

# Magic Carpet

VOL. 11, No. 7

THE STAFF MAGAZINE OF AIR-INDIA

JULY 1967

## Air-India Expects To Earn More With Jumbo Jets

**A**IR MARSHAL M. S. Chaturvedi, our General Manager, stated in an interview with All India Radio on May 30, 1967, that if Air-India is to continue to operate economically on highly competitive international routes it will be necessary to purchase the 400-passenger capacity Boeing 747 aircraft as soon as possible. The alternative, he added, would be for Air-India to withdraw from international routes altogether and become more or less a regional operator.

We have decided to purchase, subject to the Government approval, four such large capacity Boeing 747 jet aircraft — two of which will be delivered in 1971 and two in 1972. The four aircraft will cost Rs. 83.60 crores (US \$111.47 million). When the Jumbo Jets go into scheduled service, Air Marshal Chaturvedi said, we are expected to earn between Rs. 20 to Rs. 23 crores, (approximately US \$26.5 million to \$30 million), per year.

The Boeing 747, popularly known as the Jumbo

Jet, will offer standards of comfort and luxury unmatched in the present generation of jets. As the world's largest commercial jetliner, the Jumbo Jet will be as tall as a 5-storey building and allow plenty of room for such innovations as spacious lounges, theatres, business offices and private staterooms available today only on ocean liners.

### Better Economics

When asked about the economics of operating a huge ship like the Jumbo Jet, Air Marshal Chaturvedi replied that the out-

standing feature of this aircraft is the better economics it offers over the present jets. He pointed out that the operating cost per seat-mile is expected to be 21 per cent cheaper than the present 707 aircraft operated by Air-India and that between now and 1975 a 17 per cent increase in passenger-kilometres was estimated. This would help us make the Jumbo Jet operations profitable, he said.

Air Marshal Chaturvedi agreed that the introduction of the 400-passenger Jumbo Jet aircraft will

(Contd. on page 2)

The Malaysian Minister for Transport Tan Sri Sardon bin Haji Jubir and Dr. Karan Singh, Minister for Tourism and Civil Aviation, signing an agreement in New Delhi to operate air services between India and Kuala Lumpur. (For story see page 4)



NEW LOOK



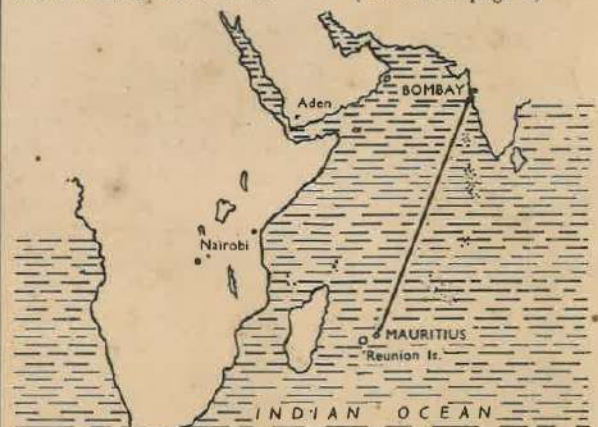
Our Receptionist Purnima Mazumdar wearing the new sari uniform. (See page 2)

## Boeing 707 Service to Mauritius

**A**IR-INDIA will inaugurate a non-stop fortnightly Boeing 707 service between Bombay and Mauritius on Independence Day, August 15, 1967.

The distance of 2,917 statute miles between the two countries will be covered in approximately five hours forty minutes. The

(Contd. on page 2)





## New Uniform Saris For Receptionists

**A**IR-INDIA'S Indian receptionists all over the world are wearing a new look with a change in their uniform sari from June 1967.

Woven from the finest green and blue Indian silk Air-India's new uniform sari has been chosen in two different colour combinations. One sari with grey as background and the other with bronze as background have a similar overall floral pattern in muted shades of 'cholis' (blouses).

The subdued blend of colours on the rich, glossy texture of the fabric makes Air-India's new saris suitable for daytime and night-time wear. The saris will be worn with matching grey and bronze colour

## WEDDING



Vatsala Unni, daughter of Mr. K. K. Unni, our Asst. General Manager, and Mohandas who were recently married in Kollengode in Kerala. Vatsala obtained her B. A. (First Class First) degree in French from the University of Bombay in 1965. Vatsala who was awarded a prize by the Alliance Francaise for the best student of her class for two consecutive years won a scholarship and studied at the Sorbonne University, Paris, in 1966.

## Service to Mauritius...

(Contd. from page 1)

service will leave Bombay of Mauritius who have every Wednesday for deep cultural affinities with Mauritius and return to India. The direct link between India and Mauritius Bombay the same day.

### Direct Link

Commenting on the operations, Air Marshal M. S. Chaturvedi said that "Indians form 66 per cent of the population

of Mauritius who have deep cultural affinities with India. The direct link between India and Mauritius will not only bring Mauritius closer to India but will go a long way towards cementing the age-old traditional friendship between the people of India and Mauritius."



## Drought Relief Fund

**B**HALCHANDRA Hirlekar from Accounts in Bombay District Office has on his own collected Rs. 1,057/- from our staff in Bombay for the Prime Minister's Drought Relief Fund.

This collection will be included in Air-India's contribution to the Fund.

## Come Interline with us

This is the first of a series of features which will appear periodically — we hope — bringing you interline news.

What is interline? No official definition is available but it is correct to say that in airline parlance "interline" refers to the activities of two or more air/surface lines in a joint venture. This joint venture is the transportation of passengers, baggage and cargo.

As a result of interline arrangements, a passenger may pay in a single currency and purchase tickets from one IATA Member for his travel through several countries on the services of innumerable carriers.

participating in this Multilateral Agreement. The Signatories to this Agreement can limit their participation to either the carriage of passengers and their baggage or to cargo or both. It is also possible for a carrier to participate in the Agreement with only selected carriers.

### Agreements

Air carriers may also enter into similar agreements with Shipping Companies. Such agreements are known as Air/Sea Interchange Agreements. There are approximately 150 air and sea Companies including Air-India participating in such Agreements.

The importance of interlining can be gauged by the fact that an international airline may earn as much as 30% of its total revenues from sales made by other airlines. It just goes to show that we can be competitors and still be business partners. We can all share "The Pie in the Sky".

M. G. Khairaz

## JUMBO JETS

(Contd. from page 1)

create knotty passenger and ground handling problems at already congested airports. However, he said, "similar apprehension was expressed before the 707s arrived. But these problems were licked and I am confident that problems posed by the 747s will eventually be solved by the time the Jumbos touch down at Bombay". The airports in India, he added, will have to be modified to accommodate large passenger loads and it is up to the Government to take immediate steps to see that the existing handling facilities at the arrival and departure lounges are streamlined.

### Advantage

Comparing the Jumbo Jet with the American SST, for which we have booked delivery positions, Air Marshal Chaturvedi said that the SST will have a definite advantage over the 747 in that it will slash flight time between say Bombay and New York by half. This means that you can leave Bombay after breakfast and arrive in New York in time for another breakfast on the same day. He stated that although operating costs of the SST are still a matter of conjecture, it could be safely assumed that the SST will be at least 15 per cent to 20 per cent more expensive to operate than the 747 and it is expected that there will be a 15 per cent to 20 per cent surcharge on super-sonic travel. The 747, on the other hand, will have an important role to play in the operation of both international and regional services on high density routes which cannot be undertaken by SST aircraft.



**A**IR-INDIA'S delegation to the Composite Cargo Traffic Conference of IATA at San Juan was led by Mr. I. D. Sethi, Tariffs Manager and included Mr. R. D. Mahambre, and Mr. P. F. Mehta.





Mr. S. K. Kooka, the Commercial Director, presenting a postal mailbag containing One thousand one-rupee notes to Mr. Harda. Also seen in the photograph are Mrs. Harda (left) and Mr. J. C. Malani (centre).

## Noshir Harda Retires

**OLD-TIMER** Noshir Harda, a veteran of the Mail Section since 1948, said farewell to Air-India after 31 years of service with the Corporation.

At a party held at our Commercial Head-quarters on June 2, Commercial Director Mr. S. K. Kooka said, "We have gathered here today to say farewell and not goodbye to Noshir Harda. I wish him every

success and happiness for the future.

"After retiring from his active service in Air-India Mr. Harda is entering private business and I am sure this will fetch him more than you and I would get. He was a wonderful employee and a wonderful associate, and we are sorry indeed to see him go."

Good spirited humour was the keynote of CD's

speech on the occasion. The CD came out with interesting tidbits of their association in Air-India when they worked together.

In a brief reply, Mr. Harda thanked the Commercial Director, his colleagues and staff who presented him with a silver tray as a memento and a postal mailbag containing one thousand one-rupee notes.



Mrs. Dorothy Plant (right) during the farewell party.

## FAREWELL PARTY

**MRS. Dorothy Plant, our Public Relations Consultant in Hong Kong, was given a farewell party at our Hilton Hotel office by Mr. Basil Gulati, Manager, Hong Kong-China-Philippine area.**

leaders from various fields in Hong Kong."

Mrs. Annie Leung presented Mrs. Plant two Indian saris — one a rich red-purple trimmed with gold and the other a blue-purple with silver trim.

### Privilege

Speaking on the occasion, Mrs. Plant said, "The first VIP I interviewed on joining Air-India was Pearl Buck, who is my favourite author. Since then I have met an interviewed a gamut of world-renowned personalities such as William Holden who has invited me to visit his Safari Club in Nairobi and Ursula Andress. Also in Air-India it has been my privilege to meet princes, princesses, heads of state, executives of the United Nations and other leading international organisations. My work in Air-India has provided an equally exciting opportunity of meeting

### P. M. Rao

**M**R. P. M. Rao, Aircraft radio Maintenance Engineer, retired on June 23, 1967. Mr. Rao has been working in Air-India since 1948 when he joined the Electronics Overhaul Shop as a Leading Hand.

### Farewell

Members of Air-India and IAC staff bade an affectionate farewell to Mr. Rao at a party in the Electronics Overhaul Shop on May 5, 1967. Mr. D. P. Nimkar, Chief Engineer (Overhaul), described Mr. Rao as "amiable, sincere and methodical." He said Mr. Rao had a "pleasing personality."

Mr. P. M. Rao is seen here with a bouquet in his hand.



## Kamala Iyer Wins First Prize

**K**AMALA J. Iyer, daughter of Mr. S. J. Iyer of the Works Engineering Division, Engineering Department, won the first prize

in Veena, Instrumental. The prize was won during the Annual Test for standards II and II of Bharathia Music and Art Society.

## From the Mailman

**I**T is very heartening to report that almost all for beating their April target by 100 per cent.

Top credit is due to Singapore, Perth and Sydney, for beating their April target by 100 per cent.

The Corporation's mail revenue exceeded the April target by 20.91 per cent and not 19.5 per cent as erroneously stated in the previous issue.

According to the mail loads lifted in May, the Corporation's revenue exceeded the mail target by 20 per cent.







Mr. R. N. Kaul, our Commercial Manager-Sales greets the Malaysian Minister for Transport and Mrs. Jaipal Singh on arrival at Santa Cruz.

Accompanying the Minister were Mr. C. H. Moreira, Director of Civil Aviation, Mr. Saw Huat Lye, Deputy Secretary, Ministry of Transport and Mr. Tunku Said bin Zakaria from Attorney General's Office, Malaysia.



## MALAYSIAN MINISTER VISITS SANTA CRUZ



**T**HE Malaysian Minister for Transport, Tan Sri Sardon bin Haji Jubir, visited Delhi to sign an agreement with the Government of India for the operation of air services between India and Kuala Lumpur.

Dr. Karan Singh, Minister for Tourism and Civil Aviation, signed the agreement on behalf of India in Delhi on June 9, 1967. The Agreement entitles Air-India to operate services to and through Kuala Lumpur and Malaysia-Singapore Airlines Limited to operate to Madras.

On his way back to Kuala Lumpur, the Malaysian Minister visited our Training College, the Jet Shop, Test House, Boeing Hangar, Ancillary Overhaul Division, Simulator and the Flight Safety Mock-up at Santa Cruz.

Mrs. Jaipal Singh, Dy. Minister for Tourism and Aviation accompanied the Minister to Bombay. They were received at Santa Cruz on June 11, by Mr. R. N. Kaul, Commercial Manager-Sales Mr. N. D. O'Neal, Engineering Manager and Captain Dick Khan, Operations Manager (Training).

The repair work carried out on the Conway flame tube being shown to the Minister by Mr. N. D. O'Neal. On the right is Mr. R. N. Kaul.

In the Test House with Mr. S. R. Shenoy, of Jet Shop (r)



In the cockpit of our Boeing 707 Simulator.

The Minister is seen here at our Training College with Mr. T. P. K. Pillai.





# "Paper Soiree"

**M**INI SKIRTS and wide, floral ties were the order of the day as more than 200 guests from wire services, press, travel and fashion industry, theatrical world and friends overwhelmingly responded to Air-India's invitation to a "Paper Soiree." The feast was held on May 9 at the Lotos Club in New York, a converted mansion built in 1900 in the French Renaissance style, combining touches of baroque and rococo throughout its large halls.

Glittering, crystal chandeliers lighted their way as the guests climbed a circular, heavily carpeted staircase to the second floor which was effectively transformed by us into a world of paper fantasy and flowers. Paper blossoms sprouted from the floors tables and ceilings; grim statuary was draped with colourful garlands.

Additional decoration was provided by girls in paper mini dresses—one of the many "coups" of the evening. Guests milled between a profusive bar and an elaborate table of Indian hors d'oeuvres. Music was provided by John and Jeffrey and Brother Tom while actress Susan Hoffman danced more or less alone to their almost minstrel music.

## Contribution

Suspense mounted as the time neared for Air-India's contribution to U.S. mod fashion to make its debut. The models, wearing their paper saris, were poised at the top of another winding staircase prepared to burst through a strip of paper fabric which covered the bottom of the stairwell.

Guests crowded into the area as Phillip Zito, Sales Promotion Manager and Master of Ceremonies, told the assemblage that the girls were about to appear and gave a dramatic, hard-hitting speech. He explained that the "lotus green" and "royal purple" sari is made of six yards of Kaycel, a new and sophisticated paper fabric, and is an authentic adaptation of a traditional and classic Indian silk sari.



Pallavi Patel from our New York Office, wearing the paper sari with its matching "Choti"

"The paper sari is a blend of the old and the new, so to speak. Indian music is now IN, so why not Indian fashion?"

There was a thundering applause of approval as an international entourage of photographers covered the event. Bulbs flashed, models pivoted and descended the stairs, circulating through the crowd and answering questions about the sari. Everyone was anxious to touch the paper fabric, skeptical that paper could fall into such graceful folds.

Designed exclusively for Air-India, the sari can be worn to a formal ball, to a barbecue or for entertaining at home. Soft, supple and flame-proof it

can be dressed and worn over and over again.

The lingering guests expressed two hours later that a good time was had by all and it was indeed a successful evening for Air-India and the Paper Sari. But just how successful it was we were to discover in the days ahead. Newspaper and magazine clippings poured in from every corner of the U.S.A. as well as from Canada and abroad, and the public response was beyond our imagination.

## Surprise

Elisa Daggs, designer of the sari, recently attended a formal ball in Princeton, New Jersey. Much to her surprise and delight, there were six women dressed in Air-India's Paper Sari. Now there is little doubt that the sari will become a paper-fashion classic.

The Paper sari costs US \$8.95, plus postage. A

Two PR girls model "mod" paper dresses by Elisa Daggs. Left, Linda Frankel of Air-India; right, Barbara Tafuri Lange of Varig Airlines.

booklet with photographs on how to properly drape the sari accompanies each order.

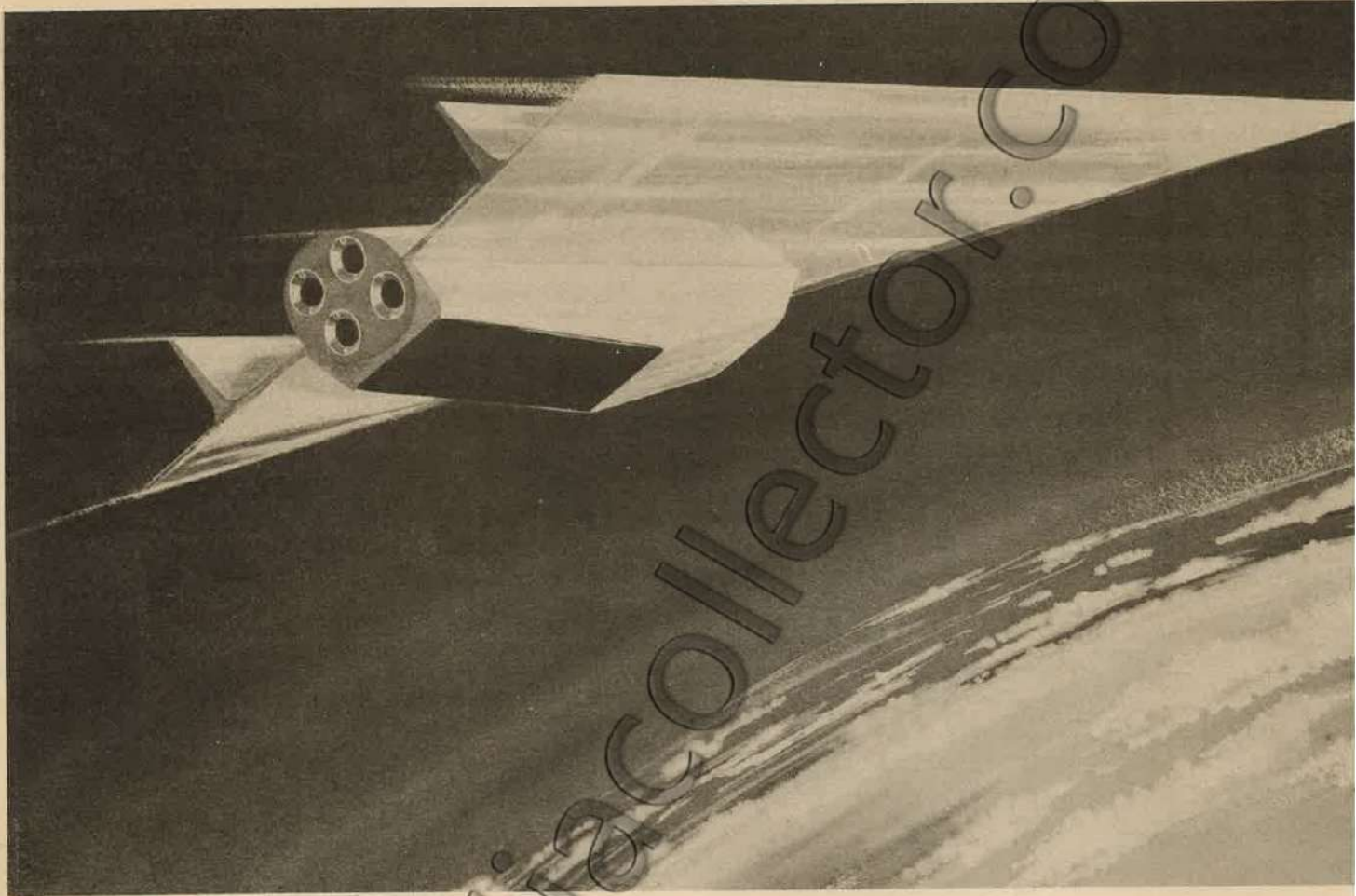
M. Chudasama

Paper sari-clad models line up on staircase with Elisa Daggs, designer of the paper sari and Lynn Miller of Van Brunt and Co.





# FLIGHT SCHEDULE FOR



**L**ONDON TO AUSTRALIA in a single hop of two hours or to New York in too short a time to enjoy a leisurely drink seems the ultimate in high-speed travel and smacks of science fiction as something unattainable. Yet it is by no means impossible, and the word for it is hypersonic. Aircraft we use today fly at speeds less than that of sound; they are described as subsonic. Some military aircraft travel faster than sound; they are supersonic. So will be the Concord and the proposed American supersonic aircraft. So what is hypersonic? It is the word used to describe speeds of more than five times the speed of sound, of more than Mach 5 as they say.

The dividing line is set at about this figure—and it is only an approximate one, for nothing critical happens at exactly Mach 5—for various reasons. First, as supersonic speeds get nearer to Mach 5, problems of heating and thermal stresses are enough to worry about. Furthermore, the air drawn in to the engines is very hot at such speeds, so that there are chemical changes. Finally, aerodynamic mathematical equations, with some assumptions and approximation, are easy to solve for speeds up to about Mach 5, but for higher speeds they are not. There is therefore a sort of barrier, which can be for clarity's sake be set at Mach 5. Any aircraft speeds above it are hypersonic.

The Mach number cannot be translated absolutely into miles per hour because the speed of sound or any disturbance in air depends

on pressure and temperature. Mach 1 at ground level is far different from Mach 1 at 50,000 feet. (This is why the Mach number is preferred by aircraft engineers.) However, at the height at which such an aircraft might fly Mach 5 can be regarded as roughly equivalent to 3,000 m.p.h. A speed of Mach 8 could be visualised as about 5,000 m.p.h., which would get an aircraft from London to New York in 40 minutes, and to Sydney in 2 hours. Work by aircraft engineers in the U.S. and the U.K., especially at Bristol Siddeley Engines and the Royal Aircraft Establishment at Farnborough, has now shown that speeds of this order and beyond appear to be attainable with practical aircraft.

Naturally many questions spring to mind. If such aircraft are possible, would they be

worth the making to use? Leading these and other questions mainly on the basis that hypersonic civil As for military use, If an all-out crash development were prototype, an expense million pounds would spread over 10 to 15 years, accumulating from many teams, the development of a European co-operation a joint U.S.-U.K. aircraft would be the burden.

No such aircraft are still many projects





Artist's Impression of a hypersonic aircraft

can be resolved into three major ones. First there is the propulsion. Secondly there is the design of airframe. Thirdly, associated with the other two, there is the question of heat stress and the production of materials suitable for the varied tasks.

The possible design of craft is very largely a U.K. achievement at present. What keeps an aircraft up is lift, due to the action of the moving air on the frame. What tries to slow the vehicle down and stall it is drag, which includes any force opposing lift. A vital statistic for the aircraft designer is therefore the lift-to-drag ratio, which must obviously be greater than one, and the higher it is the better.

### Shock Wave Effect

An approach to the speed of sound, however, brings a greatly increased drag at the sound barrier, when disturbances in the air cannot get away from the aircraft's leading edge—the well-known shock wave effect. The solution so far has been to sweep back the wings more and more, with a loss of lift but the maintenance of a usable lift-to-drag ratio for small supersonic speeds. But there is a limit even to sweepback, and the Concord has a single slender delta shape for the whole airframe, which is intended to fly at Mach 2.2.

Even this shape will not work for hypersonic speeds. So Dr. D. Kuchemann and his colleagues at Farnborough have said in effect: we cannot avoid the shock wave, so let us make use of it. They have designed a shape to ride on the shock wave—a waverider—which is like a long triangular pyramid with the apex forward, so that, wingless and clean in profile it would sear through the high air

in the U.S. and the U.K., where the leading authority is Dr. R. R. Jamison, who works with his team at Bristol Siddeley Engines. As speeds increase to Mach 3 or 4 so the known turbojet engines become less efficient and the heating effects become difficult. The type of engine to be used for hypersonic flight must therefore be the ramjet, which in essence is merely a tube with the air drawn rapidly in at the front, compressed, then combusted with fuel, and the resulting gases expanded and shot out at the back. With the known ramjet, the slow-down of the air at hypersonic speed would produce impossibly high temperatures, going up to over 2,000°C. at Mach 8. By changing the geometry, however, combustion can take place with the air slowed down only to supersonic speed, and the heating is less severe. Such a ramjet has been dubbed the scramjet. The fuel, incidentally, would be hydrogen, stored as liquid at -253°C.

It is obvious that any aircraft must start from rest on the ground and return to rest on landing, so that it must be able to travel temporarily at subsonic speeds. A composite engine has been designed consisting of a turbojet and a scramjet, with variable geometry to allow each to take over at the appropriate speeds.

### Serious Problem

The heating of parts of such engines constitutes a serious problem, and much research is still going on into suitable materials for the different parts. Not only are known ceramics and metals such as tantalum and zirconium investigated but so are exotic ceramics such as zirconium carbide and silicon nitride. For all this research new devices and

## London to New York in 40 minutes

Would they be economic? Experts have given much thought and the range have decided craft could be economic. Advantages are obvious. Programme of research and undertaken to produce a craft of a few hundred tonnes would be necessary. But, with the knowledge of the world's research, it could cost much less. A five-year programme (or even less?) could help to share the costs. They have been designed and there are many problems to be solved. These

like an arrowhead. This shape is called a Caret because of the cross-section, and it would hold inside it the payload, gear and propulsion systems. Experiments in the tiny hypersonic wind-tunnel and calculations from theory have shown the feasibility of such a shape. Assuming the same ratio of fuel to all-up weight as the present-day big jets have, and assuming a fairly low but achievable lift-to-drag ratio of four and a reasonable fuel consumption a range of 8,000 miles or so has been proved attainable with such a waverider hypersonic craft. By using the fuel to absorb some heat and other devices to keep down excessive heating, the skin temperature can be kept down to 600°C. at Mach 8, and existing steels can be used.

On propulsion a great deal has been done

apparatus have been developed and there are investigations of jointing problems such as riveting and welding.

In this way the picture of things that might come is being created in a number of advanced laboratories. For a craft of Mach 8 the emphasis for use is mainly on range. Thus global non-stop aircraft of a novel profile are seen to be possible, given adequate research and development. The prospect of the ultimate in all-speed combined propulsion units inside a suitable shape is exciting all forward-looking aircraft engineers and U.K. engineers are among the leaders. Whether such aircraft will ever be built, however now depends on quite other things than technology. If they are, a new dimension in communication will have important political and social repercussions. ■





**WE WERE** very pleased that during the Chairman's recent stay in London he was able to visit some of the departments. Furthermore, the departmental heads, their number twos and their ladies enjoyed the reception which was held one evening and we were particularly gratified that the Chairman gave us such an interesting and informative talk.

We also welcome Air Chief Marshal Arjan Singh to our offices during his visit to the U.K. He had a full itinerary during his stay in this country, but one of the duties he performed was to take the salute at the passing out parade at R.A.F. Cranwell, which he did at the invitation of the Chief of British Air Staff.

### Mango Party

We gave our annual mango party for the ladies of the Women's Travel Club of Great Britain which was once again a great success, and this year was attended by even more members than usual. We are told on good authority that this is one of the highlights of the Women's Travel Club's annual programme and as they have a lot of high powered connections, we feel rather flattered.

Our sales boys have got well into their new sales promotion entertaining schedule and this year this included a mango party for travel agents. There have been several educational and interline

trips and they are continuing their policy of entertaining travel agents with their business house contacts.

### Autogyro

We shipped the autogyro which plays a high flying role in the new James Bond picture which has just opened in London. It was being taken to the U.S.A. for promotion purposes in connection with the film in that country. The designer, Wing Commander Wallis, supervised the shipping and also travelled on our flight at the same time as the autogyro.

Many will remember that in 1963 two rare white tiger cubs were brought by us from India to the U.K. where they went to the Bristol Zoo. It was recently reported that Chamali, the tigress, had given birth to a cub at the zoo, and this is the first time in Europe that a white tigress has cubbed in captivity.

As we go to press plans are afoot for an invitation to go to all members of our staff to a fund raising Saturday afternoon at the Regional Director's residence during July in aid of the Chairman's Drought Relief Fund Appeal.

**Trevor Turner**

The Regional Director, U.K., discusses our Bond Street mural with Air Chief Marshal Arjan Singh during his visit to our offices.



Wing Commander Wallis supervises the loading of his autogyro on our flight to New York. The autogyro was used in the latest James Bond film 'You Only Live Twice'.

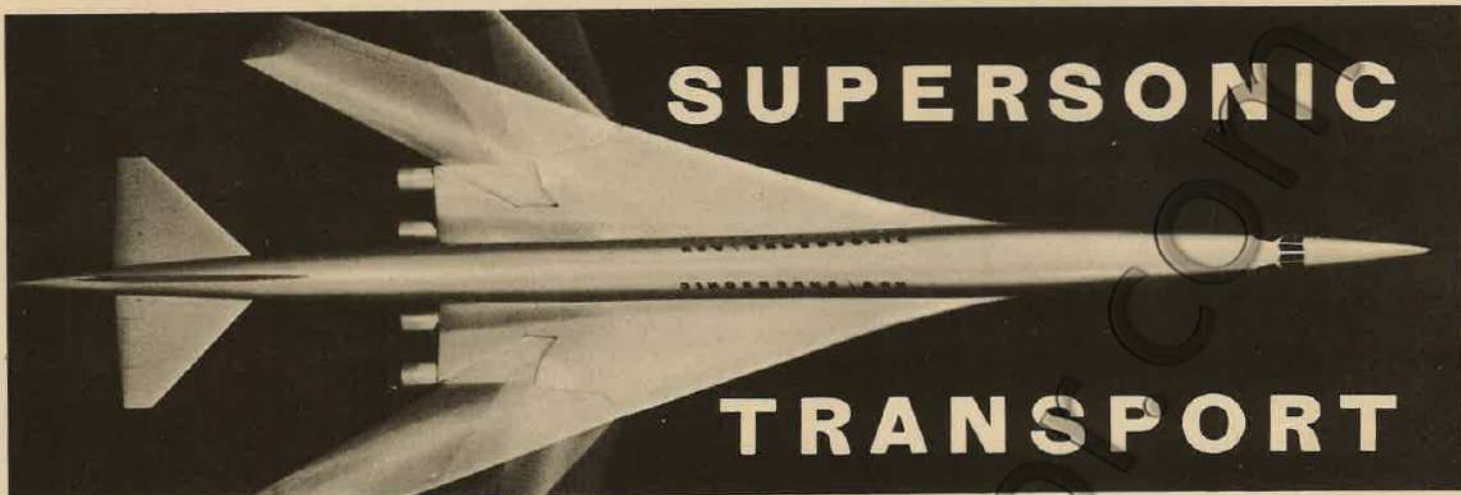


Mr. Victor Lowmes from the Playboy Club, London, and actress Joanna Pettit before they left on our service to New York.

Eva Sedlakova, one of our Czech hostesses, enjoying a mango while off duty at the Skyways Hotel swimming pool.







**O**N October 3, 1942, a German V-2 rocket became the first actively controlled, fin-stabilized projectile to achieve supersonic velocities. Thereby the V-2 demonstrated that a vehicle with active controls could remain stable in flight through the transonic speed range and beyond.

Five years later, on October 17, 1947, the supersonic airplane became a practical reality when Captain Charles E. Yeager flew the rocket powered research aircraft X-1 slightly faster than sound, demonstrating that supersonic manned flight was possible.

Since then a variety of aircraft, including the record-holding X-15 (4,104 m.p.h.) and most recently, the military A-11 (more than 2000 m.p.h.) have made supersonic flight seem almost routine.

In the years since the flight of the X-1, aeronautical engineers have almost continuously examined the practicability of commercial aircraft that would fly faster than the speed of sound. Such examinations have become more pertinent in recent years with the successful employment by airlines of high-speed subsonic jet transports.

### Concorde

It remained for the British and French to make the first definite commitment to build a supersonic airplane for commercial service. Their Concorde is an aluminium aircraft designed to carry 118 passengers in the 1450 mph range.

In the U.S. the Boeing Co. has been granted a contract by the Federal Government to build a swing-wing SST.

Of particular concern is the development of the advanced technology neces-

sary to build a passenger carrying airplane that is not only capable of supersonic flight but also safe, durable and economical to operate.

### Flight Range

The design of every airplane makes use of a principle laid down by the French engineer Louis Breguet, some 60 years ago. He said that the range of an airplane, or the maximum distance it can travel, depends on two main factors: flight efficiency and the ratio of fuel weight to the gross weight at the start of a flight. In evaluating the technical feasibility of any new airplane the engineer establishes the desired flight range and then asks if he can achieve the flight efficiency and the fuel-to-gross weight ratio needed to realize this range.

A component of flight efficiency is the Lift/Drag ratio of the airplane. Lift is the upward force provided by the flow of air over the surfaces of the aircraft. Drag is the total resistance the aircraft meets in travelling through the air. The L/D ratio is a measure of aerodynamic efficiency.

Another factor is specific fuel consumption, which means the weight in pounds of fuel burned per hour for each pound of engine thrust.

Flight efficiency is a composite measure of aerodynamic and propulsive efficiencies of the airplane, represented by the formula:

$\text{Mach No.} \times \text{Lift/ Drag ratio}$   
Specific fuel consumption

The economic future of the supersonic transport is very much dependent on the success of aeronautical engineers in providing the highest possible value of this quantity. It is apparent from the above formula that if everything else remains the same, flight efficiency increases with increasing Mach no. This is one of the principle reasons why many engineers prefer speeds approaching Mach 3 for the SST. Far higher speeds are theoretically attainable, but for the present Mach 3 seems a reasonable upper limit for commercial flight because of problems that higher speeds would present in overheating of materials and fuel.

### L/D Ratio

In an effort to optimize, the scientists devised several aerodynamic designs of different configurations and characteristics (e.g. arrow like swept-back wings, delta wings with balancing surfaces at the nose, variable sweep wings that can be swept forward to increase the span and aspect ratio and to decrease the sweep angle to improve low speed performances and handling characteristics) and conducted extensive wing tunnel tests to evaluate and compare their aerodynamic qualities. The biggest dilemma faced by the designers of SST is that as he seeks the benefits of increased Mach no., he finds that the L/D ratio deteriorates. In general the configurations with best L/D ratio in supersonic flight are quite poor in subsonic flight.

Since subsonic flight efficiency is important dur-

ing the climb-out, landing and holding segments of the flight, the engineer must demand a high L/D ratio at flight speeds below Mach 1.



At subsonic speeds thrust is produced most efficiently by moving a large volume of air at fairly low velocity; at supersonic speeds it is more efficient to produce the same thrust by moving a smaller volume of air at a higher velocity. The former is best accomplished by a turbo-fan engine, and the latter by a turbo-jet engine. A turbo-fan engine has a large fan that drives part of the incoming air through a section of the engine surrounding the compressor; this secondary air is ejected through ducts or is bypassed to the tail pipe to mix with the hot gases ejected by the turbine. The turbo-jet engine has no fan; all the air is passed through

compressor-turbine combination. Burning takes place in combustion chamber between the compressor and the turbine. A turbo-jet engine produces a high velocity jet of exhaust gas that is more efficient for supersonic flight than the low velocity exhaust of a turbofan engine. The problem of the supersonic engine designer is to combine the best features of each.

### Metal Fatigue

The principal problem introduced by speed is aerodynamic heating, produced by the impact and friction of air molecules. At Mach 3 and altitude of 70,000 feet the leading edge of the wing is heated to about 550° Fahrenheit. This is well beyond the temperature at which the usual materials of commercial airliner construction retain adequate strength. As the aircraft structure is exposed to alternating stresses day after day and year after year, there is a tendency for the metal to become fatigued and ultimately to fracture. Metal fatigue is a progressive phenomenon originating with tiny cracks that gradually grow under repeated stress until fracture occurs.

A titanium alloy appears to meet the unique and stringent requirements for strength, stiffness and high temperatures of the SST. The alloy contains 90 per cent titanium, 1 per cent molybdenum and 1 per cent vanadium. It has appreciably greater tensile strength at high temperatures than the conventional aluminium alloys used in today's transport aircraft.

(Contd. on page 11)



# SPORT FOLIO

## ATHLETIC MEET

**T**HE STAFF Recreation Club in Calcutta held its Second Athletic Meet at the Rabindra Sarobar Stadium on April 9, 1967. Mrs. R. K. Narpatsingh, wife of our Manager, Calcutta, distributed prizes on the occasion.

The proud hero of the Athletic Meet was Brahmamoy Banerjee who not only won the Individual Championship, but also bagged two first prizes, two second and one third in various events. He beat Mihir Bhattacharjee by a point.

In an exciting finish during the Tug-of-War, the Airport Traffic proved its superiority by beating the Booking Office in the finals.

Equally spectacular was the ladies' 75-metre dash in which Brinda Das emerged with flying colours.

The Accounts "cashed" the first prize in the Relay Race. And the Veterans' Race turned out to be an event for the veterans only with Manager Mr. R. K. Narpatsingh and Asst. Manager Mr. J. L. Kalia winning the first and second prizes respectively.

*Brahmamoy Banerjee receiving the Individual Championship Cup from Mrs. Narpatsingh.*



## Alberto Rodrigues

**H**UNTING is a favourite hobby of Mr. Alberto Rodrigues, who is our Traffic Assistant at the airport in Nairobi.

Mr. Rodrigues says, "On two occasions I have faced

wounded buffalo that almost got me. I consider wounded buffalo the most dangerous animal."

Nairobi-born Mr. Rodrigues has always hunted in Kenya. He is now planning a Shikar trip.

*Alberto Rodrigues is seen here in the centre.*



*Our New York Soccer Team played exhibition matches against Air-India, Bombay, and Indian Youth XI during their recent visit to Bombay. The photograph shows Air-India teams from New York and Bombay.*



*The Indian Hockey Federation Team for Madrid Hockey Festival leaving Santa Cruz Airport. The team carried Maharajah model as their mascot and distributed Air-India leaflets in their brochure.*

## AIR-INDIA PRESENTS TROPHIES

**M**R. K. HOSOISHI, the Fourth Indian Open Golf Champion, and Mr. S. Yamaguchi and Mr. T. Matsuki, the other two members of the Japanese Team, flew from Tokyo to Calcutta and back on our Boeing 707 service. The three Japanese Professionals came to Calcutta to participate in the Fourth Indian Open Golf Championship held from April 13 to 16 at the Royal Calcutta Golf Club.

*Mr. K. Hosoishi with the Championship Trophy.*

Air-India was the host at a party to meet the visiting Japanese Golf Professionals. Those present included Mr. I. Katakami, Consul General for Japan, and Mrs. Katakami; Major P. G. Sethi; John Forman, Captain, Royal Calcutta Golf Club; Mr. V. K. Chowdhury, Secretary, Indian Golf Union; Mr. A. Mehra; Col. S. B. Tanwar, Defence Service Institute; Mr. T. Tayama, Messrs. C. Itoh & Co; Mr. and Mrs. N. Koba; Mr. and Mrs. K. Kobayashi; Mr. Tomiki; and members of the Japanese community.

Mrs. Shimizu and Mr. Tachikawa won Air-India trophies for scoring a "Hole in One." The trophies presented by Air-India Japan were given during the party for the visiting golfers.





## SUPERSONIC TRANSPORT

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It however produces a higher ratio of structural weight than aluminium. This presents another problem — the estimated ratio of payload to gross weight for the SST as now envisioned is approximately 8 per cent compared to about 15 per cent for the subsonic jet of comparable range.

### Design

The venerable factors of lift, drag and thrust are still the controlling elements in airplane design. We are faced, however, with the new and highly important factor of sonic boom with its major influence on airplane weight and configuration. General investigations of the sonic boom problem have also pointed out new aspects. One of these is that the shock wave strength on the ground is amplified when the airplane is accelerating in climb or in level flight; and also when turning at supersonic speed. This amplification may well be the worst aspect of the boom.

In the highly competitive air transportation market the supersonic transport must achieve economical operation — that is, operation at costs comparable to those of present transports.

### Productivity

It is not entirely justifiable, however, to compare the supersonic transport with its subsonic predecessors solely on the basis of seat-mile cost. There is also the very important possibility that the significant speed increase will yield an increase in airplane "Productivity", measured in passenger-miles over a given period of time. The productivity of the subsonic jet is significantly higher than that of its piston engined predecessors, and there are some grounds for believing that the SST's productivity will be higher than that of today's subsonic jet aircraft.

Capt. A. E. Dotiwala.

Pradeep Kumar, son of R. B. Menon, Accounts Department.

Mathangi, daughter of V. R. Murthi, Engineering School.

Milind, son of L. K. Gramopadhye, Communications Section.

Meenakshi, daughter of P. Ganesan of Planning Department.

Haridas, son of A. G. Nair of Personnel Department.

Prakash and Kalpana, children of C. D. Kelshekar, Customer Service.



Ratna to G. J. Lalvani, London Airport.  
Shakunthala to T. K. Kunder, Catering Section.



*The  
Young  
Idea*





Chairman Mr. J. R. D. Tata is seen here at the staff party in London with (from l.) Mr. M. A. S. Dalal, Mr. A. Khairaz and Capt. K. R. Gazder.

Our General Manager, Air Marshal M. S. Chaturvedi, during his visit to Aden. (From left) Mr. S. Desai, Indian High Commissioner; Mrs. H. D. Bilimoria; Hon. Mr. Justice M. A. Luqman; our General Manager; Mrs. Desai; and Mr. H. D. Bilimoria, our Manager in Aden.



Air Hostess Erica Lall during Perth's 1967 Homes & Industries Fair.



▼ U.S. Ambassador Chester Bowles, and his wife leaving for London on our Boeing 707 service. They are seen here at Delhi airport with our Manager, R. Venkataraman.



Hair stylist Vidal Sassoon and his wife Actress Beverly Adams, when they travelled from New York to London on our service.

