Lewis Imm (right) demonstrates his balance computor to two TWA operations men.

Automatic Brains

by Edward Churchill

It's getting so a pilot nowadays need not give a second thought to loading his ship or plotting its flight. Lewis Imm saw to that.

YOUR pilot lays aside his pencils and charts, the things to which he's been chained these many years. While Flight One is taxied up to the line for a scheduled trip on Amalgamated Airways the pilot, who heretofore has been spending from half an hour to 45 minutes doing mental gymnastics to create what is known as a "flight plan," now coolly turns the knobs on a box which is, roughly, a foot wide, a foot and a half long and about three inches deep. In about a minute he's done with his computing and is ready to get into the left seat without even lifting his cap to scratch his head in perplexity.

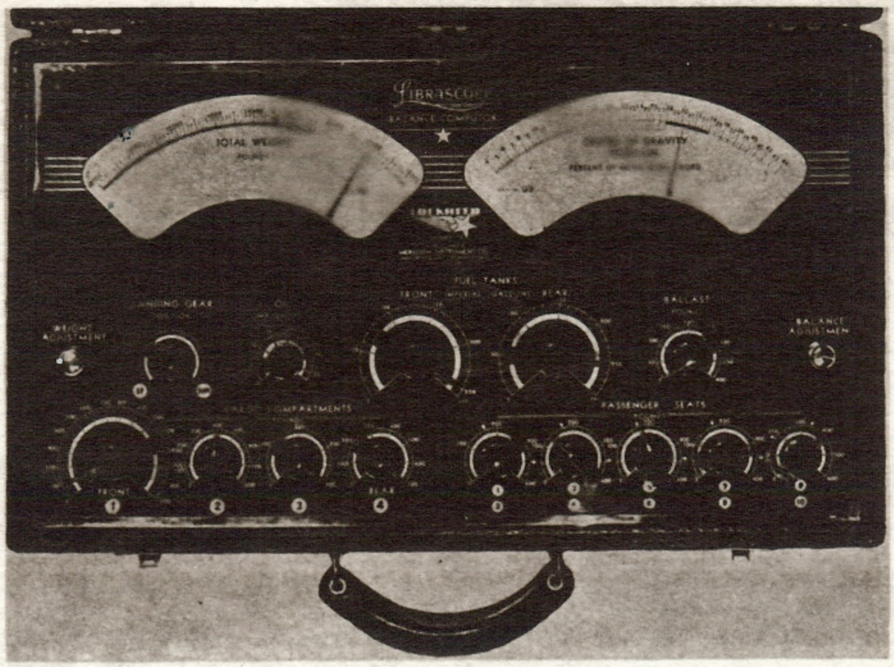
He's used the Librascope flight computor. At the same time, at an Army airport, a flight officer is taking off a bomber with full details of his trip at his finger tips. Down at the waterfront a Naval pilot is smiling his satisfaction as he kicks open his throttles, for he knows at what altitude to fly to his destination, how long his flight will take and the amount of power he'll need to get there. This Librascope has reduced flying's advance work to an absolute, carefully calculated, mathematical science.

One more step toward safety, economy, speedy travel and efficient operation has been taken. You can credit it all to a young inventive genius, Lewis W. Imm, who operates a small but growing factory on San Fernando boulevard, in Glendale, Cal. Imm, erstwhile plane designer, ex-engineer with the Bureau of Air Commerce (CAA), is one of those people who decides something should be done about something—and then does it. A gambler at heart, curly-headed and bespectacled and in his middle thirties, he has presented aviation with three major developments during the past two years and a half. First the balance computor, then the power computor and now the flight computor, the operation of which is roughly described above. Imm, given to miraculous mental gymnastics, is quite as unusual as his products.

Today, airlines and operators in 47 countries are using his balance computors. He's sold more than 200 of them, his gross profit exceeding $40,000. He employs eight workers in his factory, which occupies 30,000 square feet. He has a capital investment of $18,000 and a list of backers as long as your arm, most of the group being aircraft manufacturers.

"Their interests are small," he explains. "I have them in because I want their good, hard, sound judgment and

At right is balance computor used on Howard Hughes' round-the-world Lockheed "14".



business advice. A fellow doesn't really get interested in anything until he has money in it."

Two and one half years ago Imm took it upon himself to resign from the CAA, where he was employed as an engineer, because he saw the aviation industry needed a balance computor and he was pretty sure he knew how to make one. He was a little more than $200 in debt at the time. That didn't bother him. He went out and got another $1,000 "on his face" and went to work. He sold the first balance computor, which will be explained later, just six weeks after he tendered his resignation.

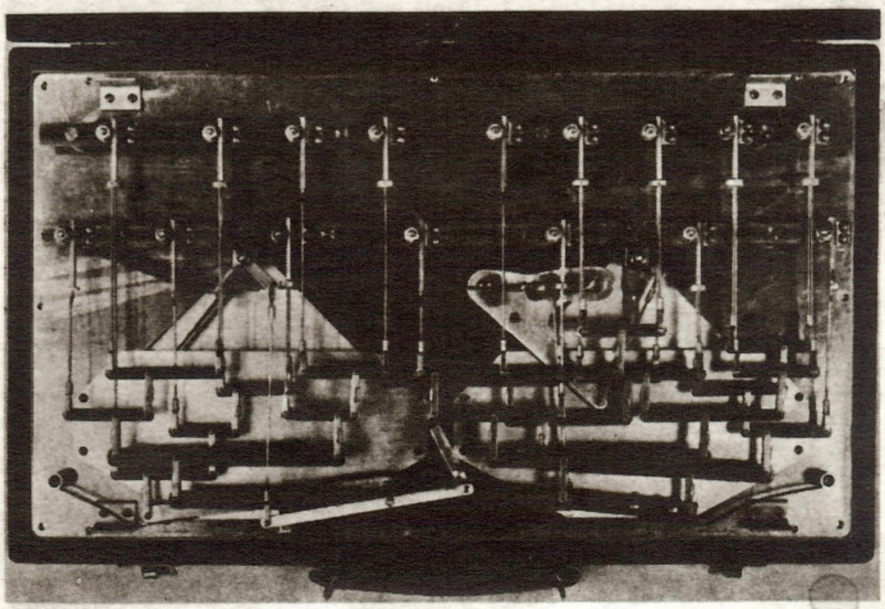
The balance computors now are being used by TWA, British Airways, Continental Airlines, Northwest Airlines, the United States Army and Navy, Trans-Canada Airlines, Australian National Airways and Guinea Airways—just to mention a few.

With the success of the first invention, the balance computor, Imm immediately put his money right back into the company to develop the power computor and the flight computor. He has several other startling inventions which he isn't quite ready to discuss.

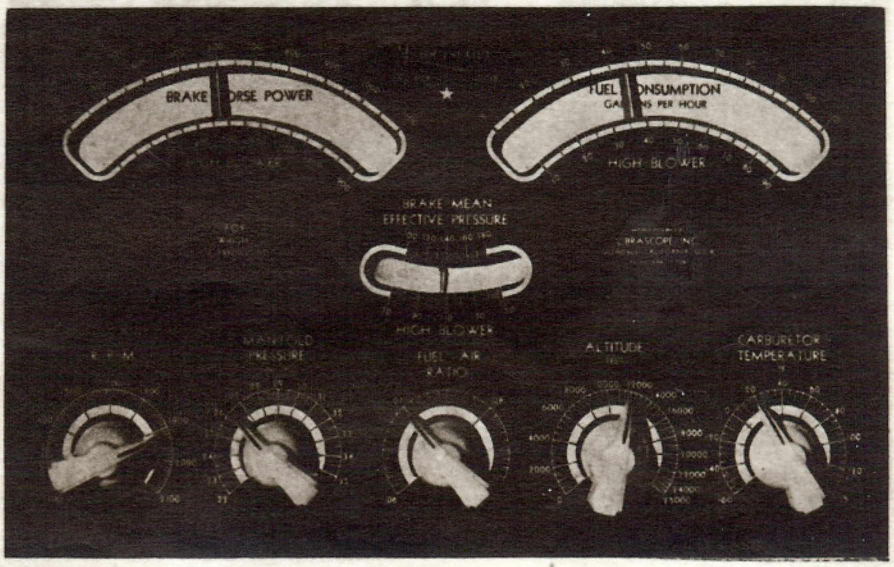
To go back, now, to the Librascope flight computor. It's in the described box. The inside, filled with wires, levers, triangular contrivances and gears, would baffle Rube Goldberg. A book could be written about the neat hook-up. However, the knobs and the dials on the front are the pilot's interest. Just for the experience, let's turn the knobs and figure a flight plan from Los Angeles to Albuquerque.

First, we decide to fly at 11,000 feet, so we set the altitude marker at that point. We know the outside air temperature at that altitude will be 42°—the weather man has told us so. Then we set the outside temperature marker. We have the wind direction and velocity from the same source. We adjust the drift correction dial and the wind velocity dial. We set our total weight on another gauge, the proposed elapsed time on another, which in this case would be 3 hours and 45 minutes. Then we move the brake horsepower dial until the total distance indicator shows 703 miles, the airline distance between airports. When this is done, the brake horsepower indicator reveals the necessary horsepower output to get us there on time.

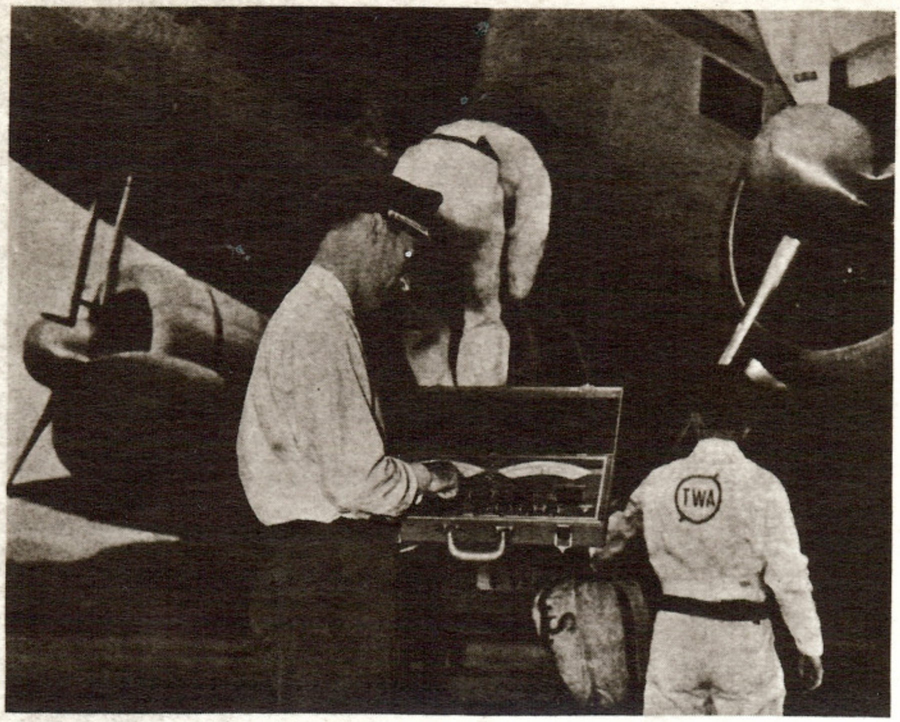
This accomplished, we set the carburetor air temperature, as we know at what heat we'll run. Then we set the r.p.m. needle, watching the brake mean effective pressure gauge as it hits 140, point of safest and most economical operation. In this way we establish the revolutions



Right center is rear view of balance computor mechanism. All Librascopes are similar.



Power computor now is widely used by airlines. Results obtained are very accurate.



The airline dispatcher above is using a balance computor to accurately calculate the loading of a Douglas DC-3. Librascope computors differ with each type airplane.

per minute we'll have to have from our motors. Then we check our manifold pressure, getting the amount needed to "take out" the required horsepower. We get total fuel consumption, true course ground speed, indicated air speed and everything else essential. Just a few simple twists of the wrist and out the window go pages of calculations. Here, in less than a minute, is everything we need to know. Imm points out:

"The flight computor has at least 14 uses. It calculates the horsepower required to fly a known distance with weather conditions, total weight, altitude and time of flight given, total fuel consumption and indicated air speed necessary to complete the flight on schedule being given at the same time.

"It calculates the time elapsed, total fuel consumption, and air speed required to fly a known distance with horsepower, altitude, total weight and weather conditions given.

"The distance which may be flown with a given amount of fuel when weather conditions, altitude, engine r.p.m.'s, and manifold pressure are known is calculated quickly and with accuracy.

"With the other conditions affecting the flight set in the computor, the time of arrival over check points along the flight can be taken from the time dial directly by setting the distance pointer to the distances of check points from point of departure. Should the time of arrival over check points differ from pretermined time, the computor will make corrections, showing how horsepower may be altered to maintain schedule.

"It shows the best cruising altitude to permit making schedule with minimum horsepower. With given total weight and weather conditions it shows immediately the best horsepower, air speed and altitude for maximum range with fuel carried. It also shows how horsepower and altitude may be regulated to provide maximum fuel economy on long range flights.

"It shows the engine r.p.m. and manifold pressure required to maintain maximum allowable brake mean effective power at all cruising speeds, reducing fuel consumption as much as 20 percent and allows the propeller to be operated at a lower and more efficient r.p.m.

"The brake mean effective pressure indicator gives immediate warning if horsepower required to maintain schedule will be injurious to the engine, its speed of calculation allows the wind correction to be added before the compass deviation and magnetic variation, it will accomplish dead reckoning flight planning, may be used for 'rectifying' and 'return to coarse' calculation, and will assist in calculating radius of action."

That's all. And, while Imm smiles happily, the airlines rush to get his product. So do private flyers, the military and Naval men, operators in foreign countries. While he thinks up more "gadgets" his factory works overtime. Incidentally, if you don't speak English, you can get 'em in five different languages and metric measure.

You don't leave 'em on the ground, either. As Imm points out, if you're up there and aren't sure, you check your position, re-figure your flight, and go onward with a light heart. Of course, a fellow doesn't just step out and invent a thing like that overnight. He starts with more simple things. Twenty years ago the average pilot didn't know whether or not the center of gravity of his airplane was flirting with the center of lift. He probably had the idea that when the two got together there'd be some kind of an accident, or maybe he'd need an overhaul.

Ten years ago, when Fokkers and Fords vied for the domination of the airlines, center of gravity, center of lift and their relation to each other became more important. When you put so many hundred pounds and so many pounds there, strange things happen to airplanes because gravity and lift are divorced. As ships got bigger, the problem became greater. Dispatchers came to work one day, turned gray the

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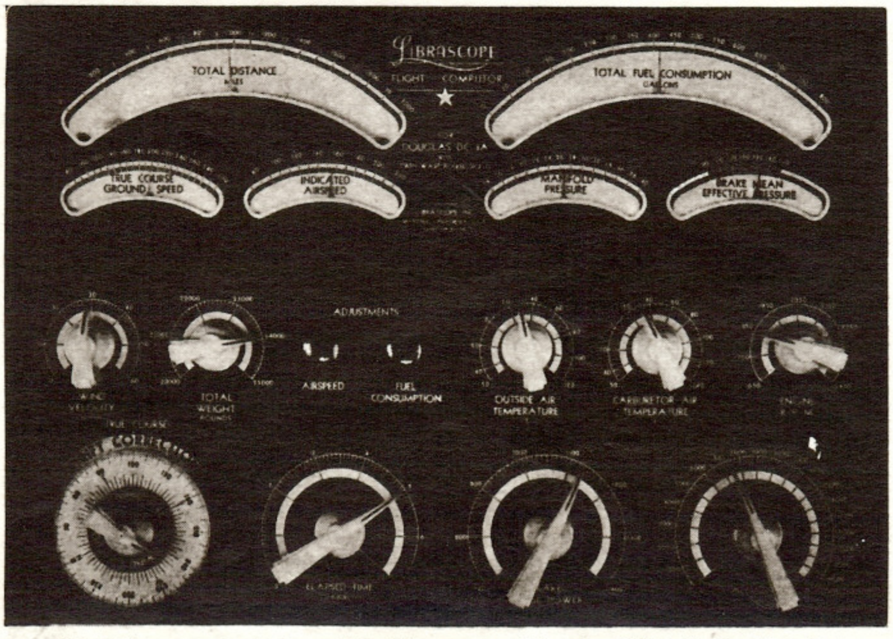

This flight computor is for a Twin Wasp-powered Douglas DC-3. Notice that finely calibrated adjustments are provided for the calculation of any flight problem.

Automatic Brains

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next trying to calculate load distribution.

"Something," said Nebraska-born Imm, "should be done about that."

He put his brain to work and, suddenly, two years ago, the Librascope balance computor appeared. Everybody was a little startled. Dispatchers had been figuring wildly between hops for years trying to balance ships. Now, all you had to do was to figuratively put the balance computor on the left side of the ship, know the weight divisions of your load, and turn some dials. When you got through, about 30 seconds later, you knew how much gas to put in the forward tank, how much in the aft, how much mail, express and baggage could go into fore and aft compartments, how many passengers could sit where. Not only did the computor tell you exactly what your total load was, but where it must be stowed to get the center of gravity and center of lift together for efficient and safe operation. When you got all through, one dial told you the total weight of your ship and another just how it was balanced.

The idea was pretty good. Imm sold the gadget to 25 airlines throughout the world. Lockheed delivers one as standard equipment with each "14" and "18" *(Lodestar)* sold. The Army and Navy bought them for bombers and other equipment. All a flight officer had to do was to get his crew, baggage, fuel, bombs, ammunition and other odds and ends together, turn his knobs and know exactly where they were in the ship.

Now, happy dispatchers turn dials, know that this must go here and that there. Pilots take-off knowing they aren't going to have to either lean against the wheel or pull on it for the next 400 miles. A balanced ship means more efficient operation. It means greater safety on take-offs and landings and in icing and during turbulent air conditions.

But Imm, with this under his belt, wasn't satisfied. He'd taken care of the dispatchers and made it easier on the pilots' arms, but he felt he had to give the pilot's heads a rest. So he went to work on his second gadget—the power computor. The main function of this little box is to show rapidly and accurately the horsepower, fuel consumption and brake mean effective pressure for a given set of operating conditions. In addition to this, the device shows what effects a change in r.p.m.'s, manifold pressure, altitude pressure or temperature will have on the horsepower, fuel consumption and the brake mean effective pressure.

"The brake mean effective pressure in the engine on the power stroke should be 140 pounds per square inch at maximum safe operation," he explains. "Too high manifold pressure and too low r.p.m.'s mean damage to the engine, the overload affecting cylinder heads and bearings. With r.p.m.'s running high and manifold pressure low, fuel consumption may be high, running up to ten per cent waste."

The power computor eliminates all guess work as to how the engines are functioning or should function. Again, it means economy and safety and elimination of the human element in calculating.

Imm found that the manufacturers, operators and private owners liked this

one—to say nothing of the military services. So he started making it, and thought up number three—the flight computor described at the beginning of the article. The power computor is a part of the flight computor.

After exhaustive tests, Imm is just getting into production on the power and flight computors. The gadgets have caused a minor revolution in flight procedure and buyers are standing in line for them as fast as they are ready. The fact that sales are few is that Imm hasn't been able to expand as rapidly as he might have wished because he's had to train every man working for him. And it was only three months ago that he incorporated.

Imm, who is quite as interesting as his product—any man who can run a $200 debt and an idea into a $40,000 business in two years is worthy of attention, even if you don't count his contributions to aviation—boasts that he has no claim to an exciting life. He works with figures, he says. He's a mathematician and that's all.

Truth is, he once learned to fly and he once held a license. But for a time he was too poor to keep it up and, after that, he got too busy doing something about something that he couldn't get in his flying time. Back in his past, you find that he's also a glider pilot. As soon as he can get supply up to demand he's going to get his license back.

He was born May 16, 1905, at Milford, Nebraska. His family moved to a ranch in South Dakota and he sandwiched schooling with herding cows until 1920. He attended high school at Aberdeen, S. D., entering with the desire to be a mechanical engineer. Figures were his meat. So that he could get money to go to school, he operated a filling station his father left at his death.

The year 1925 found him at the University of Minnesota, driving a taxicab and operating a filling station to get money to live and learn. To make his education cheaper he finally joined his family at Lincoln, Neb., where they'd moved. He finished two years at the University of Nebraska, finding time to be chairman of the student chapter of the American Society of Mechanical Engineers. He also organized the first glider club at the university and the Engineering Control Board there.

All this didn't keep him busy. During 1928 and 1929 he worked on a part-time basis with Arrow Aircraft and after graduation, became a full time engineer. In 1930 and 1931 he added to his experience as resident engineer for the Kari Keen Aircraft Company at Sioux City, Iowa. It was Imm who, on returning to Arrow later, got that airplane and the Ford motor together.

In 1935 he became engineer with the Bureau of Air Commerce. On September 28 of that year he was married to Wilma Lee Meredith. Later he was transferred to Inglewood, California. It was at Inglewood that he started worrying about the problems of the dispatchers and the pilots, their load balances and their flight plans.

"My toughest time," he says, "was between my resignation and the sale of the first balance computor. There I was with wife, child and debt."

But he proved that a man with an idea can still go places. Now he lives in Glendale, works there, has a son, Donald who is three years old, and says his hobby is mathematics. Now and then he puts aside his computors, however, to listen to a good musical program on the radio.

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