TSA) (26) letter, or Indirect Air Carrier certification statement, stating that the consignor is **TSA (26)** approved. The cargo of such consignor does not need to go through extensive security checks.

11.5 Types of Unit Load Devices

- Air containers: below is an LD-3 container, a widespread **Unit Load Device (ULD) (15)** from the manufacturer PalNet[16]. Nevertheless, Challenge rarely uses them.

Figure 36 - Picture of an air container - Source: PalNet

- Pallets: the other commonly used **ULD (15)** is the pallet. It serves to consolidate shipments. During my internship, I saw many PMCs, of which you will find a picture hereunder.

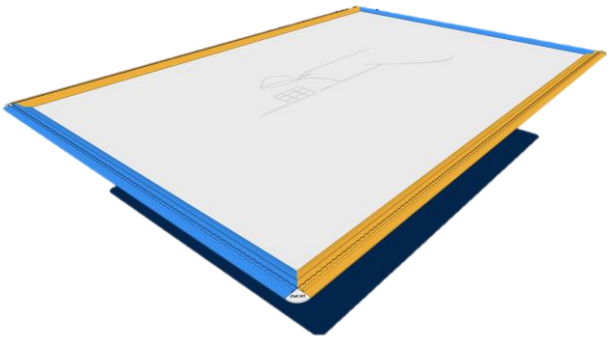


Figure 37 - Picture of a PMC pallet - Source: PalNet

[16] German company producing ULDs for many air freight companies around the world.

11.6 Master Airway Bill - House Airway Bill database

AWB No.	FWB?	HS CODE?	EORI?	CNEE EORI	REMARK	FHL?	HS CODE 2?	EORI 2?	CNEE EORI	REMARK 2	CNOR	CNEE
70071171225	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	CASPIAN BUSINESS CONULTING LLC	DD CLASSICS
70071217786	YES	YES	NO			YES	YES	NO			CLEARFREIGHT INC (60191)	GULF AGENCY CO. CYPRUS LTD.
70074011140	NO	NO	NO			NO	NO	NO			FEDEX TRADE NETWORKS TRANSPORT & BROKERAGE 11434	S. FRITZ LOGISTICS AND SHIPPING LTD.
70074039910	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	AMERICAN FRIENDS OF THE ISRAEL MUSEUM	TRANSCLAL FINE ARTS LTD 6099100
70074054595	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	HYUNDAI MOTOR COMPANY	CAR-GO LOGISTISTICS GMBH
70074060825	YES	YES	NO			YES	YES	NO			ALLIANCE PACIFIC CORPORATION INC.	ALLIANCE HEATHROW EORI GB507484538
70074062995	YES	NO	NO			YES	YES	NO			CONCORDIA INTERNATIONAL FWD CORP	CONCORDIA U K
70074063043	YES	NO	YES	GB751026757000		NA	NA	NA		DIRECT FLIGHT	WHITE CUBE LONDON 10006	MTEC WAREHOUSING LTD
70074063102	YES	YES	YES	IE4618356U		YES	YES	YES	IE4618356U		EXPEDITORS - JFK	EXPEDITORS IRELAND LIMITED *SNN
70074065633	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL,M
70074065666	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL,M
70074066145	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INFINITY IMP & EXP INC	FREIGHT 4U LOGISTICS BVBA 4460
70074070356	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL,M
70074070360	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL,M
70074070371	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL,M
70074070393	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL,M
70074070430	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	THE BOEING COMPANY 85215	GOVERNMENT OF ISRAEL,M
70074070441	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	THE BOEING COMPANY 85215	GOVERNMENT OF ISRAEL,M
70074070452	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL, M.
70074070474	NO	NO	NO			NA	NA	NA		DIRECT FLIGHT	INTERGLOBAL FORWARDING SERVICES INC 07305	GOVERNMENT OF ISRAEL,M
70074072224	YES	YES	NO	VAT513046615	INVALID EORI	NA	NA	NA		DIRECT FLIGHT	DHL GLOBAL FORWARDING 11430 NY	DHL GLOBAL FORWARDING ISRAEL LTD.
70074073845	YES	YES	NO	VAT513094649	INVALID EORI	YES	YES	NO			DSV AIR SEA INC. - I902	DSV AIR SEA LTD
70074073860	YES	YES	NO	BE009076840	INVALID EORI	YES	YES	YES	NL007051104		DSV AIR SEA INC. - I902	DSV AIR SEA NV - I441
70074073882	YES	YES	YES	NL008702445	REMOVE "B01"	YES	YES	YES	NL007051104		DSV AIR SEA INC. - I902	DSV AIR SEA NEDERLAND B.V.
70074073893	YES	YES	YES	NL008702445	REMOVE "B01"	YES	YES	YES	NL007051104		DSV AIR SEA INC. - I902	DSV AIR SEA NEDERLAND B.V.
70074073915	YES	YES	YES	NL008702445	REMOVE "B01"	YES	YES	YES	NL007051104		DSV AIR SEA INC. - I902	DSV AIR SEA NEDERLAND B.V.
70074074346	YES	YES	NO	VAT513094649	INVALID EORI	YES	YES	NO			DSV AIR SEA INC. - I902	DSV AIR SEA LTD

Figure 38 - Master Airway Bill - House Airway Bill database - Source: internal

CNEE	EORI	VALID?
ASML NETHERLANDS HQ	NL007051104	YES
BMP EUROPE LTD	GB408239261000	YES
BOLLORE LOGISTICS BELGIUM N.V.	BE0408195103	YES
BOLLORE LOGISTICS FR	FR55208853601782	YES
BOLLORE LOGISTICS FR (70030)	FR55208853601774	YES
BOLLORE LOGISTICS NETHERLANDS BV	NL004587674	YES
BOLLORE LOGISTICS UK	GB432381373000	YES
CARGOMIND POLAND	PL534237975500000	YES
CENTRAL GLOBAL CARGO GMBH	DE3063283	YES

Figure 39 - List of EORIs - Source: internal

Above is an excerpt of the database I drew to study Import Control System 2. On the left, another sheet of the Excel workbook, the identification numbers database. It helped me have a clear view of the situation, and it saved me from always having to visit the European database.

11.7 Challenge Group timeline

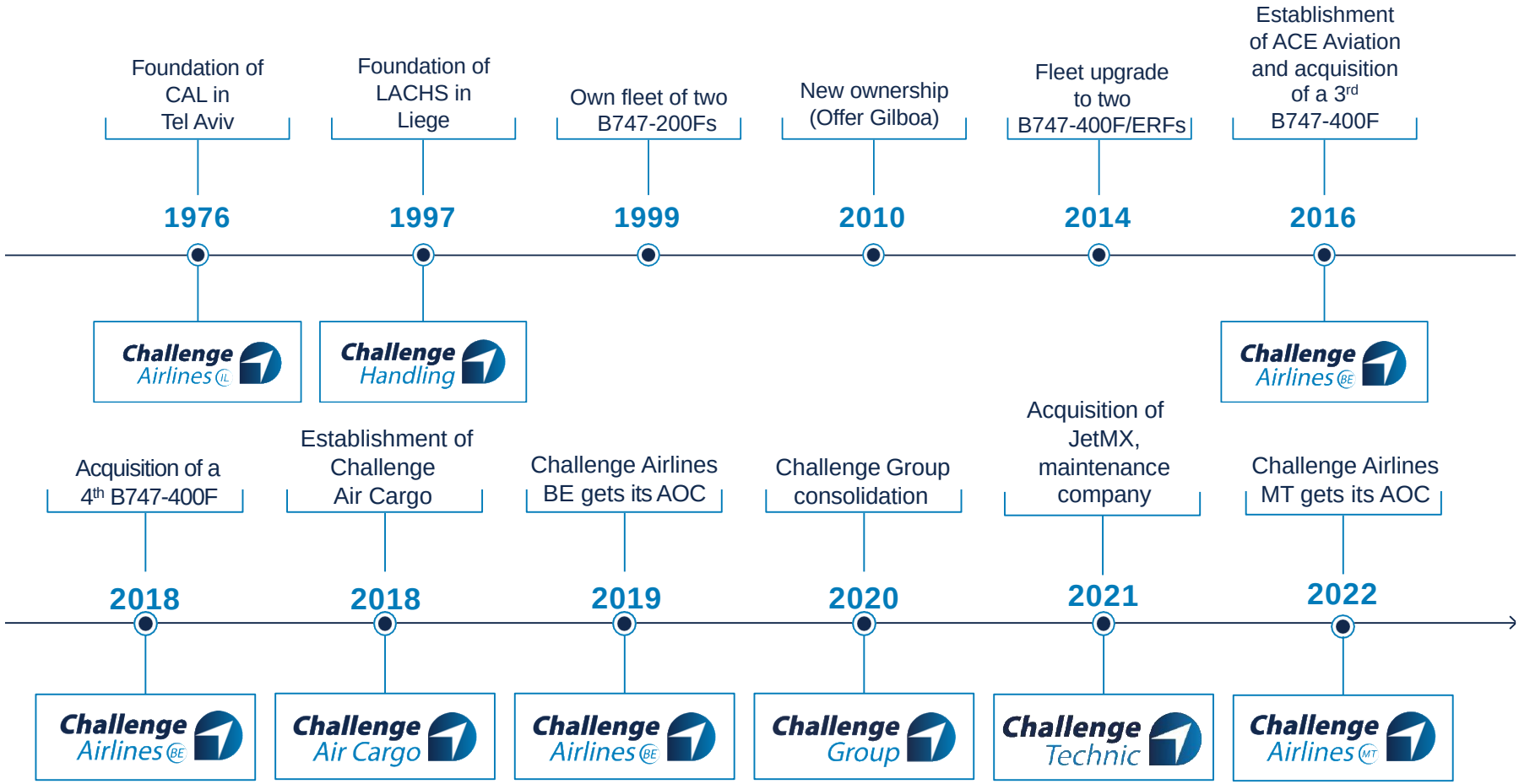


Figure 40 - Challenge timeline - Source: internal

11.8 Contact list

Here is a list of the people who helped me write the thesis:

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11.9 High loader

Figure 41 - High loader - Source: Trepel Airport Equipment