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**ABSTRACT:** This paper will deal with projected operating and manufacturing costs of a large airship design which is considered practical with today's technology and environment. It will be based on data and information developed during an 18-month study by the Southern California Aviation Council, Inc. as to the question of feasibility, engineering, economics and production problems related to a large metalclad type airship. It will provide an overview of other classic airship designs and explain why metalclad was selected as the most prudent and most economic design to be considered in the 1970-80 era. Crew operation, ATC and enroute requirements will be covered along with the question of handling, maintenance and application of systems to the large airship.

Few of man's contrivances have held the continued capacity to awe people as have the airships. Even today in the era of the 747 and 747, blimps are a main attraction in the sky. It is unfortunate that our national approach for bigness is equated with expense and this makes us lose sight of the economic advantages as experienced with the supertankers, jet aircraft and industry.

It is well known that supertankers of 200,000 tons are more cost productive in movement of oil than a 20,000 ton tanker. In aeronautics, aircraft were sold by economics and reliability starting with the DC-3 which cost 5 cents per passenger mile, the DC-6 which cost 2.5 cents per passenger mile, to the present wide bodies which currently operate at costs of 1.5 cents per passenger seat mile.

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The airships left us almost 40 years ago, yet continually are proposed on a cyclic basis. The span between those cycles becomes progressively shorter and commences with vast claims for its unique abilities or economics. The massive problems of the past are eliminated with the stroke of a pen and the all encompassing words "New Technology." While in some respects this may be true, claims are damaged by half vast science fiction approaches to technology. As the cycle advances, glowing magazine and news media reports issue forth exclaiming in expansive phrases the benefits soon to accrue to mankind, transportation, manufacturers, ecology, environment and pure science.

There is perhaps no other man-made and conceived machine so capable of generating such loyal support, boundless enthusiasm, deep emotion and the utter lack of common sense of what it is and what it is not. No other form of transportation has received so little financial interest as the airship, except commercial sailing ships of recent years.

In Germany Graf von Zeppelin, a man who had an idea and put it to work, is the classic of achievement in the face of adversity. Initially putting his own capital into his idea, something few will do today in the most prosperous nation in the world, he gained some limited success and ran out of money which is a common end to most dreams. Two lotteries later, courtesy of the King of Wurtemberg, he developed his first successful military financing. We may well wonder if Las Vegas might not become the future financing empire for our aerospace industry. It has certainly applied more imagination to attracting things and doing things than many of our other sources.

Airships of the days gone by were victims of a variety of maladies created as a byproduct of the violation of natural laws and planning without adequate foresight. The airship holds a distinctive safety record throughout its history totaling 758 dead, of which 497 were military combat fatalities. It is symptomatic of our society that today we will spend 9 million dollars to burn the "Hindenburg" all over again for a motion picture, to continue the myth that airships are unsafe, while funding for any aspect of airship technology cannot obtain first class postage financing.

The world rose in outrage over environmental problems that affected the health of all. It was a different story when it affected their autos, fuel and pocketbooks. The airship appears to offer many unique benefits in the environmental area without creating a cavity in the national pocketbook. Railroads in the northeast were granted 2 billion dollars and it was recognized as being too little too late. Safety in rail transport is almost non-existent with continued accidents, fatalities and losses of property.

Within ten years almost 50 percent of all United States existing rail trackage will be abandoned at the request of the Federal Department of Transportation. Most of this will be in the agricultural sector of the nation. Truckers are planning to pick up the slack at a prohibitive price tag to ail of us who use the highways.

Plans have gone forward to build trucks which will comprise two or three units, expanded from 12 to 14 foot widths and over 120 feet long. In a very few years of this event, our national highway system will be a sea of broken concrete from coast to coast. We will be forced to fight for available roadway with these giants. Air traffic and aircraft have little to go before saturation points are reached and which have already caused a high degree of public disaffection with security checks, lack of parking, baggage losses and traffic delays at overcrowded airport facilities.

Similar to a truck traveling fixed highways that reach New York, Chicago or Cleveland in the rush hours, airplanes must compete for available air traffic roadways into the airport, or in reality the funnel. It is here that most major accidents take place, both on the road and in the air, and our system breaks down. It is here where unimaginable future traffic jams will occur. It is here that the imagination of America's genius of industrial and scientific expertise must concentrate. Additional airports can be built at a major inconvenience to passengers and at a 1974 cost of 1.5 billion dollars for an intercontinental and 500 to 700 million dollars for a regional airport. Additional freeways and expressways will be built with their related massive population dislocations and at a cost of several million dollars per mile of concrete.

Compare this to the potentials possible if we think in terms of airships. Safety, a most important consideration, would seem to be answered by the past record of airships when hydrogen was not involved. With helium one must consider the dramatic effects of a collision between two feathers.

Engineering, design, construction, all questions continually raised about the airship, are expanded upon to a degree that is not consistent with reason and logic as related to problems. Supertankers today are larger than what we would consider big in the average airship. Costs certainly will be consistent with what is required to engineer tankers of 200,000 tons or less.

Ability to serve and perform within economic and safety requirements is possible. Have we lost our touch in the United States? Until the airship we never let anything deter us from being a success. Significantly the challenge could be picked up by other nations and credit will go to their ingenuity and engineering. Germany, which proved the concept, lost out only because of a little man who set the world on fire.

Ask yourself, are the risks worth the gamble and do they justify the development of the airship? Are arguments made by many proponents and opponents valid? Does the airship have the capacity to make the quantum jump that is expressed so often? If it does, to what degree does real potential exist?

Since the time the airplane has shown promise, California has been interested in aviation and has helped develop it as a useful transport means. The introduction by independent airlines of low cost coach service has resulted in air transportation being our primary transport industry after the private auto.

Concurrent with the airplane, California was also the home of Lighter Than Air development which commenced with Captain Thomas Scott Baldwin and Roy Knabenshue's pioneering experiments with dirigibles in Pasadena and the San Gabriel Valley. Their efforts resulted in a light-weight aero engine being pioneered and a variety of dirigibles were built, flown and tested on what is now the site of the Rose Bowl. The relationship between aerospace and the military can be traced to Captain Baldwin's sale of his airship "The Signal Corps" to the U. S. Army a year before the Wright Brothers managed a similar purchase.

In 1911, Calbraith P. Rogers completed the first transcontinental flight in a Wright flyer, the Vin Fiz, specifically making a landing in Pasadena to collect a \$10,000 award at the site of Tournament Park, the present location of Cal Tech. It was to California that Lindbergh came to buy a Ryan monoplane specifically redesigned for the flight to Paris.

In California the DC-3 gave birth to a long line of Douglas transports and provided the competitive incentive that shrunk the world from weeks and days to hours. It was from California that man started his first steps to the moon and space.

It seems, therefore, that after the years of controversy over the airship, and its unique capabilities, that Californians will look into it. They will determine that it was something that was overlooked much like the gattling gun of 100 years ago, only to become a major weapon again.

Based on the era of the airships and their successors, the blimps, it appeared that the answers should be forthcoming and that a plentiful supply of data and detail would be available. The Southern California Aviation Council, Inc. founded in 1958, has pioneered major studies to determine both the adequacy of existing airports, future needs and regional considerations. It is a quasi-official volunteer organization based in Pasadena and is funded by county governments of Southern California. Its charter is broad and permits it to act and engage in any and all aspects of aviation which affect Southern California.

In 1971 SCACI commenced a program to seek better methods of moving perishable products. The Lighter Than Air Committee was a direct result of the impasse in this area, to evaluate the vast claims being made for the airship. Its purpose was to determine what data was available and whether the airship holds a potential to solve California's transportation problems.

Early in the study it was apparent that much emotion as well as a lot of misinformation was involved in any effort to examine Lighter Than Air objectively. Federal interest in the subject was non-existent to a surprising degree. Many comments made by federal officials indicated a complete ignorance of the subject and characterized an attitude that anyone investigating LTA was an immediate candidate for the lock-up. One official characterized LTA engineering and development with a bland, "Everything there is to know about Lighter Than Air was known in the first 50 years of this century," and accordingly "It's a matter for the Air Transport Association and the private sector." Many officials have indicated substantial interest, but ask that they not be mentioned for what are obvious reasons. There is, however, government

interest which could surface with efforts to provide sound and intelligent approaches. As the effort continued adverse attitudes diminished and genuine interest and outside help was gained. Many organizations are interested in the subject.

The consistent factor associated with this interest is the wide divergence of backgrounds that are represented and the lack of nostalgia as an attraction, but rather commercial and scientific interest. Among this group are people who had backgrounds on the rigid airships, the Navy blimps and indeed a few associated with the R-100 and R-101 of England, a former German pilot of World I who served several hundred hours on the Bomber Zeppelins, military officers on active duty, along with some very distinguished people in aerospace.

One immediate result was access to private files and obtaining data that could well have been lost forever. Long forgotten papers and designs were located. Films of airships were salvaged and materials and artifacts catalogued for future examination. A reasonably firm foundation to examine the engineering, design, economic and practical aspects of the airship has been obtained.

Pertinent to any such examination, many claims by proponents are ill conceived and unsupported by factual record and factual data. Many problems associated with airships are products of imagination as well as fact. There are other aspects of the airship overlooked and/or glossed over by proponents, that have limited foundations which require more examination. Expansive claims for pollution elimination, fuel conservation and ultra heavy lift must be subject to critical questioning though there is some credibility to many of the claims.

Before any honest evaluation of a program can be conceived and advanced there must be determinations of the economics. SCACI produced a major study on the subject and economics involved. Taking 18 months overall, conclusions support further exploration of the airship concept. The question of whether the airship will be developed must be founded on the basis of its economic viability and operational capabilities as a transport, military or logistics mode.

A conclusion reached by the Lighter Than Air Committee of SCACI is that further feasibility studies are not required to substantiate additional studying of the airship concept. It is SCACI's conclusion that future activity must be directed to a moderately sized research vehicle investigation. SCACI believes a moderately sized vehicle of at least 3.8 million cubic feet in displacement will provide the basic criteria. This vehicle's development should be, it is suggested, a joint government/industry program to explore and develop the concept.

There are many factors related to the development of safe, efficient and economically feasible airships. The factors relate not to the airship itself, but to the systems applications which must be applied to make it practical.

## DECIDING ECONOMIC FACTORS

To provide a foundation for basic economics of airships, certain factors are known. There are classic type airships and advanced concept types. Adding lately to the confusion is the addition of the hybrid. The latter will not be covered for a variety of reasons, but mainly it is suggested if you are going to build an airplane put wings on it and fly it like an airplane. If it is to be an airship, efforts to place wing and lifting foils are counterproductive, if one assumes that all other problems have been overcome relating to gas expansion, size and altitude.

The development of airships and their history will be presumed to have been well covered. It should be noted that anyone interested in Lighter Than Air must become well versed in the history of the subject as well as the past engineering accomplishments and mistakes. We allude to girder/fabric airships of the 20's and 30's as evolved from the basic Zeppelin concepts, the pressure ships of fabric and the ZMC-2 and SMD-100 metalclads.

The Graf Zeppelin was without question the most successful airship. American efforts ended in disaster, mitigated to some extent by the use of helium, but nevertheless resulting in the loss of 3 of the 4 rigid airships. One, a German commercial design, ZR-3, was surveyed for a combination of political and economic reasons well in advance of its lifetime, long before being broken up.

The second most singularly successful rigid type airship was the metalclad ZMC-2. It is given little credit for its achievements because of its diminutive size and lack of general knowledge that it was the first and only airship designed specifically for experimental reasons. It developed necessary criteria and data for future larger metalclad designs.

Early in the SCACI LTA Study it was apparent that to develop airships on the basis of engineering of the 20's and 30's is doomed to failure. Lying in wait are the same causes that eliminated the airship concept. Examination of the fabric pressure ships indicates similar potentials for failure with large sizes and indeed further examination disclosed that this was a primary cause of the cancellation of fabric pressure airships by their single customer. Elimination of semi-rigid airships is based on fabric ships if application of metal hulls was applied.

Any transport system's acceptance is controlled by the degree of safety of the system and this applies to the airship. No airline passenger would willingly board a flight if the known odds were 8 to 1 against reaching the desired destination. As long as odds remain one in 10 million in favor of his getting there, he will fly. This standard is applicable to auto, rail, ship or bicycle.

The history of the rigid commercial airship lends confidence to potential voyagers whether as crew or as passenger. The history of pressure airships has a record of safety not achieved by any other form of transport. There is an added factor, speed or the time and distance factor. Sightseeing from a blimp is a desire of many people, more than there is capacity to carry.

Flying a continent or ocean is another matter, when measured in days compared to hours by jet. The fabric airship is speed limited with its maximum speed well under 100 miles per hour. The girder/fabric rigid airship has the capability to reach 100 mph sustained speeds, but its safety is questionable, and is sustained by results now recorded for history. How does technology overcome these factors which are supported throughout transportation history?

One of the very early determinations by the LTA Committee is that regardless of design technology the rigid classic airship will retain complete vulnerability to the elements. It was further indicated that in spite of the excellent capabilities of Dr. Eckener and his associates, very capable training and excellent ability to handle airships, that they were aware of this failing. Every effort was made to avoid major frontal conditions or risk destruction and potential accidents. The fabric airship offers a better safety factor in this regard, with some hard data remaining of very extensive Navy efforts in 1958 to prove, and they did conclusively, that airships were not fair weather vehicles.

SCACI efforts are now directed toward examination of all metal airships, capabilities, safety and ruggedness. The ZMC-2 fully supports the theory of metalclad airships. For general purposes it was small and experimental. Unfortunately no civilian use was made to examine its unique capabilities. It proved, however, the soundness of the concept.

One man who sought to seek out and prove some of its rugged capabilities, Captain Bill Kepner, later Lt. General Kepner of the USAF, in 1930 requested permission to operate the ZMC-2 in storm conditions of the nature that destroyed the Shenandoah. Captain Clark, USN, then in command of Lakehurst Naval Air Station, denied permission. Even today General Kepner states that the ZMC-2 was the strongest airship ever built and certainly capable of taking on any major storm without fear of destruction.

SCACI recognizes that there are many who will take umbrage at the suggestion that rigid airships and fabric airships are limited and cannot fulfill the claims, illusions or science fiction approaches of many airship proponents. We recognize that a few will scoff at the all metal airship as being impractical and not being in conformance with their ideas and proposals. Be that as it may, we can only suggest that they study the subject further.

To SCACI metalclad construes plastic and other space age materials of lightweight and substantial strength. We have selected this path because speed is a major criteria and the fabric ships cannot match the speed demanded in modern day transportation. Life span is important and fabric cannot exceed an 8 to 10 year life at which point its deterioration extends to a high danger point. Fabric is size limited as was evidenced in the SPG-3W series. If airships are to become viable they must be large by a factor of 20 over the SPG-3W types.

Girder/fabric airships consist of an internal structure which is designed to carry all the aerodynamic, stress, torsional and payload distribution. It was conceived to carry internal gas cells. Externally, a fabric covered airship required both constant attention and replacement and must be made taut after or during each trip.

W. A. Klikoff in his paper "Pressure Airships," presented at the Fifth National Aeronautic Meeting of the ASME in Baltimore, Maryland, May 1931 says it better than SCACI can.

"Design Conditions and Factors of Safety" -- In the present design of rigid airships a rather peculiar system of factors of safety is adopted. Factors of safety of 4 and higher are used for static loads, but when the aerodynamic loads are superimposed, then the designers do not increase the structural strength in proportion to the increase of load, but increase the structural strength only to some extent which causes decreasing of the factors of safety. This practice is justified by the fact that conditions of superimposing both types of loading occur less often and the effects of higher loads on the structure will be less. For this reason airship designers are satisfied to drop their factors of safety to as low as 2, and sometimes even smaller for the worst loading conditions. This method of design may give the operating personnel a false sense of security, making them overconfident in the strength of airships under normal flying conditions, and in case of emergency they may treat the airship without due caution, causing perhaps a breakage of structure and severe disaster. Several airship accidents were traced to this cause by some of the experts.

AND

This hogging bending moment and this longitudinal force due to gas head pressure are present in all airships. In rigid airships there exists another factor due to gas pressure. Whereas in non-rigid types the transverse component of pressure produces uniform transverse tension in the covering, in rigid airships this transverse component acts as a side load on longitudinals, complicating their design by loading them with side load combined with direct stresses due to the bending of the whole airship. This loading condition of longitudinals tends to explain why gas pressure is often called a liability in the case of conventional rigid airships.

AND

The gas-head pressures due to the properties of lifting gas produce forces and moments reaching such magnitudes that the airship designer should undoubtedly try to utilize them as much as possible to his advantage. The longitudinal force is the most helpful one because it tends to produce a uniform tension throughout the structure, and all materials used in airships can carry much higher tensile loads than compression loads."



While Mr. Klikoff presented that paper over 41 years ago his analysis is still correct. All metal airships offer some unique advantages to the airship concepts operationally and have substantial economic advantages in manufacture.

All metal airship designs are simple compared with others. Metal airships will pay a penalty if sized too small. As they grow in displacement and size, advantages start to outstrip those of other types. Metal is capable of resisting higher pressures and high loadings. Fabric is limited. Metal such as aluminum applied to the large metal airship costs 85 to 95 cents per square yard, while fabric costs at least \$10.00 per square yard.

Fabric airships must approach the investment and development depreciation costs on the basis of 8 to 10 years, while the metal airship has no assigned minimum life span at this date. If the DC-3 is used as a comparative, the metal airship could take on eternal connotations. The major advantage of the metal airship is that it can uniquely be developed for high speed flight at speeds of 200 mph and higher.

A favorable economic aspect is that in aerospace we are metal workers with resources, knowledge and capability to fabricate shell type structures economically through mass production techniques. One factor of the metal airship is that its size, while posing some problems also permits simplification of construction methods.

The conclusions drawn by SCACI are that airship design, manufacture and life-span if predicated upon metal designs, will be practical from the economic, manufacturing and operational requirements. To follow classic methods of the past will be to place impossible burdens in the path of development and costs beyond comprehension.

#### ECONOMIC FACTORS OF AIRSHIP DESIGN, MANUFACTURE AND OPERATION

##### Design

While it is not readily available to researchers there is more than adequate design and engineering material available to eliminate the necessity of starting from scratch on airship engineering. Substantial detailed analysis of the ZMC-2 and follow-on engineering projects for larger sized metalclads has been compiled and upgraded at SCACI. Obviously each group that creates a design idea will incorporate their individual identity and engineering concepts. Some diligent investigative and exploratory research will provide a bounty of material. It is for the investigator to determine his path to follow as SCACI and its people have followed the path of the metal airship.

Approaching the subject with the large amount of excellent data available will permit reasonable approaches to determining projected costs. Whether interested parties can obtain their objectives at reasonable cost will be determined by their interest, persistence and ingenuity.

### Manufacture:

It has been the style recently to seek funding for programs based on double the estimated cost while hoping that it will not end up costing triple the estimate. It is anticipated that some organizations may use this approach. We would like to make, however, some suggestions which we believe are valid with respect to manufacturing costs.

Airships were built for almost 40 years. The primary cost was for engineering and design, not fabrication or manufacture. A comment was long ago made that airplanes breed like rabbits while airships breed like elephants. History does not support such a conclusion. Count Zeppelin and his organization produced airships in World War One at a faster rate than we can produce 747's or C5A's, time and facilities taken into account. The later history of airship manufacture and fabrication after World War One indicated that every airship built was constructed, erected and inflated in what must amount to record time for the small working crews involved. Goodyear employed fewer than 140 people, including engineers, when the ZR-4 and ZR-5 were being built. Slate Airship employed a group of 40 people and construction time was less than 100 days. The Zeppelin works employed some people who were engaged in a variety of other tasks, as well as airship construction. ZMC-2 was built with less than 40 people.

Methods exist and the investigator will find them if he looks. New methods are being developed at present with indications of great promise of short fabrication times and economies of mass production.

### Airship Tooling

Metal working tools are available in quantity which can readily be applied to airship construction. Tooling is available at what amounts to scrap metal prices. The airship does not require complicated and sophisticated tooling set-ups. Tool and die makers will be necessary for basic metal tooling and are competent to do the job. Expensive R & D tooling development programs are not required. Even the hull itself will not require excessive expense in special tooling. Special jigs will be fabricated by the erection crews and engineering task force from common materials. In short, the process of building and maintaining airships requires far simpler tooling than required by fixed wing aircraft.

### Airship Operations

There are known quantities in the airship which relate to operational costs. Powerplant requirements and fuel consumption charts can be developed with a reasonable degree of accuracy and be directly related to costs per mile, per hour and per ton mile. Past practices of employing massive engineering crews will be eliminated in design planning. Flight crew complements are suggested to consist of 2 men on small units and 3 men on large units. Additional crew members would be added as determined by flight time planning to serve as relief crew members, as is done in current Air Carrier services today.

The compacting of control consoles will relieve crew and pressure, a major determining factor in fixed wing operations. Addition of current navigational and communications electronics simply reduce pilot pressure. The use of closed circuit monitoring systems allows the flight engineer far more reliable systems operation and control than is possible with on-board service personnel. Crew costs can be projected accurately, taking into account time aloft, duty time, pay raises and inflation.

Landing fees, facilities, ground support equipment, mooring and handling equipment are all determinable quantities and only the exercise of judgment is required. Future expense measured against presently known expense will provide an index. The above are calculable with reasonable accuracy.

#### UNKNOWN ECONOMIC FACTORS OF OPERATION

At present even with the best of educated guesses certain cost factors will enter the picture, from commercial and military aspects that are not projectable with a high degree of accuracy.

The cost of manufacture is directly related to depreciation schedules and the cost of engineering. This cost while projectable if using airframe manufacturers as an example, can vary considerably from design discussion to actual delivery. Educated guesses are possible but remain to be proven conclusively. They will be a major factor in determining the economic viability of airships.

Major overhaul and servicing requirements may remain a partial unknown until actual operations and several hundred thousand hours are accumulated to provide basic data. Known factors relating to powerplants are projectable with a high degree of accuracy. There may be some unknowns related to hull overhaul and major section replacements as a result of metal fatigue in some structures. Much of this can be accurately estimated prior to manufacture, but there remains the potential for error.

Airships, if commercial operation is considered, will pose some very unusual insurance considerations. A projection was made based on the experience of the Hindenburg. The SCACI projections may provide at least a long needed starting point.

#### Helium Gas and Hydrogen Gas

Helium is recognized as being the safer alternative, although it is believed that metal airships can operate with both gases with almost equal safety. Helium currently costs \$35.00 per 1,000 cubic feet, FOB Kansas. Hydrogen can be obtained commercially in bulk at 65 cents per 1,000 cubic feet at present. The lift factor, while a major inducement to consider hydrogen is not as substantial an inducement as the wide disparity between the costs of the gases. The fast breeder reactor poses a potential to produce substantial amounts of helium as a by-product. A cost determination to separate helium from natural gas as opposed to the cost to separate it from radioactive particles as a by-product has not been studied and is needed. It may prove that helium will be abundant and cheap, a major consideration for future airship economics.

Hydrogen is a major economic consideration if it in part becomes a fuel source for future airships. Consideration of such use has been made, but not as related to costs and economics of airship operations. It is another area of study currently underway at SCACI.

Carriage of ballast is a restriction pertinent to airships. Most sea-going ships must operate in ballast after discharging their cargo. This does not appear to pose a problem which cannot be eliminated from operational considerations. It does not appear as significant a problem as it has sometimes been represented. Considerable efforts are being directed to this question. The primary question is economic and carriage of ballast does not seem to pose major economic restraints on the airship.

#### The Purpose of Economics

For 40 years the arguments have raged and they show no signs of diminishing or of being proven or disproved. Evidence exists that the airship can meet the economic tests necessary to include them in our transportation system in day to day activity. Evidence also exists that airships have proven less than durable in the face of adverse weather.

In the United States every airship built differed significantly from every other and the results ended in disaster. In Germany, airships were built in series and achieved a high degree of success both operationally and economically. To continue to study the airship as a concept will only further add to the confusion about what they are and what they are not, what they can do and what they cannot do, what they will cost and what a waste it would be to develop the concept. In recent months indications are that several small airship designs of impractical payload considerations may be constructed. This, while a step in the proper direction, does not mitigate the many other problems associated with airship potential or problem areas, if indeed it does not further damage the image of airships conclusively.

SCACI believes the airship deserves development in the form of a series of prototypes which can be adequately flight tested and can be developed for special purposes. The design must be simple and utilize the vast knowledge gained from the past combined with proven technical developments of the last 40 years.

Some interesting hybrids have been proposed and may hold some promise for future research but the prototype we propose has got to work and that means maximum utilization of things we know right now.

Prototype development will be essential to a program to establish learning curves of management, manufacture, design, systems development, training and operational procedures and standards. Prototypes must be considered as an expendable item to apply modifications and newly gained knowledge and not be expected to solve all the problems upon the first flight. This has too often been the case in the past. This objective is the present goal of the SCACI Lighter Than Air Committee and its Technical Task Force. We hope the near future will bring a realization of this goal.