AIRSHIP: A VIABLE AIRLIFT OPTION

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In 1783, as Benjamin Franklin watched the ascent of a small unmanned hydrogen balloon over Paris as a 'technology demonstrator', an onlooker remarked, "Of what possible use is it (the balloon)?" Franklin shot back, "What is the use of a newborn babe?"[1]

AIRLIFT – A MOBILITY OPTION IN WAR AND PEACE

Wars of the last hundred years have highlighted the importance of all roles of air power and airlift is one of them. Conflicts of the last two decades, in particular, have shown that airlift can bring about significant asymmetry in military powers of the opposing forces. It ensures prompt and timely transportation of personnel – combatants, technicians and those supporting operations, including civilians; supplies to maintain their combat potential and, equally important, the ordnance to execute the war. Airlift is the lifeblood of military logistics. Its profound effect on warfare has turned the course of history on numerous occasions.

Air maintenance is the lifeline of troops in remote areas inaccessible by road. Transport aircraft and helicopters deliver supplies many times faster than surface means across mountainous and jungle terrain often crisscrossed by rivers. Relief operations involving emergency airlift and air evacuation save innumerable lives during earthquakes, cyclones, tsunamis and floods. Airlift is the backbone of search and rescue operations. Some countries dedicate air effort for fire fighting also.

The option to airlift is influenced primarily by the urgency of *time*. Occasionally, *inaccessibility* of locations by other means of transportation,

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1. This repartee has been attributed to different people in history. Attribution apart, the balloon turned out to be a useful airborne platform and was soon adopted for military purposes. It is time to have a re-look at airship as a viable option for airlift.

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even when there is no urgency, may prompt airlift. For reasons of economy, surface means are always considered before resorting to airlift. Prudence demands judiciousness in use of airlift resources in peacetime to conserve them for national emergencies and wars – the most economical airlift options needs to be exercised, when the stakes are low.

AIRLIFT PLATFORMS

The earliest airlift platforms included the *lighter-than-air* balloons and the airships[2]. The Wright Brothers' aeroplane (1908) was a *heavier-than-air* platform. The most common ones of today are either fixed or rotary wing aircraft. Tilt-rotor aircraft are hybrid machines that have features of both. Less common, yet in use, is the air cushion (hovercraft) technology. In August 2012, the U.S. military tested a radical new hypersonic aircraft, the X-51 WaveRider. It was expected to reach a speed of 7200 kmph within seconds.[3] The experiment failed.[4] Success would have implied the distance between London and New York being covered in an hour.

At this point in time, when *speed* seems to be an obsession the world over, a suggestion to relook at the airlift potential of airships may sound downright quixotic. A moment of dispassionate thought will, however, present a different perspective since airships have been in use for more than a century in different roles – bombing, reconnaissance, patrolling and anti-submarine operations. The focus here is on their airlift capability in peacetime.

The starting point of this paper is the thought that airlift is a necessity to meet defence and development needs of a country and that the operational and economic viability of any airborne platform that can airlift personnel and cargo must be considered without prejudice.

HOW ARE AIRSHIPS DIFFERENT?

Lighter than air gases like hydrogen and helium provide the buoyancy

2. Airships could be *rigid* or *semi-rigid*; they could be *blimps* or *dirigibles* – there are subtle technical differences. Here, all these air platforms are being covered under *'Airship'*.
3. Agencies, *"London to New York in an hour? Key test today"* in The Times of India online edition dated August 14, 2012 accessed on August 21, 2012.
4. BBC NEWS Technology, *Hypersonic jet Waverider fails Mach 6 test*, August 15, 2012 available at http://www.bbc.com/news/technology-19277620 accessed August 21, 2012.

necessary to keep an airship afloat. The gas is counterbalanced with weight – cargo or otherwise, to maintain equilibrium. Powered engines are needed mainly to propel the platform. Thus, a failed engine would not bring an airship crashing down. Though they fly at speeds lower than the fixed wing aircraft and helicopters, they have the advantage of range, endurance and hover; the latest ones on the drawing board boast of the advantage of payload too. They consume relatively less fuel for propulsion.

The airframe of an airship requires just enough strength to support itself and to bear the stresses associated with low-speed flight. Its low speed makes it less susceptible to the dynamic stresses that can cause conventional aircraft to break up in flight, if damaged. Helium leaks slowly into the atmosphere because the gas envelopes need a slightly higher pressure than the ambient atmosphere.

Airships do not require long runways and large prepared surfaces for launching and landing. They require relatively less facilities on the ground than the conventional aircraft. Therefore, they are capable of delivery of payloads even to locations with minimal infrastructure. Depending on technological feasibility, airships may be able to carry payloads comparable to some of the largest fixed-wing aircraft. With suitable design, development and modifications, it may be possible to use them for a variety of airlift operations including parachute drops of personnel and supply.

Heavier-than-air aircraft, in contrast, require stronger, and therefore generally heavier airframes. They need more powerful and reliable engines because they generate lift by *pushing* their wings/ rotors through the air at high speed. They need fairly well established infrastructure on the ground for operations.

AIRSHIPS – A SIGNIFICANT PAST

Balloons and airships were used as observation posts in the early days of aviation and were the first to carry men and material across inhospitable terrain. German navy airships patrolled the seas as early as 1914. They used Zeppelins for bombing in early 1915. The U.S. navy too used airships extensively from the 1920s through the 1950s, primarily in anti-submarine, reconnaissance and maritime patrolling roles. Occasionally, civilian airships were used for advertising and transportation. Early 1930s saw airships carrying passengers across the Atlantic. An innovative and daring application of the airship was a "*flying aircraft carrier*". USS Macon and the USS Akron were rigid airships

used for launching Curtiss Sparrowhawk biplane fighters.[5] During the 1920s dirigibles were used for luxury air-travel, particularly for cross-Atlantic flights. A mooring mast spire atop the Empire State Building is a symbolic relic of a time when airships were believed to be the future of air mobility.[6]

The lurking fear of accidental fires due to the use of the highly inflammable hydrogen gas, in the initial years, was a big negative incentive. The fears were rooted in just one accident. On May 6, 1937, one of Hindenburg's airships on a PR mission, burst into flames at Lakehurst, New Jersey. Though, of the 97 people aboard 62 survived, it was deemed as one of the most infamous disasters of the 20th century. The accident earned extreme notoriety because of the media presence. Terrifying photographs of the accident were splashed on the pages of newspapers and magazines all over the world. Mr. Pankaj Som Chaturvedi of TRA Aerospace asserts that it was not the use of hydrogen gas but the highly inflammable paint applied on the surface of the airship that aggravated the fire. *Body count* was perhaps not the only reason for public alarm because four years later, when the airship USS Akron crashed into the Atlantic killing more than twice as many people but the accident drew much less attention. Nonetheless, such accidents with media glare relegated the airships into oblivion.[7]

Successful and widespread use of fixed wing aircraft including gliders weaned off the attention of the protagonists from further development and military use of airships. Vulnerability of the airships to ground defence is always a given. It was the reason behind the waning interest in the platform. The last dedicated military airship went out of use in the early 1960s.[8] The research to exploit lighter than air platforms continued, albeit at a slow pace. Replacement of the highly inflammable hydrogen gas by an inert gas like helium allayed fears of disasters but to no avail.

RECENT DEVELOPMENTS

The last two decades have seen a revival of interest. Police blimps patrolled the sky during the Republican National Convention (2004) and during the Olympic

5. *USS Macon and Sparrowhawk* available at http://www .youtube .com/ watch? v= IWoE QR l8d Cs & feature =related accessed September 5, 2012.
6. *"Passenger Dirigible"* on Dead Media Archive site available at http:// cultureandcommunication. org /deadmedia /index.php/Passenger_Dirigible accessed on November 5, 2012.
7. "*Airships: The Hindenburg and other Zeppelins*" available at http:// www .airships .net/ hindenburg/ disaster accessed on May 27, 2012.
8. Keith Hayward, *The Military Utility of Airships* (London: RUSI, 1998), p. 1.

Games in Atlanta (1996) and then in Athens (2004). The Special Anti-Crime Unit of Trinidad & Tobago (SAUTT) operates a blimp for security surveillance. In April 2009, it provided surveillance of the 5th Summit of the Americas in Port-of-Spain.[9] These are uses of airships for surveillance and policing. With suitable modifications, it may be possible to design airships specifically for airlift. Boeing was to build an ambitious heli-stat – a combination of a blimp and a helicopter. The project was shelved, apparently for want of funds.[10]

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The need of inexpensive airlift platforms with low operating costs and capable of carrying heavy cargo has generated renewed interest in airships, as alternatives to surface transport and the conventional aircraft, to some extent. Some of the armed forces, the world over, have narrowed down to manned and unmanned airships. The civilian effort covers a wider spectrum of use.

A November 2011 study under the auspices of United States Congressional Budget Office deliberated on the use of airships in intelligence, surveillance and reconnaissance (ISR) role and for limited missile attacks against less capable adversaries on the ground without an air defence cover. According to the study, concern had arisen during the 1990s that rapid deployments like those, to large airbases in Saudi Arabia during the first Iraq war, would not be possible in a future scenario if such airbases were not available. Proponents argued that transport airships capable of landing in any suitably large open area could reduce the military's dependence on overseas bases.[11] Needless to say that this is a coveted capability for India with its major airlift commitments.

The report suggests that the U.S. army, air force, and the Defence Advanced Research Projects Agency (DARPA) were focussing on unmanned craft for ISR. Over the previous two years, Department of Defence (DoD) had funded more than $500 million for projects related to *lighter-than-air* platforms, and additional spending is planned for the future. Additionally, several privately funded development efforts

9. *"Police Aviation"* at http://en.wikipedia.org/wiki/Police_aviation accessed on August 27, 2012.
10. Lewis Page, "Airship 'Sky Tugs' ordered from Lockheed for Canadian oilfields: P-791 military hover suck-blimp gets civil application," posted in *Science, 28th March 2011, The Register* at http:// www . Theregister .co .uk/ 2011/ 03/ 28/ p791_ ordered_ for_ Canadian _oilsands/ page2 .html accessed on November 5, 2012.
11. Author's discussion with Mr. Pankaj Som Chaturvedi and report of a study titled, "*Recent Development Efforts for Military Airships November 2011*" available at their site http:// www. cbo.gov/sites/default/ files/cbofiles/attachments/11-01-Airships.pdf accessed August 19, 2012.

Presently, *lighter-than-air* platforms are being used mainly to cover sporting events and policing. They are also being used to carry over-dimensioned cargo like the long blades of windmills

were under way that could yield airship designs suitable for adoption by the DoD. The *Pelican* and the *Sky Tug* are hybrid airship projects to enable carriage of 20 to 60 tonnes over ranges of about 1,000 to 3,000 nautical miles. These payloads and ranges compare well with some of today's leading airlift aircraft of the world – the C-130, the C-17 and the C-5. From 2003 to 2006, the DARPA pursued *Walrus*, the Hybrid Ultra-Large Aircraft (HULA) Project to build an airship that could carry 500 to 1,000 tons up to 12,000 miles in less than seven days.[12]

Presently, *lighter-than-air* platforms are being used mainly to cover sporting events and policing. They are also being used to carry over-dimensioned cargo like the long blades of windmills, which cannot be carried by trailers to locations on hilltops due to difficulty of manoeuvring through winding roads and hairpin bends.

The U.S. uses airships mainly as unmanned, long endurance surveillance platforms. They carry relatively small payloads and, therefore, need much less gas and their pressure height limits are high enough ensuring survival above the battlefield.[13] They have been used in Afghanistan regions not threatened by ground defence. As said earlier, with modifications it may well be possible to use similar airships for mobility.

Northrop Grumman and its industry partners have successfully developed the world's largest, most-persistent, lighter-than-air operationally piloted aircraft.[14] Though details in the open domain are not readily available, it is believed that China has also used (tugged) aerostats in Mongolia for movement of cargo.

Skylifter, an Australian firm, is developing an airship that will carry up to 150 tonnes over 1000 kms. According to the firm, once developed, the airship will carry rural hospitals and disaster relief centres to remote areas.[15]

AVERAGE THROUGHPUT CAPACITY: A SIMPLE COMPARISON

One of the simplest measures for characterising strategic lift systems is

12. Ibid.
13. Lewis Page, n. 10.
14. "Aviation Defence News," *Vayu*, V/2012, p. 147.
15. "Giant airship that can carry entire buildings 2000 kms," *The Times of India*, Wednesday, October 6, 2010, p. 21.

average throughput capacity: the product of payload and the distance that payload can be moved in a day. Despite their slow speed, (sea) ships tend to have a high throughput capacity, primarily because they can carry much more than an aircraft can. For a notional deployment from the United States to the Middle East, a sealift ship would provide nearly 30 times the throughput capacity of a C-17. Cargo airships could provide an intermediate capability, delivering cargo more quickly than ships but not as quickly as conventional aircraft. Large airships with payloads of 500 to 1,000 tons would yield greater throughput capacity than today's aircraft.[16]

At medium distances (up to about 100 nautical miles), the number of airships needed to maintain a given cargo throughput (say, 1,000 tons/ day) would be similar to the number of helicopters. At long distances (> 100 nautical miles), the greater ranges offered by the airships would enable them to maintain a given throughput with fewer aircraft. This advantage would enable a single airship mission to meet the requirements of several posts/ units/ formations on the ground sequentially, instead of individual missions that would be needed with other aircraft.

PEACETIME AIRLIFT: SOME ASSUMPTIONS

Past experience and derived wisdom suggests that even in peacetime, physical shipment by air occasionally assumes greater relevance and importance than the speed of delivery. Quantity does matter – tonnage airlifted is always a concern. Despite want of statistical data in the open domain on the airlifts carried out by the Indian Air Force, it may be safe to assume that a major portion of the effort is devoted to peacetime transportation of men and cargo and airborne training of the troops. Also, since war is not an on going process, airlift takes place in a *safe* environment generally free of threat to the airlift platform. Further, technologies meant for remote guidance and control have reached high levels of maturity. It will be possible to make use of those technologies on airships.

Therefore *if* and *when* airships are devoted to airlift they would take flight in a secure airspace. Ditto for airlifts that would be undertaken to assist the civil administration during disasters and natural calamities – survivability/ air defence of the airships must not be a grave overriding issue under those circumstances.

16. Despite low throughput, fixed wing aircraft and helicopters have certain distinct advantages over sealift. An aircraft could begin delivering cargo much sooner than sealift. Thus, it is important that when considering transportation, planners ascertain urgency for airlift.

AIRSHIP AS AN AIRLIFTER: SOME STRAIGHT OPTIONS

Trend suggests that in the *not-too-distant* future, more and more airships of varying sizes will share the skies with other flying machines. Countries that invest in the technology are likely to benefit from the airlift potential of the airships. Proposals already exist for airships that could accommodate payloads of various sizes ranging from 20 to 50 tonnes. Some obvious uses of airships include:

- **Airborne Hospitals**. To provide medical services to people in remote areas during peacetime. Such hospitals would be of immense value during epidemics and disaster relief operations.
- **Air Maintenance**. Airships could be used for delivery of supplies to the Drop Zones (DZs) and Advanced Landing Grounds (ALGs) in the eastern sector as a matter of routine.
- **Connecting Island Territories**. In the Andman and the Lakshdweep Islands, airships could provide superior connectivity.
- **Airborne Training**. It may be possible to use airships both for static-line and combat freefall (CFF) training jumps. Relatively smaller drop zones would be needed for training jumps from airships.[17]
- **Troop Movement**. In regions with less road density and across inhospitable terrain, men take several days to arrive at the nearest railway stations when they proceed on leave/ duty in another part of the country. Airlift could be a boon for those serving in such areas.
- **Infrastructure Development**. Construction and maintenance of aircraft operating surfaces, roads and accommodation for personnel in the border areas is an on-going process. It lacks speed for want of heavy machinery and steady supply of large amounts of construction material. Airships could provide necessary logistical support.
- **Winning Hearts and Minds (WHAM)**. Used thoughtfully, airships can be effective in WHAM by reaching out to the masses in areas affected by Naxal activities.
- **Easing Traffic**. Airlift of vehicles and men across cities can reduce volume of traffic on the roads. It can relieve the surface transports of their rush hour woes.
- **Ferry Across Rivers/Terrain**. Airships may be utilised to carry deliverables where rivers are aplenty and bridges are very few like Assam, Kerala and the Sunderbans. Air ferries can transform lives of the people.
- **Unit Movements**. Large convoys and military special trains are

17. Some jumps from fixed wing aircraft would still be required for more realistic training.

involved in movements of units/ formations within India. Airships could accomplish such movements more smoothly.

- **Managing Roadblocks**. Landslides and accidents disrupt traffic for days on end because of inaccessibility of the sites by surface means. Helicopters can carry limited heavy equipment and raw material for repairs. It may be possible to address such needs more effectively with airships.
- **Fighting Fire in High-rise Buildings**. Airships could be used for fighting fires in high-rise buildings by landing fire-fighting teams and delivering equipment and large quantities of water on rooftops.
- **Jungle Fire fighting**. Similarly, airships could deliver large quantities of water to fight jungle fires.
- **Oil Exploration**. Oil exploration needs heavy machinery the transportation of which requires new roads. Construction of new roads only for exploration for more or less one-off use is an expensive proposition. Besides, creation of such infrastructure takes a long time and harms the environment. To address the problem, Canada has ordered Lockheed Martin for airship 'Sky Tugs' for their oilfields.[18]
- **Evacuation**. In a scenario like the expulsion of Asians from Uganda (1972). It may be difficult to evacuate a large population using conventional aircraft. Due to the high throughput of airships at short distances it may be possible to evacuate large numbers of people to a friendly neighbouring country using heavy lift airships and then, evacuating them by ships or conventional aircraft at a comfortable pace. During the Iraqi invasion of Kuwait, it was more important to get more people out of harm's way than to carry them to India instantly. In that situation, use of heavy lift airships could have made the exercise simpler.

EXPANDING THE HORIZON

Airships, and other airlift platforms for that matter, are mere means to an end. Their effectiveness depends on how well they are exploited. The huge earthquake and tsunami that struck Japan's Fukushima Daiichi nuclear power station on March 11, 2011 knocked out backup power systems that were needed to cool the reactors at the plant, causing three of them to undergo fuel melting, hydrogen explosions, and radioactive releases. Radioactive contamination from the Fukushima plant forced the evacuation of communities up to 25 miles away and affected up to 100,000 residents, although, it did not cause any immediate deaths. Helicopters

18. N. 10.

that carried water to dowse the fire at the nuclear reactors were handicapped. They could carry small payload, about 2.5 tonnes, which had little effect on the blaze. Their *bellies* had to be coated with lead to lessen the effect of nuclear radiation. This further reduced their capacity to carry water. Pilots who flew those sorties did so at the peril of their life. A pilotless airship with a capacity of 60 to 70 tonnes would have achieved more tangible results – no risk to lives, much larger quantity of water being delivered in every lift. Besides airships could have effected evacuation of much larger number of people. Similarly, an airship could have carried hundreds of residents upwind and saved them from the poisonous gases emanating from the Union Carbide pesticide plant in Bhopal (1984).

Airships as *airborne aircraft carriers* can throw open a wide range of options hitherto not contemplated with seriousness or, if at all, seen with considerable scepticism. It may be possible to conduct sustained search, rescue and relief operations from such platforms during accidents and disasters. Dozens of *Airmules*[19] could ply casualties in and out of an airborne hospital. *Keeping vigil* over an area for long hours and delivering troops instantly to counter terrorists, insurgents or Naxals could be a considered option.

Situations like the Berlin Blockade that require airlift in a secure airspace cannot be ruled out in the future. On the Easter Parade (April 16, 1949) Tunner's men had airlifted a record 12,941 tonnes into Berlin, in 1,398 sorties averaging one round trip for every one of the 1440 minutes in the day.[20] Today, assuming that airlifters with, say 60 tonnes payload capacity[21] are available and are pressed into action, only 216 sorties at the rate of nine sorties per hour would be required to carry the same tonnage.

Imagine squadrons of airships sprinkling water over crops in drought-affected areas or spraying chemicals when large pest infested areas need immediate attention.

Possibilities are numerous; horizon needs to expand.

LIMITATIONS

Development of airships has remained dormant for decades. There is limited

19. "The AirMule is a compact, unmanned, single-engine, VTOL aircraft. Still under development, it can evacuate 2 casualties. It could be used for other payloads for other missions. It is suited to special robotic operation, for example via Tele-Presence." More information available on Urban Aeronautics site at http:// www .urbanaero .com /category /airmule accessed on December 18, 2012.
20. Lt. Gen. William H. Tunner USAF, *Over the Hump* (Wahington D.C.: Office of Air Force History, USAF, 1985), p. 222.
21. This is a modest capacity assuming the pace of developments; the *Skylifter* aims at 150 tonnes capacity.

collective and cumulative experience in airship designing, operation and maintenance. Advances in the technology have not been tested and proven to high levels of confidence. Doubts remain even about the most modern airships. Technologies needed for critical systems – propulsion and power, fabric for airship envelopes, flight control systems and sensors – are in different stages of development.

Airships are less tolerant to poor weather conditions. High winds, in particular, can make airships difficult to control, especially in ground proximity. They are sluggish flying machines difficult to manoeuvre in response to changing wind direction and situation on the ground. They sacrifice speed for endurance as compared to fixed-wing aircraft.

Helium is rare and very expensive. Availability and storage of the gas is a major concern. Use of airships will necessitate insurance of steady supply of the rare gas. Even for the aerostats presently in use by the Indian Air Force, procurement of the gas is a logistician's nightmare. The few known sources of supply are either in the U.S. or traders are located elsewhere. The irregular supply can breakdown naturally or by design. Limited sources of supply leave scope for coercion by the supplier's country. Storage, handling and distribution of the gas are linked issues, which deserve serious thought. The U.S. faced these problems while using tethered blimps to provide security surveillance at fixed locations in Iraq and then in Afghanistan.

In peacetime, the possibility of an airship being targeted from the ground with a hostile intent is as rare as a similar threat to a civil or a military aircraft. In times to come, however, such threat will deserve attention. If somehow air defence threats materialise in an otherwise *safe* environment, airships would need more time to exit the area and reach *safe airspace*. Less manoeuvrability would magnify such threats. In any case, if an airship were to be hit by ground fire, its survival would depend on the extent of damage. While evading imminent threats may be difficult for airships, their probability of survival after being hit may be much higher than the fixed wing aircraft and helicopters.

OVERCOMING HURDLES

The technology behind majestically soaring airships is more complex than it appears to be. The ship's weight reduces as fuel (used for propulsion) burns, creating an imbalance, and sending the ship further up into the atmosphere. Same effect is experienced when the cargo is *offloaded*. So, to

stay at a cruising level, ideally, the airship must release expensive helium gas into the atmosphere. This would result in continuously wasted gas, just to maintain altitude. Scientists have evolved a mechanism that would enable better altitude control without releasing the precious gas into the atmosphere. The development entails compression of helium gas in-flight to vary the overall buoyancy of the airship. Aeros' Pelican airship is one such project funded by the Pentagon's Rapid Reaction Technology Office and is likely to be used by the armed forces/ security agencies in the US.

The problem of availability of Helium gas may get addressed in due course of time as Mr. Pankaj Som Chaturvedi says that there are possible sources in the Gulf region. He adds that hydrogen is not as unsafe a gas as it is made out to be. Experiments are on to use hydrogen gas with abundant caution. Traces of helium gas were found during oil exploration undertaken in India; however, commercially viable quantities are not possible as yet.

Powerful propulsion systems will be required to overcome *sluggishness* and *low speed*. In addition to the piston engines (propellers), jet propulsion could be considered. Experiments could be carried out using the Total Technical Life Expired (TTLE) aircraft engines of suitable types to address the issue of propulsion.[22]

Effect of wind may be countered to some extent. A solution may be found in the manner in which small but powerful *tugs* tow massive warships in the harbours. *Tugging/towing* could be an option for airships too. Air cranes or tilt-rotor aircraft could be used to *tug* airships.[23]

Presence of airships, in the airspace already crammed with civil/ military aircraft, would lead to air traffic woes. This, however, is a manageable problem. Thoughtful planning and execution of projects can prevent congestion.

Cost is an issue. Some supporters of the airships argue that airships would cost less to purchase and operate than other aircraft. They cite, the significantly lower fuel consumption of airships relative to fixed/ rotary-wing aircraft. At this juncture, a comparison is difficult and unfair as technology is in an early stage of development. Because of uncertainty, cost estimates would be highly speculative. The cost must take into account the tangible and the intangible gains from the use of airships.

22. Such innovations/ modifications have been resorted to in the past. Packet aircraft were fitted with a jetpack to improve thrust. Rockets were fitted on to Hercules aircraft (Op Eagle Claw) to enable near VTOL capability. IIT Kharagpur has attempted generation of electricity using TTLE aeroengines.
23. Powered fixed wing aircraft have been used successfully to tow gliders, targets and banners.

CRYSTAL GAZING

Proposals have been put forward for hybrid airships that could accommodate large payloads. Airships carrying 20 tons (about the payload of a C-130 intra-theatre airlift aircraft) could operate independent of runways, slower than helicopters but with substantially larger payloads. Airships carrying 50 tons (about the average payload of a C-17 inter- theatre airlift aircraft) or more could complement today's strategic airlift aircraft and sealift ships.

If used as an *airborne aircraft carrier* like the USS Macon and the USS Akron, an airship would give impetus to search and rescue, and relief operations. Small fixed wing aircraft or helicopters operating from a large airship would deliver more tangible results than those operating from different bases scattered over a large area. It could save precious time during *Golden Hour Rescue*. Manned/ robotic aircraft shuttling between the airship and multiple sites of disaster could bring in casualties; carry relief teams, medicines and food for the victims.

Airships would be worthwhile additions to the military's strategic airlift capability providing airlift over intercontinental distances. Their success and usefulness will depend largely on technological development and cost of operation. The future of airships as airlifters will also depend on whether there is a demand for increased deliveries before ships could arrive and whether there is a need to deliver cargo directly to locations that cannot be easily supplied with existing transportation systems.

PATH AHEAD FOR INDIA

Defence Research and Development Organisation (DRDO) has developed the Aerostat radar, which will help strengthen the air defence network of the armed forces and boost the country's surveillance and air defence capabilities. "*Nakshatra*" has been tested up to of 4.5 km altitude; it could carry 800-1000 Kg/ 17,000 cu m volume. Project is on drawing board stage. Once finalised, it will take 5 years to complete. 1 km/ 300 kgs payload has been tested.[24] The present developments in *lighter-than-air* airborne platforms are aimed at enhancing Intelligence, Surveillance and Reconnaissance (ISR) capability. It is time that parallel effort is devoted to acquiring airlift capability.

CONCLUSION

When one talks of airships, two images flash past the mind – one of a slow

24. "DRDO aerostat Akashdeep at Aero India," *India Strategic*, Mar16-Apr 15, 2011. p. 54.

majestically flying airship with a "Goodyear" logo and the other, of a burning Zeppelin (the Hindenberg disaster). Most have forgotten the effective and successful use of airships by the Germans for routine airlifts. Over 50 years have elapsed since the last military use of an airship. Use of airships was given up not because they were technically unsound but because of cost considerations in that era and fear of accidents due to the use of the inflammable hydrogen gas. We have soared miles ahead of the Hindenberg disaster. Now helium is in use and superior technologies and safety systems are in place. There is a need to re-look; there is a need to look ahead.

Consequent to discussion on a report prepared by 100 leading aerospace experts in late October 1984 at the National Research Council of USA for NASA, ten aircraft categories were identified as being best suited for the year 2000. Among others, categories relevant to this paper are firstly, a long-haul airlifter with 16,000 kms range and gross weight in half-million kg class, and secondly, an STOL or STOVL (short take-off and vertical landing) combat airlifter able to operate 24 hours a day in adverse weather.[25] Three decades down the line airships seem to meet some of those specifications.

In case of the U.S., fuel for transport aircraft represented nearly 40% of the Air Force's energy costs in fiscal year 2009. It would be a similar ratio in case of most armed forces of the world. If airships prove to be as fuel efficient as expected, they might be able to operate at substantially lower cost than existing airlift platforms – a cherished advantage in these days of skyrocketing fuel prices. Besides, the use of airships will prolong the calendar life of the other airlift resources (fixed/ rotary wing aircraft).

Hybrid airships would probably be the preferred design for airlifters because they provide greater lift for a given gas volume and they can be easier to handle while near the ground, particularly during loading and unloading, when the total vehicle weight (aircraft plus cargo) changes substantially. Furthermore, airships would need to demonstrate sufficient dependability in day-to-day operations before they could be relied on to maintain continuous flows of cargo.

Airships will be environmentally sound as they would be "fuel-sippers" as compared to normal cargo aircraft. It is time that we set aside the disdain that airships have been looked at with, and reconsider exploiting them to advantage.

25. Air Commodore Jasjit Singh, *Air Power in Modern Warfare* (New Delhi: Lancer International, 1988), p. 267.