

# CARGO GLIDER

## VERSUS

# Cargo Plane and Helicopter

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THE commercial cargo glider is a distinctly different proposition from any glider that has heretofore been constructed. Up to the present time gliders have been for two purposes: sport and war. The commercial cargo glider has but one justification for its existence: commerce, as its name implies. Its sole reason for existence is to further business. It must justify itself on a business basis: in dollars and cents, or there is no place for it. It makes not one iota of difference how many glider enthusiasts are behind the cargo glider. If the businessman cannot be gotten behind it, it will fail.

Perhaps these statements sound like platitudes, but they bear repeating again and again. Many noble experiments in aviation have been made by people who were more conscious of stresses and wing-loadings than of shippers and schedules. These experiments have often been utterly absurd on the face of them from a business point of view, and would have been condemned on business standards long before they got started.

Fortunately there is taking place a gradual infiltration of businessmen and business principles into aviation. Business principles must underlie the development of the commercial cargo glider or else it will be in for hard knocks and possibly complete failure.

This paper will attempt to cast some light on the question of the commercial cargo glider: does it appear to be justified on business principles, and if so, where can it profitably be operated.

The most logical starting point in any exploration into shipping opportunities which may exist for the cargo glider is a forecast of operating costs. These are most easily expressed on a ton-mile base, that is, how much it costs to transport one ton one mile. Cost estimation will, I hope, be gone into more authoritatively by the other participants in this evening's meeting. As I could not very well tell in advance of the meeting whether they were going to present cost estimates and, if so, what they would be, it was necessary for me to include the estimates which we have worked up in All American. For a cargo glider train of ten tons payload capacity the lowest possible operating costs appear to be about \$1.00 a mile, or \$.10 a ton-mile. If we try to allow for errors in the calculations and over-optimism, we come out with a figure of \$1.50 a mile, or \$.15 a ton-mile. This figure should be reached after a short test period.

The larger the glider train, the lower will the ton-mile cost be; and vice versa, the smaller the train, the higher will the ton-mile costs be. This is a principle of aircraft operation which holds equally true for gliders. If loads of no greater than 1,000 lbs. can be secured, the cost of operating equipment suited to these

small loads runs as high as, or higher than, air express rates of \$.70 a ton-mile.

Let me be sure to emphasize that ton-mile costs can only be estimated for a cargo glider train in terms of a given capacity. These costs cannot be estimated in the abstract. They must be estimated for particular loads.

The next step in the analysis of the freight which can be secured for the cargo glider is to find out what shippers pay the various types of surface carriers which at present haul their freight, since glider freight must come, for the most part, from the surface carriers.

Surface carrier freight is roughly divided into that which goes by rail express, that which goes by truck, rail freight which goes in less than rail carload lots, and rail freight which is shipped in large enough volumes to fill a railroad car. This arrangement of types of freight is in descending order from the highest rate to the lowest. Rail express is rail freight that gets service which is so fast as to be equivalent to passenger service. It moves at an average rate of 9.2c per ton-mile. Truck freight averages 5.5c per ton-mile. Rail freight which moves in loads which are not large enough to fill a car pays 3.8c per ton-mile, while that which moves in carload lots pays less than 1c per ton-mile. Obviously rail express and truck freight are the most vulnerable to competition by cargo gliders since they pay the highest rates. Conversely, carload rail freight moves so cheaply that it is difficult to forecast any cargo glider business from this source.

This determination of surface carrier rates is a starting point, but it is no more than a starting point. Too often the analyses of the potential of air cargo transportation have stopped here.

The second step in determining what items of freight presently carried by surface carriers the cargo glider can secure is to determine which of these items have characteristics which make them particularly benefited by the fast transportation which the cargo glider can make possible. The category of freight which comes to mind early as being suited to the cargo glider is urgently needed items, such as medical supplies and parts for broken-down machinery; but this freight moves in very small quantities from a large number of points to a large number of points; and it moves sporadically. It is not well suited to cargo glider transportation, although it has been subject to considerable study by air freight analysts.

A more likely type of freight which the cargo glider can benefit is perishables which will undergo less deterioration because of the quicker service of the cargo glider, or which can be picked from the tree or vine later with less fear of spoiling in transit. Perishables offer the greatest potential for the cargo glider of any categories of freight.

A third type of freight which the cargo glider can secure is that which is at present packed very heavily in wooden containers. This freight has to be packed heavily in order to withstand a long rail or truck haul and sometimes several shifts between truck and train en route. The cargo glider requires few or no shifts in transit. It can be packed just once at the loading door of the shipper. It may then be unpacked directly at the loading door of the receiver. The time in transit is only a small fraction of the time required by the surface carrier. Very often perishables, which stand to benefit by cargo glider service more than any other type of freight, are packed in heavy wooden boxes or crates. These can often be replaced by paper or fiber containers with large resultant savings in weight.

Refrigerated freight is often well suited to cargo glider service. Much freight is refrigerated by ice, which is placed either in the package or around the package while in transit in the truck or freight car. The time saving made possible by the cargo glider cuts down materially on the ice required, and as a result there is a saving of weight. We have found in our contacts with shippers, items of freight whose wooden containers plus ice weighed twice as much as the actual product itself. If such an item pays \$.10 a ton-mile to be carried by truck, and if the cargo glider makes possible the use of paper or fiber containers with little or no ice, it is estimated that the weight could be cut at least in half. This halving of the weight means that the shipper paying \$.10 to the truck to haul his freight could afford to pay \$.20 to haul it on the glider and still come out the same on his total transportation charge. This situation that I have described is not at all unusual in the field of perishables. We have found it to exist many times.

Finally, freight which moves over circuitous rail and highway routes is particularly vulnerable to the cargo glider. Rail distances average 20% above air line distances. Air distances are by their nature much more direct. A shipper paying 9.2c to have his freight hauled by rail express could afford to pay on the average 10.9c to have it hauled by cargo glider simply because he has to pay for fewer miles. In our contacts we found one shipper who sent his product by truck over an extremely circuitous route because he was located at the end of a peninsula. The rate he could afford to

pay for cargo glider service over the more direct route, and still come out with the same total transportation cost, was \$.50 per ton-mile.

Let us not fool ourselves with happy rationalizations about the cargo glider in its relationship to the cargo plane. The cargo glider is a direct competitor of the airplane; and the quality of service offered by the airplane will to a considerable extent determine how much business the cargo glider can secure. If you propose to carry air freight by cargo glider from La Guardia Field to Chicago you are fairly certain to be beaten out by the cargo plane from the start. Although there is some discussion on the subject, the weight of opinion seems to be that the airplane is more aerodynamically efficient than the cargo glider train. In addition to the possible aerodynamic disadvantage of the glider train, there is the added expense of glider pilots and a pick-up unit and pick-up operator, although in time the pilotless glider may become commercially practical. The place to use the cargo glider is where its operational characteristics give it the edge on the cargo plane. In that particular field it will have the best chance of success.

Although in time the cargo glider may be used as a method of carrying small shipments sent by air express, it seems to me that the best immediate field for the cargo glider lies in the haulage of large volume freight. Large volume is synonymous with large equipment; and large equipment is synonymous with low ton-mile operating costs. The lower the ton-mile costs, the less vulnerable is the cargo glider to competition by cargo planes.

Besides being large in volume, the freight should be dense, so that the cubic capacity of the plane is not filled before the weight limit is reached. The less dense the freight the higher is the necessary ton-mile charge.

The type of freight which can best be hauled by glider is that which is shipped regularly day after day and week after week rather than that which moves if, as, and when. It is, of course, best that items which have no seasonal element in them are carried. Where seasonal items are hauled, there is a time during the year in which the glider train must either find other work or be put in the hangar. For low cost, the operation has to be a regular one running through the entire year or over a long season. Unfortunately, most perishables are highly seasonal.

The first pick-up of All American Aviation's experimental cargo glider run carrying lobsters from Allerton Beach, Hull, Mass. to Bendix Airport, Teterboro, N. J. The cargo was shipped by the Hull Lobster Company, whose plant was less than five blocks from the take-off point, to the Jordan Lobster Company in New York City. The tug is All American's veteran Stinson test plane, NX-2311. The glider is a modified Schweizer TG-3A. Flying time between Hull and Bendix was 2 hours and 10 minutes. Mr. Rush did much of the exploratory work on this project.



Obviously, if the glider is best suited to large volume transportation, the movement should be from one point to another point, and not scattered. If the shipper ships five tons a day to ten points, it is easy to see that the glider train cannot make the contribution to his shipping problem that it can if he ships his entire five tons to one point.

The final requirement of a successful cargo glider operation is that there be an absence of airports at either one or both ends of the route. Where there are no airports there can be little competition from cargo planes, as the original haul and the final haul must be made by truck, which takes time and is costly. The farther away the airport is from the shipper or receiver, the greater contribution does the cargo glider make as compared with the plane. This fact leads to the conclusion that there is far more opportunity for the glider to fill an economic need abroad than in the United States with its relatively good airport coverage and its plans for rapid expansion of airports.

Let's look at the other side of the picture now. The cargo plane has certain advantages over the cargo glider. The first advantage is the aerodynamic one. The airplane is probably more efficient than a tug and glider train.

The second is the cost advantage—there being no glider pilots required, no pick-up unit and no pick-up unit operator.

The cargo plane has the further advantage in that it can fly a higher percentage of the time than the glider train. Cargo glider operations become extremely difficult when the weather is so bad that the glider pilot cannot see the tow ship, or if the glider gets too far out of the normal towing position. Even in good weather it is certainly more difficult to have two or more operators flying two or more aircraft in unison than it is to have one pilot flying one craft.

These advantages of the plane over the cargo glider are so great as to make direct airport-to-airport competition by the glider practically impossible. Without the pick-up unit, the glider is at a hopeless disadvantage almost everywhere. It must be towed off, and it consequently requires a much longer field than does a cargo plane of the same capacity. There are practically no offsetting advantages over the plane for the towed-off glider.

The cargo glider has the edge over the cargo plane for those types of shipments which have been pointed out in these ways: In the first place the cargo glider can be used in operations which give it a time advantage over the cargo plane. Where truck haulage is required at both ends of the cargo plane route, the glider has an obvious edge. The nearer the airports are to the shipper and receiver, the less is the time advantage of the glider. The longer the haul, the less significant is this advantage of the cargo glider. From this principle, it follows that the place of the cargo glider is in relatively short hauls—of perhaps up to 500 miles. For hauls longer than this distance the advantages of the cargo plane probably give it the upper hand from the point of view of time-saving.

This time advantage of the cargo glider as against the cargo plane on routes which are poorly supplied with airports and where hauls are short becomes a cost advantage as well. When the cargo glider eliminates

the truck haul it eliminates the trucking cost. Very frequently the truck haul is not in the direction of flight, so that backtracking is necessary. Short truck hauls are very costly in terms of ton-mile rates.

A further advantage of the cargo glider over the cargo plane arises because of a higher utilization of the towship than is possible with the cargo plane. While the glider is being loaded by the shipper, the towship is away doing work elsewhere. When the glider is loaded, the towship arrives, picks up the glider, and delivers it to its destination. There it drops the glider and immediately picks up another. This economy in utilization of equipment through having a detachable power unit is demonstrated on the highway by the trailer truck, on water by the tug and barges, and to a considerable extent by the locomotive and railroad cars, particularly freight trains.

Closely related to this advantage of higher possible utilization of equipment is economy in the cost of equipment. In all of these fields of transportation, the power unit is more costly than the cargo vehicles and must be utilized as much as possible. A glider, similarly, does not have to be constructed so expensively as a cargo plane. In fact, I believe the glider of the same payload capacity as the C-47 costs only about one-fourth as much, and this ratio is based on wartime glider production costs on types of ships which were never in production before the war. As production techniques improve, the cost of gliders will decrease.

It should be borne in mind, however, that in order to utilize the tug to its best advantage there will have to be more than one glider. There must be at least one glider in the air in tow during all working hours. There must also be one loaded and waiting which can be picked up when the glider in tow is delivered. There will also have to be a loaded glider waiting at the other end of the trip. The simplest possible glider operation requires at least three gliders—one at each end of the trip and one in the air.

But it is rare to find the destination plant and the shipping plant at the same location. Consequently, when the loaded glider is delivered, an empty glider



Loading the glider for the trial glider operation conducted by All American Aviation, Inc. This loading was done for the benefit of the newsreel photographers, hence the open boxes. Loading for the actual flights to Bendix Airport was done with much less show.

will have to be picked up from the receiver and dead-headed to the shipper's plant where it will be dropped and an already loaded glider picked up. If more than one glider is going to be towed, then the total number of gliders needed for a one-glider operation will have to be multiplied by two, or three, depending on how many are going to be towed at the same time; and as more points are added to the proposed line, more gliders will have to be added. Each point must have a glider for unloading while the towship is away and each must have one for loading while waiting for the towship to arrive. Obviously, unless the cargo glider route is planned in advance with the greatest care possible, the investment in the gliders will far exceed the investment in a cargo plane of the same capacity.

Just as the cargo glider will make possible packaging economies as compared with trains and trucks, it will make packaging economies as compared with the plane. A plane trip requires loading on the truck at the shipper's plant, unloading at the airport, loading onto the plane, unloading at the destination airport, reloading on a truck, and finally unloading at the receiver's plant. The glider requires only one loading—at the shipper's plant, and only one unloading—at the receiver's plant.

Here again, we should not oversimplify the glider operation. Direct loading at the shipper's plant and unloading at the receiver's plant may not always be possible. Where the plant is located in the middle of a city the cargo glider cannot land alongside the loading platform. Perhaps a landing by the platform is possible at only one end of the journey. Then the advantage of the cargo glider is diminished, although it need not be eliminated entirely.

Finally, the elimination of the slow truck hauls required in the cargo plane operation reduces the ice or other refrigerants required by the latter.

Theorizing about the economic place of the cargo glider is a radically different thing from getting shippers to sign on the dotted line. Very few shippers are interested in promoting glider technique or pioneering in air transportation. When you approach them on cargo glider transportation they invariably get out a pencil and paper and figure whether you are going to save them money or not. Unless you can save them money they are not interested.

I would now like to describe a cargo glider route which we laid out for All American. It is the best that we were able to lay out under existing conditions. It is an example of a shipping situation which can better be served by cargo glider than by any other form of existing transportation.

The southbound trip would cover 336 miles from shipper to receiver. From the receiver to the nearest shipper having a suitable return load would require a run of 89 miles empty. The return trip would cover 292 miles. Twenty-five additional miles would be required to get from the receiver at the north end of the route to the return shipper at the same end. Since we anticipated dropping off loaded gliders and circling while they were unloaded, then picking them up empty and dropping them at the shipper's plant for reloading while we circled, we came out with a total of 1078 miles for the round trip, of which 42% was non-revenue. As the gliders we planned to use were small,

very little time was allowed for unloading and reloading, so that this 42% non-revenue miles could not be reduced very much by adding gliders. In other words, on the best worked-out glider routes, a very high percentage of non-revenue mileage must be anticipated. We estimated that one round trip per day would require 11 hours and 27 minutes. Nevertheless, the shippers at both ends of the route could supply products in quantities required to fill a glider train of two tons payload capacity and at price higher than air express rates. With suitable equipment it is hard to see how this route could lose money. Unfortunately, such shipping situations are not found at every turn, although they do exist.

I hope I have made two things clear so far: that the cargo glider has a chance of success, but that its place is specialized and must be studied very carefully before the glider train is put into operation.

This is my appraisal of the present outlook for the cargo glider. Its future outlook may be different, primarily because of one development: the helicopter.

It has been pointed out that the glider has roughly four advantages over the cargo plane: (1) a time advantage by eliminating the truck haul at both ends of the air journey; (2) a cost advantage for the same reason; (3) a cost advantage by providing packaging and refrigerating economies, and (4) a cost advantage by allowing higher utilization of equipment and employing less costly equipment.

The helicopter also has the first three advantages over the plane. It eliminates the truck haul and it allows packaging and refrigerating economies. Its advantages in these three respects are, furthermore, greater than those of the cargo glider. Where a glider requires a field at least five wingspans long and free from obstructions, the helicopter requires only a space a little bigger than the machine itself. It can fit into far more places than the glider can. The commercial application of the Brodie System of landing the glider on a cable may offset this advantage to some extent, however. The helicopter cannot provide the fourth advantage, allowing higher utilization of equipment and utilizing less costly equipment. This is an advantage which nothing on the horizon promises to outmode yet. Even when the helicopter is perfected so as to be commercially useful, the cargo glider will still have a useful place. The helicopter should be kept firmly in mind as cargo glider operations are established, nevertheless.

This paper has been devoted to an analysis of the inherent characteristics of the cargo glider which make it commercially acceptable, but the paper would not be complete if it did not at least touch on something else: the men who design the gliders, the men who make the gliders and the men who operate them. On the ability and perseverance of these men will depend, to an enormous extent, the success or failure of the commercial cargo glider. If intelligent, business-minded, hard-working men inaugurate cargo glider service, the success of the idea is more than half assured at the outset; and if those who perform the initial experiments haven't these characteristics, the cargo glider project has two strikes against it before it starts. The commercial cargo glider is not, by its nature, assured of success. The idea is not willy-nilly a money maker; but the cargo glider has a good chance of success in the hands of the right managers.