The Chartered Institute of Logistics and Transport

AIR FREIGHT

Briefing Paper

CILT(UK) Aviation Policy Group

AZIMUTH ASSOCIATES

Contents

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Executive summary

This paper, written on behalf of the CILT, describes the nature of the air freight sector. It aims to provide an overview for CILT members, policy makers in government, industry, and others with a particular interest in UK cargo aviation. Whilst passenger air transportation is more widely understood, the freight industry is perhaps less visible and more impenetrable. It is, however, vital to the functioning of the UK's import and export markets, and in safeguarding its supply lines. As the impact of Brexit, the Covid pandemic, and war have illustrated, resilience in the UK's air freight sector is vital to the national interest.

Air cargo is generally more complex than passenger transport and has specific and invaluable social and economic benefits, facilitating trade, contributing to global economic development, and creating millions of jobs. In 2021, over 66 million tonnes of air cargo were transported worldwide, an increase beyond 2019 levels after a dip during the Covid pandemic.

It is important to note the difference between the carriage of goods in the belly hold of passenger aircraft and on dedicated freighters. Whilst in the UK (pre pandemic), belly hold dominates with around 70% of the market, the role of freighters is vital for several reasons including:

- **Passenger aircraft serve destinations people want to visit and may not serve key cargo trade routes**
- **Passenger airline schedules may not meet shipper timing needs**
- **Palletised cargo space is not available on single-aisle passenger aircraft**
- **Passenger aircraft cannot carry hazardous and project/outsize cargo**
- **Payload/range considerations on passenger aircraft may limit cargo carriage**

Whilst globally there has been an ongoing increase in cargo markets, the UK is not performing in line with other countries. As well as a lack of growth, the UK also has a much higher proportion of cargo carried as belly hold compared to its use of dedicated freighters. It also seems that trucking to and from northern European airports may be substituting for direct air connections, either due to a lack of suitable capacity at airports or to a lack of airline connectivity.

The role and evolving nature of integrators, forwarders, and cargo airlines are key to understanding the market. Developments include the move for forwarders and airlines to begin to act as integrators. This may be in response to capacity issues and high rates as well as to improve service to customers and, for airlines, to leverage assets. Amazon's business model – vertical integration in the supply chain through its purchase of a fleet of aircraft – has been a game changer in the sector.

In 2019 and pre Covid, air freight rates and revenues had fallen due to the impact of global trade wars. However, during the pandemic the lack of cargo capacity compared to the continued demand for goods, congestion at airports and in other parts of the supply chain, combined with the growing demand for e-commerce shipments and transport of personal protective equipment (PPE), put significant upward pressure on air freight rates.

Forecasting air cargo is completely different from predicting passenger markets. This is for a number of reasons including the different seasonality between the two sectors, the need to combine weight and volume metrics for cargo, the importance of capacity not only on runways but in the supporting infrastructure and resources required for cargo, and, in the UK, issues around trucking air freight to northern European airports.

A key focus for the CILT is on sustainability and their views were set out in a COP26 Briefing Paper in November 2021. Based on 2019 figures, UK aviation was responsible for 38 $MtCO_2e$ of emissions, around 1% of domestic and 7% of UK transport emissions. CILT believe the key measures to achieve net zero by 2050, which can be applied to air cargo as well as passenger operations, are:

- **Fuel efficiency improvements, overseen by improved ICAO standards**
- **Zero emission aircraft, such as smaller, short haul electric types and larger, long haul hydrogen/ electric-powered**
- **Sustainable aviation fuel**
- **Offsetting, controlled through ICAO's CORSIA agreement**

Additionally, the current NATS airspace modernisation programme is likely to make a considerable impact on reducing aircraft emissions. Airports can also play a role by switching to electric ground vehicles, ensuring buildings are net zero, and making better use of automation and 'big data'.

Many opportunities exist and aviation will see radical change over the next century from new modes of transport, new power sources, and increased efficiency and sustainability. The crisis deriving from the Covid-19 pandemic has stimulated rapid growth in air cargo. Unprecedented growth in e-commerce and the need for rapid deployment of PPE, vaccines, medicines, and medical equipment has driven modernisation and innovation in the sector. However, labour and skills shortages must be addressed if the UK is to maintain its global competitiveness.

Speed is an essential source of competitive advantage and is an important driver for the demand for air freight. Investment in high tech operations and innovations will be paramount to future-proofing the industry. The use of drones and eVTOLs for cargo would transform last mile delivery although brings considerable challenges in terms of technology, air traffic management, safety, and security.

The role of cargo-only aircraft as trailblazers in assessing and enabling the introduction of new propulsion systems, airframe designs, and aircraft types should not be underestimated. Progress is never without apprehension and the freight sector can provide the industry and public with confidence in the innovations and changes that are vital to the future of the planet.

Background

The Chartered Institute of Logistics and Transport (CILT) is a professional institution embracing all modes of transport. Members are engaged in the provision of transport services for both passengers and freight, the management of logistics and the supply chain, transport planning, government, and administration. The Institute's principal concern is that transport policies and procedures should be effective and efficient, based on objective analysis of the issues and practical experience, and that good practice should be widely disseminated and adopted.

The Institute has a number of specialist national policy groups, a nationwide structure of locally based groups, and a Public Policies Committee which considers the broad canvass of transport policy. CILT has previously been active in policy development by responding to consultations, submitting evidence to inquiries, and publishing articles, particularly in the CILT's journal, *Focus*.

This briefing paper has been prepared by Dr Sally Dixon of the CILT's Aviation Policy Group. It is aimed at policy makers in Government, industry, CILT members, and others with a particular interest in UK aviation policy. A particular theme for 2022 across all CILT policy activity is the relationship between policy and societal values, encompassing recovery from Covid, the route to net zero, levelling up, and planning reform.

The role of the key players is explained and key differences between cargo and passenger aviation, whose histories have always been entwined, are highlighted. The terms 'freight' and 'cargo' are often used interchangeably: in this paper the use of cargo refers to goods carried by air whereas freight is generally used to denote the type of carriage.

The first recorded cargo-carrying flight in the UK, from Shoreham (now Brighton City) Airport on 4th of July 1911, carried a box of Osram light bulbs. However, it was not until after the Second World War that the age of air freight began in earnest. This first century of commercial flight has transformed the way we live and how and with whom we conduct business.

The use of air freight was prompted by and was a catalyst for a general worldwide trend towards globalisation, a change in management practices including just-in-time (JIT) and made-to-order models, trade and economic liberalisation between countries, and other political changes including open skies agreements. Now, the growth of e-commerce, the impact of the Covid-19 pandemic and, for the UK, the withdrawal from the EU have created increasing demand for air freight services.

Types of air cargo

Air cargo, goods carried between one point and another in an aircraft, is only one of the various types of cargo, which also include goods transported by road, rail, and sea. Pre pandemic, air cargo accounted for less than 1% of world trade by tonnage[1], some US $6 trillion worth of goods and 35% of the total world trade by value[2]. During the pandemic the percentage of all goods carried internationally by air rose to more than 3%[3]. This included 750,000 tonnes of vital Personal Protective Equipment (PPE) in 2020.

Air freight is vital to the transportation of commodities that are:

- **Perishable such as fruit, vegetables, seafood, and flowers**
- **High value such as precious metals, works of art, jewellery, and currency**
- **Low weight such as IT components and mobile phones**
- **Time critical or have a high business impairment value (where not having the item would incur considerable cost to business) such as medical items (pharmaceuticals, equipment, etc.), and machinery parts where outages would be costly such as for aircraft and telecommunications equipment**
- **Knowledge intensive goods that are heavily based on advanced technological innovations**
- **First to market goods where rapid copying/counterfeiting is the norm, such as launches of fashion apparel**
- **Goods characterised by low demand predictability such as food and equipment required in response to a crisis (natural disaster, war, etc.)**
- **Mail, documents, etc.**

It should be noted that commodities including fruit, vegetables, seafood, flowers, and clothing are sometimes portrayed as luxuries that should not be transported long distances, incurring 'food miles'. While local sourcing may be appropriate in certain situations, some items may only be available in remote locations and their importation brings improved consumer choice. The benefits of air transportation are well documented and importing certain goods may provide essential economic and social benefits to developing countries.

Carriage of cargo

There are two main ways cargo is carried by air; belly hold and dedicated freighter services. Belly hold cargo is cargo stowed under the main deck of a passenger aircraft. By contrast, dedicated freighters carry cargo on specialist aircraft with no paying passengers.

Combi carriers, a combination between passenger and cargo, can carry either passengers or cargo or with a partition in the cabin, a combination of both. During the Covid pandemic, a number of passenger aircraft were converted to use for carrying cargo on the main deck, dubbed 'pfreighters'. In Europe, the European Union Aviation Safety Agency (EASA) has allowed airlines to use passenger aircraft as freighters only until July 31, 2022.

It should be noted that Low Cost Carriers (LCCs) generally do not carry cargo since their reliance on fast turnarounds precludes delays inevitable with the loading, off-loading, and security and customs clearing of goods. Dedicated freighters, carrying cargo only, do not tend to operate a point-to-point, bi-directional service. Whilst scheduled services will operate to a timetable, other services, particularly charters, can 'hop' or 'tramp' from airport to airport, picking up and setting down cargo, as demand requires.

Types of freighter service

Generally, segmentation of air freight falls into three main service sectors:

- **Scheduled freight including general and express freight**
- **Charter freight made up of urgent and/or special handling requirements almost entirely carried on dedicated cargo aircraft rather than as belly freight**
- **Mail**

Other segmentations can include:

- **Belly freight using passenger aircraft**
- **Express freight using freighters**
- **Perishables**
- **Specialist, niche, or heavy freight including dangerous goods and live animals**

Differences between cargo and passenger air transport

Air cargo is generally more complex than passenger transport since it:

- **Involves more players including shippers, forwarders/handlers, airports, airlines, and consignees**
- **Requires more sophisticated processes including security screening, customs clearing, etc.**
- **Constitutes a combination of weight and volume where aircraft have both maximum payloads and space available**
- **Includes varied priority services such as express**
- **Involves both integration and consolidation strategies**
- **Requires multiple and flexible itineraries with cargo aircraft 'hopping' or 'tramping' from airport to airport as demand requires rather than the set schedules used in passenger transport**

Social and economic benefits of air freight

Whilst around only 3% of total cargo by volume travels by air each year, approximately 35% of total cargo by value is air freighted, some $6 trillion worth of goods annually[4]. The commodities transported by air are generally vital to societies across the world. The recent demand for urgent medical supplies during the pandemic highlighted the important role of air freight in meeting the need for vaccines, medicines, and medical equipment.

Air freight is a trade facilitator, being valued for speed, security, and reliability, contributing to global economic development, and creating millions of jobs. For land locked, remote and island nations, air freight is particularly important. Air transport stimulates innovation and has a positive impact on productivity and GDP. Air transportation is also considered a safe mode of transport: accidents and losses are much less likely than with transport by road or sea since airlines and airports operate with high levels of security.

The importance of air freight to economies is increasing for a number of reasons[5]:

- **Firms using Just-in-Time (JIT) methods to reduce inventories use air freight to transport products, components, and raw materials in the fastest and most reliable way.**
- **For perishable and time sensitive items, air freight is the fastest way to transport products to customers to meet their needs and preferences.**
- **Declining costs as a result of liberalisation and technological progress make air cargo logistics more appealing.**
- **Firms with production facilities overseas and global supply chains increasingly rely on air cargo logistics.**
- **The growing importance of e-commerce is allowing firms to sell into global markets, including growing economies such as India and some in Asia, increasing the demand for air freight.**
- **Customers are demanding rapid delivery and return of the products they purchase online.**

Global air freight

Air cargo metrics include value, tonnes carried and available, and revenue. Freight tonne kilometres (FTKs) measure metric tonnes of revenue load carried per kilometre, Cargo Tonne Kilometres (CTKs) includes unaccompanied baggage and mail, Available Cargo Tonne Kilometres (ACTKs) measure available CTKs of the global fleet, and Revenue Tonne Kilometres (RTKs) is the revenue load in tonnes multiplied by the distance flown. However, the volumetric nature of cargo is vital to a full understanding of demand, capacity requirements, and availability. This is particularly pertinent for air cargo, where a combination of weight and volume is necessary to calculate load.

IATA[6] report that air cargo transportation, measured in CTKs, increased by 6.9% in 2021 compared to 2019 (pre-Covid levels) and 18.7% compared to 2020. Since 1990 when IATA began monitoring cargo performance, this increase is second only to the 20.6% gain in 2010. Performance varied around the world, with Middle East-North America, Asia-Africa and Asia-North America routes expanding by 29-39% compared to 2019. Other markets contracted, including the Within South America, which reduced by -38%.

IATA attribute the differences, at least in part, to the availability of cargo capacity. They say that:

"***Markets that were able to use freighters performed in general better than those reliant on belly-hold capacity which was lost with the lack of international widebody passenger flights***[7]."

As examples, IAG Cargo's financial results for 2021[8] showed the company increased revenues by 30% and tonnage increased by 21.4% compared to 2020. They say,

"***The results reflect the surging demand for air cargo capacity as global trade rebounds.***"

Stating that demand for air cargo exceeded 2019 levels throughout 2021. Etihad Airways also registered record cargo results for 2021, with cargo revenues increasing by 49% year on year to $1.7bn with volumes increasing by 26.8% to 729,000 tonnes[9].

World freight figures

Worldwide air freight traffic, despite dipping during the Covid pandemic, has increased beyond 2019 levels. In 2021, over 66 million tonnes of air cargo were transported worldwide, as shown in Figure 1.

The global CTKs for 2021 (and to March 2022) are shown in Figure 2, which highlights that demand for cargo is typically highest around holiday seasons, particularly ahead of Christmas but also with peaks for celebrations such as Valentine's Day, Mothering Sunday, etc. The seasonal pattern of demand for cargo is significantly different from the demand for passenger travel.

Figure 2 shows that seasonally adjusted March 2022 air cargo volumes have been considerably impacted by the conflict in Ukraine and the growing disruptions of Omicron in Asia.

In terms of world figures, Table 1 shows tonnes for 2021 (where available), 2020 and 2019 at the world's busiest airports. Tonnage figures reported by airports includes cargo arriving, departing, and transhipments (arriving and transferring to a different outbound aircraft). Table 1 shows the considerable increase from 2019 (pre-pandemic) figures at all these airports. Hong Kong overtook Memphis to reclaim the number one ranking for tonnage at world airports.

European cargo airports

Table 2 shows the cargo and mail tonnes at the main European airports and the number of all-cargo flights (CATMs), comparing the years 2021, 2020 and 2019. The top three airports, Frankfurt Main, Paris Charles de Galle, and Amsterdam Schiphol remain in the same positions. Leipzig benefited from the conditions created by the pandemic, enabling the airport to overtake London's Heathrow for fourth place in the rankings. After two years of exceptional growth, Liège has also overtaken Heathrow, pushing the London airport to sixth place[10].

Milan Malpensa, which has benefited from a new DHL hub in 2020, three years after FedEx established a facility, saw freight traffic increase by 45% from 2020 and 36% from 2019[11]. Growth was driven by import flows of Covid-related medical devices and the exponential growth of e-commerce products distributed by air[12]. This moved Milan up the rankings to above Brussels although both airports remain some way behind Cologne.

Where other airports in the top European spots tended to increase the tonnage handled during the pandemic, Heathrow's total cargo has reduced from pre pandemic levels. This is probably an indication of the reliance the UK has on passenger belly hold capacity that cannot be replaced easily or quickly by freighters.

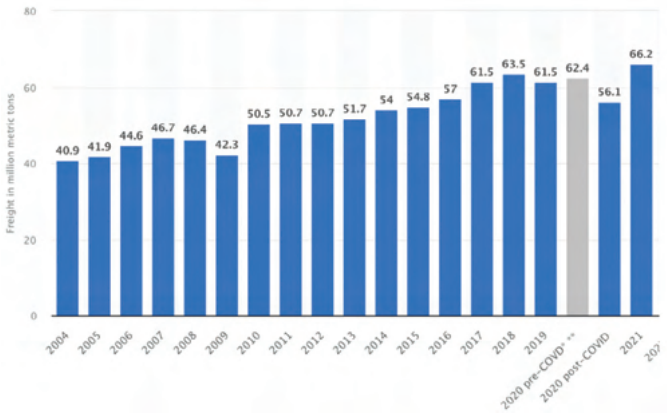


Figure 1. **Worldwide air freight traffic 2004 to 2021**

Source. IATA; ICAO; Airfinance Journal (Airline Analyst); Refinitiv; S&P Global Platts https://www.statista.com/statistics/564668/worldwide-air-cargo-traffic

Figure 2. **CTK levels, actual and seasonally adjusted**

Source. https://www.iata.org/en/iata-repository/publications/economic-reports/air-freight-monthly-analysis---march-2022/

Country	Airport	2021 tonnes ('ooos)	2020 tonnes ('ooos)	2019 tonnes ('ooos)	% change 2019/2021	% change 2019/2020
Hong Kong	Hong Kong (HKG)	5,026	4,468	4,809	4.5%	-7.1%
US	Memphis (MEM)	4,480	4,613	4,323	3.6%	6.7%
China	Shanghai (PVG)	3,983	3,687	3,634	9.6%	1.4%
US	Anchorage (ANC)	3,555	3,158	2,745	29.5%	15.0%
S Korea	Incheon (ICN)	3,329	2,560	2,508	20.4%	2.0%
US	Louisville (SDF)	3,052	2,917	2,790	9.4%	4.6%
Taiwan	Taipei (TPE)	2,812	2,343	2,182	28.9%	7.4%
US	Los Angeles (LAX)	2,692	2,229	2,093	28.7%	6.6%
Japan	Tokyo (NRT)	2,644	2,017	2,103	25.7%	-4.1%
Qatar	Doha (DOH)	2,620	2,175	2,216	18.2%	-1.8%

Table 1. **World cargo airport figures**

Source. https://www.aerotime.aero/articles/28955-top-10-busiest-cargo-airports-world updated with 2021 data from https://aci.aero/2022/04/11/the-top-10-busiest-airports-in-the-world-revealed/

Country	Airport	2021 tonnes ('ooos)	2020 tonnes ('ooos)	2019 tonnes ('ooos)	% change 2019/2021	% change 2019/2020
DE	Frankfurt Main	2,261	1,911	2,089	+8.2%	-8.5%
FR	Paris CDG	2,058	1,740	2,096	-1.8%	-17.0%
NL	Amsterdam	1,680	1,455	1,592	+5.5%	-8.6%
DE	Leipzig	1,587	1,377	1,228	+29.2%	+12.2%
BE	Liège	1,412	1,120	902	+56.5%	+24.3%
UK	Heathrow	1,403	1,146	1,587	-11.6%	-27.8%
LU	Luxembourg	1,088	905	853	+27.5%	+6.1%
DE	Cologne/ Bonn	967	842	799	+21.0	+5.4%
IT	Milan	741	516	558	+32.8%	-7.5%
BE	Brussels	668	512	562	+18.9%	-8.9%
ES	Madrid	483	371	511	-5.5%	-27.4%
UK	East Midlands	423	382	336	+25.9%	+13.6%
UK	Stansted	264	255	224	+17.9%	+13.8%
CH	Zurich	238	182	355	-33.0%	-48.7%
DE	Frankfurt Hahn	227	203	142	+59.9%	+43.0%
DK	Copenhagen	210	160	226	-7.1%	-29.2%
NO	Oslo	176	162	172	+2.3%	-5.8%
AT	Vienna	176	155	221	-20.4%	-29.9%
FI	Helsinki	176	143	221	-20.4%	-35.3%
DE	Munich	173	150	350	-50.6%	-57.1%
IE	Dublin	151	123	133	+13.5%	-7.5%
ES	Zaragoza	137	90	111	+23.4%	-18.9%
PT	Lisbon	133	96	154	-13.6%	-37.7%
NL	Maastricht	128	136	111	+15.3%	+22.5%
ES	Barcelona	109	94	143	-23.8%	-34.3%

Table 2. **Main European airport cargo figures for 2021, 2020, and 2019**

Source. https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do
https://www.liegeairport.com/flexport/en/actualites/2020-was-a-record-year-for-liege-airport-confirming-its-key-role-as-a-health-airport/ for Liège CAA figures for UK airports

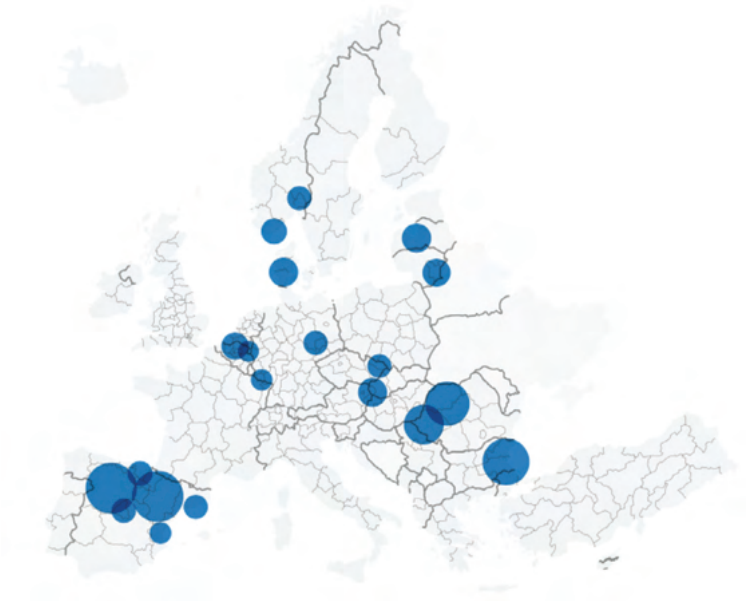


Figure 3. **Fastest growing European air cargo hubs**

Source. https://cpcases.com/news/europes-biggest-freight/

In terms of growth between 2019 (pre-Covid) and 2021, the top five airports are Frankfurt Hahn (59.9%), Liège (56.5%), Milan (32.8%), Leipzig (29.2%), and Luxembourg (27.5%). East Midlands Airport recorded 25.9% growth, putting it in six place in terms of growth.

Figure 3 shows the top 20 growing European hubs for freight and mail by tonnes per year. The data refers to 2008 to 2018 so is pre pandemic and requires updating. However, the figure shows that several countries, notably Spain, are developing rapidly to become important hubs for European freight processing. Airports in Norway, Bulgaria, Romania, Latvia, Lithuania, and Slovakia have also shown growth over this period. In the UK, whilst East Midlands remains the second biggest cargo airport in the country behind Heathrow, as discussed elsewhere in this report, the UK does not compete in terms of air freight growth.

The role of freight forwarders and integrators

There are generally two models of air freight: air freight forwarding and integrated air freight. Figure 4 shows the door-to-door air freight value chain from its origin with the shipper to its destination with the consignee. The customer contracts with either an integrated carrier (such as FedEx, UPS, DHL, etc.) or a freight forwarder. More recently and perhaps increasingly, airlines are examining the potential to increase their offering by moving away from simply providing airport-to-airport services. Further detail is provided on page 20.

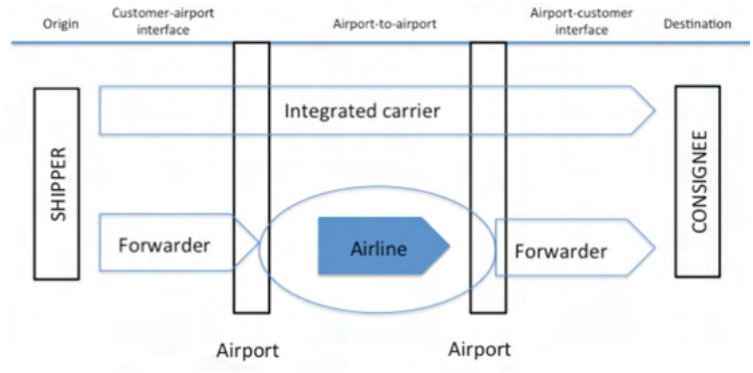


Figure 4. **The door-to-door value chain**

Air freight forwarders

Freight forwarders are organisations that provide services to shippers and importers. Originally freight forwarders received a consignment of freight from a shipper and arranged its routing, transportation handling, and documentation to either the final receiver or to a foreign airport, without owning the vehicles (trucks or aircraft) involved. In more recent years, the role of the forwarders has developed with the largest companies now describing themselves as logistics providers.

Freight forwarders purchase services – the carriage of goods – from airlines. These services are generally not available direct to businesses or the public. As such, forwarders are intermediaries who act on behalf of importers and exporters to move goods between locations. As businesses, freight forwarders can be highly differentiated and exceptionally specialised. For example, Sound Moves/Rock-It Global is a forwarder specialising in moving equipment and staging for live music and events around the world.

A recent article in the Loadstar[13] highlighted how forwarders are increasingly taking control of their air freight needs through long-term charter deals. This may not be simply in response to capacity issues and high rates but to improve service to customers.

Integrators

Integrated carriers such as DHL, UPS, and TNT have successfully competed with freight forwarders to acquire significant air freight market share by providing door-to-door services. Integrators do this by using their own road transport, handling, transit warehousing facilities, and aircraft. Since they own the assets involved, integrators can move large volumes of goods over global routes quickly, often at premium rates.

Integrators mainly use dedicated freighter aircraft although they may buy capacity on passenger aircraft. Originally branded as express operators, they now compete more directly with freight forwarders. The largest integrators, DHL and UPS, rank in the top five in terms of tonnes carried per year. Table 3 shows the world's top 30 air freight forwarders by tonnes for 2021 and 2020.

Table 3 highlights that none of the top forwarders are headquartered in the UK.

Rank	Air freight forwarder	Headquarters	2021 tonnes ('ooos)	2020 tonnes ('ooos)
1	DHL Supply Chain & Global Forwarding	Germany	1,795	2,051
2	Kuehne + Nagel	Switzerland	1,418	1,643
3	DSV Panalpina	Denmark	1,272	1,071
4	DB Schenker	Germany	991	1,162
5	UPS Supply Chain Solutions	USA	966	966
6	Expeditors International of Washington	USA	841	955
7	Apex Logistics International	Hong Kong	750	520
8	Nippon Express	Japan	720	753
9	Hellmann Worldwide Logistics	Germany	587	587
10	Bollore Logistics	France	574	634
11	Kintetsu World Express	Japan	567	601
12	Sinotrans Ltd	China	502	530
13	Kerry Logistics	Hong Kong	494	453
14	Ceva Logistics	Switzerland	440	477
15	Agility Logistics	Kuwait	415	415
16	Crane Worldwide Logistics	USA	337	337
17	Yusen Logistics	Japan	337	380
18	Dachser SE	Germany	330	345
19	Geodis	France	308	363
20	FedEx Logistics	USA	262	276
21	NNR Global Logistics	Japan	245	260
22	Pilot Freight Services	USA	240	230
23	C.H. Robinson Worldwide	USA	225	210
24	Hitachi Transport System	Japan	221	538
25	AWOT Global Logistics Group	China	220	158
26	Dimerco Express Group	Taiwan	200	213
27	Logwin AG	Luxembourg	180	180
28	Cargo-Partner	Austria	172	173
29	Trinity Logistics USA	USA	164	164
30	Damco/Maersk Logistics	The Netherlands	158	158

Table 3. **Top air freight forwarders for 2021**

Source. https://www.ttnews.com/top50/airfreight/2020 and https://www.ttnews.com/top50/airfreight/2021

Cargo airlines

Boeing, in their Air Cargo Industry Overview[14], provide four categories of air cargo operators. These are:

- **Belly-only operators who provide cargo capability within their existing passenger networks**
- **Cargo specialists who provide dedicated main-deck freighter capability for general freight, charter operations, and specialised loading and carriage capabilities**
- **Combination carriers who use both dedicated main-deck freighters and belly capacity, particularly to and from home markets and hubs**
- **Express carriers who operate main-deck freighter fleets, providing time-definite services as well as general air cargo capability**

Passenger aircraft belly hold configuration

Passenger aircraft have cargo (and baggage) holds beneath their main deck as shown in Figure 5. The figure shows a widebody aircraft but is similar for narrow bodies. For all but the smallest aircraft, cargo is carried in Unit Load Devices (ULDs), numbered as LD (for Lower Deck) together with an indication of size. For example, an LD3, as shown in Figure 6, is designed to be loaded onto the lower decks of aircraft such as Airbus A300, A310, A330, A340, A380, B747, B767, B777, B787.

All cargo aircraft configurations

All-cargo airlines configure their aircraft specifically to load, carry, and unload cargo. This means the aircraft have large doors for loading and unloading, which may be at the front (shown in Figure 7), rear and/or side, no seats but an empty galley that can be configured for various types of cargo, no windows or emergency exits as these are unnecessary, and particular flooring with rollers and latches to hold down crates (shown in Figure 8).

All cargo percentage ofglobal CTKs

Figure 9 shows the global percentage of scheduled Cargo Tonnes-Kilometres (CTKs) for 2021. Routes travelling east/west and west/east account for the bulk of CTKs.

Cargo airline rankings

IATA produce rankings for cargo airlines by scheduled CTKs. Table 4 shows the ranking and CTKs in millions for both international and domestic figures combined for 2020 compared to 2019. In terms of international CTKs, Qatar Airways ranks top, followed by Federal Express, Emirates, Cathay Pacific, and Korean Air. Federal Express rank first for domestic CTKs, followed by UPS, Air Transport International, Atlas Air and China Southern Airlines.

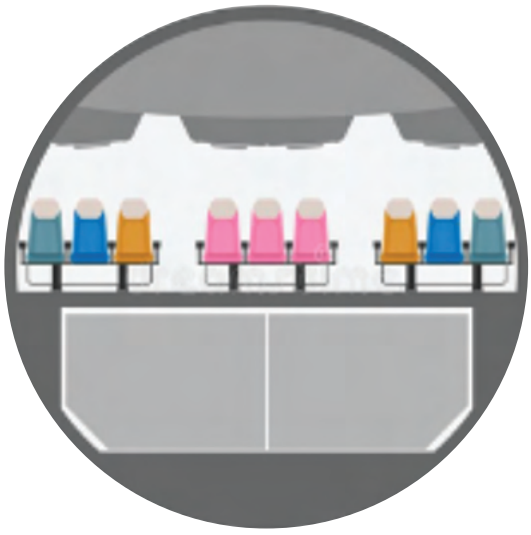


Figure 5. **Typical passenger aircraft cross section**
Source. Dreamstime.com

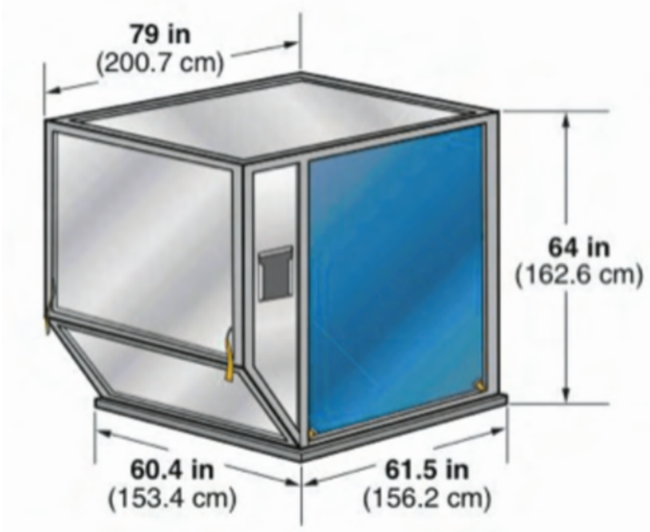


Figure 6. **LD3 specification**
Source. https://uldcare.com/uld-tools-and-solutions/uld-types/

Figure 7. **Cargo aircraft loading doors**

Source. https://www.youtube.com/watch?v=UFW-M1Xbx0U

Figure 8. **Cargo aircraft main deck**

Source. Lufthansa Cargo AG

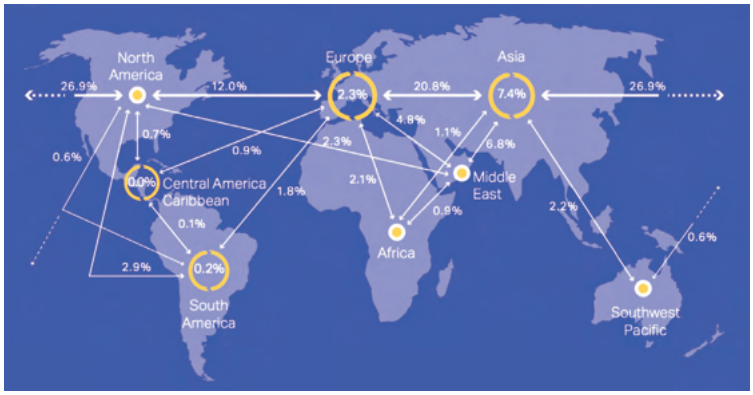


Figure 9. **2021 percentage of international scheduled CTKs**

Source. https://www.iata.org/contentassets/a686ff624550453e8bf0c9b3f7f0ab26/wats-2021-mediakit.pdf

IATA append several notes to the collection of their data, which are available from the source link on page 24.

CAA data[15] shows the total tonnes of freight through UK airports by nationality of the operator. In 2021, of the total 2.32 million tonnes set down and picked up, around 750,000 (32%) was carried by UK operators, 324,000 (14%) by other EU operators, and 1.25 million tonnes (54%) by other overseas operators.

IATA describes the 2020 decline in demand for some airlines as due to supply chain disruption caused by strict pandemic lockdowns, a lack of belly cargo capacity, and the impact of lockdowns on demand. For example, British Airways reduced CTKs by around 35% in 2020 compared to 2019 figures, from 4.21 billion to 2.72 billion[16]. However, some airlines, notably FedEx and UPS, increased CTKs as shoppers switched to online purchasing.

By freight tonnes carried (rather than CTKs), IATA figures for the top 10 cargo airlines in 2021 are shown in Table 5. The figures for freight tonnes show Federal Express lead the board by a considerable margin across international and particularly domestic scheduled freight tonnes carried. None of the airlines shown in Table 5 are UK-based.

Whilst British Airways, as part of the IAG Group (International Consolidated Airlines Group S.A.), is now an Anglo-Spanish airline, it plays a key role in transporting belly hold cargo to and from the UK. BA World Cargo, the dedicated freighter arm of BA, is now part of IAG Cargo[17]. However, BA do carry belly hold cargo and Figure 10 shows tonnage carried since 2014. The pandemic dramatically increased tonnes carried during 2020 when the airline began using passenger aircraft to carry cargo.

The UK has relatively few substantial air cargo carriers. Figure 11 shows the amount of cargo, measured in tonnes, on airline cargo services based in the UK carried in 2020. The figure for BA will reduce post pandemic, when the airline returns to belly hold-only carriage of cargo on passenger flights.

The UK's only maindeck freighter airline is CargoLogicAir Ltd based at Heathrow Airport. CargoLogicAir's majority shareholder is Alexey Isaykin, an ex-Soviet Russian military colonel. Mr Isaykin has Cypriot residency, and the airline was unaffected by sanctions on Russia although he resigned as Director in June 2022. In 2020, the company reduced its fleet from four and now has two modern, nose-loading B-747-400ERF freighters. Having suspended its Air Operating Certificate for a short period for significant restructuring, the company relaunched operations in April 2020, coinciding with the Covid pandemic. In 2020, CargoLogicAir carried 34,551 tonnes.

Rank	Cargo airline carrier	2021 tonnes ('ooos)	2020 tonnes ('ooos)
1	Federal Express	19,656	17,503
2	UPS	14,371	12,842
3	Qatar Airways	13,740	13,024
4	Emirates	9,569	12,052
5	Cathay Pacific Airways	8,137	10,930
6	Korean Air	8,104	7,412
7	Cargolux	7,345	7,180
8	Turkish Airlines	6,977	7,029
9	China Southern Airlines	6,591	6,825
10	China Airlines	6,317	5,334
11	Air China	6,121	6,767
12	Atlas Air	5,458	4,522
13	Kalitta Air	5,211	3,593
14	Aerologic	4,870	3,581
15	Lufthansa	4,828	7,226
16	AirBridgeCargo Airlines	4,609	5,168
17	Singapore Airlines	4,156	6,146
18	United Airlines	3,950	4,852
19	EVA Air	3,888	-
20	Asiana Airlines	3,601	3,567
21	Polar Air Cargo	3,478	3,809
22	Ethiopian Airlines	3,394	-
23	All Nippon Airways	3,172	4,389
24	KLM	3,025	3,609
25	Silk Way West Airlines	2,876	-

Table 4. **Top cargo airline carriers by CTKs**

Source. https://www.iata.org/contentassets/a686ff624550453e8bf0c9b3f7f0ab26/wats-2021-mediakit.pdf

	International		Domestic		Total	
Rank	Airline	Tonnes ('ooos)	Airline	Tonnes ('ooos)	Airline	Tonnes ('ooos)
1	Federal Express	2,555	Federal Express	5,454	Federal Express	8,009
2	Qatar Airways	2,329	UPS	3,512	UPS	5,064
3	Emirates	1,814	Air Transport International	790	Qatar	2,329
4	UPS	1,552	SF Airlines	698	Emirates	1,814
5	China Airlines	1,550	China Southern Airlines	597	China Airlines	1,550
6	Korean Air	1,500	Air China	542	Korean Air	1,530
7	Turkish Airlines	1,421	Atlas Air	514	Turkish Airlines	1,460
8	Cathay Pacific Airways	1,220	China Eastern Airlines	460	Atlas Air	1,366
9	Asiana Airlines	880	Kalitta Air	452	Kalitta Air	1,290
10	Cargolux	858	Hainan Airlines	306	China Southern Airlines	1,186

Table 5. **Top cargo airline carriers by scheduled freight tonnes carried in 2021**

Source. https://www.iata.org/contentassets/a686ff624550453e8bf0c9b3f7f0ab26/wats-2021-mediakit.pdf

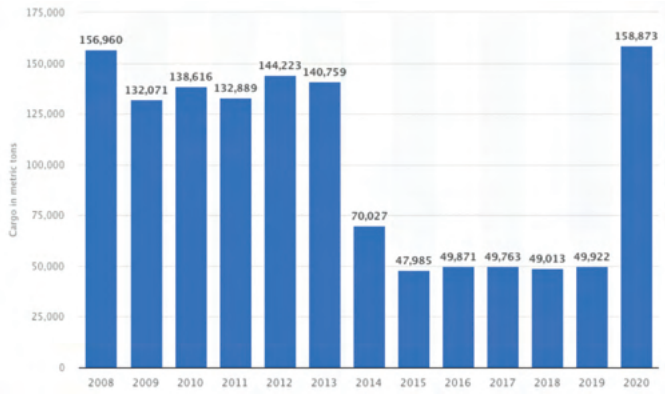


Figure 10. **British Airways plc cargo uplift in tonnes from 2008 to 2020**

Source. https://www.statista.com/statistics/309506/british-airways--uk-freight-cargo

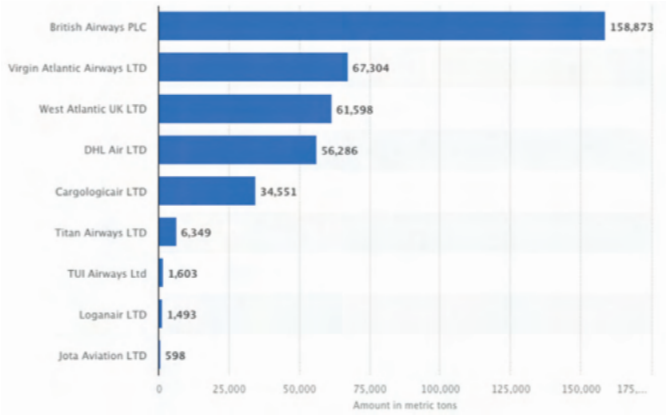


Figure 11. **Cargo uplifted by UK-based operators in 2020**

Source. https://www.statista.com/statistics/1023060/tonnes-of-cargo-uplifted-by-uk-freight-airlines/

However, on the 10th of May 2022, CargoLogic Germany, which is wholly owned by UK-registered CargoLogicAir, was declared bankrupt after it was banned from European airspace in March 2022[18].

West Atlantic UK Ltd (formerly Atlantic Airlines), headquartered in Coventry, is based at East Midlands Airport and operates with B-737-300/400/800 and ATR-72 aircraft. The UK company is part of the merged entity West Atlantic AB, headquartered in Sweden. In 2020, West Atlantic UK carried 61,598 tonnes.

Cargo airline relationship with forwarders

Whilst airlines can offer freight services direct to customers with, in theory, a higher margin than involving air freight forwarder 'middlemen', they rarely do. Instead, their main relationship is with freight forwarders, with whom they generally have, "*a 'love and hate' relationship*"[19]. However, it may be that:

"***the attraction of the narrow product offering of many airlines – airport-to-airport – is waning and other sectors are looking at creating a more integrated logistics strategy for air***"[20].

As Zhen Li found in extensive research in 2018, freight forwarders consistently capture around 75% to 80% of the value from the air freight chain, defining how much exchange value is charged to the customer[21]. Perhaps in response, some air cargo carriers with scheduled services hold weekly capacity auctions (such as at New York's JFK airport and Chicago O'Hare International Airport), where forwarders and integrators bid for space. This has been disrupted by the Covid pandemic but can be expected to be reinstated.

A number of vertical and horizontal acquisitions have taken place in the sector. This includes Amazon's purchase or lease of almost 100 aircraft, and a number of shipping lines obtaining aircraft to become 'shipping-airlines'. For example, Maersk with its estimated 70,000 shipping customers, now has an airline subsidiary, Star Air. In Asia, Evergreen, who operate a fleet of container ships with a combined capacity of more than 1.2 million TEU and maintain services across a broad array of global trade lanes, own EVA Airways, a Taiwanese international airline with around 90 aircraft.

While some very large forwarders believe shippers are not looking for a one-stop air freight shop (which would perhaps drive customers to integrators), it does seem customers are looking for speed, transparency, quality, and sustainability, at a bearable cost.

Rates and revenues

Until the pandemic, airlines have:

"*allowed cargo to be no more than a contribution to the fixed costs of a passenger flight. They have shown little or no interest in the ultimate customers' needs, and appeared to have learned little from the market share-eating integrator entrants.*"[22]

Boeing, in their 2016-2017 World Air Cargo Forecast[23], noted that airlines operating freighters generate 90% of the industry's revenues, with all cargo and passenger belly generating 10% each, as shown in Figure 12.

During the pandemic, the lack of air freight capacity meant that rates and revenues rose to exceptional levels, as shown in Figure 13. IATA[24] note that:

"*In 2019, air cargo rates and revenues had fallen due to the impact of global trade wars on the demand for goods. In 2020, the lack of cargo capacity compared to the resilient demand for goods, the congestion at airports and other parts of the supply chains, also combined with the need for rapid e-commerce shipments and transport of personal protective equipment (PPE) put significant pressures on air freight rates.*

They increased dramatically during the peak of the supply chain disruption from March to May 2020 and moderated somewhat during the middle of the year, before climbing again during the peak cargo season in Q4. As a result, air freight rates were 55.9% higher in 2020 overall compared to 2019, at 2.79$/kg.

Combined with the relatively resilient outcome in air cargo volumes (down 9.1% year-on-year in 2020), this means revenues from transporting goods by air rose by 27.2% in 2020. At $128.2bn, this is a new all-time high. This far from offsets the fall in passenger traffic, but still provides needed support to airlines that were able to operate cargo flights." (Page 6)

It should be noted that air cargo rates for goods (not entire aircraft) are generally quoted as £/$ per kilogram. They may also include a measure of volume (length x width x height). As with Royal Mail stamps and other surface carriers, they do not generally include mileage although the route will impact the rate charged.

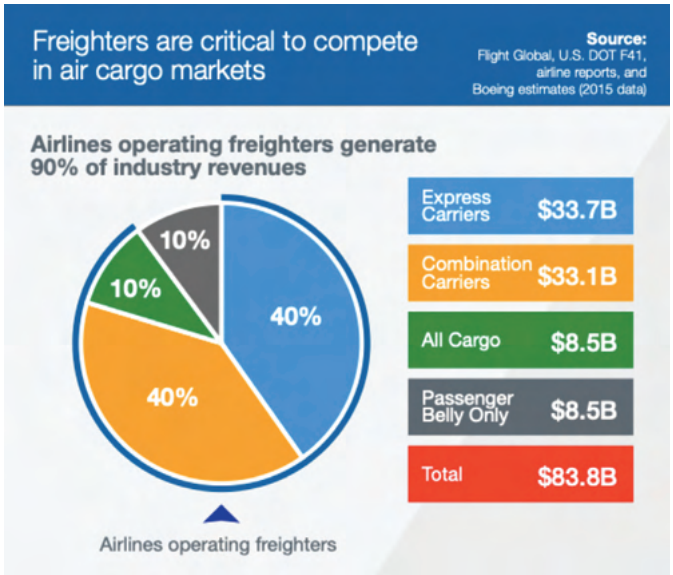


Figure 12. **Cargo industry revenue generation**

Source. https://www.boeing.com/resources/boeingdotcom/commercial/about-our-market/cargo-market-detail-wacf/download-report/assets/pdfs/wacf.pdf (page 3)

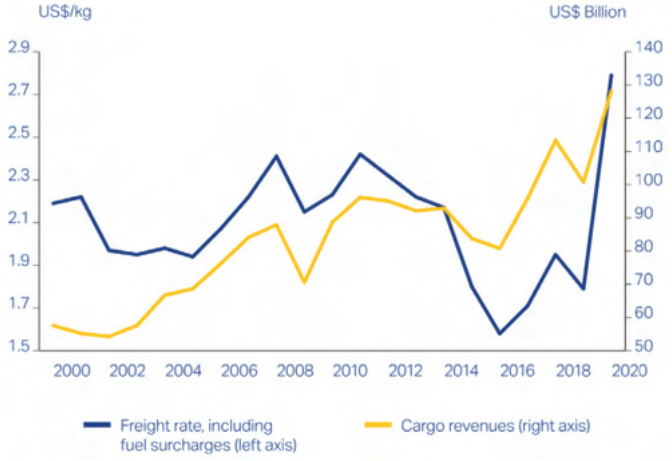


Figure 13. **Air cargo rates and revenues**

Source. IATA, CargoIS, The Airline Analyst https://www.iata.org/contentassets/a686ff624550453e8bf0c9b3f7f0ab26/wats-2021-mediakit.pdf (page 6)

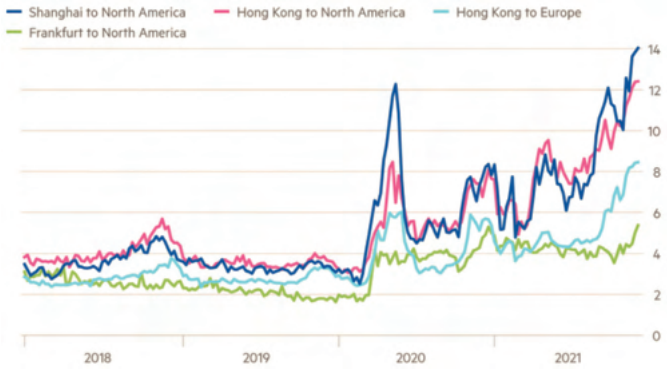


Figure 14. **Air freight rates 2018 to 2021**

Source. https://www.ft.com/content/15b44fc9-5f86-4b28-ae05-a3233db13977

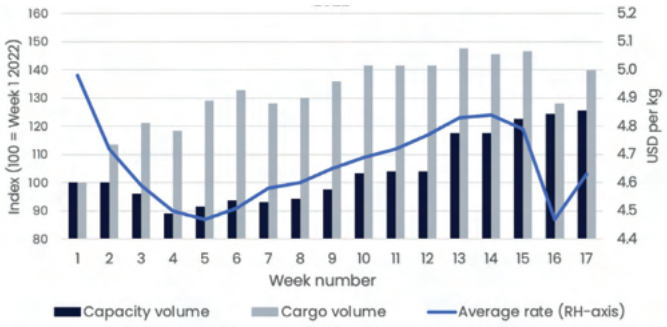


Figure 15. **Air freight capacity, volumes, and average rates for 2022**

Source. https://theloadstar.com/airfreight-rates-soften-as-bellies-bounce-back-on-the-atlantic/

Average air freight rates

The pandemic created huge capacity shortages for cargo as passenger flights reduced, removing considerable belly hold capacity. In December 2021, prices on routes from Shanghai to North America reached $14 per kilogramme for the first time, an increase from $8 at the end of August and above the previous high of $12 in early 2020 as the pandemic first hit supply chains. There were similar rises from Hong Kong to Europe and the US, and on transatlantic routes between Frankfurt and North America[25]. Average air freight rates for 2019 to 2021 are shown in Figure 14.

Since the end of March 2022 and the increase in passenger flights, capacity over the transatlantic is now higher than pre-pandemic levels. This has led to a reduction in rates, as shown in Figure 15 (note that week 17 is end April 2022). Extra capacity has lowered dynamic load factors from the beginning of the year on routes from western Europe to North America, although Xeneta data shows there was a small increase from 63% to 67% in the last week of April. Other trade lanes, who have yet to recover capacity, have experienced higher load factors.

However, the impact of conflict in Ukraine, Covid-related safety measures in China, the higher cost of living, and staffing shortages are continuing to put pressure on the sector.

According to Xeneta:

"***As of the end April (week 17), shippers from Europe to the US are reporting an average short term rate of $4.10 per kg. Long-term rates have not yet followed the same downward trend as the spot market and, on 30 April, the average rate for long term contracts signed in the past three months was more than $1.70 per kg higher than the average short-term rate, at $5.90 per kg. Early indications show a softening in both rates in early May.***"[26]

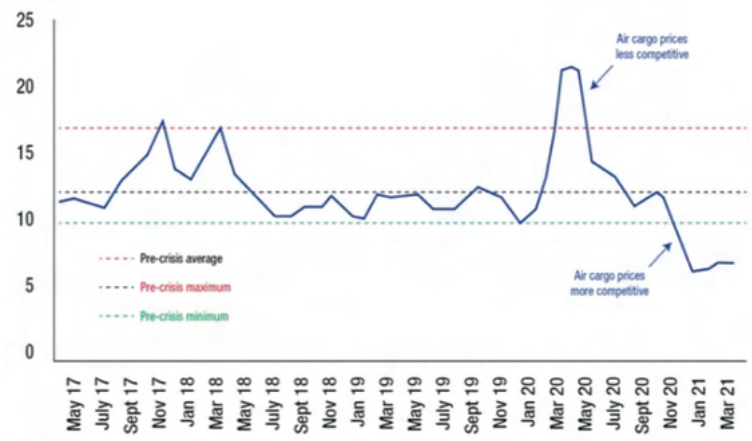


Figure 16. **Ratio of chargeable weight rates per kg for air cargo and ocean container transport**

Source. https://www.reedsmith.com/en/perspectives/global-air-freight/2022/01/impact-of-covid19-on-cargo-related-claims

Air freight to ocean shipping comparison

Ocean shipping has and continues to suffer considerable constraints including the blockage of the Suez Canal in March 2021, record-breaking shipping rates, backlogs of vessels waiting outside ports, and pandemic-related shutdown of ports. These issues have driven the average cost of shipping a 40-foot-equivalent unit to more than $10,000, around four times higher in 2021 than in 2020[27].

Figure 16 shows the comparison between ocean container shipping and air freight. 2019 pre-pandemic ratios show air cargo was around 12 times more expensive than ocean freight.

Air freight prices rose significantly in April 2020 during the early stages of the pandemic when belly hold capacity declined. However, container freight rates increased dramatically between January 2019 and March 2022 with 2021 a year with a particularly steep increase in global freight rates[28]. This altered the ratio between the two modes of transport such that air cargo became much more competitive compared to container shipping, as shown in Figure 16.

All-cargo freighters vs belly hold cargo

Averaged across the world, the carriage of cargo by air is split fairly evenly between belly hold and freighters. However, there are considerable differences between regions, as shown in Figure 17. In terms of financial returns, freighter operators, who offer a higher value of service, generate nearly 90% of the total air cargo industry revenue[29].

UK inconsistency with rest of world

In the UK, the pre-pandemic belly hold/all cargo ratio was quite different from the global picture at around 70/30, or indeed almost 80/20 in some years (excluding the pandemic), in favour of belly hold. The Covid crisis highlighted the importance of dedicated freighters and in the UK the CAA report that cargo carried on freighters in 2021 was 1.6 million tonnes, up 87% on 2019 pre-Covid figures[30]. The UK 2021 ratio for belly hold/all cargo freighters was around 35/65.

Most of the UK's belly hold cargo is transported through London's Heathrow Airport. Various reasons have been suggested for why the UK is out of step with the rest of the world. These include the positive benefit of Heathrow's connectivity and/or the negative impact of capacity constraints in the London airport system, particularly as it affects cargo. Further details are provided on page 33.

Cost comparisons

The cost of moving goods by air transported as belly hold in passenger aircraft can frequently be more competitive than dedicated cargo airlines. This is because belly freight, as surplus capacity, can be sold at marginal cost with operating costs allocated to passenger services.

However, there is a general misconception regarding pricing differences between belly hold and all cargo carriage, since pricing is market driven and dependent upon availability and demand for space. This means that for some thick routes, particularly between the UK and USA, space in belly hold is at a premium and rates can be especially high. Since demand often exceeds available capacity, cargo can get 'bumped' – refused loading even though it may be pre-booked. This seems to disproportionally affect smaller shippers, as major customers get priority with airlines.

Compared to sea shipping, air cargo prices in 2021 were around six to eight times higher than sea freight, much lower than the 2019 price differential of 11 to 15 times[31]. Although shipping rates are expected to reduce, the price difference between air and sea modes is expected to continue to be closer than in the past.

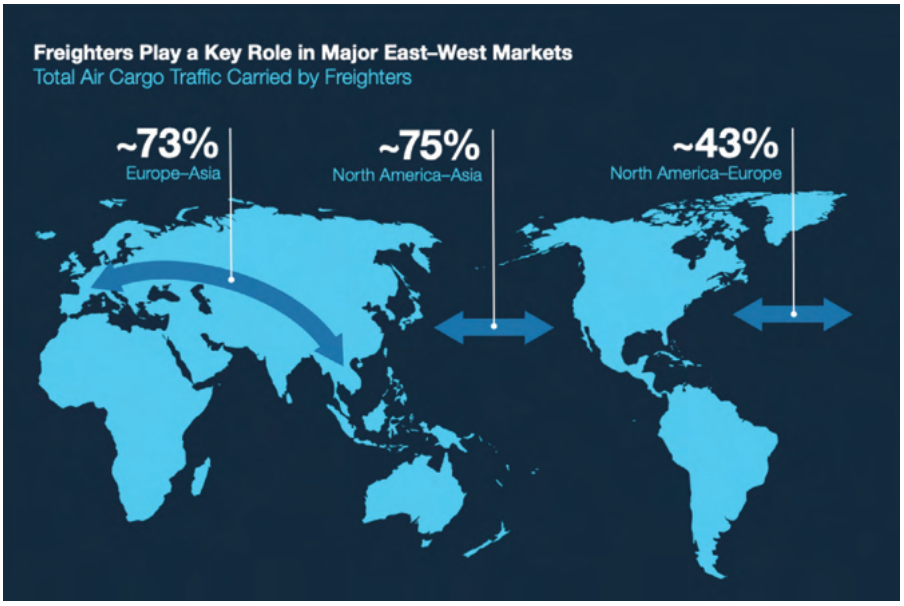


Figure 17. **Air cargo traffic carried by freighters by percentage**

Source. https://www.boeing.com/resources/boeingdotcom/market/assets/downloads/2020_WACF_PDF_Download.pdf (page 9)

Dedicated freighter markets and advantages

Whilst some freighters, usually scheduled operations, do operate simple round trips, the data shows that inbound patterns do not necessarily mirror outbound patterns. This provides flexibility to add new pick up/drop off points as the market dictates. By contrast, belly freight is not necessarily forwarded on single passenger flights and may take a route involving a series of airports. This adds air miles, additional fuel, and intermediate airport handling to overall forwarding costs and impacts.

The global Covid pandemic has shown that, whilst cargo may have played second fiddle to the passenger market in previous years, it has been a lifeline for airlines during these last two years. The freighter fleet grew by 12% in 2020 and cargo growth was 13% in 2021[32]. Indeed, Boeing[33] says that:

"***freighters will remain the backbone of the world air cargo industry.***"

This is for the following reasons:

- **Most passenger belly capacity does not serve key cargo trade routes**
- **Twin-aisle passenger schedules often do not meet shipper timing needs**
- **Freight forwarders prefer palletised capacity, which is not available on single-aisle aircraft**
- **Passenger aircraft belly hold cannot serve hazmat and project/outsize cargo**
- **Payload/range considerations on passenger aircraft may limit cargo carriage**

Dedicated freighters offer significant advantages to shippers, including:

- **More predictable and reliable volumes and schedules than passenger belly hold**
- **Greater control over timing and routing**
- **The potential to handle outsize cargo and hazardous goods**

Freighter conversions

Passenger aircraft have long been converted to use as freighters, particularly once newer models become available. However, during the pandemic, when passenger travel was much reduced and airlines grounded large parts of their fleets removing considerable belly hold capacity, the demand for freighters increased dramatically.

Initially, as an immediate response to the capacity shortage caused by the pandemic, a number of passenger aircraft were converted to 'pfreighters'. These aircraft carried goods (netted but generally not palletised or in ULDs due to loading and space constraints), on the seats of passenger aircraft or had their seats temporarily removed. This was particularly driven by the need to move PPE and essential equipment and supplies.

Aircraft are converted by removing seats, bathrooms, and galleys, and plugging windows – cargo aircraft can easily be identified by their plugged potholes. The fuselage is stripped back, including removal of floor cladding and internal partitions, to allow for cargo-specific modifications. Passenger aircraft have several small doors for customers and larger access for belly hold cargo, whereas cargo aircraft require large doors for loading and unloading pallets. These changes – removing and creating access – as well as strengthening and adapting the floor to load and take the weight of pallets/ULDs, can take around four months to complete, depending on the aircraft type.

It is likely the strong demand for new and converted freighter aircraft will continue beyond the Covid pandemic, driven particularly by the growth in e-commerce. For example, Asia is expected to account for 57% of global e-commerce logistics market growth between 2020 and 2025[34] and this is expected to drive global aviation growth.

Additionally, shippers have grown accustomed to the reliability and speed of dedicated air cargo operations. This demand is coupled with aircraft operators moving to 'green' their business by introducing newer, more environmentally friendly aircraft to their fleet. These impacts together have created considerable demand for both new aircraft and for passenger aircraft conversions for freighter use.

Air freight trucking

The role of road transport in air freight networks, sometimes refered to as airline trucking or Road Feeder Service (RFS), is a largely obscure element in logistics models. RFS refers to trucks, often bonded, that are allocated an airline code and operate between airports.

In Europe, considerable air freight trucking takes place to and from the UK but may also be noticeable elsewhere in Europe where there is high dependence on belly hold capacity including France and Scandinavia. The dramatic reduction in belly hold capacity, increasing global air cargo volumes, and driver shortages have put strain on the RFS sector since the pandemic[35].

Trucking vs short haul flight

The short haul belly freight market has historically been extremely price sensitive, with airlines competing with trucking companies for loads. Whilst price may be one of the determinants for cargo destined to travel as belly freight, trucking to and from passenger hub airports may also be linked to shippers' preference (including the location of their hubs, if relevant), the availability of capacity on routes (particularly 'thick' or busy routes such as UK/US), and to lack of airport capacity (which includes all infrastructure and not just runway capacity).

Aside from price, speed is a key determinant for choice of transportation method. Whilst flying is undoubtably the fastest means of transportation, it should be noted that compatibility issues can arise in transhipments. The time taken to transfer cargo from a widebody long haul aircraft at a hub airport to a 'feeder', short haul aircraft (narrow body aircraft used to transfer cargo from hubs to other airports) and vice versa may be considerable and this needs to be considered in determining the speed differential between trucking and flying. However, legacy equipment and practices at airports may be unnecessarily exacerbating transhipment times, impacting the choice to truck.

For the UK market, air cargo trucking to and from the UK to join flights at northern European airports can add to overall delivery times. Delays at the Channel Crossings, due to strike action, paperwork issues at the border between the UK and the EU, poor weather, and other maritime issues all impact overall delivery times. As a recent example, the problems associated with laying off almost 800 P&O crew has resulted in long and potentially ongoing delays to crossings and reduced capacity on the Short Straits.

For cargo that will be flown on dedicated freighters, the decision to truck to or from a northern European airport is likely to be due to airport capacity constraints (prior to the pandemic). Capacity includes runway slots, storage and handling facilities and equipment, and staff. Ultimately, time and cost added to transportation to and from the UK result in economic losses for British businesses.

Availability of data

The lack of publicly available statistical data differentiating air freighter and RFS and other truck operations makes analysis difficult. Road transport can be complementary to air freight, linking the shipper with freight airports and freight airports with the consignee. RFS can also act as a replacement for freighter flights with trucks given an airline code and customs cleared.

Oxford Economics discussed this issue nearly a decade ago (before the economic and air freight recovery), saying:

"***In all likelihood, short-haul cargo may have fallen due to both capacity constraints at Heathrow and freight forwarders substituting road or rail transport for short-haul destinations. Which phenomenon is more important? Volumes of short-haul cargo peaked around the time the Channel Tunnel opened in 1994 and have fallen ever since. Therefore, this hints that much of the decrease in short-haul volumes may be due to the lower-cost option of truck transport to continental Europe rather than capacity constraints at London area airports.***" (Oxford Economics, 2013, p. 16)

By contrast, the dedicated air cargo market is mainly used for long-haul services where trucking can only be to and from an airport and is not a substitute for transportation by air.

Calculating air freight trucking tonnage

Estimating the scale of air freight trucking is no easy task. Whilst calculations and forecasts from various analysts differ, all indicate that the scale of air freight trucking is considerable.

Capacity constraints such as HGV parking facilities in the event of disruption to crossings have been a concern for some years. Operation Stack, which has been used since 1996, closes the coast-bound side of the M20 in Kent to traffic in order to park trucks waiting to cross the Channel. Hauliers have experienced significant delays due to the migrant situation in Calais, bad weather, industrial strikes in France, and now problems after Brexit.

A review of RFS airline schedules in 2018 showed that, over a year, RFS movements across the Channel to European airports could amount to around 41,800[36]. This figure was validated by the Airline Operators Committee at Heathrow[37], where they believe around 100 to 125 export RFS trucks per day and approximately the same for imports, connect with the airport. This equates to between 36,500 and 45,625 truck movements each way per annum.

Whilst the average payload is unknown, at an average of only 10 tonnes per truck this equates to some 800,000 tonnes per year. Although this situation is likely confined to Heathrow since it affects belly hold operations only, the movements and tonnage figures could be considerably higher.

The role of airports

Aside from a relatively few specialist facilities, many airports have, until the pandemic, considered freight operations as secondary. Airports are infrastructure-intensive businesses with a high ratio of fixed costs and their focus on passenger transportation may be due to airport management's better understanding of this market.

Aside from runway and operational charges (landing fees, the sale of fuel, and air traffic control), the revenue streams associated with passenger markets are various and include passenger processing (baggage handling and security), charges for dropping passengers at the terminal, use of baggage trollies, retail, hospitality, fast track security, as well as other land and property use income streams such as for parking and hotels.

Airport freight strategy

For airports, the cargo business model is rather different and perhaps less widely understood. In terms of revenues, landing fees are calculated by aircraft weight and freighters generally deliver more tonnage than passenger aircraft. For example, an Airports Council International (ACI) report for North America in 2019 highlights that:

"***landing fees (by aircraft weight) on freighters deliver more tonnage than passenger flights, up to 75% more for a B-747-8F vs. a 747-8I, for example***".[38]

For airport property and land use strategy, handling and warehousing activities use considerable space and generate associated incomes. As the air freight model changes across the supply chain, all parties will have to strive to deliver rapid service to their customers. Whilst the role of the airline – to fly between airports – may not change, improvements on the ground and in the onward logistics will be crucial[39] and airports will need to understand and react to the need to provide competitive advantage.

Since privatisation in the UK, some major airports sold off their cargo facilities. For example, in 2010, BAA, a Ferrovial subsidiary, sold its stake in Airport Property Partnership (APP) to UK company SEGRO for £244 million. The sale comprised a total built area of around 380,000 square metres, some 18 buildings, mainly warehouses and cargo assets at Heathrow, Stansted, Edinburgh, and Gatwick airports. The sale was, "*part of the company's strategy of divesting non-strategic assets*".[40]

Heathrow Airport's cargo facilities

As the UK's busiest freight airport, Heathrow handles more than 1.5 million tonnes of cargo each year of which around 95% is usually carried as belly hold on passenger aircraft (based on 2019 pre-Covid figures). Since the sale of Heathrow's cargo facilities, SEGRO Airside Heathrow covers 112,266 square metres on the airfield[41]. In 2019, the layout of the cargo facility, which has been much criticised for its inability to respond to demand and the way cargo is handled, particularly congestion at the 'horseshoe' freight area[42], is as shown in Figure 18.

Congestion and inability to process cargo expediently persist at Heathrow, with one user commenting in November 2021:

"***Some import arrivals which are normally checked in within a few hours, are currently taking up to a week to be made available for collection, a higher amount of freight than usual is being classed as UTL (Unable To Locate), and some export bookings are being refused due to capacity issues.***"[43]

However, although SEGRO owns the buildings skirting Zulu cul-de-sac at Heathrow (as shown in Figure 18), the apron area remains under the ownership of Heathrow Airports Limited (HAL) and their lessees are responsible for operational efficiency. Whilst many complaints have been publicised, other commentators believe the horseshoe layout at Heathrow works well, permitting more ground handling and aircraft type diversity than SEGRO's aspirational in-line apron. SEGRO's plans to develop their cargo business at Heathrow is shown in Figure 19.

Ground handling

Handling cargo is a specialist activity since the carriage of goods by air must comply with regulations imposed by the operator, IATA, and export and import authorities of the countries through which the cargo will depart, transit, and arrive. Some procedures apply to all types of cargo and others may only apply to particular categories of goods. Goods require a waybill, also known as a consignment or despatch note, which acts as a contract between the shipper and carrier. This document contains information such as the despatcher and receiver's details, weight and dimensions, description of goods (including any declaration for dangerous goods), and a monetary value.

Figure 18. **Heathrow cargo facilities**

Source. https://www.segro.com/~/media/Files/S/Segro/documents/2019/heathrow-asset-tour.pdf

Figure 19. **SEGRO aspirational plan for Heathrow**

Source. https://www.segro.com/~/media/Files/S/Segro/documents/2019/heathrow-asset-tour.pdf

At the airport, cargo and ground handling staff prepare the cargo for flight. Goods are security cleared including x-ray and Explosive Trace Detection (ETD) screening. Cargo can also be sterilised on the outer surfaces using UVC sanitisation devices. Many cargo handling facilities continue to use manually operated forklift trucks, scissor lifts, tugs and trailers to load and unload aircraft. However, the use of Automated Guided Vehicles (AGVs) and robotics are beginning to come into use. Cargo sheds may also contain refrigeration (chilled and frozen) units, general storage (usually on racking), and can have space for clearing stock sold in duty free outlets at the airport.

Loading must take account of weight distribution to ensure the aircraft is balanced. Correct loading is a legal requirement and vital to the safety and structural integrity of an aircraft. Specified maximum allowable weights cannot be exceeded and the centre of gravity must be (and remain) within the permitted flight envelope. Correct loading also reduces fuel burn and therefore emissions. Pilots are responsible for the completion of a load and trim sheet although this is mostly undertaken using computerised systems.

The importance of investment in airport cargo facilities

Underinvestment has long been an issue for cargo facilities at UK airports. In 2018, the Steer report, 'Assessment of the Value of Air Freight Services to the UK Economy', commented:

> "***The quality of the UK's air freight infrastructure is a major issue, with freight facilities at UK airports often being decades old and having suffered from continued under-investment. While other airports are not as slot congested as Heathrow, they now cater to significantly more widebody freight capacity than the facilities were originally designed for.***"[44]

Due to space constraints at many airports, cargo operations are frequently handled off site at bonded operations. This means goods can be processed and security cleared in a warehouse away from the airport. The cargo is then bonded (sealed) and conveyed to the aircraft for onward transportation. Whilst this can introduce complexity and time into the freight operation, it can avoid capacity constraints at airside facilities.

Whilst cargo revenues and returns may not, without full understanding, be seen to compare favourably to passenger hubs, and cargo seen generally as 'non-strategic', there are many benefits to airports in handling both belly hold and dedicated freighter cargo. These include:

- **Resilience: Income streams from cargo may provide airports with increased resilience, particularly at times when passenger travel may be reduced (such as a global pandemic, a local issue or a threat from terrorism or war).**
- **Route viability: For airlines, carrying belly hold cargo can make a route viable where passenger transport only would not. Airports that can offer cargo handling can therefore encourage more routes and increase runway usage.**
- **Economic impact: There can also be little doubt that cargo airports create jobs and support local and national economies, providing access to global markets.**

Cargo at UK airports

In the UK, the total tonnage at UK airports for 2019, 2020 and 2021 is shown in Table 6. These figures highlight the drop off in passenger aircraft belly hold capacity and the switch to cargo aircraft during the pandemic. As the figures show, whilst the rest of the world's cargo transportation by air increased from 2019 to 2021 by around 7.6% (see Figure 1), the UK was around 8% below pre-pandemic levels, despite nearly doubling the tonnes carried on cargo aircraft. Table 6 also shows 2010 figures and the relatively small change in tonnage, less than 10% in two decades, to the UK. This seems to be an indication of the constraints at UK airports for cargo, with the bulk of the increase in UK air cargo transportation being carried out through European airports with trucking between the continent and the UK.

Table 7 shows the tonnes of cargo carried on dedicated freighters at key UK cargo handling airports for the years 2019, 2020 and 2021. For comparison, belly hold tonnes are also shown. Interestingly, it was Heathrow that considerably expanded their dedicated freighter operation during the pandemic rather than the operations at East Midlands, Stansted, Doncaster, and Prestwick that traditionally focus on dedicated freighter operators. Gatwick and Manchester also significantly increased cargo in terms of percentage change but by relatively small tonnages. It should be noted that East Midlands' 26% growth represents an increase of more than 87,000 tonnes between 2019 and 2021.

Figure 20 shows the long-term trend for UK air freight for the period 2007 to 2020 measured in 1,000 metric tonnes. This rather static picture contrasts with the global growth trend, as shown in Figure 21 (previously shown in Figure 1 on page 11). As well as being out of step with the rest of the world in terms of the belly hold/dedicated freighter ratio (as detailed on page 26), the UK is also not increasing its air freight in line with global trends.

There are a number of possible reasons for this disparity, including but not limited to:

- **The UK's trade with globally distant countries has not increased, perhaps due to a focus on trade with EU and near neighbour countries**
- **The UK's traded goods do not demand air transportation, being transported by sea or other surface modes**
- **The UK's airport infrastructure (including warehousing, stand capacity, etc) is unable to handle the demand for air freight (pre-pandemic)**
- **The airline network to and from the UK is insufficient to serve the origins and destinations of cargo bound for and departing the country**
- **The market (freight forwarders, integrators, etc) prefer to truck air freight to and from northern European airports**

Given the UK does not rank highly against other countries in terms of growth in the sector and is lagging other parts of Europe, particularly Spain (see Figure 3 on page 12 for further details), it is important for all those involved in the industry to consider the reasons and implications. Post Brexit, it seems imperative that the UK is 'open for business' and that goods can be imported and exported from and to countries around the world. If the UK is reliant on trucking to Northern European airports, questions of resilience and national security should be discussed and potentially addressed.

	2021 ('000s)	2020 ('000s)	2019 ('000s)	% change 2019/2021	2010 ('000s)	% change 2010/2019
Belly hold tonnes	822	766	1,764	-53.4%	1,604	+10.0%
Cargo aircraft tonnes	1,508	1,236	772	+95.4%	721	+7.1%
Total tonnes	2,330	2,002	2,535	-8.1%	2,325	+9.0%

Table 6. **Tonnes at all UK reporting airports**

Source. CAA airport data, table 15

Airport	2021 cargo aircraft ('ooos)	2021 belly hold ('ooos)	2020 cargo aircraft ('ooos)	2020 belly hold ('ooos)	2019 cargo aircraft ('ooos)	2019 belly hold ('ooos)	% change 2019 to 2021 cargo aircraft	% change 2019 to 2021 belly hold
Gatwick	2	9	1	25	-	110	962.8	-91.4
Heathrow	646	757	467	683	84	1,504	671.0	-49.7
Luton	26	-	31	-	35	-	-27.9	-98.9
Stansted	263	1	251	3	217	7	21.0	-89.8
Belfast Int	28	-	28	-	25	-	12.5	43.8
Birmingham	16	7	13	5	14	16	15.4	-58.6
Doncaster	24	-	23	-	18	-	35.0	-
East Mid's	423	-	382	-	336	-	26.0	-
Manchester	18	35	4	44	4	105	373.2	-66.7
Prestwick	16	-	12	-	13	-	24.2	-

Table 7. **Cargo tonnes at key UK airports, 2021, 2020 and 2019**

Source. CAA Airport data, table 15

It should be noted that Gatwick Airport handled considerably more cargo before the current ownership made the strategic decision to focus on high-volume low-cost business. For example, in 2010, Gatwick handled 102,454 tonnes on passenger aircraft and a further 1,577 on freighters. This compares with more recent figures shown in Table 7. Also, note that, at the time of writing, the future of Doncaster Airport is uncertain.

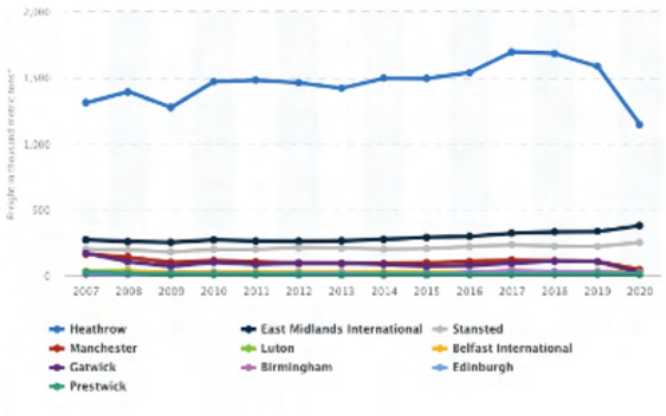


Figure 20. **Air freight at main UK airport 2007 to 2020**

Source. https://www.statista.com/statistics/303659/air-freight-at-selected-airports-in-the-uk/§

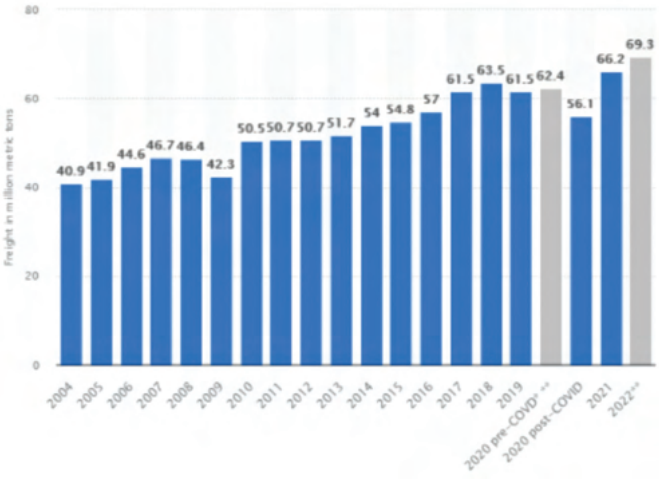


Figure 21. **Worldwide air freight from 2004 to 2022**

Source. https://www.statista.com/statistics/564668/worldwide-air-cargo-traffic/

Policy, regulation and competition

The world depends on the transportation of people and goods, which creates both economic, environmental, and social development benefits and challenges. Aviation, a key part of the transport network, is a global industry. As such, regulation and policymaking in the UK (or any other sovereign country) must be progressive rather than harmful to the competitiveness of the UK's aviation sector and the economy generally.

Connectivity is vital to the country's economy, not just for passengers but for goods. In the UK, it seems that focus is too frequently on passenger transportation, often ignoring the specific and different needs of air cargo. Arguments about whether, for environmental reasons, to restrict passenger movements by air fail to address the need for air cargo, which allows the import of urgent and perishable goods and connect exports with world markets.

Competition issues

Authorities around the world constantly monitor competition, particularly anti-competitive behaviour. A recent example is the European Commission's decision[45] to confirm fines of over €700 million on 11 air cargo carriers for price fixing, dating back to the early 2000s. These fines were imposed not just on EU airlines but on those carriers operating in, out and within the EU.

Since the UK's withdrawal from the EU, a number of regulation and competition issues have arisen. The new situation, with the UK outside the European single market:

> "***represents an unprecedented reversal of liberalisation in aviation***"[46].

Issues include ownership of airlines and airports as well as Freedoms of the Air. Early 'no deal Brexit' concerns around Freedoms, in particular cabotage, the right of an airline of one country/territory to carry domestic traffic within the territory of another carrier, and Fifth Freedoms, the right or privilege to put down and take on in the territory of the first State traffic coming from or destined for a third State, have largely been avoided.

CAPA – Centre for Aviation summarises the post-Brexit situation as:

- **Traffic rights between the UK and EU are preserved. Cabotage rights are removed, but this makes little practical difference.**
- **Ownership and control restrictions are mainly as expected, but allow UK airlines to be EU-owned. Options for reciprocal liberalisation still to be considered.**
- **Meanwhile, EU airlines with a high percentage of non-EU shareholders have taken steps to ensure EU ownership and control.**
- **The two sides aim for close cooperation on safety and security, broadly retain the status quo in other areas, and aim for a "high level of consumer protection"**[47].

The issue of ownership has mainly affected British Airways (BA), currently owned by International Consolidated Airlines Group, S.A. (IAG), a Spanish registered company. EU ownership regulations require airlines operating flights between EU countries to be "*owned and controlled*" by member state entities. IAG is taking steps to resolve this issue but the effect on air cargo capacity is as yet unknown.

Aside from problems arising from Brexit, the UK is facing a skills shortage, which is affecting a number of sectors including logistics. Increasing the attractiveness of the sector to young people will be key to maintaining competitiveness, not only for aviation but for the resilience of the UK's overseas trade.

Airport expansion policy

Since the 2008 Planning Act, responsibility for granting planning for substantial airport expansion has been moved from Local Authorities to Central Government. Nationally Significant Infrastructure Projects (NSIPs) for airports are those that include construction of a new runway, increases in passenger handling by more than 10 million per year, or increases of more than 10,000 CATMs. Planning permission for NSIPs is through a Development Consent Order (DCO) process, where the final decision is made by the Secretary of State.

A recent CILT paper[48] describes in detail the processes and policies for making decisions on airport expansion, giving examples of several recent projects. Cargo is a significant factor in some of these examples and this section indicates how air cargo is being considered. Policies are continually evolving, especially in relation to decarbonisation, but the main current aviation policies are the Aviation Policy Framework of 2013, the Airports National Policy Statement (ANPS) of 2018, and the Making Best Use (MBU) statement of 2018.

In terms of cargo handling capability and recent DCO and planning applications, only Manston Airport, which will be a dedicated cargo airport, and Heathrow, include substantial increases in cargo.

- **Heathrow's third runway**

A third runway at Heathrow was recommended by the Airports Commission in 2015 and established as Government policy in the ANPS. Initial consultations began in 2019 but the project was put on hold since the Covid pandemic. It is not clear when the DCO application might be revived. However, the initial proposals, as well as including a third runway and passenger terminal expansions, also included a major expansion of the cargo facilities, doubling capacity to around three million tonnes per annum.

The third runway would increase capacity for aircraft movements by around 50% but it is not clear how much of this would be available for CATMs, especially as a night jet ban was part of the proposals. Should the third runway be built, opening is likely to be phased over several years. If runway capacity is predominantly absorbed by LCCs, there may be limited capacity for cargo aircraft.

- **Gatwick Airport's short emergency runway usage**

The proposal to use the Northern Runway at Gatwick will be considered under the MBU policy and is currently in the pre-application consultation stage. This will allow small aircraft to take off although the existing main runway will be used for all arriving aircraft. Given Gatwick's preponderance of LCCs, cargo activity is limited, and the Northern Runway plan is unlikely to result in a significant increase in cargo activity.

- **Luton Airport**

The Luton Airport DCO application for a second passenger terminal and an increase in passenger throughput are at pre-application consultation stage. Existing levels of dedicated freighter operations are expected to continue with some increase in belly hold transportation although this is likely to be limited.

- **Manston Airport**

The proposal to reopen Manston Airport as a dedicated cargo hub, focusing on providing capacity for dedicated freighters, was submitted as a DCO in July 2018. As currently drafted, the DCO allows for 17,500 CATMs. The Secretary of State approved the DCO in 2020 but this was withdrawn in 2021 following a legal challenge. Redetermination is expected imminently.

- **Stansted Airport**

Approval has been granted for an increase in the number of passengers using Stansted Airport from 35 to 43 million passengers per annum. However, the proposals did not include any increase in the number of ATMs, and the cap on CATMs will decrease from 21,000 to 16,000 per annum.

- **Bristol, Leeds Bradford, and Southampton airports**

Proposals for expansion at Bristol and Southampton Airports have been approved and Leeds Bradford's plans for a new passenger terminal has been withdrawn. None of these include significant air cargo activity.

- **East Midlands Airport**

East Midlands Airport, the UK's second largest air cargo hub, is not currently pursuing any major expansion plans. Its most recent master plan, from 2015, suggested more than doubling cargo tonnage by 2040 with a significant increase in CATMs. Cargo facilities would be expanded by incremental additions to existing facilities and on land reserved within the airport boundary.

Policy and regulation issues

In the UK, there are a number of pressing issues relating to policy and regulation of the air freight sector. These include:

- **Enhanced data and resources at Government Departments to aid decision-making**

Civil Servants, particularly in specialist policy areas, need access to data to inform their decision making. As an example, air freight policy does not seem to have been examined in the same way as air passenger policy over many years, if ever. As a result, data on air cargo generally is limited. Government departments need to be supported to ensure air cargo is given at least equal attention as that given to air passenger transportation.

- **Specialist policy expertise**

The lack of resilience in supply chains, a considerable concern for some time, is now critical. It will be essential for relevant government departments to have the resources and expertise available to ensure supply lines move freely. Air cargo is a critical component of the UK's logistics sector and requires specialist knowledge across all government departments with influence on airports, airlines, and those engaged in shipping, forwarding, warehousing, and clearing cargo. The upcoming explosion in the use of new technologies, new propulsion systems, and unmanned air vehicles will be likely to exacerbate current issues.

CILT plays a significant role in understanding, providing advice, and creating opportunities for knowledge transfer through its activities in education, events, and publications.

Forecasting air cargo

Forecasting cargo is quite different from forecasting for passenger markets, for a number of reasons, including:

- **Passenger markets are generally seasonal with a planning horizon of around six months. Whilst the demand for air cargo is closely linked to the economic cycle and some demand can be seasonally predicted, demand for ad hoc cargo is generally notified no more than three weeks in advance.**
- **Passenger markets are driven by absolute numbers whereas air cargo requires a combination of weight and volume. For forecasting to be accurate and take account of range and payload issues (such as flowers versus oil rig drilling equipment), both volume and weight need to be included in a demand model.**
- **Theoretically 'spare' capacity at passenger-focused airports cannot simply be allotted to freighter use. This is because, a) passenger-focused airports make intense use of aircraft stands and freighters may be on a stand for many hours, and b) capacity may mistakenly be calculated only by runway slots and not at the supporting infrastructure and resources that are required such as handling and warehousing.**
- **Capacity constraints (such as in the London area in pre-pandemic times), can obscure demand, for example, trucking air freight to northern European airports as discussed in Section 7.**

Cargo growth predictions

World air cargo traffic has averaged 4.1% per year since 1989, as shown in Figure 22.

In terms of future growth, Boeing predict roughly the same average increase, at 4%, with their high forecast at 4.5% and low at 3.4%. They say that:

"*Over the next 20 years, the freighter fleet will grow more than 60% from 2,010 to 3,260 units. There are 2,430 freighters forecast to be delivered, with approximately half replacing retiring airplanes and the remainder expanding the fleet to meet projected traffic growth. More than 60% of deliveries will be freighter conversions, 72% of which will be standard-body passenger airplanes. Of the projected 930 new production freighters, just over 50% will be in the medium widebody freighter category.*"[49]

However, not all regions will experience the same level of growth, and Asia, particularly Pacific Rim countries, are expected to outperform other areas.

Air Cargo News[50] reports from industry interviews that issues with sea freight will continue to drive demand for air transportation. However, ongoing Covid-related problems will result in little change to belly hold capacity in the near future. Outdated cargo handling infrastructure, airport bottlenecks, and labour issues affecting ground handlers, forwarders, airlines, and trucking companies will be likely to compound capacity constraints.

National level models

CILT has previously noted a long-standing challenge to forecasting air cargo. Many forecasters and commentators have backgrounds in passenger markets and do not fully understand the complex issues involved in air cargo. The situation is complicated in the UK by the government's forecasting, which does not model freight in detail[51], only making 'assumptions' for the purpose of estimating CO_2 emissions.

It would help greatly if the government had a cargo model, similar to the National Air Passenger Demand Model (NAPDM). NAPDM produces national level forecasts for terminal passengers travelling from, to or through the UK. Without such a national level air freight model, forecasters at airport level are prone to criticism and disputes between parties are difficult to adjudicate.

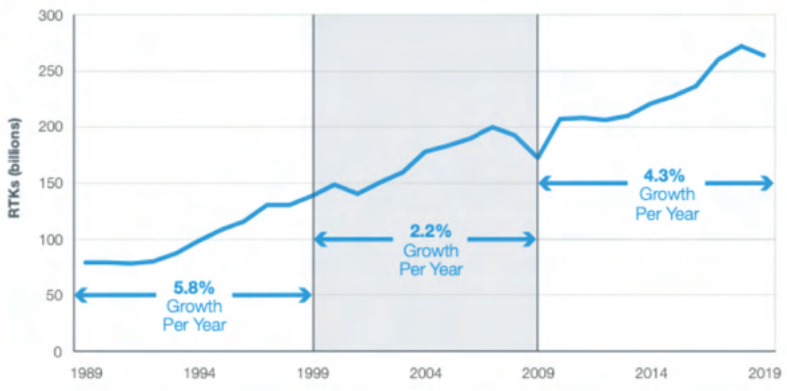


Figure 22. **Air cargo growth 1989 to 2019**
Source. Boeing World Air Cargo Forecast 2020-2039 (page 21)

This is particularly pertinent in more recent years, as air transport trends have increasingly become decoupled from GDP/GVA growth. For example, IATA figures show the 2021 global demand figure for air cargo was 18.7% compared with 2020, outpacing the 9.8% rise in global goods trade[52]. For cargo, the huge increase in global economic interaction over the past few decades has led to exponential growth in cross-border trading and therefore to the need for air transportation of goods. This is particularly the case for e-commerce, pharmaceutical, and perishable items. Evidence is provided by world data, where the annual growth rate for air freight continues to exceed the total growth rate of global freight. The bi-directional causal relationship between air transport and GDP/GVA growth is also frequently ignored but is particularly germane for air cargo.

Some air freight forecasters use national models (lacking in the UK) and apply gravity models to 'allocate' traffic to specific airports. This is less than optimal since it does not take account of many issues that may attract or detract users. Some of these issues are described in the following section.

Airport specific issues

In compiling a forecast for a specific airport, both 'push' and 'pull' factors need to be considered. 'Push' factors are those that may lead customers away from other airports or prompt a change to current models. In the UK, these factors include issues such as:

- **Capacity constraints including warehousing and handling and limited runway slot availability**
- **Bumping belly-freight from passenger aircraft**
- **Channel crossings delays**
- **Problems with security screening**
- **Potential changes to the dominance of belly-freight from Heathrow**

'Pull' factors work to attract customers to an airport. These may include:

- **Competitive position (including pricing)**
- **Speed of turnaround of aircraft**
- **Speed of security clearing and processing for onward or inward surface transportation**
- **Availability of warehousing and storage (including for chilled or frozen goods)**
- **Geographic location of the airport and proximity to markets and surface transport**
- **Airspace, particularly stacking issues**

Additionally, the costs of switching airports need to be considered. These include[53]:

- **The cost of physical relocation**
- **Cancellation of long-term contracts**
- **Loss of economies of scale, although if an entire operation is switched, economies of scale would be gained at the new airport**
- **Market effects such as marketing new routes and a potential loss of custom in the early years following the switch**
- **Network effects lost by switching to a smaller airport**
- **Capacity constraints at other airports, particularly in slot allocations**
- **Sunk costs such as an airline's investment in the airport from which they are switching**

Cargo forecast detail

Air cargo forecasts need to include:

- **Number of CATMs inbound, outbound, and transhipped**
- **Tonnes carried inbound and outbound**
- **Type of aircraft by ICAO category**
- **Origin and destination**
- **Type of cargo carried**
- **Time of day inbound and outbound**

Each CATM (either inbound or outbound) has a movement in the opposite direction – each inbound flight will at some point be outbound. Forecasting backloads (tonnes carried on the return flight) can be more complex to define.

Forecasts need to assist all aspects of master planning. For example, the forecast fleet mix will define the number and type of aircraft stands required. The freighter fleet mix is generally shown using the ICAO aircraft design code[54], which are:

- **Code C: Wingspan 24 to 36 metres such as ATR-72, B727, B737-700, A320, etc.**
- **Code D: Wingspan 36 to 52 metres such as B757, B767, A310 etc.**
- **Code E: Wingspan 52 to 65 metres such as B777, B787, A330, etc.**
- **Code F: Wingspan 65 to 80 metres such as B747-800 and A380-800**

Stands are expensive to construct, and increasingly so by size, so accurately forecasting need at this level of detail is essential.

Sustainability

Greening the aviation sector is vital to the future of transportation and the protection of our planet. Achieving net zero aviation, whilst a topic of much debate, has a target date in the UK of 2050.

Sustainability in air cargo can be considered across the value chain, which includes:

- **Transportation of goods and people to and from airports**
- **Operations at airports**
- **Flight including airframe design, propulsion systems, fuels, and air traffic control**

The Sustainable Aviation organisation define four ways to achieve net zero[55]:

- **Improve operational efficiency**
- **Switch to sustainable aviation fuels**
- **Build the next generation aircraft**
- **Manage residual emissions**

CILT's views on aviation decarbonisation were set out in a COP26 Briefing Paper in November 2021[56]. It noted that, in 2019, UK aviation was responsible for 38 $MtCO_2e$ of emissions, which is about 1% of domestic emissions and about 7% of UK transport emissions. CILT believe the key measures to achieve net zero by 2050, which can be applied to air cargo as well as passenger operations, are:

- **Fuel efficiency improvements, overseen by improved ICAO standards**
- **Zero emission aircraft, such as smaller, short haul electric types and larger, long haul hydrogen/electric-powered**
- **Sustainable aviation fuel**
- **Offsetting, controlled through ICAO's CORSIA agreement**

In the UK, NATS, the country's leading provider of air traffic control services, is currently engaged in an airspace modernisation programme. Once complete, improved aircraft routing will result in more efficient flying, optimised routing, and less time in the air, reducing fuel burn and emissions. Fuel efficiency improvements will occur as older aircraft are replaced in airlines' fleets, such as Singapore Airline's recent order for A350F aircraft.

Electric aircraft could also be useful in the cargo market, where longer turnaround times may provide the opportunity to recharge batteries on stands. Since cargo aircraft tend to 'hop' between airports to drop off and collect goods, flying shorter segments could also be compatible with the use of electric all-cargo aircraft. New developments in the use of hydrogen propulsion systems could be implemented in around a decade. A complete redesign of aircraft and their engines is underway by numerous organisations and the next generation of flight is expected in the next 10 or so years. Trials with cargo aircraft before introduction into passenger markets may help increase confidence among the public.

Using sustainable aviation fuel (SAF), although not without issues, could reduce emissions by around 70% compared to fossil fuels. Whilst electric and hydrogen may initially be employed in short and medium range aircraft, SAF may be required for long range aircraft and as such is likely to remain in use for cargo operations for some years. Offsetting, controlled by international agreements, is a way of dealing with residual emissions.

In addition to decarbonising aircraft in flight, there are specific opportunities for cargo operations to decarbonise on the ground. This includes the use of electric vehicles, ensuring buildings are net zero, and making better use of automation and 'big data'. A particular challenge involves the decarbonising of HGVs, which operate to and from airports. However, as with aircraft, a range of measures are being developed for HGVs including alternative fuels.

There may be some scope for a modal shift to rail, particularly for trucking movements, although this would require substantial investment in infrastructure to provide appropriate intermodal facilities. Such facilities do exist but only in a few locations around the world. The use of river access to airports is also largely ignored but could be explored by those located close to such infrastructure. For example, Manston Airport, once reopened, has stated its intention to use the Estuary and River Thames for access to and from London markets.

The future

Aviation will see radical change over the next century, with new modes of transport, new power sources, as well as increased efficiency and sustainability. The transportation and handing of air cargo have perhaps not kept pace with the available technology. This has been made particularly evident in the past two year when:

"***the pandemic exposed a lot of deficiencies in cargo handling***"[57].

For example, many airports persist in the use of forklift trucks, which is both slow and potentially dangerous for operators, instead of adopting mechanised processes and/or the use of robotics and AI. Digitalisation provides the opportunity for specialist freight airports to insert services into the supply chain to derive addition revenue streams.

Whilst the Covid-19 pandemic has stimulated rapid growth of air cargo in line with growth in e-commerce, labour shortages around the world in the logistics sector, including airport cargo ground handling staff, may well be an additional driver for modernisation if growth is not to be hindered. The UK is facing a skills shortage, which is affecting a number of sectors including logistics. Increasing the attractiveness of the sector to young people will be key to maintaining competitiveness, not only for aviation but for the resilience of the UK's overseas trade. CILT plays a significant role in providing education, qualifications, and career support for people in the sector.

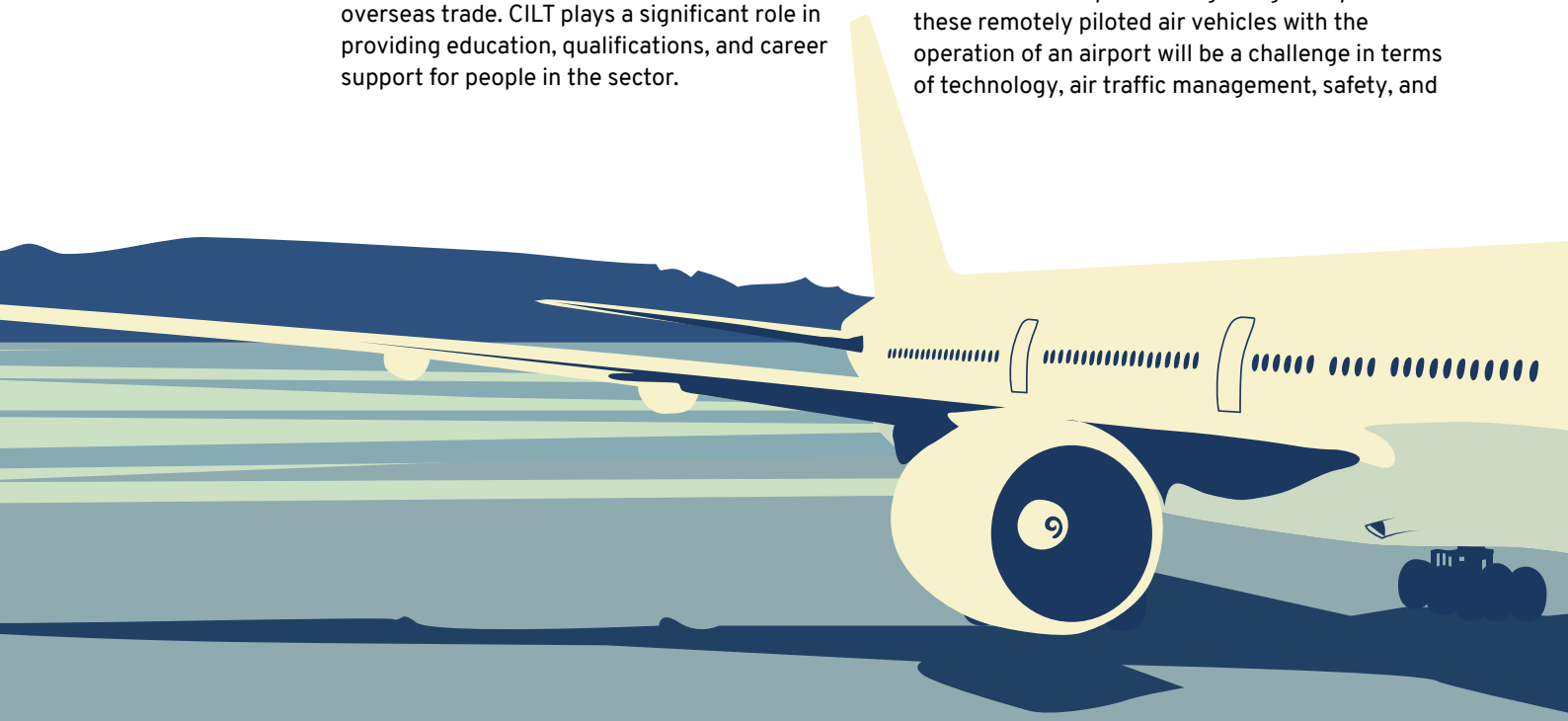
Since speed is a key source of competitive advantage and improving customer experience, this drives demand for air freight. As such, investment in high tech operations will be paramount to future-proofing the industry. Consumer demand is driving the need for order-to-delivery windows of between 24 and 72 hours, a target only air transportation is likely to be able to meet:

"***Everyone knows they need digitised supply chains; they are just often stuck in a mindset that puts bricks over bytes. The rallying call for leadership right now is that change management in the supply chain is long overdue.***"[58]

Amazon's business model, vertical integration in the supply chain through its purchase of a fleet of aircraft, has been a game changer in the sector. The impacts of this move by Amazon and others are yet to be fully realised.

Technology is also likely to play a role in optimising air cargo loads. Until now, backloading, filling a return flight arriving with imported goods with outbound exports, has been difficult. It may be possible to use national or global digital twin technology to facilitate this initiative, saving considerable air miles and associated emissions.

The use of drones and eVTOLs for cargo could soon become commonplace. Integrating the operation of these remotely piloted air vehicles with the operation of an airport will be a challenge in terms of technology, air traffic management, safety, and



security. However, unlocking the potential for drones to deliver efficient and cost-effective services to and from airports presents huge opportunities. There are already a number of UK-based companies moving forward in providing infrastructure either as new standalone facilities or at existing airports. These include Urban Air Ports[59], Skyports[60], and Flexport[61]. Flexport has committed to purchasing two 'super' cargo drones that will be made by Natilus[62]. The new aircraft has blended wing body'(BWB) geometry with two high-bypass turbofan engines, 110 tonnes of cargo capacity and 5,400 nautical miles of range.

As we progress towards net zero in aviation with the introduction of new propulsion systems, airframe designs, and aircraft types, cargo-only aircraft can be trailblazers, providing the industry and public with confidence in these innovations. There may also be further developments in the lighter-than-air cargo-carrying airships. These would provide clean transportation and the ability to access parts of the world where infrastructure, such as airport runways, is under-developed.

It is clear that airports need to prepare themselves for the introduction of new aircraft types including hydrogen, hybrid, electric and lighter-than-air. They may choose to offer biofuels to customers and provide specialist MRO (Maintenance, Repair and Overhaul) and hangarage for new types of aircraft. Additionally, hyperpersonalisation (which leverages artificial intelligence (AI) and real-time data to deliver more relevant content, product, and service information to each user), Big Data, the Internet of Things, digitalisation, and reducing the intermediaries in the air freight transportation supply chain offer the potential to create addition revenue streams for airports.

The pandemic has precipitated many changes, not least in terms of the proportion of cargo carried by dedicated freighters. It also coincided with an increased awareness in environmental issues and in the need for decarbonisation. Changes in the patterns of demand have been seen throughout the transport and logistics sectors and these will result in the transformation of the sector and the infrastructure and services required.

The need for supply chain resilience has triggered some degree of on-shoring or near-shoring, while environmental concerns from some quarters have increased calls to reducing air travel. Whilst passenger transport declined dramatically during the pandemic, for air cargo there has been growth in most sectors. This trend is expected to continue for the foreseeable future and so greater understanding of the sector is fundamental to drive forward the innovations being made and to the sector's ambitions to reach net zero.

References

1
https://www.boeing.com/resources/boeing-dotcom/commercial/about-our-market/cargo-market-detail-wacf/download-report/assets/pdfs/wacf.pdf

2
https://www.iata.org/en/programs/cargo/sustainability/benefits/

3
https://www.iata.org/contentassets/c81222d96c9a4e0bb4ff6ced0126f0bb/iata-annual-review-2021.pdf

4
https://www.iata.org/en/programs/cargo/sustainability/benefits/

5
https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR020002/TR020002-002459-7.4%20-%20Azimuth%20Report.pdf para 2.2.2

6
https://www.iata.org/en/pressroom/2022-releases/2022-25-01-01/

7
https://www.iata.org/en/iata-repository/publications/economic-reports/diverse-outcomes-in-passenger-and-cargo-traffic-in-2021/

8
https://www.iagcargo.com/en/press/q4-financial-results-2021/

9
https://www.aircargonews.net/airlines/etihad-cargo-registers-record-cargo-results-in-2021/

10
Since the figures for Liège and Heathrow are quite close, different methods of recording may alter these rankings and other sources may list Heathrow before Liège.

11
https://market-insights.upply.com/en/airports-benelux-airports-strengthened-by-freight-traffic-recovery

12
https://www.aircargoweek.com/mxp-riding-the-cargo-wave/

13
https://theloadstar.com/forwarders-take-back-control-as-shipping-airlines-flourish-in-buoyant-market/

14
https://www.boeing.com/resources/boeing-dotcom/market/assets/downloads/2020_WACF_PDF_Download.pdf p. 18

15
https://www.caa.co.uk/Documents/Download/9115/8cce8a5d-a76b-4652-8fab-41ae2288f104/4664

16
https://www.statista.com/statistics/1131679/cargo-tonne-kilometer-british-airways-plc/

17
https://www.iagcargo.com/en/our-history/

18
https://www.aircargonews.net/airlines/freighter-operator/cargologic-germany-declared-insolvent/

19
https://dro.deakin.edu.au/eserv/DU:30131094/zhen-valueimpacts-2019.pdf p. 7

20
https://theloadstar.com/forwarders-take-back-control-as-shipping-airlines-flourish-in-buoyant-market/

21
https://dro.deakin.edu.au/eserv/DU:30131094/zhen-valueimpacts-2019.pdf p. 204

22
https://theloadstar.com/forwarders-take-back-control-as-shipping-airlines-flourish-in-buoyant-market

23
https://www.boeing.com/resources/boeing-dotcom/commercial/about-our-market/cargo-market-detail-wacf/download-report/assets/pdfs/wacf.pdf

24
https://www.iata.org/contentassets/a686ff624550453e8bf0c9b3f7f0ab26/wats-2021-mediakit.pdf

25
https://www.ft.com/content/15b44fc9-5f86-4b28-ae05-a3233db13977

26
https://theloadstar.com/airfreight-rates-soften-as-bellies-bounce-back-on-the-atlantic/

27
https://www.economist.com/finance-and-economics/a-perfect-storm-for-container-shipping/21804500

28
https://www.statista.com/statistics/1250636/global-container-freight-index/

29
https://www.boeing.com/resources/boeing-dotcom/market/assets/downloads/2020_WACF_PDF_Download.pdf p. 9

30
https://www.caa.co.uk/news/2021-quarter-four-flight-data/

31
https://www.aircargonews.net/airlines/freighter-operator/ongoing-boost-from-shipping-and-bellyhold-shortages/

32
https://www.iata.org/contentassets/c81222d96c9a4e0bb4ff6ced0126f0bb/iata-annual-review-2021.pdf

33
https://www.boeing.com/commercial/market/cargo-forecast/

34
https://www.mckinsey.com/featured-insights/asia-pacific/asia-the-highway-of-value-for-global-logistics

35
https://www.aircargonews.net/monthly-exclusive/road-feeder-services-under-pressure/

36
See The Azimuth Report Volume I page 38 for further details https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR020002/TR020002-002459-7.4%20-%20Azimuth%20Report.pdf

37
CILT/David Parish email 26 January 2021

38
https://airportscouncil.org/wp-content/uploads/2019/05/Air-Cargo-Revenues-and-Fees-Report.pdf p. 3

39
https://theloadstar.com/forwarders-take-back-control-as-shipping-airlines-flourish-in-buoyant-market/

40
https://newsroom.ferrovial.com/en/press_releases/baa-sells-its-stake-real-estate-company-app-to-uk-company-segro-244-million-pounds/

41
https://www.segro.com/property-search/estates/united-kingdom/heathrow/segro-airside-heathrow/overview?sc_lang=en

42
See for example https://theloadstar.com/good-news-frustrated-forwarders-heathrow-gets-set-transform-air-cargo/

43
https://www.woodlandgroup.com/news/news/delays-at-heathrow-cargo-facility/

44
https://airlinesuk.org/wp-content/uploads/2018/10/Assessment-of-the-value-of-air-freight-services-to-the-UK-economy-Final-Report-v22-Oct-2018-bSENT.pdf p. ii

45
https://ec.europa.eu/commission/presscorner/detail/en/IP_17_661

46
https://centreforaviation.com/analysis/reports/brexit-and-aviation-alls-well-that-ends-well-almost-548205

47
https://centreforaviation.com/analysis/reports/brexit-and-aviation-alls-well-that-ends-well-almost-548205

Acronyms

ACI
Airports Council International

ACTK
Available Cargo Tonne Kilometres (available CTKs of the global fleet)

AGV
Automated Guided Vehicles

AI
Artificial Intelligence

ATM
Air Transport Movement

BA
British Airways

CAA
Civil Aviation Authority

CATM
Cargo Air Transport Movement

CILT
Chartered Institute of Logistics and Transport

CORSIA
Carbon Offsetting and Reduction Scheme for International Aviation

CTK
Cargo Tonne Kilometres (includes unaccompanied baggage and mail)

DCO
Development Consent Order

EASA
European Union Aviation Safety Agency

ETD
Explosive Trace Detection

eVTOL
Electric Virtual Take Off and Landing vehicles

FTK
Freight tonne kilometres (metric tonnes of revenue load carried per kilometre)

GDP
Gross Domestic Product

GVA
Gross Value Added

HGV
Heavy Goods Vehicle

IAG
International Airlines Group

IATA
International Air Transport Association

ICAO
International Civil Aviation Organisation

JIT
Just-In-Time - a management strategy where companies aim to receive goods as close as possible to when they are needed

LCC
Low Cost Carrier

MRO
Maintenance Repair and Overhaul

$MTCO_2e$
Metric tons of carbon dioxide equivalent

NAPDM
National Air Passenger Demand Model

NATS
National Air Traffic Services

NSIP
Nationally Significant Infrastructure Project

PPE
Personal Protective Equipment

RFS
Road Feeder Service

RTK
Revenue Tonne Kilometres (revenue load in tonnes multiplied by the distance flown)

SAF
Sustainable Aviation Fuel

ULD
Unit Load Devices

UTL
Unable To Locate

UVC
Ultra Violet C (radiation with wavelengths between 200 and 290nm)

48
Airport Expansion, CILT, May 2022

49
https://www.boeing.com/resources/boeing-dotcom/market/assets/downloads/2020_WACF_PDF_Download.pdf p. 10

50
https://www.aircargonews.net/airlines/outlook-2022-another-challenging-year-for-air-cargo/

51
DfT, UK Aviation Forecasts: Moving Britain ahead. Available from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/878705/uk-aviation-forecasts-2017.pdf, para 2.56

52
https://www.iata.org/en/pressroom/2022-releases/2022-25-01-01/

53
https://www.caa.co.uk/media/fj1lb0qg/halcap-1133-appendix-e-evidence-and-analysis-on-competitive-constraints-non-con.pdf p. 26

54
https://skybrary.aero/articles/icao-aerodrome-reference-code

55
https://www.sustainableaviation.co.uk

56
https://www.ciltuk.org.uk/routetozero

57
https://www.routesonline.com/news/29/breaking-news/297601/shortage-of-ground-handlers-threatens-air-cargos-fast-growth/

58
https://ciltuk.org.uk/Portals/0/Hidden.pdf?ver=2022-02-03-132113-873&gator_td=HRkt2xyuCWx0%2brMeFCs9tLFXy6LB7Prw3ca1M9Weco7%2f%2fXSwoT9fR0gnpaDHU1M2XcqbAlo77pNwDHJt4qks4hCpbWvgU9yLkm6U5TmB4d%2fSOXWn9p96HFLBrVn2lzZSu6tXCPZFrJoKY%2brlabP6aQ%3d%3d&gator_td=zg5ZSyD5fqFIsRM0OcLLzZzm%2bapMUhSi85jJRSqMO%2bcXYpyupzkR6vfJir%2bK1j0JCd8%2b7GcYpKPezmxPteeU3ZqdhNbraQIR%2boST4hJStYmvKtgghfN82UihLTAO8egByil%2fhd2%2fMEuEyNwNqdjg27NOn80jQrHvsasCU%2fvk%2bYxe5FbiPKdjAKm%2bKmAlDuUCPs7OnPBnwjTyeRa66VXCJcc3igX2z4qKGUDYjtEwwOk%3d Page 31

59
https://www.urbanairport.com

60
https://skyports.net

61
https://www.flexport.com

62
https://theloadstar.com/flexport-places-advanced-purchase-commitment-for-100-tonne-cargo-drone/

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