Office of Force Transformation
Department of Defense
Transformation Trends 30 Mar 2004

" We must change what we lift, how much we lift, how we lift it, and ultimately, why we lift it".

Art Cebrowski, Director, Office of Force Transformation, March 2004

This is the first in a series of three articles laying out the Office of Force Transformation's interest in, and vision for the development of Ultra-Large Airlifters. The first article establishes the foundation for reasoned discussion and to stimulate broad interest on the subject. This is a focus on a broad and diverse capability, and is not a platform centric approach. Indeed, the US Army also realizes this need and has partnered with OFT in this future work. Army funding will support the next step of laying the baseline of data that provide a solid foundation of logical development across government and the private sector to focus, encourage, and accelerate the inevitable future development.

Future articles will increase in granularity and refine the OFT vision and path to enable this capability. No single platform type can satisfy every commercial and military need. A variety of innovative designs exist, but a comprehensive review is necessary to determine which stakeholders across government and industry best match up in terms of needs and capabilities, and to then to demonstrate to key stakeholders why they should participate with OFT to build this capability.

Rob Holzer, Outreach Director, Office of Force Transformation
1401 Wilson Blvd, Suite 301, Arlington, VA 22209
Tel: 703-696-5715 email: rob.holzer@osd.mil

Fantasy to Prophesy: The Need for a New Lighter-Than-Air Aerospace Capability

LTC Michael Woodgerd

Introduction

The future US military must be far more mobile than it is today. For tomorrow, the US military must think in terms of maneuver, rather than deployment. It must maneuver directly from origin to ultimate destination, across much longer distances. The starting point may be in the United States, another country where forces are based, a point in the sea where ships or other platforms form a sea base, or a congested port. The destination could be almost anywhere in the world. This requires the ability to reach all relevant points on the surface of the planet and place a significant capability there in order to alter the initial conditions decisively in our favor. The only medium through which we can move that will give us this ability to *maneuver*, rather than simply *deploy* is through the medium of the air – that ocean that touches the entire surface of the planet.

This requires the ability to fly some particular capability – a combat unit, a hospital, a sensor package, etc. – directly from its origin into or near to its ultimate operating area. This requires a platform capable of delivering a significant payload, such as a large volume of equipment or hundreds of tons of cargo, to a bare field or patch of ocean almost anywhere in the world. This may be thousands of miles from home station to an area far inland within a theater of operations or it might be from the shoreline of an overseas theater into the area of operations. Only a technology capitalizing on static lift can provide this new concept of vertical maneuver in sufficient scale. The US military must take a fresh approach and apply Archimedes Principle -- *Any object, wholly or partly immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object* -- to the aviation arena instead of only to the nautical realm. Put another way, if a craft is lighter in weight than the volume of air that is displaces, it has buoyancy – "free lift" – equal to the difference in weights. This is the advantage offered by utilizing lighter-than-air (LTA) technology. This static lift exists 24/7/365, and while it is both a blessing and a curse depending upon the circumstance, it is an opportunity we can exploit to place a capability (anything from a futuristic laser to pallets of bottled water and repair parts) into perhaps hundreds of small landing zones scattered throughout dozens or even hundreds of square miles.

For decades, the department has spent billions of dollars and millions of man-years on dynamic lift or even orbital solutions. Dynamic lift requires power. This is expensive, there is limited room for further technical development, and the air itself is not unlimited in terms of room to operate. By looking at a new type of lift, we can utilize the currently untapped physical sectors of airspace and the technology space to tremendously expand our national mobility.

In the private sector, lack of transportation limits certain types of commercial endeavors. Trade cannot flow to and from many areas of the world in a cost effective manner. Trade is not conducted, construction projects cannot be undertaken, and natural resources go untapped simply because there is no way to move goods, material and people in either a cost effective manner or even get them to the area of interest. Investment consortiums and other investors seek new ways to meet these and other market needs, knowing that the first ones to provide such commercial mobility will have little or no competition and significant demand in certain niche markets.

Logically, when presented with unmet needs for the future, we look to the present, and if need be, the past to find either a solution, or at least a reference point. Today, air, sea, and land transportation capability cannot meet the demands described above. The past, rather than being merely a less efficient version of the present, instead offers a potential answer. LTA is a proven technology currently not sufficiently exploited. LTA offers multiple solutions for multiple divergent needs, but the focus here is on mobility. The potential value that an LTA borne communications relay offers to users – civilian and military – who suffer from a lack of dependable terrestrial communications links is tremendous. Those other applications, such as the stratospheric airship, while tremendously significant, are outside the focus of this paper.

LTA technology offers the breakthrough in mobility to meet multiple military and commercial needs. The evolving military term for the specific transportation capability is Ultra-Large Airlifter (ULA). A ULA is a large airship or potentially a type of hybrid air vehicle (HAV) that uses lifting gas (helium) for all or most of its lift, has a payload far greater than conventional aircraft in terms of volume and weight, range in the thousands of miles, speed significantly greater than surface ships, and does not require significant destination infrastructure (such as air- and seaports).

ULAs do not yet exist, however. To develop such a capability and to operate it is far beyond the reach of US military resources that even now strain to meet daily real world missions. It would be impossible to divert force structure from proven and integrated capabilities to new ones in any kind of near to mid term horizon. Thus, we need a civilian capability accessible in the same manner we now use civilian aircraft through the Civil Reserve Air Fleet (CRAF) or the Voluntary Intermodal Agreement (VISA) for sealift. This civilian capability, however, does not exist either.

This paper describes why the development of a ULA capability for the United States is unlikely to be a purely governmental/military effort, but rather one reliant heavily upon the private sector as well. The purpose of this paper is primarily to answer the many basic questions posed by decision makers and others over the past few years of studying, briefing, and discussing this subject and describe "why" ULAs are viable and "why" they will not simply result from a traditional program. Two follow on papers will provide a more detailed view of the "what" and "how" of the way ahead, including emerging results of the effort. The remainder of this paper describes the basic physics involved, further describes what ULAs are and why they should work, identifies quantifiable value added to military maneuver, and identifies the critical synergy between civilian and military applications. The final portion of the paper briefly identifies the way ahead to develop the broad commercial capability that the US military must access to meet its mobility needs.

ULA Descriptions and LTA Basics

The actual systems that fall into the ULA category are proposed but not yet proven. LTA overall is mistakenly perceived as a failed technology. Why should the military and commercial investors offer these systems serious consideration? Two reasons: the potential payoff, in both civilian commercial applications and military deployment is too great to simply ignore, and enough historical data exists to form valid conclusions about future viability. A two-step process validated these reasons. The first step evaluated the value a ULA would add to military deployment. The second step evaluated how viable an approach relying on LTA technology/platforms could be. The first required using proven deployment modeling, combined with real-world strategic deployment experience to give some quantifiable measures. The second required a broader study of historical benchmarks, aspects of technology, commercial viability, survivability issues, and other considerations. A study conducted by the US Army Center for Army Analysis, a joint study of future mobility concepts, and contractor efforts funded by the Army and the Joint Staff have addressed those areas.

The term Ultra-Large Airlifter is broad by design. It includes airships, and a variety of hybrid air vehicle designs. For simplicity, this paper uses the term airship both for convenience and because the vast majority of technical data and almost all historical data applies to airships, also known as fully air buoyant (FAB) vehicles. Less data exists on "hybrid" designs, also known as semi air buoyant (SAB) vehicles. Analysts will simply extrapolate where appropriate. For "users", the differences are not crucial to basic understanding of the capability and mostly apply to specific operational use where specific platform characteristics would matter, just as they do with ships and planes.

First, some basic definitions are in order. An airship is a lighter-than-air (LTA) craft with its own motive power. It can stay aloft solely because of "static lift" – the buoyancy of its lifting gas, which is less dense than air. Lift is defined as the "delta" between the weights of the lifting gas and the equal volume of air replaced. The lifting gas, normally helium, inside an airship allows it to float within the ocean of air. In this it is similar to a ship, which is buoyant because it is lighter than the equal volume of denser water that it displaces. An airplane relies on the "dynamic lift" it creates by passing a wing rapidly through the atmosphere. Thus, an airplane must move to stay aloft, where an airship, in most circumstances, can stay aloft with no motive power at all.

A hybrid air vehicle, particularly the most commonly proposed "lifting body" types, combine the static lift of gas with the dynamic lift generated by body shape as the vehicle moves through the air. This allows it to carry more payload than a pure airship <u>of the same size</u>, for which it trades off the capability to stay aloft relying only on static lift. This difference in ability to achieve or maintain equilibrium is the essential difference between an airship and a hybrid air vehicle. Since an HAV operates more like an airplane, it is designed to operate in a "heavy" condition; its flight characteristics and landing area requirements will be different than that of an airship. This may be an advantage or a disadvantage in any specific application. The operational requirement and the geography will determine which it is.

To allow a more focused discussion, it is useful to consider these future platforms not from the perspective of a particular technical type, airship or HAV, rigid, semi-rigid, non-rigid, etc. but rather from a functional perspective. Thus, during the Advanced Mobility Concepts Study, the need for the following three categories emerged: VTOL-Crane, VTOL, and STOL/CTOL. These are not exclusive, but provide a common framework. LTA offers a vertical or nearly vertical ability, which translates into much greater flexibility of landing areas. Different designs will occupy varied places on this capability spectrum, and like all man-made devices, will be utilized according to needs and capabilities. VTOL, STOL and CTOL all refer to how a craft takes off and lands. Conventional take off and landing (CTOL) describes everyday aircraft. If the craft can take off and land in a shorter area, we refer to it as Short Take off and Landing (STOL), and thus if the take off and landing distances approach the vertical, we have a VTOL platform. One technically possible design modifies this construct. If a craft can hold a position near the ground and raise/lower a cargo compartment or large objects, it would be a sort of flying crane, hence the term VTOL-Crane. The landing zones required for these varying types obviously vary a great deal, as would the design criteria for each type of ship.

Figure 1: Ultra-Large Airlifter (ULA) Attributes and Likely Types

Historical Benchmarks

The closest historical data point to a ULA is a rigid airship, of which 161were built in the first four decades of the 20th Century and performed as passenger liners, mail carriers, strategic bombers, naval scouts, and goodwill ambassadors. Another key source is US Navy experience with both rigid and non-rigid airships, of which it operated over 200 of the latter, especially in WWII, and then up to 1962.

Two particular comparisons provide an idea. The German airship *Graf Zeppelin* circled the world in 1929 at an average speed of 65 MPH. Flight legs included Germany to Japan and Japan to Los Angeles. Two US Navy rigid airships, the USS *Akron* and USS *Macon*, which were flying aircraft carriers designed for a scouting role, had a maximum speed of 85 MPH, a cruising speed of 65 MPH, and a design range/endurance of 9,000 miles. Airships also demonstrated consistency in performance. The *Graf Zeppelin* made a total of 144 ocean crossings, including 68 round trips across the South Atlantic during regularly scheduled passenger service between 1934 and 1937, carrying over 13,000 passengers and crew.

During WWII, the US Navy operated over 200 blimps during the period 1941-1945. The overall Operational Readiness Rate and Accident Rates were comparable to Heavier-than-Air (HTA). During WWII and airborne early warning and anti-submarine warfare patrols in the 1950s, airships demonstrated the ability to remain on station continuously for days during even the most violent winter weather. Navy experiments on the effects of icing found that rime ice, the most dangerous, rarely formed on the airships and minor changes in altitude avoided the effect. In fact, pilots could not even stay in the dangerous areas enough to gather sufficient data. Analysts had to construct mathematical models to complete their estimates.

The LTA heyday was during the two World Wars and during the interwar period. There is a unique symmetry between today and those interwar years. Today, the US Army, in particular, and the US Department of Defense as well, are devoting a great deal of thought and effort towards transforming. The 1930s were a time of incredible innovation as well, which led to carrier aviation and the use of lighter-than-air, for instance, all of which were developed in fiscally constrained times. Even during the Great Depression, and with an incredibly small force structure, the military experimented with flying aircraft carriers, and with matching airships with surface shipping, in what we would now call sea basing.

The Absence of LTA Today

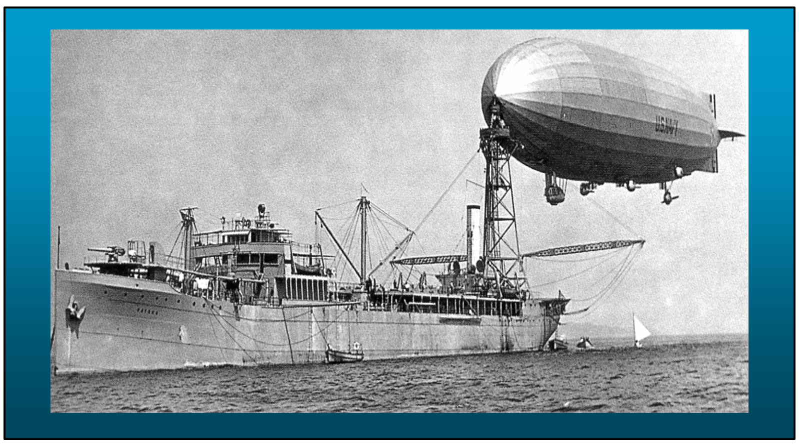
So why are airships not in common use today? Airships reached their technological zenith in the early 1930s—coinciding with the worldwide Great Depression. Neither governments nor commercial industry, such as the Goodyear Corporation, had enough money to build many airships. Airships were part of military force structure and so were fighting for a share of very small defense budgets. Spectacular crashes, large capital investment requirements, and the more rapid development cycles of airplanes deprived airships of widespread credibility. Successful operations of airships involved very few personnel and took place out of sight over oceans. Aircraft, by contrast, filled the skies during and after WWII and involved hundreds of thousands of people operating them, living near them, or suffering under their attack. The massive infrastructure of airfields, aircraft, pilots and support personnel after WWII made aircraft the most commercially viable system.

The primary reason that LTA has not re-emerged, except for advertising blimps, is simply one of money, though other factors also matter. Few subjects are plagued by more misperception and confusion than LTA. The grandiose claims of many promoters over the past decades, combined with recent commercial business failures have muddied the waters. Until now, there was also simply no significant market for LTA technology—no compelling demand for transportation or for surrogate satellites of the type a stratospheric airship may provide. There is also no coherent "industry" to promote itself and provide professional standards and advocacy. The commercial demand to lift Big, Ugly Freight did not exist, nor was the potential "middle market" for goods between airfreight and sea freight fully considered. Those markets now do exist, though not without competition in some cases. The demand density is scattered, and, like the LTA "industry" itself, there is no professional body to articulate the need. Several years of research have identified several key potential areas/participants, and refinement continues to narrow down the highest payoff applications. The technology to build craft large enough to profitably service those markets now exists. The world supply of helium is now large enough to fill those craft. The global economy is larger, stronger, and more transparent now and so could support fleets of airships and hybrids in commercial operation.

Freedom from Infrastructure

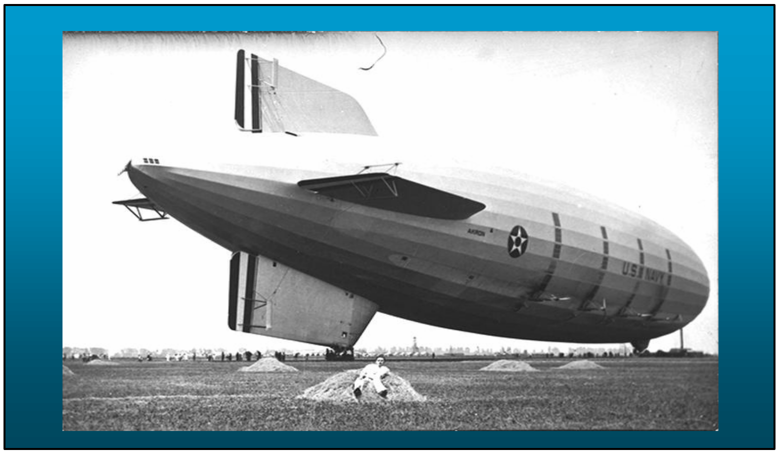
Figure 2 shows USS *Shenandoah* moored to the airship tender USS *Patoka*, a converted oilier. Airships, like any system, have unique abilities and limitations. Navy airships used the *Patoka* as a base of operations for extended periods (three weeks was the record). The airship would moor to the mast on the stern of the ship. The *Patoka* provided all sustainment for both crew and airship and could even steam some distance with the airship moored to the mast. This illustrates that innovative operational thinking will be necessary for proper utilization of any airship or ULA in military operations, but that the possibilities are there. If we could do this in the late 1920s, then we can do far more in many more innovative ways by the 2020s.

Figure 2: USS *Shenandoah* Moored to the USS *Patoka:* Sea-Basing 1924



Figures 2 and 3 highlight a critical point, which is the relative infrastructure independence of an LTA system when compared to traditional lift assets such as aircraft and ships. Very little infrastructure is actually needed compared to that of a port or an airfield. Other technological approaches utilize already invented and partially developed approaches to ground handling, such as the Air Cushioned Landing System (ACLS), that will replace the mast, most of the ground crew, and the location of some support equipment. Basically, LTA based systems offer a small footprint and no demand for the complex infrastructure of airports and seaports with the attendant expense and environmental concerns. This allows delivery of critical payload or some key capability directly from origin to destination or at least bypassing many chokepoints. Reducing "touches" of cargo and allowing delivery of material to a large degree outside of the existing transportation bottlenecks offers significant financial advantage. The reader must take care not to confuse the personnel/equipment required to support the ULA itself ((in flight and ground operations) with those personnel/equipment necessary to offload/handle cargo and passengers. The technical designs and the choices of cargo are inter-related.

Figure 3: USS *Akron* Moored at an Expeditionary Mast (Forward Operating Base) in Florida



<u>Survivability</u>

Airships are widely believed to be fragile and useless for military purposes. This is a misperception based upon a few tragic accidents and much evidence exists to refute it. A common mistake is to believe that airships, or other LTA vehicles, are somehow inherently vulnerable simply because they are capable of being lighter-than-air[1]. Critics point to the crashes such as the *USS Shenandoah* and the *USS Macon*. These ships suffered structural failure because aerodynamic forces in a certain situation placed stress upon the structural members that exceeded design limits. This happened partially because the design was not strong enough. For example, the Shenandoah was copied from a German ship designed to operate at extremely high altitudes and thus was not designed to be strong enough for low-level operations. Add to that aggressive handling by American crews and the stronger weather systems in North America, and structural failure is not surprising. The point is that future airships/HAVs must be well designed and well operated, just like any other aircraft or ship must be.

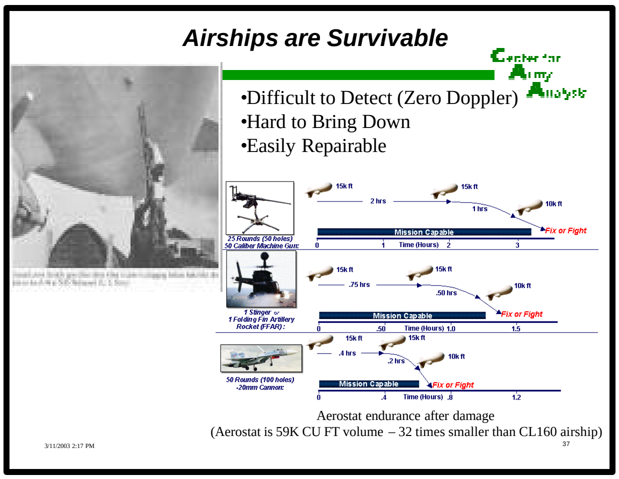
During WWII, US Navy blimps performed antisubmarine patrol, convoy escort, and search and rescue missions. The loss rate was 17 percent (29 blimps), and the overall accident rate per flight hour was very close to Navy HTA rates. More recent testing done by the UK Ministry of Defense and the US Army JLENS Program showed that airships and aerostats are quite rugged. The internal pressure required to keep the envelope (or "bag") tightly inflated is very small and remains so even when holes blown in the material the gas inside is not under great pressure to rush out. Therefore, unless the damage is a catastrophic rip, airships degrade gracefully and would likely come down under good control. Envelopes do not reflect radar, so finding them is so somewhat difficult.

Figure 4 demonstrates survivability very well. The charts show deflation times after damage. The picture on the left shows a ground crew stabilizing a hole in the envelope with a sailor's T-shirt. The point to

[1] Airships, or fully air buoyant vehicles, are capable of being literally lighter-than-air, depending upon many aerostatic factors. They very often operate slightly heavier-than-air because of their mission payloads, for ease of control, or other reasons, and are thus not literally always lighter-than-air.

take away is that even with a hole that big in the envelope, the ship did not deflate. They do not pop like a child's balloon, the gas does not explode into flame, and the ship does not plummet immediately and catastrophically to Earth. Unless the damage is a tear along a seam, which might empty the lifting gas in large amounts quickly, an airship should deflate slowly and it is actually the bag's loss of rigidity that causes the loss of ability for controlled flight. The ship then comes down in a more controlled manner than an airplane would. The point is not that an LTA vehicle is somehow invulnerable, but rather that they are like all other flying machines. They can absorb damage up to some point, and are not some sort of fragile toy.

Figure 4: LTA Survivability Examples



Strategic Mobility

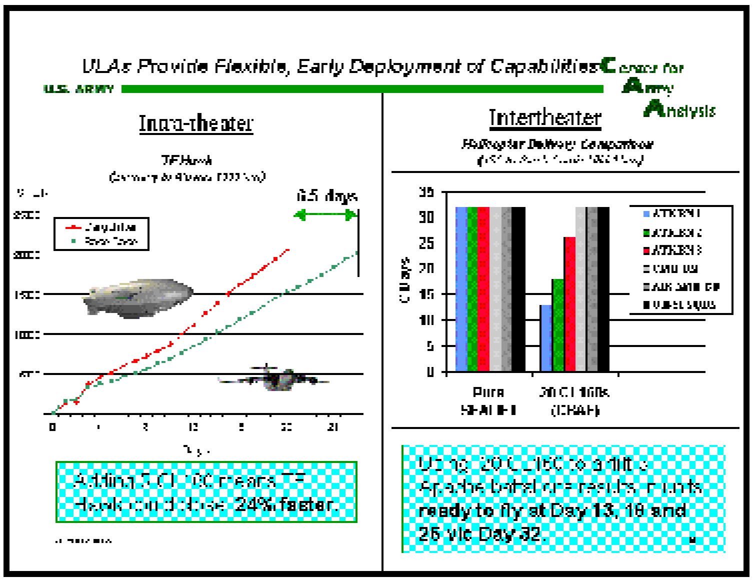
The beginning of this article described a ULA as a craft that uses lifting gas (helium) for all or most of its lift, has a payload far greater than conventional aircraft in terms of volume and weight, range in the thousands of miles, speed significantly greater than surface ships, and does not require significant infrastructure for operations. Those are the desired capabilities of the final craft that will come after the development and use of smaller craft. Obviously the reality of ballast issues, ground handling and other aspects will shape the realistic limits. Volume is more important than weight. Ships and planes tend to "cube out" before they "weigh out". That is, a craft might be able to lift more weighty cargo, but the cargo area of a craft is full before that weight capacity is reached. The military moves far more trucks than it does tanks.

One example is flying helicopters, and other similar high value equipment. It is advantageous to fly a helicopter in an operational configuration to provide an operational capability faster. Current aircraft and ships do not allow this, but a ULA, which is much larger than current aircraft, can have a larger volume payload bay. This would allow shipment of helicopters and similar cargo in an operational configuration. For example, deployment modeling, factoring in all movement time as well as preparation for and recovery from reduction for shipping, showed the notional ability to move an AH-64

Apache Attack Battalion 10,000 nautical miles and have it up and flying in 12 days versus 33 days by normal self-deployment coupled with strategic sealift.

One critical aspect to understand is speed, as measured from origin to destination. Aircraft have great speed, but that is only over certain legs. Look at travel time from actual origin to your destination, in terms of speed and complexity (Figure 5). Average speed of military deployment, from the motor pool to ultimate destination moved by surface shipping is 12 miles per hour. With an airship or hybrid air vehicle, this may become 60 to even 90 miles per hour, a significant speed differential. As a benchmark, existing commercial passenger travel by air, from home to final destination including all stops and waiting, averages 68 miles per hour. The airship operates like a ship. It will cruise 24 hours per day nonstop until it needs to refuel. The best way to understand and conceptualize an airship is to remember that it is a ship in every way. The ocean it moves through is an ocean of air. It is crewed and operated like a ship. It operates 24 hours per day and performs best over water.

Figure 5: Sample Deployment Comparisons



Effective utilization of this technology will ultimately require a worldwide infrastructure driven by the commercial assets that need it. It is best to have an airship tweaked to its atmospheric conditions and have the pilots used to that area of the world. It is not as effective to move them from climatologically different regions. Militarily, we leverage existing commercial assets and we devote time and effort day to day to ensure we have that commercial capability and access to it. Through our Civil Reserve Air Fleet (CRAF) system we provide subsidies to the airlines in return for providing extra strategic lift when called upon. It is a symbiotic, win-win relationship where by combining the commercial demand and a military demand, we are helping to make sure that lift asset is continually used so it can turn a profit and keep relative cost down.

Landing Areas/Ground Handling/Ballast/Weather Forecasting

The factors cited above are the main issues relevant to the end user. Different technical approaches address each aspect differently. Many people are now familiar with some of the commercial proposals for heavy lift airships and hybrid air vehicles. Which one is most effective will depend upon the exact mission. Landing areas may range between the 2-3 US football fields of a VTOL-Crane approach up to flat open areas of well over 100 US football fields for a larger HAV. Ground handling can be addressed several ways and is arguably the biggest challenge to a lighter-than-air craft. Any craft that uses static lift must consider its static condition, for the relative "lightness" and "heaviness" is in constant flux. For the end user this means that ballasting must be factored in to compensate for offloaded cargo. If your location has water, such as small rivers or ponds, then taking on water is a simple solution. Humans live near water, which covers much of the earth. Significant hydrological research has demonstrated how surprising the accessibility of significant water actually is. Hybrid air vehicle designs may allow such ballasting to occur some distance away from the pick-up and/or delivery sites. While it is a critical factor driving vehicle design and operational employment, ballasting is not the crippling weakness that many believe. Several different viable technical approaches to buoyancy compensation exist or can be developed. Finally, weather forecasting is critical. Investment of research and effort in all these areas will be necessary.

Commercial Role/Markets

While military uses of LTA were dominant in the past, and will be critical in the future, the commercial aspect is arguably the more important. Without two men: Paul Litchfield, on the American side, and Alfred Colsman, a name you never hear, on the German side, airships might not have existed after WWI. They were the businessmen who enabled Goodyear and Zeppelin to exist. Colsman kept the Zeppelin Company conglomerate solvent and provided the funds for building the *Graf Zeppelin*. Dr. Eckener is by far the most famous airshipman, and rightly so. His personality, marketing skills, flying skills, and economic sense enabled the regular passenger operations that conclusively proved the utility of LTA in a regularly scheduled commercial role. Later, however, revenues did cover most operating costs, even with only two ships in regular passenger operations. This suggests that an economically viable fleet size may be relatively modest. Most historians have noted that the passenger operations did not show a profit, which is true given that the investment in design and construction had to be carried against the initial ship(s) for accounting purposes.

Like Goodyear, Zeppelin[2] looked at the long-term financial potential. Litchfield's solid economic focus and solid financial status was what enabled the US to have airship fleets in WWII. Even the military money, which was actually written into the budget by Congress to build the Akron and Macon [two flying aircraft carriers built and operated in the 1930s], could not by itself justify fleets of airships. There has to be a commercial potential for any such capital investment. Litchfield was a visionary; he invested money up front for a long-term economic benefit. He took a long view, and built the infrastructure for airship construction and the two flying aircraft carriers for a monetary loss because he sought a new industry and markets that he would dominate.

The case for current markets is somewhat challenging. As described in <u>The Innovator's Dilemma</u>, it is impossible to measure a market that does not yet exist. Even so, analysis so far shows many potential areas. First, there are those markets that are not now serviced at all, such as moving large volumes of equipment to remote regions for construction or to mine/drill for natural resources. Moving any cargo into and out of land-locked countries in the world – the world's poorest countries – and to and from less developed countries where there is little existing infrastructure calls for an LTA vehicle to avoid the requirement for building significant new infrastructure. Just as Asian countries jumped straight to

[2] The two companies actually partnered as Goodyear-Zeppelin until WWII.

cellular phones, a ULA capability can enable new trade patterns around the world. As an aside, stratospheric airships may allow even more cellular phone usage and do other functions now done by satellites or towers. Note that in these examples the available landing areas at origin and destination, as well as the actual cargo that generates the profits, must drive the design of the ULA.

Opportunities now exist that did not exist before. Developmental challenges, however, exist now as in days past. The up front capital investment may be tremendous, and the time required for design, construction and certification (the latter often overlooked) is measured in years. To justify this tremendous investment, investors must be confident of significant profits, and this suggests many craft in operation to achieve economies of scale and return on investment. The military also needs hundreds of airships to exist so there would be enough to either operate in an arrangement similar to the Civil Reserve Air Fleet (CRAF) and/or to lease. This means there must be a large LTA industrial base similar to that of aircraft. LTA operations must demonstrate three things to investors and regulators: consistency of operations, complementary or different capabilities than existing assets offer, and commercial viability.

Figure 6: Multiple Valid Designs Support a Broad Capabilities Base

A future LTA industry should not be considered solely in terms of the uses of the various airships and hybrid designs that will exist to meet diverse needs of cargo and passenger movement, communications relays, sensor platforms (think of the many uses of satellites in agriculture, security, and others), and others yet to be discovered. The "industry" itself will be a potent force. The following description of the post WWII heavier-than-air aerospace industry in the United States is illustrative.

"The development of radar and of very large airframes for bombers made the modern air travel industry possible years before it would otherwise have grown up...The jet engine…revolutionized air travel a decade later…Not only did air travel become one of the driving forces of the postwar American economy, but aircraft construction became a major enterprise and a vital part of America's exports. American planes…continue to dominate this extremely capital-intensive industry."[3]

The tremendous technical challenge of building any such craft, especially the proposed hybrid designs, will demand great resources of engineering brilliance, technical innovation, organizational expertise, time, and money--especially the latter. The driver to bring these companies/technologies to fruition and maintain their existence must be a business bottom line--satisfying one or more commercial needs at a competitive price. Building, operating, maintaining, and crewing these giants of the air will be an entire industry in itself. Government must play a supporting and even crucial role.

The example of Litchfield and Colsman combined with current commercial and military needs of strategic deployment suggest that now is the time to combine idealism with the pragmatic business and military sense. We must identify the key points where commercial, military and government needs overlap to identify the next logical leaps of developing a capability. We can then form the teams to design, build and operate this essential new capability across North America.

The need is for literally hundreds of these ships to meet diverse missions. The challenge of course is finding the right combination of people, putting them together and focusing the energies of either existing manufacturers or new players to produce these capabilities. The fact that no military is going to foot the bill on its own pushes us to find an innovative way to partner in some manner to develop this capability. It has been said that, "Airplanes are designed by aeronautical engineers, helicopters are designed by mechanical engineers, and so far airships are primarily designed by idealists." But the example of Litchfield, Colsman and the current opportunity suggests that now is the time to combine idealism with the pragmatic business and military sense, to help identify the next logical leaps of developing a capability and see where commercial and military needs closely match.

Summary

A compelling military need for greater mobility exists. Commercial needs for access to/from remote areas and an ability to move outsize cargo more cheaply in developed areas are examples of commercial needs for mobility. A new segment of the US Aerospace industry based upon LTA technology, and cargo-carrying platforms in particular, will also be an element of national economic power in its own right.

The challenge lies in developing a coherent, logical and defensible development plan to encourage/focus/ accelerate development of a new segment of the civilian aerospace industry centered on lighter-than-air (LTA) capabilities so that the military can utilize ULAs from the civilian sector rather than as an organic force structure component. To make this a reality, we first need a Vision of the necessary future aerospace capability and the logical path and participants to develop that capability. Such a rigorously systemic analysis must proceed from a generic, platform independent start point.

The Office of Force Transformation (OFT) sees the clear need for a new concept in vertical delivery as a key physical component of network-centric operations. The physical limits of existing ships and planes

---

[3] John Steele Gordon, "The Business of America" American Heritage, June 2001, p. 93

as well as the realization that future concepts of maneuver will drive a tremendous increase in movement requirements point toward the one area where major progress can be made; the area of Lighter-Than-Air. OFT will provide the Vision of a future aerospace capability and chart the path to move key networks of initial stakeholders to the required "tipping points" to accelerate this inevitable development.

Figure 7: The Future Worldwide LTA Industry is Inevitable

This article contains portions of papers presented to various professional and commercial forums across North America and originally published in their proceedings over the past two years. It also builds upon the author's research from 2000 until the present and extensive interviews with many experts in the fields of LTA engineering, the commercial sector, and other relevant governmental agencies. The author wishes to fully acknowledge the invaluable contribution of many others who made this work possible by their kind ongoing assistance and that provided during previous study, their innovative thinking, their generous contribution of time in proofreading this article, their polite highlighting of weaknesses, and their encouragement.