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***AeroRaft* or the like  
A Serious Heavy Lift Aerial Crane & Transport Aircraft  
Why hasn't it been done before?**

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**Discussion**

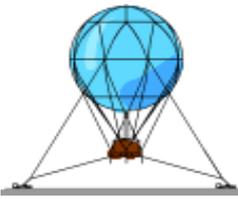
In fact, designs for heavy lift airships (HLAs) are not new, having been established to a certain extent before<sup>1</sup>, none successful. It's the particular *AeroRaft* arrangement and its derivatives that are new. One can only surmise why others didn't arrange things this way, which may be for a number of reasons, and there are a number of circumstances influencing their emergence:

- 1) In the lighter-than-air (LTA) sector there aren't very many designers anymore with real knowledge and experience capable of producing workable new arrangements, so mainly just history to go from; except for those since the industry's re-emergence towards the end of the 20<sup>th</sup> century. The shortfall of experienced designers is because there are very few businesses producing new airships today and few universities teaching airship technology, evidenced by the very low number of manned airships operating today. This is due to the industry's neglect over many years since the *Hindenburg* disaster and, in the last century's final quarter, the re-emergent industry's failure to provide reliable affordable types with low operating costs and year round operating capability without undue nursemaid tactics against the weather. There just hasn't been very much investment in this sector since the *Hindenburg*. It's pitiful and there's no good reason for the neglect; it's not rational!
- 2) People are often influenced by complex designs with so called sex-appeal and don't think too much of seemingly prosaic methods. This perhaps was the case when recruiting staff say for *Concord's* design compared to a refurbishment exercise on a *747 Jumbo* jet. Both aircraft essentially do the same job, but it appears most people would rather be associated with *Concord* - i.e. prestige; probably the UK & French governments' reasons for backing it. People perhaps think it looks better on their cv! It's the same in the LTA industry, where people perhaps would rather design large rigid airships instead of balloons or dumpy non-rigid blimps. It's a mindset that can be overcome through learning about the technology involved (largely unexplored). However, perhaps few would disagree that commercially the Boeing *747 Jumbo* jet was more successful than the *Concord*.
- 3) People with airships in mind often are influenced by what's been done before (mainly unidirectional {UD} types) and don't often go back to basics (i.e. balloons) or properly consider the foibles of former types that still must be mitigated. Prosaic balloons, generally omni-directional {O-D}, have charm and the ballooning industry is a commercial success story, but rarely considered as a basis for heavy lift purposes. The *AirCrane*<sup>2</sup> was an exception!

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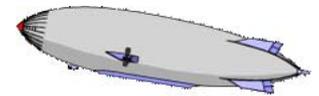
1 Paper, "Heavy Lift Aircraft – More than one way to skin a cat!" AERALL, France, Jan 2004.

2 Paper, "The CargoLifter CL 75 AirCrane", the Airship Association, Oxford Convention, 19 – 22 August 2004

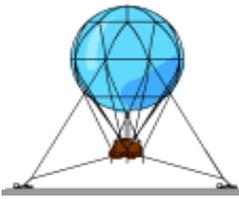


# LTA Solutions

## Lighter-than-air Technology



- 4) Garnering support for a new design not in vogue generally is an uphill battle against unsupportive people (often sitting on the fence crowing) who appear to care little whether it's developed or not. It seems to be that unknown designers (even if experienced) generally are considered to be cranks who face considerable opposition from people ignorant of the technology.
- 5) Designers perhaps are the worst people to promote their designs, where they also need business/sales capability. However, business/sales people generally don't fully understand the technology involved (or want to, their goal being mainly to get money) and mislead people with expectations that the designers can't match. The business people often take a controlling role, where the designers become servants just doing what they're told (unable to make necessary changes) it all too often ending in tears with the money spent as the crowds expected - but who did little to enable a positive outcome.
- 6) It's often war that spurs new designs rather than commerce, where powerful armed forces dictate the situation. This was true c100 years ago when LTA was booming with new *Zeppelins* to bomb Britain, aerostats to spy from and patrol blimps to shepherd convoys against the U-boat wolf packs. These days, airships generally are viewed in military circles as too slow and vulnerable. The alpha males don't appear to perceive the possibilities for things that LTA aircraft can do well. Instead they usually just pour scorn! After all, it's their job to destroy things and kill people.
- 7) Unlike the military, commerce in the free world isn't centrally organised and funded; where government generally only acts to cover infrastructure (like roads) that everyone needs. One may get grant aid to start a sweet shop, but funding for an airship business is another story.
- 8) The people who need them usually say they will buy or lease and use the aircraft when they're available, but rarely commit to any development support - probably because of losing their money on previous attempts.
- 9) The problem is 'how to start big', which such aircraft for the purpose must be, without a supporting product line of smaller developments (due to the state of the industry) that also provides the technology base to grow from? It needs those people who did invest in unsuccessful ventures to stay the course and understand that failure to deliver according to plan is only one disappointing step (of many) on the route from doing nothing to something that provides valuable experience to learn from and use for eventual success. Such is the nature of development. However, when everything is just trashed because of disappointment (so lost) it's very difficult to start again.
- 10) Now that the HTA industry is so well developed it can easily rise to produce new ways for many applications that perhaps would be the natural realm of LTA types. Consider the myriad drones that now exist, where LTA types already have a tough job to compete. If LTA and HTA were competing on an even basis this would not be the case. However, the HTA aircraft sector has failed to produce any serious aerial cranes for loads greater than 20 tonne (the limit of helicopters) despite their wealth and might, and are unlikely to do so in the future.
- 11) Vested interest from other transport vehicle developers also often belittle LTA aircraft. After all, they just see them as competition (especially the HTA aircraft sector) that they don't want.
- 12) Although there are people and organisations with good intentions, there's no effective political lobby to help the airship industry. By way of example, the fact that the Airship Association (a UK organisation trying to serve the world) came to be as an independent group is evidence of the neglect and reluctance to act by the UK establishment; where the Royal Aeronautical Society (RAeS) was the relevant body who should have instigated support. It's believed the RAeS didn't due to their members being mainly from the HTA sector and who dictate how things are run. It appears that LTA was seen as a thorn they would rather be rid of (and did get rid of it from their emblem) although there has been some softening of this attitude recently. The Airship Association is trying to help but is a volunteer organisation without very much political clout run as a club for enthusiasts!
- 13) Airship developments also don't get reported very much or favourably and often inaccurately with a giggle attitude (reduced a little now) and always with a reminder of the *Hindenburg* disaster – will it



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ever cease? While feature articles sometimes appear, public magazines like Flight or Aviation Week don't have a section for LTA aircraft. However, they do have sections for practically every aspect of the HTA aerospace industry; also true of the RAeS's members magazine Aerospace International. It's only specialist publications (not on the newsagents stands), such as the Airship Association's journal that provides news of LTA aircraft, and often only if the editor agrees.

- 14) Certification standards for aircraft since the airship industry's collapse after WW2 have been introduced that new airship development businesses must comply with. Often the standards for airships are derived from HTA aircraft without much relief or adjustment for airships and the development of the airship industry. New companies therefore somehow must become an approved aircraft development organisation before they can get a type certificate (let alone a certificate of airworthiness) for any new airship design. The burden is enormous, where new companies set up to achieve the impositions then are trashed due to costs when trying to comply.
- 15) Hybrid types appear to be in vogue at the moment. However, they face many of the same hurdles, although sex appeal perhaps is better. They're complex UD aircraft relying on both aerostatic lift and aerodynamic lift to fly, so are a technical challenge that appeals to people (to make it work) but probably needs new certification standards to ensure those challenges are properly met with safe designs. However, while they may be another useful way for transport, their usefulness as aerial cranes is arguable. This is because of their reliance on aerodynamic lift to remain airborne and thus the need (as for aeroplanes) to carry payloads internally (for streamlining and stabilisation). As UD types they also can't manage cross-winds easily. Although possible and claimed, their potential in this respect therefore likely will be limited and so not competitive with designs (like the *AeroRaft*) configured as an O-D aerial crane with potential for transport. It's a matter of horses for courses!

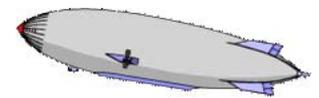
It's an uphill struggle all the way to get recognition for any dirigible LTA project and, even when there's some interest, the initiative often fails due to that interest waning or because of political pressure to drop it. The US Navy *YEZ-2A* airship (1986 – 1993) is a good example, where funds were diverted to Desert Storm instead during the airship's detail design stage – so was never built. Although just a 'drop in the ocean' of funding provided to the HTA sector, LTA was considered to be unimportant. There is therefore little incentive for people in the industry.

It's foolish to think that LTA aircraft have no place in society, particularly since they could be used to do things (such as heavy airlift) that HTA types are not suited for without enormous expense. A question to consider here is, 'why aren't there any true HTA aircraft providing serious aerial crane services over 20 tonne?' especially when the HTA sector commands the available resources.

Well, it's because it's rather difficult to defy gravity and get enough lift to support both the resulting aircraft and the payload's weight in a hover situation. Rotorcraft run out of capability for payloads over 20 tonne and fixed wing are a joke in this respect – where the power needed is phenomenal!

Politicians and military commanders appear to be rather fickle when it comes to LTA, perhaps believing that the fragile industry (as if it could) should demonstrate capability before they invest good money. And they perhaps also don't act due to embarrassment, where it's apparent that they don't understand the fundamental physics and have neglected this sector for so long that they probably now fear being shown up for their lack of foresight. Besides, the aircraft lobby system now is so strongly pro HTA that LTA has little chance. There are many proposals put forward in conferences, but these are rarely taken up with any strong conviction by political and military commanders. Now that it's been said, if they don't act soon then these sentiments will stand - exposing their weakness. This matter shouldn't be allowed to lie!

It is a fact that defying gravity is difficult and needs significant investment to do – even by LTA aircraft. However, LTA aircraft have a natural ability in this respect that improves with size – where the lifting ability increases by a factor of 8 when size doubles. This is due to the relationship that they exploit, where they rely on gravity itself to generate buoyancy instead of just opposing it. Harnessing gravity to do work that is needed is a sympathetic approach that people have not generally properly understood yet. See the



author's articles published in the Airship Association and Airship Heritage Trust journals concerning buoyancy for further insight on this.

New companies setting up as airship businesses for 'Transport Category' types, which HLAs will be, need to be aware of the general scene. They need commercial strategies to evolve and gain essential support from investors, politicians and people who need the services airships may provide, before just launching into another mammoth likely to repeat history. They also should put aside false reasoning that has dogged on for too long. In this technical age with computerised tools and a wide range of remarkable new materials and systems the goal is realisable.

With regard to new HLA projects, particularly the *AeroRaft* plus its derivatives (see below website), what's done before that provides useful information and/or technology aspects principally include:

- Production and operation of a variety of LTA aircraft demonstrating how they work and showing their viability to do useful things. This includes balloons, aerostats, airships and hybrid types. An assessment of these and HTA types for heavy airlift purposes was made and elaborated at the AERALL conference in Paris, 29 to 30 January 2004. See the author's paper<sup>1</sup>.
- Development of the *CL 75 AirCrane*, which successfully undertook load exchange and transport of a 55 tonne military tank on 7 May 2002. This is the forerunner of the *AeroRaft*, where the author was the Chief Engineer for development of the *AirCrane* and wrote its procedures for operation. For information about this development see the author's paper<sup>2</sup>, given in Oxford at the Airship Association's 5th International Airship Convention & Exhibition, 19 – 22 August 2004.
- Establishment by the HTA aircraft sector of most flight systems needed, which now are available and can be adapted/used for similar LTA purposes.
- Establishment by many industrial organisations in the transport industry (ships, trains, automobiles, etc) of efficient primary motor & generation plant that now may be adapted/used for LTA purposes.
- Production and operation of various lenticular dirigibles<sup>3</sup>, providing useful information about this O-D form.
- R&D already well advanced in new solar power and propulsion technologies (including cycloidal propellers) intended for *AeroRaft* derivatives<sup>7</sup>.
- R&D already well advanced in new high strength/tenacity fabrics needed for large aerostats
- Autonomous multi-rotor drone control technology that may be adapted.

It's believed that the way forward is to provide derivatives of the *AeroRaft* in a progressive way on a commercial basis from the bottom up (i.e. starting small) to serve needs in an affordable way that builds capability, establishes confidence and leads to heavy airlift when the technology has been shown to be viable and the business is ready. The simplicity of the *AeroRaft's* arrangement and its almost guaranteed ability to float as an LTA type provide natural ways to achieve the goal in a readily doable manner.

The market for HLAs is worldwide and waiting for efficient ways to serve. The competition isn't off the ground yet. The *AirCrane* took 2 years from scratch to be produced and show its capability. The *AeroRaft* and derivatives from it are based on this achievement. They are just a little more complex, to enable free flight instead of being just a dumb towed system, so also are doable in a short timeframe at a fraction of the cost compared with more complex types. The technology needed is available and mainly proven. The world is waiting! Why wait any longer? Why wait for the competition to lead the way?

When it happens it perhaps will cause a paradigm shift in the way things are done that leads to numerous further possibilities in many areas yet to be tapped, but needs support for development.

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3 Paper, "Lenticular Airships - An Exposition", LTA Solutions, Original: 11 Apr 2012. Rev B, 2 Dec 2017 (see website)