

The 2nd Modal Revolution : an Apology of the UltraFreighter

Historical review of the first modal revolution: passengers

After a start as toys for eccentric gentlemen, between the two wars, some eighty-five years ago, first slowly then picking up in intensity just after WW2, aircraft became a viable tool for international, including transatlantic, passenger transport. Shortly, decision-makers and magnates from shipping created the international passenger air transport industry.

This bold step was taken naturally: powerful financial strongholds rooted in shipping, led by entrepreneurs with visionary skills plus guts, offered a perfect set of ingredients to create e.g. KLM, Lufthansa, Hapag Lloyd, UTA, BOAC, SAS, Cathay Pacific, Braathens SAFE ...

But shipping and air transport no more interlace in 2015 as in the pioneering days (although here and there some solid financial bridges still remain): operative routines and management specialise as aircraft technology advances; the legal framework also specialises and as the founders are stepping down, the initial cultural ties are irremediably severed.

Road/rail transports disregarded, as a consequence of the first modal revolution, today international passenger transport has completely migrated from shipping to aviation, except for pleasure cruises, where shipping has carved out a thrifty and impregnable niche.

The next step is modal change to airfreight: who's picking up the business?

The old adage "time is money" seconded by trendier levers – obsolescence, fashion démarque, mercantile opportunity rates, expiry date, perishables, volatility, urgency – are some of many springboards jumping from maritime to air transport of cargo, the emergence of modal shift, the burgeoning of the ICAO-registered airfreighting industry.

Top 10 air freight carriers by fleet size

| | |
|-------------------------|-------------------------|
| 1. Federal Express | Fleet 688 Orders 37 |
| 2. UPS Airlines | Fleet 519 Orders 21 |
| 3. DHL Aviation | Fleet 75 Orders 13 |
| 4. Cathay Pacific Cargo | Fleet 22 Orders 18 |
| 5. Korean Air Cargo | Fleet 24 Orders 12 |
| 6. Lufthansa Cargo | Fleet 18 Orders 5 |
| 7. China Airlines Cargo | Fleet 19 Orders unknown |
| 8. Singapore A/L Cargo | Fleet 13 Orders unknown |
| 9. Emirates SkyCargo | Fleet 10 Orders 16 |
| 10. Cargolux | Fleet 14 Orders 11 |

Top 10 air freight carriers by FTK transported

| | |
|-----------------------|------------------|
| 1. Federal Express | 16.1 billion FTK |
| 2. UPS Airlines | 10.6 billion FTK |
| 3. Emirates | 10.5 billion FTK |
| 4. Cathay Pacific | 8.2 billion FTK |
| 5. Korean Airlines | 7.7 billion FTK |
| 6. Lufthansa | 7.2 billion FTK |
| 7. Singapore Airlines | 6.2 billion FTK |
| 8. Cargolux | 5.2 billion FTK |
| 9. Qatar Airways | 5.0 billion FTK |
| 10. China Airlines | 4.8 billion FTK |

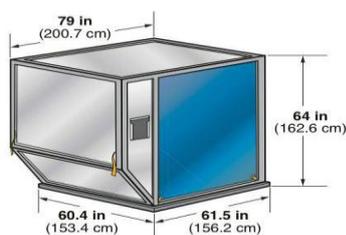
NB: Emirates (a belly-freighter) hoisted itself to world's rank n° 3 freight carrier in terms of FTK transported

But antagonistic factors are preventing airfreight from taking off: in 2013, ICAO's airfreight carriers moved 200 billion FTK or 2 % of world's containerised merchandise; the remaining 98 % or 10 trillion FTK still transited through the hands of international shipping.

Reworded, shipping vs the frail ICAO air freight industry is akin ‘Goliath vs David’; in tonnage, airfreight represents 0.2 % of global flows of merchandise, peaking to a surprising 30 % when comparing values. This last marker shows how very early the financial interest rate i played in favour of modal change: compute (value of merchandise) $\times (i) \times (\Delta$ trip time to destination); if the result \geq the cost of airfreight, then the decision is straightforward!

Considerations of this kind led to routine modal shift for valuables, post and also ISPF – itemised, small packaged freight – bringing early to the baptismal font such entities as DHL, UPS, Flying Tigers, TNT, FedEx, US Air Mail, Aéropostale plus a tide of other pioneers, closely trailed by burgeoning air freight operations coming to life in three parallel scenarios :

Firstly and by far the most important in volume, the underbelly freighting capacity of passenger airliners is expanding with the robust development of the world’s paxliner fleets :



| Paxliner model | 788 | A333 | A359 | 773 | 779X | 748i | A388 |
|----------------------------|-----|------|------|-----|------|------|------|
| Typical n° of passengers | 219 | 295 | 314 | 344 | 394 | 405 | 525 |
| N° of LD3 in lower deck | 28 | 32 | 36 | 44 | 48 | 40 | 36 |
| LD3 available for freight* | 16 | 16 | 19 | 26 | 27 | 18 | 8 |

* after CIL – checked-in luggage

The table shows the number of LD3 containers (MGW 3.500 lbs – vol 159 cuft) available onboard the various wide-body paxliners when full; if the passenger cabin of e.g. an A333 is only 65 % full, 6 more LD3 become available for freight.

Secondly, diversifying their skills in air transports, major passenger airlines create air cargo subsidiaries. Separately, dedicated air freight carriers are born, especially in Asia: Eva Air, China Airlines Cargo, Cathay Pacific Cargo, AeroBridge, Cargolux, SIA Cargo, KAL Cargo ...

The question is: who’s picking up the business? Whereas shipping took the helm first creating then legitimately harvesting benefits from the 1st modal revolution for passengers, shall now the airline Industry – or speculators, newcomers to the air transport business – alone garner the bonanza of the 2nd modal revolution, i.e., no tribute repaid to shipping?

Fortunately not, no way! – Shipping is not at all passive! Indeed, **thirdly** and as an indication of new trends in global air freight business, yet regrettably to a limited scope and modest occurrence so far : amongst the longer-standing players in shipping some are taking steps themselves to contain the diversion of the high-yield air freight business into the hands of non-shipping people. Some examples : Danish Star Air and DAMCO (Maersk Group), CMA CGM LOG in France, Chinese CSL Logistics in Shanghai and COSCO Logistics’ involvement in China Cargo Airlines, all of whom are prominent players including in air freight logistics and forwarding, a proof that shipping are aptly swarming back into air freighting.

The venue of AGA, a new tool for air freighting, aimed at shipping?

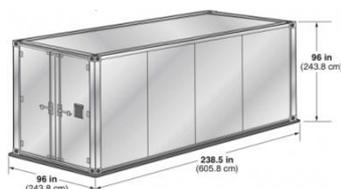
Reformulated, after letting go the controls of the lucrative passenger air transport – a business originally created by their forefathers – a handful of atavist shippers realising the strategy error are seeking to recover control of air freight, very precisely at a point in time sixty years later when the freight logistics and forwarding industry are at the threshold of a 2nd modal revolution, this one of concern to all Logisticians controlling containerised freight!

Unfortunately, modal shift to air freighting has been upheld so far due to “querelles de clocher” between Boeing and Airbus: neither is a proper Logistician nor has professed a proper strategy for air freight, each promoting their own compromised, awkwardly limping paxliner-F adaptations as the ‘perfect air freighter’, a farce resulting in inappropriate tooling.

The downside of both manufacturers' ludicrously disparate approach to air freighter manufacturing is the appearance on the market of a variety of ad hoc "universal loading devices" (ULD) that Airbus (resp. Boeing) pretend to impose as the new industry normative for air freight interlining, simply because these ULD best fit their respective aircraft designs !

Pan-modal container interlining (rail, road, shipping ...) has been solved once and for all with the introduction of the TEU and FEU = 2 x TEU. When adding the 4th mode – air freight – for the lower holds of narrow-body aircraft, Airbus' very successful A320 Series family has led to an industry-wide co-optation of the LD3-45, whereas for wide-body belly-holds, the norm – set by the first wide-bodies DC10/L1011 – is the LD3. However, on-board dedicated air freighters, the bulk of the freight is carried on main deck. For this purpose, a diarrhoea of igloos, pallets, containers, ULDs of all kinds and dimensions have blossomed, actively sponsored by the two leading aircraft OEMs, the egocentric arch-rivals Boeing and Airbus (and lobbies thereof), infatigable competitors with conflicting business interests.

Air freight operators' spokesmen need to unite and agree on a new set of container norms for main deck transport by air. To secure modal interlining throughout air/road/rail/shipping, the logical solution is the AGA or M2 (ICAO codes for TEU), with characteristics:



AGA or M2 container (=TEU)

| | |
|--------------------|---|
| Materials | Al, ALi, Ti, ALiMg, CFRP (light & strong aviation materials) |
| Dimensions | normal 8 ft x 8 ft x 20 ft – high-top 8 ft x 9 ft 6 in x 20 ft |
| Volume | normal 1,190 cuft (33.7 m3) – high-top 1,413 cuft (39.4 m3) |
| MGW/Tara/NW | normal 11.3t/1.0t/10.3t – heavy-duty 16.1t/1.1t/15.0t |

The introduction of the AGA as the new norm for main deck air freight calls for the venue of new dedicated air freighter designs aimed specifically at resolving basic logistics for AGAs or M2s : loading/unloading, handling, latching, reefer connections, e-tracking, GPS etc.

There are two modus operandi for contracting air transport of freight: the "push" (or passive) way and the "pull" (or active) way: the first implies to sit back and wait until your appointed air freight forwarder picks up his phone to push his next consignment ... which he will do sooner or later and at a greater pace from one year to the next. Everything is smooth and orderly, with 4 to 7 % y2y progression pending the geographical region. No surprises, no earthquake, this is BAU, business as usual ... The second is much more enticing and promises to be much more rewarding : it implies to seek up directly the forwarders of shipping telling them we now accept TEU containers by air freight at prices undercutting the best quotes for belly-freight, as when derived @ marginal costing by operators of wide-body paxliners.

The pull method will induce immediate reaction from said forwarders, triggering a tsunami of new air freight consignments! Remember: 1 % of modal change from shipping to air freighting equates to a 50 % boost of the yearly ICAO air freighting statistics. Based on simple maths involving the usual Opportunity Rates, an avalanche of merchandise will start moving by air, simply because of the barrier to modal shift is overcome when using the AGA.

Current dedicated air freighters (747F, A332F, 767F, 777F, MD11F plus various P2F freighter conversions, plus Antonov's Mriya and Ruslan ...) cannot compete with belly-freight offerings on-board wide-body paxliners when computed based upon marginal costing. The internal cost threshold to operators is approximately 20 cents of an € per FTK, whereas the cost level of dedicated freighters is approximately seven times the corresponding CASK (i.e., typically some 31 cents of an € per FTK). This difference in cost levels explains why dedicated air freight is slowing down, whereas belly-freight is progressing forcefully in the market.

The recipe of a successful UltraFreighter: ad hoc D&D?

How can dedicated air freight players break and undercut the challenging cost barrier of 20 cents of an € per FTK of belly-freighters? Factually, your competitors are in the market dealing commercial air transport offerings based upon operating costs some 35 % below your own plateaued cost levels, a despairing gap ?! On top, belly-freighters do fly the best aircraft in the market, incorporating the latest technological advances, whereas dedicated air freight operators fly all kinds of end-of-life P2Fs plus MD11F, A300F, 767F, L1011F etc.

This hard nut – stemming from the fact that still in 2015 the development of freighter aircraft is for some unexplained reason the 5th wheel of Airbus' and Boeing's cars – has so far not been cracked by the community of traditional ICAO-registered air freight operators.

Laziness? Lack of interest? Bad management? Lack of initiative and Leadership?

Whatever, world's dedicated air freight operators are being hit frontally by a thrifty, robustly expanding belly-freighter community who slowly but surely are taking control of the air freight market, the only reason for not yet putting the key under the mat and go fishing being that there is still enough demand out there for everybody to get a piece of the cake ...

Shipping Logisticians know this type of cost conundrum: the Harvard wizards c/o AP Möller-McKinsey at Langelinje or the Polytechnique yuppies at la Canebière c/o CMA CGM all perfectly well know how to solve the Ultrafreighter (UF) design paradigm ... the recipe is:

- (1) liberate access to the bonanza of containerised merchandise adopting the AGA;
- (2) play scale economics, going big ... metaphorically, you need a flying Triple E;
- (3) create an ad hoc UF incorporating latest advanced engine technology;
- (4) give the UF top-level structural efficiency (ratio payload/MTOW \geq 0.4);
- (5) give the UF logistic excellence with short docking turn-around times;
- (6) make maximum use of existing (CATIA-based) digital CAD-CAM protocols;
- (7) assure highest possible cargo load factors, to operate close to CATK bottom-lines;
- (8) adopt same security standards for AGAs as for shipping TEUs : GPS, e-tracking ...



Boeing 747F swing-nose (Cargolux)



Antonov An-225 Mriya swing-nose (Volga-Dniepr)

Development time may be reduced 3-4 years whence NRD&D (non-recurrent design and development) costs for an aircraft programme may be reduced with up to 7 G\$ if instead of a clean sheet design we use sub-assemblies from existing aircraft programmes, such as A350, 777 or A380, which are easily modified to fit in with a new design mission.

If our fuel efficiency improves 19 % with advanced engines, if we gain 22 % overall cost efficiency per FTK with scale economics, if our costs improve 6 % per FTK from an enhanced structural efficiency (e.g. with 33 % better payload/MTOW ratio), if on top we lower our costs 11 % per FTK with shorter ground turn-around times, then our total cost per FTK will drop well below 18¢ of an €, safely undercutting the bottom-line of belly-freighters!

But there is more to ad hoc D&D: not only shall we undercut the cost level of belly-freighters, but we shall gain exclusive access to a bonanza of containerised merchandise controlled by international shipping, directly consignable as air freight in the AGA, i.e., no more cumbersome/costly re-stowing from TEU into whichever ULD is relevant; pick-up at consignee's and final delivery to destination by standard 18-ton trailer carrying one AGA!

Exclusive access to the bonanza of shipping's AGA-conditioned merchandise implies greater demand pressure upon available space on-board the UF, the market consequence being that freight rates will escalate from natural supply of demand vs offer.

The docking operations of the UF are shortened and made easy with roll-on/roll-off loading/unloading through a swing-nose plus a tail-ramp; in addition, as an option to be discussed with buyer prospects, a dorsal hatch opening provides access directly onto the UF's main deck through a (shipping-style) bridge-crane for the AGAs; these are mechanically and automatically z+y- but manually x-latched, for safe CoG/pitch control.

The perfect concept UltraFreighter: a flying Triple E, aimed at shipping

As a business concept, the UF can only be fully apprehended by genuine Logisticians, so not by belly-freighters nor by traditional ICAO-registered air freight operators. In other words, it takes a shipper to understand what an UF can do for a Logistician, appreciate its scale economics, ponder upon the advantages of freight air-bridge and swarm operations (with optional in-flight refuelling by e.g. A332 MRTT tanker aircraft, to maximise pay-load). Simply because it would mean stretching the imagination of airline people beyond reason, these guys not knowing where to locate enough cargo to keep an UF flying in the first place!



http://commons.wikimedia.org/wiki/File:Artistic_view_of_a_PrandtlPlane_freighter.png (by Vittorio C.)

The UF is a concept AGA-liner with design capability to carry 350 tonnes of payload over 5,500 nm, comprising 26 AGA + 60 LD3 or a combination of general purpose cargoes or rolling stock, ULD, igloos, pallets to please forwarders. Each single UF can deliver in excess of 2 billion FTK per annum. A fleet of 50 UFs can cope with 1 % modal change, representing a 50 % upsurge in annual ICAO air freight statistics. We estimate the global market for UFs to be between 200 and 500 units over a period of twenty years. But there are unknowns when estimating the market impact of the UF: a connecting agent of Southern to Northern hemispheres, exporters of fruit, flowers, vegetables and other produce, artefact and perishables will want to exploit the UF for merchandise relocations to higher added value markets in the North, a perfect tool for mercantile opportunity rate valuation.

This last fact could easily double the number of UFs sold, based on the appraisal: the tool creates the need creates the market. Players controlling the fleets of UFs will also control the market. The first investors who access to UFs will actually stand forward as Leaders in their respective trades, spinning a noria of profit from investment. In the rogue language of Boston Consulting Group, with the UF you can corner the market; after the venue of the UF, all things will be different!

Converging interests: shipping, Airbus/Boeing/Antonov and UNCTAD

Common interests exist between world's freighter aircraft OEMs – mainly Airbus in Toulouse, Boeing in Chicago and Antonov in Kiev – and containerised shipping, including the freight forwarding industry : the latter are observing ever more progressive and frequent incursions by ICAO air freight operators into their markets – creaming off the higher-value slices of containerised merchandise, which they divert into high-yield air freight business through the hands of non-Shipping players – the former are sitting on the solution.

When establishing contact and dialogue, some humility will be required to secure positive, mutually beneficial business relations. In particular, the aircraft OEMs shall need to forget completely that they are the experts: clearly, for containerised shipping logistics, the people from Shipping are the experts. The airframers shall need to redefine their sales effort based on the fact that the sales targets this time are not directly airline people, but really total newcomers into the airline world. In fact, it is the other way around: Airbus, Boeing or Antonov would factually be the newcomers, into the fascinating world of Shipping!

The airframe OEMs may count on excellent support from Shipping experts, because Airbus, Boeing and/or Antonov would bring new and enticing topics into their professional lives; besides, nobody will be stepping into the flowerbeds of small package operators (UPS, FedEx, DHL and the likes) nor in any way interfere with the underbelly freighting business of passenger airlines, because the talks will centre upon developing entirely new types of freight, such as vegetables, flowers and fruits from Somalia/India to Europe, respectively from Chile/Costa Rica to USA/Canada, with high-tech and manufactured goods southbound...



Conclusion: the UF will help enhancing sustainable development and Fair Trade in emerging world regions by vectoring their agricultural production directly into higher-yield markets in the economically prosperous Northern hemisphere, a mission dear to UNCTAD, whilst more closely in line with greener CO₂ per kg-food.mile targets of the International Trade Centre.

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