DOLLARS AND POUNDS

By GROUP CAPTAIN H. R. FOOTTIT

"Nothing is so easy to ascertain as a variation of price, nothing so difficult as a variation of value."
—David Ricardo, 1816

WHEN Ricardo expounded this theory nearly 140 years ago, he had no thought of trying to put a price tag on the value of a Sabre or CF-100 fighter, or a Vulcan bomber, when pitted against an enemy in battle. He was merely putting forward "Proposals for an Economical and Secure Currency."

While his words ring a note of truth in modern commerce, they are even more true in the field of military aeronautics. If it is difficult to apply a measure of value to everyday radios, cars, trucks, television sets, and other industrial items that flow from our civilization, then it is even more difficult to apply it to a fighter or a bomber. For their value finally hinges on a future war and the equipment a future enemy may throw against us. And any assessment data are well guarded behind the iron curtain of military security that rings every national border, including many friendly ones.

False Avenue: Yet value must be given some consideration. For if we base our judgment solely on dollars, it can guide us into false avenues for improving our present aircraft and lead us to produce or procure obsolescent aircraft. Thus the whole of our future air operations may be stifled by the accounting-minded, who are only interested in numbers and not the lethality of the weapon that must take to the air against the enemy.

One of the favorite costing tools of the analyst is "dollars per pound." This is particularly true each year when Finance Minister Abbott brings down his government's budget. The air power part of this budget can be reduced to these dollars and pounds with ease. In 1947, for example, a quick calculation will show that the RCAF bought North Stars at approximately $10 a pound, based on gross take-off weight. And in later years Sabres have been purchased at some $25 per pound, while CF-100 all-weather fighters run about $35 per pound.

Dollars per pound, however, is a simple formula for preliminary planning. For once this figure is pegged, then the dollar budget for airplanes to meet a particular operational requirement is a straightforward matter of arithmetic.

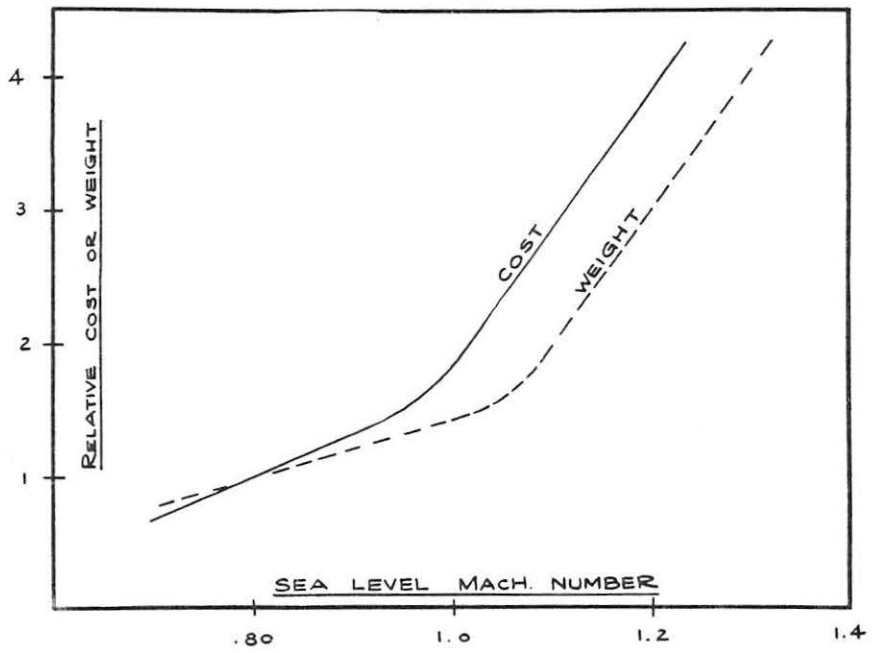


FIGURE 1
COST & WEIGHT TRENDS

Supply Operation: Last April the RCAF and the USAF began their joint operation for the resupply of northern weather stations. Fairchild C-119 Packets took off from Resolute Bay on Cornwallis Island to airlift 700,000 pounds of equipment, mail and supplies for Mould Bay and Isachsen well north in the Arctic archipelago.

This operation was the result of prior plans that normally start on a dollar and pound basis. Suppose for a future operation of this type, the airlift load demands ten new 50,000 lb. aircraft. The cost of these aircraft must be put in the budget, yet the actual type of aircraft is unknown. Using dollars per pound, the preliminary aircraft cost figure can be determined. In the past, transports of this type cost $10 per pound. Therefore the cost of the equipment to do the job will be (50,000 lbs. x 10 aircraft x $10) or $5 million, plus spares and ground servicing equipment which can also be added as a neat percentage of the total dollars.

Preliminary planning costs, on this basis, are simple, quick and effective—as long as their limitations are recognized. But the aircraft design world has recently become extremely cost and weight conscious. This worthy movement has been sparked mainly by E. H. Heinemann, Chief Engineer of the El Segundo Division of Douglas Aircraft. Mr. Heinemann has linked cost and weight with the dollars per pound criteria, and he says flatly, "Airplane weight and cost can be reduced." This excellent philosophy, however, has had wide and varied interpretations.

Magic Figure: For example, by modifying an existing light bomber, we can save 200 pounds in the weight of the starters. The aircraft costs, in production, $30 a pound. Neglecting any structure or fuel weight reductions, this appears on the bald "dollars per pound" basis, to save $6,000 per aircraft. Work this magic figure into a production rate of 25 aircraft a month, and a really

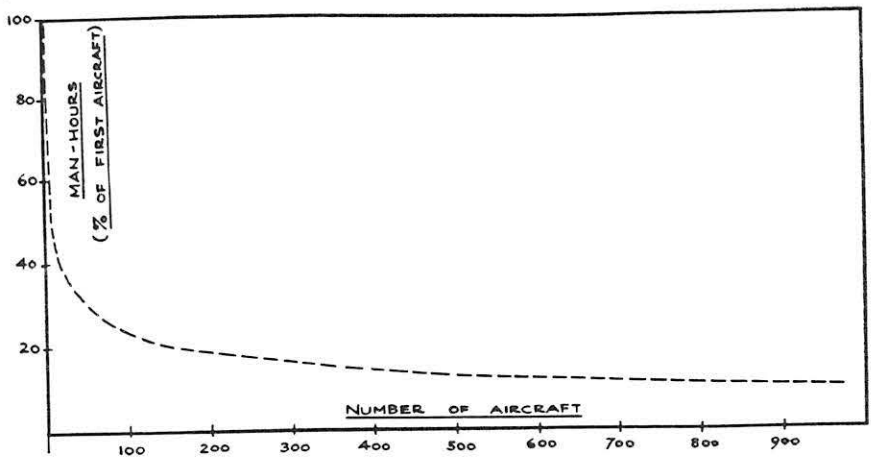


FIGURE 2

PRODUCTION AIRCRAFT MAN-HOURS

worthwhile saving of $1,800,000 a year shows up on the calculator.

Even more impressive numbers can be worked out if you consider the structural weight saving and the reduced fuel that the 200-pound lighter aircraft would require. E. H. Heinemann has estimated that 10 pounds can be saved for every direct pound reduced. Work this into the starter example, and we can really depress the budget by $18,000,000.

Of course, this example is a far stretch of the truth. It may be true if we were designing a new aircraft where reduced weight would reduce wing area, tail area, landing gear and basic structure sizes. These in turn would call for smaller engines, for the same performance, and less fuel. It is not true where all these items are fixed on an existing aircraft. In fact, a new and lighter starter may well cost much more than the original. This is not uncommon. The starter manufacturer that has made the remarkable weight saving may well try and write off his heavy development charges by high selling prices, before he gets outpaced by a competitor in a rapidly changing field.

Rising Cost & Weight: On the new aircraft side, dollars and pounds can also present a misleading cost and value figure. About two years ago A. N. Clifton, Assistant Chief Designer of Vickers - Armstrongs (Supermarine) Ltd., showed the Royal Aeronautical Society that cost and weight of future supersonic fighters were rising as shown in Figure 1.

To raise the sea level Mach number of fighters from .80 at present to 1.20 in the future the weight of the aircraft would increase about three times and the cost about four times. If our present sub-sonic fighters, cost us $1 million each, and the RCAF has $300 million to spend on fighters, then we could expect to receive 300 of them from the production lines.

If the government toes the line on defence spending and five years from now the service still has $300 million for fighters, then, on Clifton's criteria, the RCAF could only expect to receive 75 fighters of the super-sonic variety for the same money.

Old Against New: There is some indication that these figures may be true for future high speed fighters. The cost per pound may only be up one-third, but the numbers of aircraft on the flight line may be down to one-quarter. But here again, "value" must be weighed. For what good are many, slow, 1954 model fighters against a fast, 1960 atomic bomber heading over the Canadian northland for the heart of Montreal or Toronto?

Thus in the broad picture of present and future aircraft, dollars and pounds need to be weighed on the scales of engineering possibilities and operational requirements. And even in the detailed picture the raw data from which the cost per pound has been sifted must be kept in mind.

In the first place, the cost per pound figure is usually an average. It may be right for one company, and a way out for another. Soon after the last war, for example, three aircraft whose structure weights were in the order of 25,000 pounds, were found to vary from $8.00 to $13.00 a pound—a 62 percent difference. Similarly on a wider range of transport aircraft, with structure weights from 13,000 pounds to 70,000 pounds, the cost spread ran from $8 to $20: an even greater percentage change.

Eighty Per Cent: One of the major causes of this difference is usually the particular production status of the airplanes chosen. As Henry Ford once drove home to every car owner, the Ford car got cheaper as the production curve rose. After the last war P. J. Stanley, of the U.K. College of Aeronautics, carefully screened all U.S., British, German and Japanese aircraft production statistics. From this he confirmed that modern aircraft follow the production planner's "80% Law." This law merely states that each time you double the number of aircraft produced,

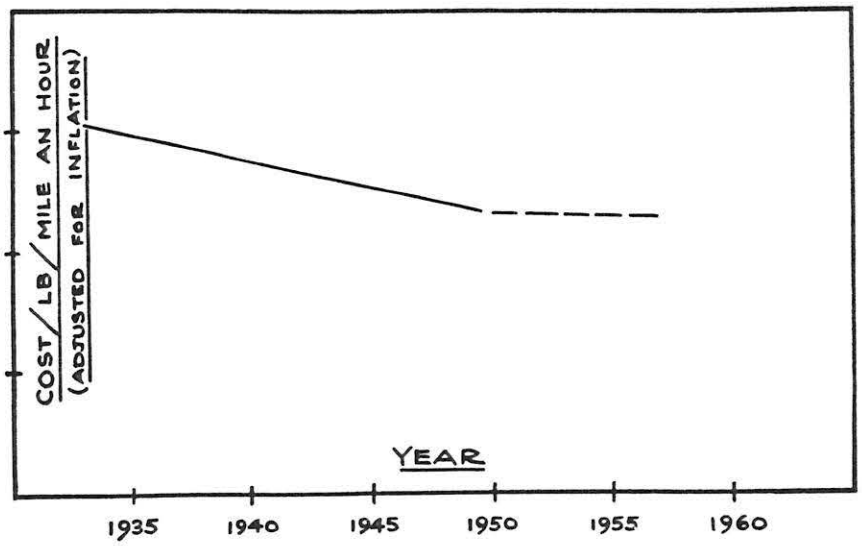


FIGURE 3

COST - WEIGHT - PERFORMANCE TREND

the manhours per aircraft is reduced to 80% of the previous figure.

A simple calculation using the 80% law quickly confirms Henry Ford. It also shows that the 1,000th aircraft will only cost, in manhours, about 10% of the cost of the first. (Figures 2). Even more startling dollar figures have been announced. As one report says, "It is important to recognize the vast difference in cost between high and low production levels. Five hundred jet fighters, for example, could be built for only 22 times the cost of the first two planes."

So when pounds and dollars are related, the pounds will remain relatively fixed, while the dollars will descend as production swings into high gear. And any comparison can be erroneous unless the production state is similar.

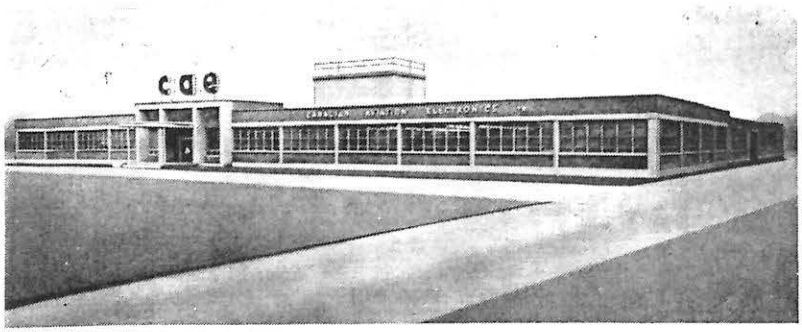
Inflationary Factors: While this is probably the largest variable in the dollars-pound baseline, there are numerous others that affect comparative analyses. Inflation has reaped its toll in Canada with the continual creep upward of the cost-index. Similarly in the U.S., the U.S. Navy, for example, discovered that inflation alone, between mid-1950 and mid-1951 cut their fixed budget so that the dollars bought 2,500 less fighter aircraft than before.

Labour costs have also risen steadily. The increased complexity, as reflected in the amount of the equipment carried in the aircraft, has demanded more skilled shop men at higher wages. Engineering staffs too have increased about three times over pre-war levels.

If these increased cost trends continue, aircraft dollars per pound based on old data, will no longer be useful—except for the statisticians plotting the growth curve. But one need not be alarmed over the rising curve, for the future may not be as bad as the shape of the graph indicates. In fact, neglecting inflation, there is some startling evidence on commercial aircraft that we are actually getting more "value" for today's dollar than ever before; and the trend may even continue.

To prove it, James W. Barton, Chief Cost Accountant for the Boeing Airplane Company, recently compared for the Society of Automotive Engineers, cost and miles-per-hour of 1933, 1939, and 1949 aircraft, and extended the curve to 1957. Contrary to many opinions, the graph swung down. (Figure 3).

(Continued on page 55)



A New Home for CAE

The big new electronics plant of Canadian Aviation Electronics Limited was officially opened June 16 by the Right Hon. C. D. Howe, Minister of Defence Production, thus marking a new high in the fortunes of this postwar prodigy. The new plant, located on Montreal's Cote de Liesse Road, cost $3,000,000 to build and equip.

CAE's operations are of a complicated and diversified nature, demanding the ultimate in fast, smooth changes from one type of operation to another. The new plant, therefore, includes many unique features which will make such changes possible.

CAE's activities include the manufacture of such production-run items as oscilloscopes, scintillometers, and moisture meters, in addition to custom-built radio and communications equipment. Custom engineering jobs embrace such projects as an electronic CF-100 flight simulator, northern radar defence installations, and many other defence jobs involving electronics.

Total area of the building is 130,000 square feet. At the front are business and executive offices while around the other three sides are engineering and drafting offices and various shops and departments.

This leaves a central core of more than 52,000 square feet, completely surrounded by a 10 foot service aisle. The part of this area nearest the front of the building has been assigned to the repair & overhaul of electronic equipment, which is considered the most stable operation in the plant. The working equipment for this department has been standardized and is more or less permanent.

Electric power requirements for the diversified program are many and varied and are met by a 550 volt, three-phase supply throughout the factory. From this central convenient source, suitable power for any need can be tapped off by means of transformers.

Much of the work done by CAE is of a classified nature, so that some areas must be kept segregated from others. Since some of this work is for short duration only, any partitions must be interchangeable and portable.

CAE PRES. K. R. PATRICK

An unusual aspect of the plant layout is the location of the microwave research laboratory, which is in a penthouse above the main office.

CAE, which started just seven years ago in the corner of a hangar at St. Hubert Airport, near Montreal, with three employees, is now a national organization employing 1,300 and occupying 200,000 sq. ft. of floor space in four major Canadian cities.

Since its early days, CAE has followed a policy of diversification. The first step in this direction was the acquisition of "CGS", a small company producing hydraulic and pneumatic equipment. Later, the Halross Instrument Corp. of Winnipeg was purchased. Now known as the Western Division of CAE, the former Halross plant produces the world famous "Scintillometer", and the CAE Moisture Meter (for the grain trade). Plans are now under way for the production at Vancouver of the new Sonotone Nickel-Cadmium storage battery. At Montreal, in a separate plant, a "Consumer Products Division", manufactures Du Mont television sets. Recently, CAE purchased the Sonotone Company of Canada Ltd., and is carrying on the production of Sonotone hearing aids at Toronto.

the mission despite marginal flying weather and heavy anti-aircraft fire with "courageous leadership and outstanding demonstration of pilot skill".

Lt.-Cdr. MacBrien joined the RCN in 1942 and during World War II served in British and Australian warships in the Pacific. He commenced flying training in 1946, receiving his wings the following year. He later flew with a Sea Fury fighter squadron on board HMCS Magnificent. This was followed by advanced courses in the U.K. and further flying with Canadian naval fighter squadrons.

He was promoted to his present rank in January of this year and is currently serving on the staff of the Assistant Chief of Naval Staff (Air), at Naval HQ in Ottawa.

Airport Revenues

A comparison between revenues and expenditures at some of Canada's major airports during the 1953-54 fiscal year was given to Commons recently by Transport Minister Lionel Chevrier.

Mr. Chevrier reported that at Gander, revenues of $2,787,000 were exceeded considerably by expenditures; at Winnipeg, the revenue was $137,000 and the expenditure, $74,000; at Toronto, the revenue was $335,000 and expenditure, $277,000; Dorval, revenue —$765,000, expenditure—$800,000.

The Minister also explained that a new runway costing over a million dollars was planned for Winnipeg. The funds for the first stage had already been allotted and the contract awarded. Other improvements planned for Winnipeg included the installation of high intensity approach lights costing $65,000, high intensity runway lights costing over $50,000, and establishment of emergency power facilities costing $40,000.

APPRECIATION: AITA recently held a reception honoring A/V/M A. T. N. Cowley, retiring DoT Dir. of Air Services (R). On the industry's behalf, AITA Pres. T. P. Fox (L), presented a watch to A/V/M Cowley, who has been associated with administration of civil aviation in Canada since it began. He holds Transport Lic. 2, and has flown over 170 varieties of aircraft.

DOLLARS AND POUNDS

(Continued from page 27)

For military aircraft, of course, a similar assessment of value is infinitely more difficult since dollars and pounds get entangled with the enemy's capabilities.

But the performance aspects of military airpower must not be clouded by dollars and debates on the military budget. U.S. Admiral DeWitt Ramsey summed it up when he said, "So long as performance requirements continue to be raised—and the sights must be raised constantly if we are to attain security in the world—we cannot expect to buy our air power in any kind of cut-rate bargain basement."