AEROSPACE BRAZIL

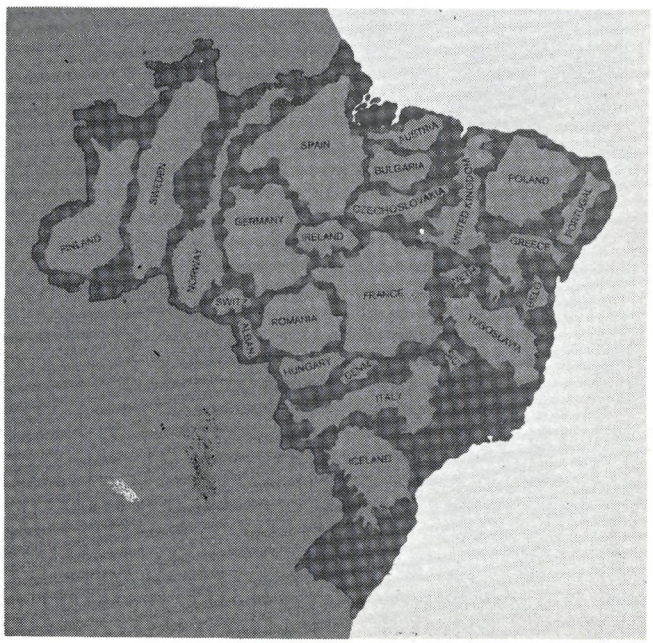
One of today's fastest growing countries, Brazil will become a world force in aviation. Airline traffic is already expanding at more than 20 per cent per year, an aircraft industry is being systematically created and a space programme is established. This special "Flight" report was prepared by International Editor Mark Lambert, who last month visited Brazil's airlines, research establishments, factories and institutes, and forms a background to the forthcoming aerospace exhibition at São Paulo, which opens on September 14.

BRAZIL is a country of "gee-whiz" figures, in terms of both size and rate of growth. The country occupies half the area of South America and contains the Amazon river system with a water surface comparable with that of the Mediterranean. It is the fifth largest country in the world and its population is the eighth largest. The volume of its gross national product is among the ten largest in the world. Its industrial output is seventh highest, not counting the Communist states.

Some figures set the scale: the population is estimated to have passed the 100 million mark during 1971. It was 17·3 million in 1900, overtook that of France in 1940 and Britain in 1950. It will be 200 million by the year 2000.

Brazil measures 2,300 miles from north to south and the same from east to west. It has a 14,000-mile land frontier touching every South American country but two. Its coast line measures 4,500 miles. Internal jet passenger flights of 4hr, equivalent to London-Moscow, are normal and an internal route network can stretch as far as the distance from Norway to the Red Sea. Surface area is 3·28 million sq miles, of which three-quarters has been only superficially explored.

Brazil was first colonised by the Portuguese in 1500 and was from the start a multi-racial society without any entrenched racial prejudices. Today the population is 60 per cent of European origin, mainly Portuguese but with large German, Italian and Spanish communities and



Top, Brazil's own aircraft, the Embraer Bandeirante. Right, above, "A country which flies will go far" says the sticker on a Volkswagen Beetle. Right, Brazil is larger than all Europe's countries together

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important Japanese and Lebanese minorities. Of the remainder, 15 per cent is negro and the rest of mixed blood.

Settlement has always remained more or less on or near the coastal plain, leaving a vast interior largely untouched. There has been a succession of booms to attract immigration and to redistribute the population internally. Each boom has been characterised by short-term exploitation rather than sustained development, a feature still recognisable today in a strong sense of commercial enterprise. In the 17th century Brazil was the world's prime source of sugar. As that crop declined under foreign competition, a gold and diamond boom took over for 100 years in the 18th century. In the 19th century it was coffee and later, until 1912, rubber.

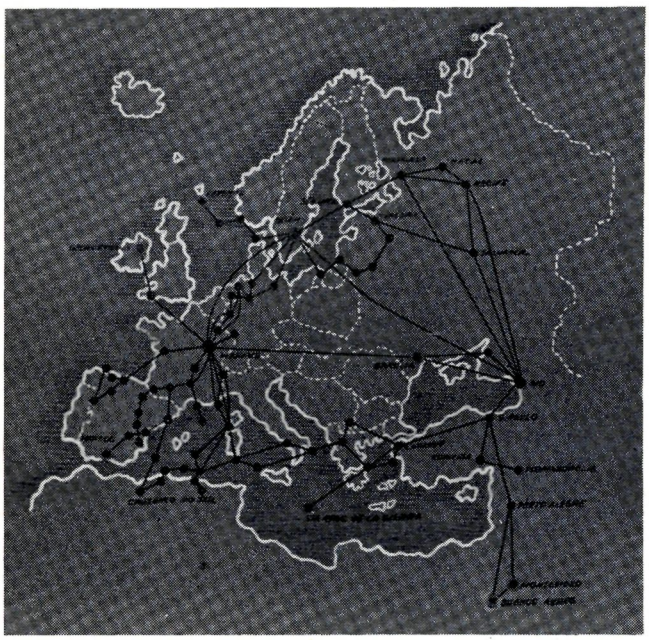
Currently, raw materials and crops form a large national resource, with very considerable new reserves of iron, tin, copper and oil being discovered as the vast task of surveying continues. Industrial exports are being vigorously developed.

Politically, the country has been a colony in an empire, a kingdom and, for the most of this century, a republic. The political event dominating the present situation was the revolution of March 1964, in which the leftist republic of João Goulart was replaced by a military Government under Gen Castello Branco. The present president, Gen Garrastazu Medici, will probably be succeeded next March by Gen Ernesto Geisel.

The present system of government could be defined as a directed democracy, or a benevolent autocracy, or a technocracy. While a definite state rein on a few kinds of activity or expression can be readily sensed by a business visitor, the system has rescued the country from potential economic and political chaos, set it on the road of expansion and is making evident efforts to improve the lot of the deprived part of the community. Most remarkable to this writer at least is that this is being accomplished without a readily apparent "ism" or preconceived ideology.

There is no mistaking the fact that the régime is military, and that retired military officers hold a very high proportion of the leading positions in industry. One explanation of this is that, although the armed forces traditionally have avoided political action, they have been the focus for higher education and technical qualification, and have had a high proportion of the country's management experience and ability.

Cruzeiro's route network over Brazil and neighbouring countries comfortably covers Europe, western Russia and the Mediterranean area



The Government and its supporters are acutely sensitive of the fact that the repressive and inegalitarian aspects of the country, the virtual extermination of guerrilla movements, and inescapable poverty have been far more energetically publicised abroad, particularly in Britain, than its tremendous social as well as industrial achievements and its rapid emergence as a world industrial power.

An important aspect of this has been the control of inflation, which has been brought down from a disastrous 144 per cent in 1964 to a forecast 12 per cent this year. In addition, the Government-fixed minimum wage of Cr312 per month is reviewed at least once a year and universally used as the basic measure for wages, rents, savings and so on. Charges are fixed as multiples of the minimum wage. Foreign-exchange rates have been adjusted on a "crawling peg" pattern. Thus the people have been protected from the effects of inflation: investment and saving have not been deterred.

The achievement so far, in broadest terms, is an increase in gross national product which for four years has averaged no less than 9·8 per cent. In 1971 it reached 11·3 per cent, which is even higher than that of Japan. Industrial exports, as distinct from the traditional agricultural exports, are now as great as those of the rest of South America combined, having doubled since the early 1960s to nearly $3,000 million in 1971. The Government has worked to boost the economy and encouraged internal investment. By liberal policies towards foreign companies, it has attracted more than $800 million of foreign capital and the associated "know-how." Foreign currency reserves are well over $2,000 million.

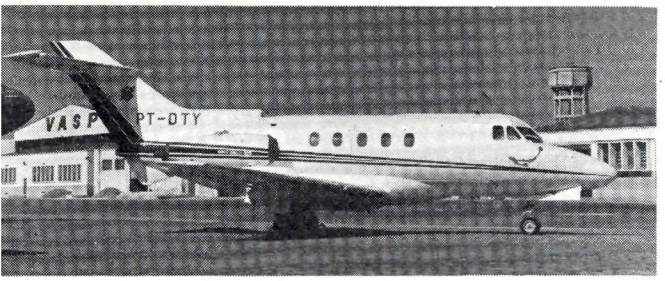
Motor car production was 600,000 in 1971 and is expected to reach one million by 1975. Volkswagen started a Brazilian factory virtually from scratch, and, after some years of losses, the plant is now profitable enough to support the home plant in Germany and will shortly become the sole world source of the ubiquitous Beetle. Fiat, Alfa Romeo and Toyota are moving in. The half-million Japanese community grow 20 per cent of the coffee, 30 per cent of the cotton and all the tea, but are now becoming increasingly prominent in industry. Japanese companies have a reputation for ploughing back capital into their Brazilian ventures rather than returning it to Japan.

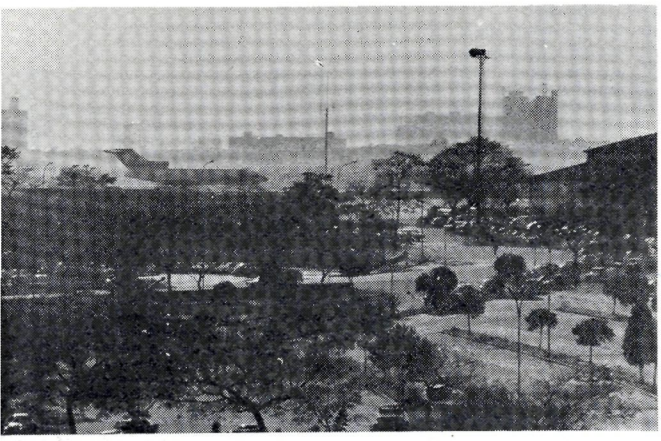
Inevitably, this boom is not evenly distributed. Industrial development is concentrated in the central south, where 67 per cent of the population occupies 26 per cent of the country's land area and earns 83 per cent of the national wages. By contrast, in the poorer north-east, 25 per cent of the population occupies 15 per cent of the land and earns only 13 per cent of the national wages. In the Amazonas, eight per cent of the population occupies 59 per cent of the land and earns four per cent of the national income.

While social inequalities can hardly fail to continue for some time to come, the Government is running very large social programmes. The considerable school programme is struggling to reduce the approximately 50 per cent illiteracy and to keep pace with a tremendous youth bulge. Some 23 million of the population are of school age, and 52 per cent of the population is under 21. University population has increased from 200,000 to 600,000 this year and will reach a million by 1975. A major programme of communications improvement has been undertaken, providing inter-city connections by microwave link and tropo-scatter as well as landlines.

There are major Government development programmes like Proterra, Sudene, Sudam and Pis intended to develop the areas of the north east and Amazonas. The tremendous Trans-Amazonica highway is designed to open up the Amazon basin for settlement by the people from the desert areas.

Internationally, the emergent economic strength of Brazil inevitably modifies its relationships with neighbouring countries, just as the improving communications are making access to them easier. Brazil has 200,000 men in its armed forces and spends some two per cent of its gross





Top, the Banco do Brasil's HS.125 at São Paulo Congonhas airport. Above, a Boeing 727 takes off from downtown Congonhas in the usual smog

national product on defence. As well as a civilian nuclear-energy research organisation aimed at power station construction and exploitation of national reserves of uranium, Brazil has a military nuclear research laboratory. The country is said to stand as close to a home-grown nuclear-weapon capability as Israel, though this seems to be an accomplishment that Brazil would rather avoid.

The Air Force has a front-line strength just emerging from a primarily anti-insurgent to an interception and tactical strike capability. A small force of Mirages supported by recently installed French radar provides the basis of a potent intercepter system. The agreement to purchase Northrop F-5Es to form a tactical force replacing T-33s and dual-purpose Xavantes was signed on July 4. Six new Vosper Thornycroft Mk 10 frigates, two built under licence in Brazil's new ship-building industry, will considerably increase naval strength, being armed with Seacat, Ikara and Lynx. Exocet has been ordered for these ships.

In these purchases, Brazil is very aware that it is advancing its own technological capability as well as strengthening defence. Personnel training and a share in the manufacture are more than ever an integral part of defence purchases—Roland will be bought, Cobra manufactured in the Army arsenal—and licences will not be allowed to tie a national company to the apron strings of an overseas supplier.

Against this kaleidoscope of achievements, problems and aims, the following pages report on the role being played by aviation in this fast-moving country. It is at once the story of air transport expanding faster than anywhere else, and of an infant aircraft industry being built up partly as a technology-intensive learning ground, partly to save imports and to generate a new export potential. Its results may at this moment be modest, but the intention to expand and the ability to do so are unmistakable.

CONTROLLED DEVELOPMENT

JUST as Brazil is proud of her artists and designers, not to mention Pelé and the Fittipaldis, she is conscious of her aviation heritage. The Brazilian Army used balloons in 1867 and Santos Dumont, aviation pioneer in France in 1806, was Brazilian. This year is the centenary of Santos Dumont's birth, a fact not neglected by the organisers of the Paris Salon.

Brazil's first airline service was flown in 1927 and air transport has played its part in the country's life ever since.

Brazil fought on the Allied side during the Second World War and sent a Thunderbolt wing to Italy—a fact still proudly recorded in the squadron badges of the 1st Fighter Group at Santa Cruz.

The scale of air transport in today's Brazil is indicated in the statistical analysis on page 198. It is a market which could absorb over 100 more jet transports by 1980. The air bridge, Ponte Aerea, which links Rio de Janeiro with São Paulo, Belo Horizonte and Brasilia with "walk-on" high-frequency services, is a bustling, everyman's transport service, which makes the Paris-London service look cumbersome.

Transport in Brazil is considered to be a federal responsibility and the airlines are therefore regarded as being delegated by the Government to provide it. Following a characteristic Brazilian pattern, the airlines are obliged to conform to the Government's conception of appropriate routes, frequencies and capacities. On the other hand, the system is democratically applied so that the incentive to excel and to compete is strongly evident in each company. Success and survival depend on the energy and expertise with which each company operates, though each is reasonably assured of profitable conditions.

The present four-airline system developed gradually from the post-war chaos in the late 1940s, when no fewer than 52 airline companies were registered and 47 of them actually operated. Now, Varig is the single chosen intercontinental airline and is considerably the largest Brazilian airline. Its main operation is intercontinental and it is limited to 33·3 per cent of the domestic market.

Cruzeiro do Sul is the designated international carrier for South America and the Caribbean. Vasp and Transbrasil (formerly Sadia) operate only internally, though internal air routes are often of continental length. All four airlines operate in pool on the air bridge, though each carefully projects its own identity in passenger announcements, even when operating unmarked FH-227s recovered from the defunct Paraense.

In the pre-revolutionary days many services were subsidised by the Government, particularly in the less inhabited regions, but all subsidies have now been withdrawn. At the same time, the network of discounts and indulgencies allowed to state and federal employees and Government officials was also abolished. Each airline was obliged to operate an unprofitable route network called Rete de Integração Nacional as a social service—Vasp in the centre

A Vasp One-Eleven 400 operating on the air bridge picks up passengers at Belo Horizonte Pampulha airport for the flight to São Paulo. The only formality is a police check on identity

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of Brazil, Varig in the south and the north-east, Transbrasil in the south and Cruzeiro in the Amazonas.

Two major events in post-revolutionary days have been the disappearance of Panair do Brasil and Paraense. Panair, in many kinds of trouble, was simply administered out of existence one morning in 1965 and its routes taken over the same afternoon by Varig. One Panair DC-8 is still flown by Varig, chartered from Panair's liquidators. Paraense disappeared quite recently.

Control of airline operations, and indeed of all aeronautical activities in Brazil, is vested in the Ministerio da Aeronautica, based in Rio de Janeiro, close to the downtown Santos Dumont airport.

The Ministry's policy and activities in the industrial field are evident in the reports on the activities of the Centro Tecnico da Aeronautica on page 200, the Instituto Nacional de Pesquisas Espaciais on page 199 and Embraer on page 201. The Ministry's Directorate of Electronics and Flight Protection is responsible for air traffic control, navigation aids and the weather service. There is an accident investigation and prevention service, also based in Rio.

There are 1,117 airfields of all kinds officially recognised in Brazil, besides countless unofficial strips. Of these, 117 are paved and new runways are built as development demands. Stol is not a requirement in Brazil. Just formed is the new Empresa Brasileira de Infraestructura Aeroportuaria (Infraer), which is to run the main airports on a commercial basis. It is to hold airport charges to approximately their present levels.

Charged with all international negotiations on airline routes and services is the Commissão de Estudos Relativos a Navegacão Aerea Internacional (Cernai), based in the Ministry of Aeronautics. Its newly appointed director is Maj Brig Edivio Caldas Sanctos, who was until April commander of the Brazilian tactical air command. He told *Flight* that Brazilian policy was to maintain "fair reciprocity" between Brazilian and foreign services, bearing in mind frequencies, freedoms and the available traffic. All operators are currently profitable on international routes to Brazil and the load factors to Europe are high enough to allow considerable further expansion. Next year, when Rio's Galeão airport puts its new runways and terminal into service, Brazil will be ready for the first services with wide-bodied jets. Then Varig, too, will have its two DC-10-30s.

The function fulfilled in the USA by the FAA is carried out in Brazil by the Diretoria de Aeronautica Civil (DAC), based on Santos Dumont airport in Rio de Janeiro. DAC operations are divided into three main branches: planning, operations and technical, the functions of the last two being in the course of decentralisation to the six Brazilian civil aviation regions.

The operations branch function includes the issue of air operators' certificates and supervision of the operation of airlines and taxi companies, though the transport policy is shaped and administered centrally in Rio. In fact, the DAC transport commission and representatives of all the airlines meet every Thursday in Rio to take any necessary action. Applications are lodged at these meetings and copies are sent to the other airlines. The other carriers have a week in which to state their case, and the initiating airline can respond in the third week. The commission makes a decision in three weeks and the operator can appeal to higher authority, but rarely finds it necessary. Cernai holds a weekly meeting on international affairs, but it is not regularly attended by the airlines.

Main function of the DAC's planning branch is to process detailed monthly reports from airlines and taxi operators and to prepare elaborate analytical statistics on costs as well as operations. Applications to purchase new aircraft, and to change frequency or route are all based on this very detailed knowledge. The statistics are in turn made available to all operators and can also be obtained by citizens.

The third branch of DAC is responsible for aircraft and maintenance supervision, personnel licensing and training and for private flying and gliding. Since no foreigner may fly as a commercial pilot in Brazil, pilot availability is a major pre-occupation. There are several civilian flying schools working to Icao standards and the clubs receive some training aircraft from the Government. The Ministry of Agriculture operates an agricultural flying training centre.

The civil aircraft register for January 1972, latest edited account available, shows the following Brazilian civil aircraft strengths:—

Federal agencies	95
State agencies	71
Municipal organisations	2
Scheduled airliners	151
Air taxi operators	270
Individual air taxis	25
Private transport aircraft	1,454
Industrial and commercial services	265
Special services	81
Training aircraft	658
Recreation aircraft	157
Total	**3,229**

It is reported that the general-aviation fleet is growing at the rate of 8·5 per cent annually. In some sectors, Brazil is still working hard to catch up with other countries. There are only 80 agricultural aircraft in Brazil at the moment, compared with 300 in Mexico, 500 in the Argentine and 5,000 in the USA. Embraer is producing the Ipanema, but the current rate of five per month protected by import restrictions is a modest start.

Current progress at Rio's growing Galeão airport, caught from the flight deck of a passing Vasp YS-11 "Samurai"

The three Brazilian aircraft manufacturers together produced 75 aircraft in 1972 and plan to produce 160 this year. The intention is to increase this total to 500 or 600 by 1975 or 1976. While airframe production is going ahead well, at least for relatively simple aircraft like Bandeirante, Xavante, Ipanema and Universal, engines are all imported and will continue to be largely so for the foreseeable future. Increasingly, Brazil is introducing its own systems and sub-assemblies. There is a network of some 200 suppliers for airframe items. Electronics manufacture is under way. The 140-channel Whinner VHF radio and the Northern N414 HF radio are in service with the Brazilian Air Force.

Now that the home industry is manufacturing numbers of aircraft and requiring to live in the civil market, the problem of price competition is becoming urgent. Brazilian manufacturers cannot yet compete in price with their US equivalents and some form of protection must be provided, at least during the growth stage of the industry.

Discussions are under way now between manufacturers and the Government, while the withholding of import permits is being used as an *ad hoc* protection for both the Bandeirante and the Ipanema. It will be a difficult decision, because the manufacturers are perfectly aware that they must ultimately succeed commercially and Brazil needs more aircraft than the national companies can yet produce. The policy is expected to be formulated during the coming months.

AIRLINES: CONTROLLED EXPANSION

Varig

BEING BY FAR the largest airline in Brazil and the national flag-carrier on four continents, Varig takes pride in itself and makes a point of living up to its reputation. It is in its 47th year of operation, was built up personally by its first president, Rubem Berta, and is now led by his successor Erik de Carvalho.

One of the main competitive features in its early jet services to the USA was careful and thoughtful cabin service and it has zealously maintained its standards.

Enjoying about the same level of traffic increase as the other Brazilian operators, Varig is planning to acquire three more 707-320Cs and three 727-100s this year, all used. Next year it moves into the wide-body field with two DC-10-30s, plus options on two more for 1975 and 1976. These and other heavy investments, say Varig, are being financed on the foreign financial market, where both Brazil's and Varig's good financial situation are making loans readily available.

While international routes are Varig's main revenue-earning sectors, internal services are also profitable. Varig says that no route is unprofitable, though some sectors are so. Varig is not allowed to take more than 33·3 per cent of the internal traffic, it may not use internal routes specifically to feed international services, and seats may not be sold on internal sectors of international flights.

Varig is operating HS.748s on internal routes, where their economics are far superior to those of the DC-3, but is increasingly using the 707 for the longer internal sectors. The 727 and 707 are promoted separately. Varig has just started a new weekly service to the USA and hopes to increase its frequency to Japan.

Like other Brazilian airlines, Varig is largely owned by its own employees. Some 80 per cent of the capital is vested in the Rubem Berta Foundation, to which all employees belong. Another 17 per cent of the shares are privately owned by employees and the remaining three per cent are owned by Rio Grande do Sul, Varig's home state (Viação Aerea Rio Grandense). The foundation is run by a college of 350 elected employees, which in turn elects the airline's chairman every five years.

The foundation provides a wide variety of services for the employees, including a very cheap supermarket, extensive medical services, interest-free loans for housing, scholarships for education and training and so on. Varig's 11,500 employees represent some 50,000 dependants.

High staff morale has accompanied a steady rise in productivity, which has increased by 16 per cent in each of the past two years and now stands at 50,000 tonne-km carried per employee.

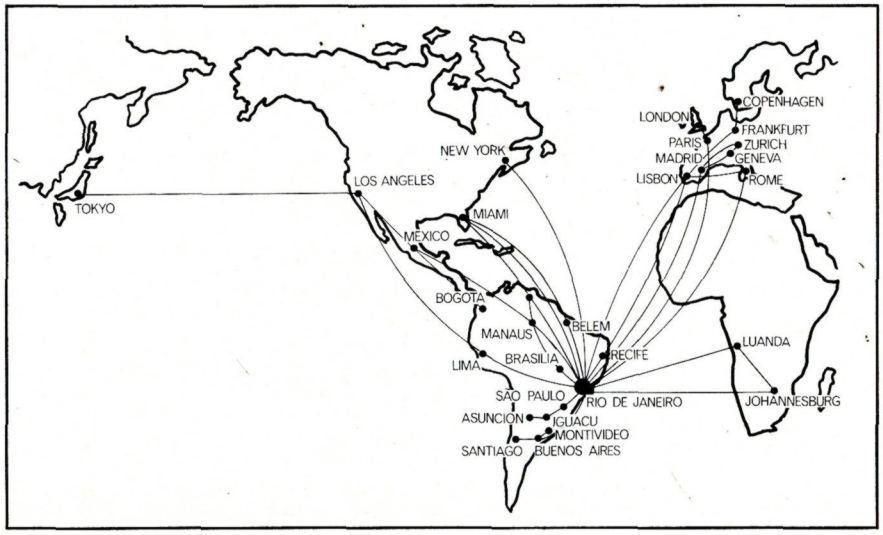
The airline now has three computers and is planning to introduce a computer-aided seat reservation system this year. Preferring to provide its own services, Varig has retained an engine overhaul capability, despite the Government policy to place this kind of service in industry. Varig overhauls its Electra engines and the similar engines from BAF Hercules at its base at Porto Alegre.

The loss of two 707s this year has interrupted an excellent safety record and was a personal loss to the aviation community in Brazil. The only previous fatality-inducing accident since 1963 was the loss of a DC-3.

Cruzeiro

CRUZEIRO'S route network superimposed to scale on a map of Europe stretches from Moscow to Lisbon and from Norway to the Red Sea. Yet its international routes are, in terms of distance, quite short extensions of its internal routes.

The airline's load factor was 60 per cent last year, Cruzeiro's president, Dr Cardos de Amorim, told *Flight*



Varig's internal route network, above, and intercontinental routes, left. It may not use internal services to feed international ones

in Rio, but has fallen to a healthier level of 52 per cent following introduction of Boeing 727-100s. The airline now wants to replace its Caravelles, inherited from Panair, with second-hand 727-100s. For operation from São Paulo's extremely restricted Congonhas airport, with 2,500ft elevation and high temperatures, the 727-200 carries no more payload than the 727-100 and costs more.

Cruzeiro lost £200,000 on its internal social service routes last year operating DC-3s, which are now universally regarded as very expensive. While the airline has not yet found an ideal feederline aircraft, Dr Amorim felt it was right to operate the indigenous Bandeirante. The loss would be lower and national industry would benefit in the process. Cruzeiro is analysing the Bandeirante and may buy some for its Amazonian routes, which are not expected to become profitable for another five years.

Despite the rapid improvement of surface communications, demand for air service continues to increase in Brazil. When the 700km road to Curitiba from São Paulo was paved some years ago, air traffic fell off for a few months, while people sampled the road journey. Then air travel increased to higher than the previous level. The road stimulated travel, but the relative speed of flying on such a long route was undeniable.

For the shorter routes, Cruzeiro is not interested in the F.28, but finds the VFW 614 attractive, though rather far in the future.

Stol capability is not important in Brazil. Initially, aircraft must be able to manage rough ground, but concrete runways are built as soon as traffic justifies larger aircraft. Nevertheless, 4,500ft runways, often surrounded by built-up areas, seem to be the rule rather than the exception.

About 75 per cent of Cruzeiro's shares are held by its employees. The airline's founder, Bento Rubeiro Dantes, originally held 51 per cent of the stock but, from 1941, he each year signed over some shares to any employee who had served well, eventually reducing his own holding to ten per cent.

Below, Cruzeiro is designated to cover Brazil and neighbouring South American and Caribbean countries. Above right, some of Vasp's 737s and a YS-11 of Cruzeiro

Vasp

SPEAKING TO *Flight* on the day of the arrival of his seventh Boeing 737-200, Vasp's president Dr Luiz Rossi was happy to record that his airline's profit for 1972 was higher than that of the other airlines: $5 million, which was 7·1 per cent profit on revenue. Profit in 1971 had been $1·8 million and the 1973 expectation was $10 million, with 9-10 per cent profit on revenue.

Passenger kilometres had increased 26·55 per cent, achieved by increasing 737 seating from 84 to 106, flying more hours and introducing an extra aircraft. Fleet-wide load factor was up from 59 per cent in 1972 to 60 per cent this year. The 737 with JT8D-9 engines could operate with very few penalties out of São Paulo Congonhas airport, but -15 or -17 engines removed even those limits. The Advanced 737 could even use Rio's Santos Dumont airport. Vasp will fit the FAR 36 hush-kit.

Although all airlines are limited to turboprops on the Rio-São Paulo air bridge service, passengers definitely favour jets and some accept the 10 per cent higher fare and the trouble of getting to Galeão in order to fly jet to São Paulo. A jet that can operate from 4,200ft in hot temperatures is attractive. Heralds, 748s and YS-11s all lose money on the air bridge. The Viscount 800 breaks even and the Electra earns.

Considering replacements, Dr Rossi said the A300B needs a route offering 1,000 passengers per day, which will not happen in Brazil in four years. The Mercure requires too long an airfield and Congonhas cannot be extended. The Boeing 7X7, said Dr Rossi, appeared to be the answer.

Brazilian fare levels were comparable with those in the USA, but Brazilian earnings were lower. The real cost was reducing with inflation, and the December fare rise would probably not cover it.

Some 15 per cent of passengers in Brazil were tourists and it was here that the main growth was occurring. Only five million out of Brazil's 100 million population fly each year.

Dr Rossi expects his first Bandeirante on October 1 for his social-service routes, where it will lose less money than the DC-3. Vasp's application to buy Swearingen Metros was based on their high speed, large capacity and the desirability of flying pressurised above warm-weather turbulence on 450km routes over São Paulo state. The Bandeirante will operate in central Brazil.

Vasp's capital structure is different from that of the

other airlines. The state of São Paulo owns 98 per cent of the equity, which means that purchase of new equipment is guaranteed by the state government, instead of by the federal Government, as for the other operators.

Transbrasil

"I'M FED UP with being number four among four," says Omar Fontana, president of Transbrasil and at once the expert and the maverick of the Brazilian air transport scene. Starting less than ten years ago as a meat-transporting offshoot of Brazil's nationwide sausage and meat concern Sadia, Transbrasil has changed its name to get away from the other image, has moved head office to Brasilia, close to government, and is fast building up traffic and capacity. Its growth, under dynamic and forceful leadership, has been phenomenal.

Transbrasil is the most intensive One-Eleven 500 operator in the world and is getting 10hr per day, wheels-off to wheels-on, in one-hour sectors. The airline's jet passenger-kilometre output increased by no less than 127·82 per cent between June 1972 and June this year while the fleet-wide increase was 70·39 per cent. A load factor of 63 per cent is being achieved on new routes started in May without advertising. Passenger kilometres flown were up 35·2 per cent in the first three months this year, and 43·47 per cent in the first six. Load factors are increasing despite extra capacity.

Transbrasil is a thoughtful operator, using flex take-off, cancelling reverse at 80kt and so on. It has also contracted with air taxi operator Lider to fly engineers and spares by Learjet to any One-Eleven going unserviceable en route.

Dr Fontana and his experts are sure that the present expansion will continue at not less than 20 per cent for the next two years. After that, imponderables could make it level off or increase. Re-equipment is necessary and capital has been doubled from Cr27 million to Cr54 million, with employees contributing a proportion.

Transbrasil aims to capture 20 per cent of the domestic market as soon as possible. The One-Eleven 500 is doing well, the three last Heralds are being exchanged for more One-Elevens next year and the best further buy is more One-Elevens, second-hand, says Dr Fontana. He needs three more 100-seaters for 1974.

Otherwise, the 727-200 is extremely attractive. It breaks

even with 57 passengers, against the One-Eleven's 42, it is known, reliable and has good resale value. But it is costly, has no QC version and passengers might prefer something more novel. DC-10 Twin, DC-10-10 and A300B are all attractive, but too far in the future at the moment.

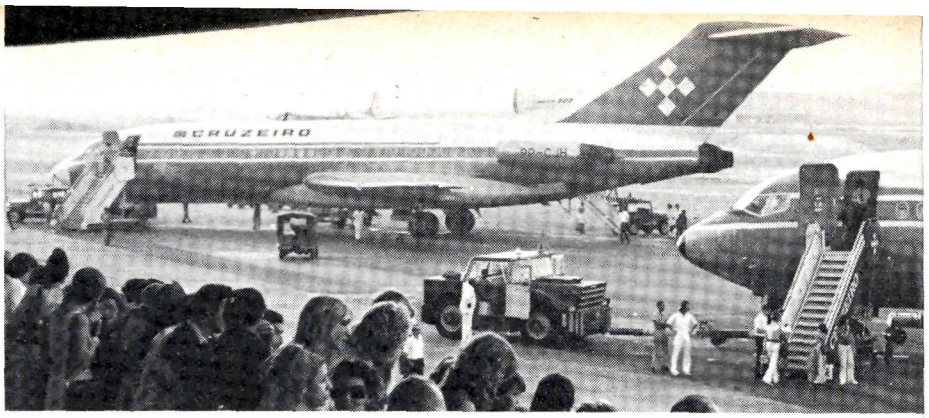
Dr Fontana was the only airline manager to maintain that third-level and feeder services, for which he is already using the Bandeirante, could be profitable. It had to be part of a system integrated with the larger aircraft, he said. His passengers transferring at state capitals to the Bandeirante are given special treatment and aircraft are painted in highly distinctive colours as a guide to transferring passengers—shades of Brazilian sunrise and sunset, sea colours in north and south and so on. Frequency is the key to third-level services. The passenger must be able to make a day trip without overnighting. A 40-seater twice a week will lose money. A ten-seater twice a day will not.

Dr Fontana also deprecated worries about Santos Dumont as the Rio air bridge terminal. Galeão will next year offer unhindered facilities for jets, compared with Santos Dumont's short runway and lack of ILS (there are only three ILS in Brazil).

Transbrasil is the airline to watch in the coming years, and a fascinating example of the interaction of a sharply competitive spirit with a closely Government-controlled airline system.

Above, one of Transbrasil's Bandeirantes ready for service. Below, the growing route network

Below, One-Eleven 500 of Transbrasil. Bottom, boarding a One-Eleven 400 of Vasp



Above left, Varig 707-320C seen over the wing of Varig's ex-Panair DC-8. Above, Cruzeiro 727-100s on the ramp at Rio Galeão

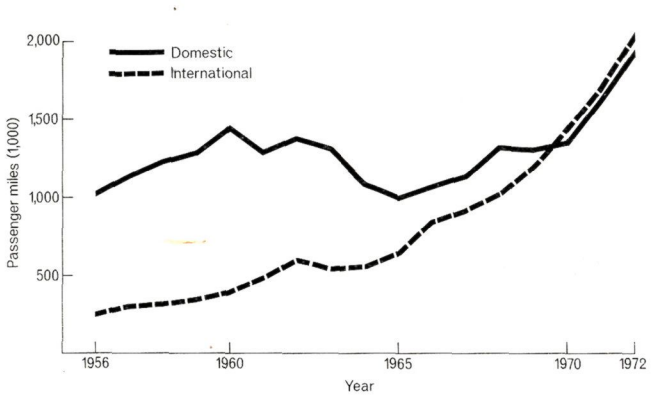
Airline performance

THE YEARS 1960-70 were bad by the standards of Brazilian civil aviation. A growth in revenue passenger-mile terms of 11·5 per cent at the end of the 1960s has now been translated into a growth rate of a little over 20 per cent, which looks likely to continue until at least the end of the first half of this decade. For planning purposes at least one Brazilian airline is basing its calculations on a growth rate of more than 23 per cent—although, prudently, it has prepared contingency plans based on growth rates of as little as 13 and 16 per cent a year. Traffic planning for domestic routes is still centred on the 100-seat jet; as yet the market is such that increasing the frequency of service remains a more attractive economic goal than opting for larger aircraft even though they can offer, when full, lower seat-mile costs.

If a growth rate of 23 per cent is maintained, more than 110 hundred-seat jets will be needed for domestic traffic alone by the end of the decade. Even if the more pessimistic 13 per cent is achieved, more than 40 will still be needed—thus representing a market that must be being eyed covetously by the two established manufacturers in Brazil, Boeing and BAC. On regional routes within South America and Brazil it is likely that Boeing 727s will be used to carry increases in traffic. Varig has recently acquired an additional three Boeing 727-100s to supplement its four -200s and Cruzeiro has stated its intention of adding a fifth 727-100 to its fleet. The long-haul routes, the preserve of Varig, will continue to be operated largely by Boeing 707s, supplemented by two DC-10-30s which are due for delivery next year.

At present most turboprops used on the less-dense domestic routes are losing money, despite a yield that varies from 7·7 to 9·0 cents per revenue passenger-mile. Transbrasil's Heralds, for example, achieved a load-factor of 51·7 per cent during the first three months of this year, but needed a load factor of 65·9 per cent to break even. As no services within Brazil are now subsidised it can be expected that the twin turboprops will be replaced on the less-dense routes by small twins such as the Bandeirante, and on the more busy ones by jet equipment—which will become progressively more economic to operate as the number of them in service grows and the advantages of scale and standardisation are realised.

Left bottom, the growth of Brazilian airline traffic since 1956. Below, the international and domestic market in 1972 and the shares of the four airlines. Middle, yield and break-even for domestic jets and turboprops. Bottom, the market for the manufacturers: up to 117 hundred-seat jets by the end of the decade



TOTAL MARKET SHARE—PASSENGER-MILES (000), 1972

Carrier	International	Percentage	Domestic	Percentage	Total	Percentage
Varig	1,818,627	90·1	591,712	31·3	2,410,339	61·6
Cruzeiro	199,072	9·9	505,861	26·7	704,933	18·0
Vasp	—	—	581,320	30·7	581,320	14·9
Transbrasil	—	—	213,130	11·3	213,130	5·5
TOTAL	2,017,699	100·0	1,892,023	100·0	3,909,722	100·0

AVERAGE BREAK-EVEN LOAD FACTOR, DOMESTIC, 1972

	Varig	Cruzeiro	Vasp	Transbrasil
Jets				
Cost per seat-mile	3·8c	3·9c	3·5c	3·6c
Total yield per revenue passenger-mile*	8·4c	8·3c	8·1c	8·1c
Break-even load factor	45·2%	47·0%	43·2%	44·4%
Daily utilisation (hr/min)	9·31	7·27	7·01	8·58
Twin-engine turboprops				
Cost per seat-mile	5·2c	5·0c	5·3c	5·3c
Total yield per revenue passenger-mile*	7·7c	7·8c	8·1c	9·0c
Break-even load factor	67·5%	64·1%	65 4%	58 8%
Daily utilisation (hr/min)	8·54	3·29	5·03	6·10

* Includes excess baggage, mail and express and freight revenues.

THE MANUFACTURERS' OPPORTUNITY—THE DOMESTIC JET MARKET

	Passenger-miles (1,000)	Increase (1,000)	Required number of additional jets
13·0%	5,029,841	3,137,818	44
16·0%	6,202,841	4,310,818	61
23·4%	10,172,972	8,280,949	117

Assumes: (1) Hundred-seat jets, with a daily utilisation of 9hr, on an average sector of 435 miles with a 50 per cent load factor.
(2) Demand growth projections: 13·0 per cent, 16·0 per cent and 23·4 per cent (23·4 per cent is the existing yearly average increase).
(3) Yearly productivity of 236,170 passenger-miles per employee (average based on the main state European airlines).