Blandford Colour Series

Airliners between the wars 1919-39

Kenneth Munson

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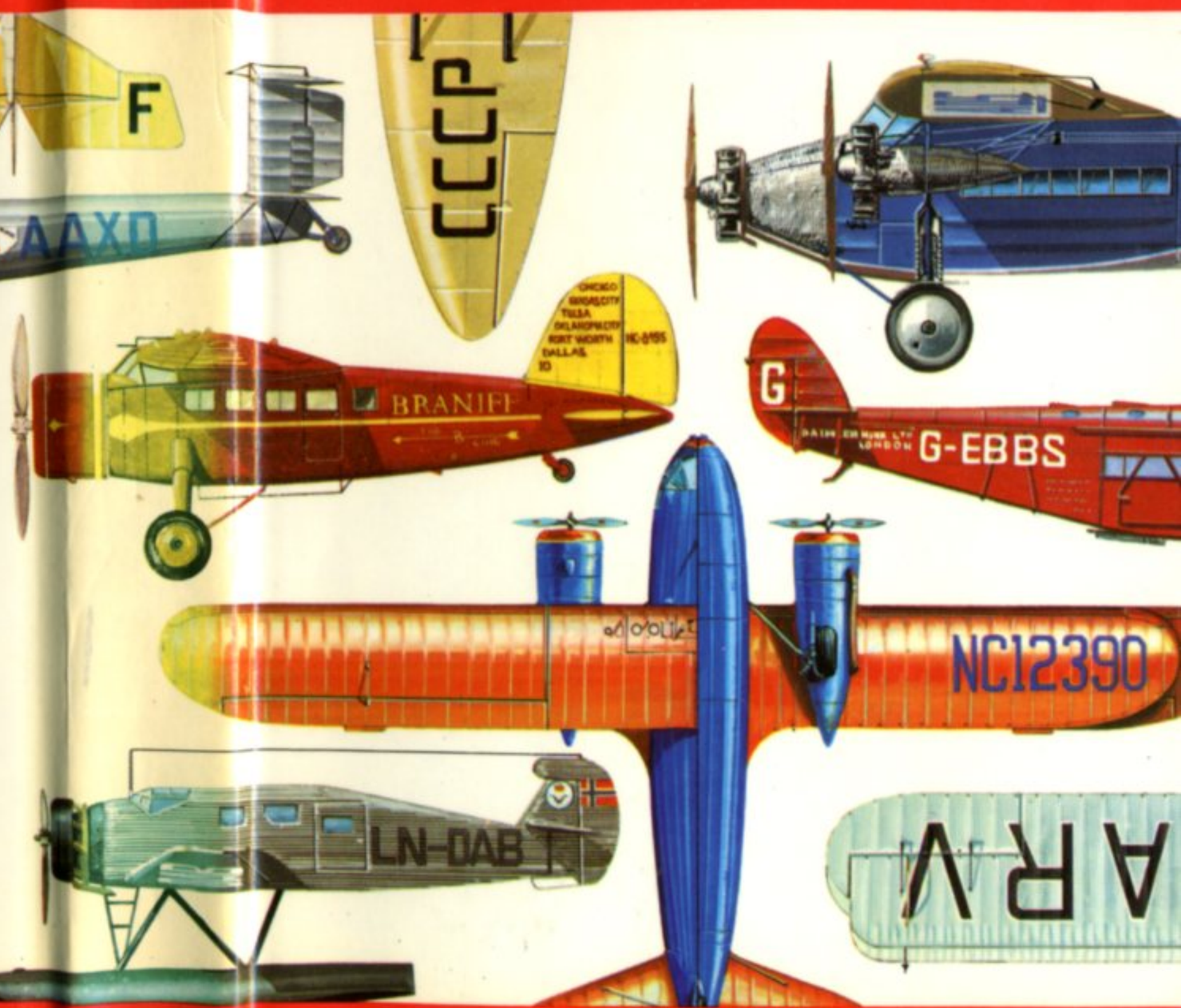

Kenneth Munson

The years between 1919 and 1939 saw the birth, growth and establishment of the aeroplane as an accepted means of public travel. Beginning in the early post-war years with aircraft such as the D.H.4A and the bloated Vimy Commercial, crudely converted from wartime bombers, the airline business gradually imposed its own requirements upon aircraft design to produce, within the next two decades, all-metal monoplanes as handsome as the Electra and the de Havilland Albatross.

The 70 aircraft described and illustrated in this volume include the trailblazers of today's air routes—such types as the Hercules, H.P.42, Fokker Trimotor, Condor, Henry Ford's "Tin Goose" and the immortal DC-3. Here, too, are such truly pioneering types as the Junkers F 13 and Boeing Monomail, and many others of all nationalities, in a wide spectrum of shape and size that ranges from Lockheed's tiny 6-seat Vega to the grotesque Junkers G 38, whose wing leading-edges alone could seat six passengers.

The Pocket Encyclopaedia of World Aircraft in Colour

AIRLINERS

between the Wars

1919–39

The Pocket Encyclopaedia
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AIRLINERS

between the Wars

1919–1939

by

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PREFACE

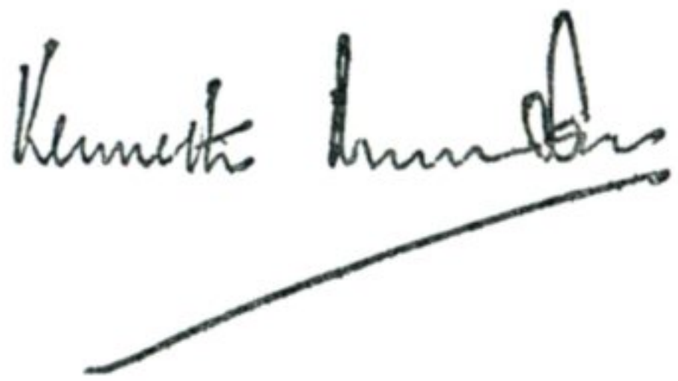
The period dealt with by this volume covers both the birth and the growth of air transport, for there were no airlines before World War 1 except those operated by Zeppelin airships. For the airlines, therefore, the 1920s were as much a pioneering period as 1903–14 was for aviation itself, and many were the historic flights and famous men and aircraft involved. In a volume of this size the selection of aircraft to be included can only be a representative one, and for the omission of any reader's favourite type I apologise in advance. Nevertheless, the 71 aircraft illustrated do, I believe, give a reasonably balanced cross-section of the more important types, and related variants are mentioned in the text. The products of Boeing, de Havilland, Douglas, Fokker, Junkers and Lockheed figure prominently, which is as it should be.

A second apology is perhaps needed for the brevity of the aircraft descriptions, even though this volume is longer than any other in the series. In the main, space has not permitted fuller details of aircraft sold from one airline to another, and only the initial customers are normally recorded. Similarly, it has not been possible to include full registration and fleet details of types built in very large numbers. There are, however, other more comprehensive and more detailed works which do give such information, and which I am grateful to acknowledge as major sources of my own reference while compiling this volume. In particular I would mention *British Civil Aircraft 1919–59*, by A. J. Jackson (Putnam, 2 volumes); *European Transport Aircraft since 1910*, by John Stroud (Putnam); *US Civil Aircraft*, by Joseph P. Juptner (Aero Publishers, volumes 1 to 5); and *A History of the World's Airlines*, by R. E. G. Davies (Oxford University Press). To all of these the reader can confidently be recommended for further information about the aircraft and airlines mentioned in this volume. In addition, acknowledgment is made of items published at various times by *Air Enthusiast*, *Air Pictorial*, *Air Progress*, *Aircraft Illustrated*, *Aviation Magazine*, the *Journal of the*

American Aviation Historical Society, and *Profile Publications Ltd.*

Advice concerning the colour schemes portrayed again came predominantly from Ian D. Huntley, and among others who kindly provided help and encouragement in various ways were Everett Cassagneres, Lt Col Nils Kindberg, W. B. Klepacki, Alec Lumsden, John Stroud and John W. R. Taylor. To them, and to Mrs Janet Howell for typing the manuscript, my thanks are extended.

June 1972



INTRODUCTION

In the period between World Wars 1 and 2, two great competitive flying events stand out above all others – the contests for the Schneider Trophy, which ended with a British victory in 1931, and the 'MacRobertson' race from England to Australia in 1934. The latter event was held as part of the centenary celebrations of the state of Victoria and of Melbourne, its capital, with prizes donated by Sir William MacPherson Robertson. The race was open to all nationalities, and was divided into a speed section (based on elapsed time for the journey) and a handicap section (based on flying time only). It started from Mildenhall, Suffolk, and ended at Flemington racecourse, Melbourne, with main control points at Baghdad, Allahabad, Singapore, Darwin and Charleville; the total distance was 11,300 miles (18,185 km).

So far as the record books are concerned, the 'MacRobertson' also ended in a British victory: the de Havilland D.H.88 Comet was designed to win the race, and it did so. But of infinitely greater significance was the identity of the second aircraft to arrive in Melbourne, which had flown a standard commercial route of 12,530 miles (19,875 km) – 1,230 miles (1,690 km) longer than the prescribed route – and had done so in only $5\frac{3}{4}$ hours' flying time more than the D.H.88. Its average speed for the whole journey was about 160 mph (257 km/hr).

This aircraft was a twin-engined Douglas DC-2 of KLM Royal Dutch Airlines, carrying a 4-man crew, 3 fare-paying passengers and a 420 lb (191 kg) cargo of mail. Before the race, many people had been sceptical of the chances of a normally-loaded commercial transport aircraft flown by an airline crew. It would be competing against several faster aeroplanes, some of them flown by such eminent competitive pilots as Charles Scott and Tom Campbell Black, Roscoe

Turner and Clyde Pangborn, James and Amy Mollison, and Jacqueline Cochrane. Indeed, one London newspaper was moved to dismiss the KLM entry as 'an audacious assumption that such a ship could expect to compete with the fastest planes on the Continent'. KLM, however, knew a thing or two about its latest American acquisition, and proved – as it had set out to do – that a standard, modern commercial transport aircraft, carrying a useful payload, could cover the world's longest air route in less than 4 days, without any sacrifice of its passengers' comfort. The successes of both the D.H.88 and the DC-2 proved, more convincingly than ever before, that the retractable undercarriage and variable-pitch propeller were henceforth essential ingredients for commercial aircraft of the future.

Until that time, the air transport scene the world over had been dominated first by biplanes and then by lumbering, fixed-gear tri-motors. Prior to World War I there had been no scheduled airline services in existence, apart from those operated in Germany with Zeppelin airships, and hence the early 1920s saw not only the beginnings of air transport as a business, but the use of many improvised 'airliners', many of them embodying only the minimum of conversion from the wartime roles for which they were designed. In some of these primitive conversions, the passengers were as exposed to the elements as the pilots, and had likewise to be provided with leather coats, flying helmets, gloves, goggles, and – in extreme cases – a hot water bottle as well.

Thus, perhaps, the most pressing initial need of the embryo airlines was to offer their passengers a reasonable standard of comfort, and evidence of the importance attached to this need was soon to be seen in such post-war designs as the Westland Limousine and the Blériot-Spad 'berlines', and in the restaurant facilities introduced on several European routes. Operating economics were not at first of widespread concern, at least on the continent of Europe, where most of the early pioneering airlines received substantial government assistance. The lack of such assistance was felt keenly in Britain, where the four major airlines of the early 1920s had to struggle hard for survival until the government

decided to amalgamate them in 1924 to form Imperial Airways, the 'chosen instrument' of a new British air transport policy. The world 'imperial' did not then provoke the inflammatory reaction that it does today. Indeed, one may well ponder how different the world air transport scene might have been if there had been no empires forty years ago to provide the incentive to pioneer the global and transcontinental air routes which we now take for granted. The air transport adventure of the 1920s and 1930s might have followed a very different path without the initiative of Great Britain in opening up air routes to the Middle East, South Africa, India and Australia; of France to North Africa and the Orient; of Belgium to the Congo; of the Netherlands to the East and West Indies; and of Germany to South America.

Comfort, safety and speed: these were the attractions with which the airlines set out to win their prospective public. Designing comfort into an aeroplane was no great problem, but the number of airline accidents in the early years of operation was too high to become an accepted norm. Operating conditions, including the need to maintain schedules in often unfavourable weather, were partly to blame, but all too often aircraft succumbed to circumstances which more powerful or more reliable engines would have overcome. Improvements in aero-engine design and output, and in particular the progress made with air-cooled radial engines after the war, played a large part in the improvement in the general safety record of air transport as the years went by. Nor is it mere coincidence that many of the most successful airliners of the inter-war period were those which flew with many different types of engine. Anthony Fokker, one of the shrewdest salesmen in the aviation business, very soon realised that the powerplant of an aeroplane was, as often as not, the factor which decided a customer for or against the purchase of a particular type of aircraft. His policy therefore was to produce basic airframe designs that could be adapted readily to the powerplant of a customer's choice, and it paid off handsomely, especially in the case of the F.VIIb-3m tri-motor. The same degree of adaptability undoubtedly influenced the

popularity of many other types, including the Junkers F 13 and the Ford Tri-motor.

Speed, the one selling factor paramount today over surface transport, was slow to come to air transport. Paradoxically, it came at last from the United States, where passenger transport, playing second fiddle to the transportation of mail by air, had been relatively slow to develop. The turning-point came in 1927, the year in which the US government threw open all air mail operations to private enterprise and the year in which Charles Lindbergh flew alone across the Atlantic. Within months of Lindbergh's epic flight orders were rolling in for the little Ryan Brougham, sister-ship of his *Spirit of St Louis*, but the aeroplane which truly ushered in the speed era of air transport in the US was the Vega – the first of Lockheed's famous 'plywood bullets'.

By the beginning of the 1930s, the world's airlines had to a great extent succeeded in making air transport attractive to a large section of the public. They had yet to solve the problem of making it attractive to themselves, in terms of operating costs. The aircraft which could carry a worthwhile payload over a reasonable range were obsolescent and slow, while the faster types could carry only a small load over shorter distances. Throughout the 1920s dozens of small airlines had been absorbed in mergers to form larger and financially healthier organisations, while others had disappeared altogether through failure to make their operations pay their way. The time was ripe for a breakthrough, in the form of an aircraft that could combine the requirements of comfort, safety and speed with the best payload/range capabilities of existing types.

The first sign of such a breakthrough came with the Boeing 247, which first flew on 8 February 1933 and entered service with United Air Lines in the same year. United's unprecedentedly large order for the 247 was a family affair, for both it and Boeing were members of the huge United Aircraft and Transport Corporation, but this cannot obscure the advance in state-of-the-art airliner design which the Boeing 247 represented. Apart from its cantilever monoplane layout, retractable landing gear and use of all-metal con-

struction, it introduced many other, lesser innovations. Among these were the first use, in a production airliner, of supercharged engines and control surface trim tabs. Here was an aircraft that, in its definitive Model 247D form, could cruise at 189 mph (304 km/hr) with a 2,582 lb (1,171 kg) payload of 10 passengers and baggage over a 750 mile (1,207 km) range, and could climb under full load on one engine.

At last the cost-effective modern airliner was in sight; but the Boeing 247 was to maintain its lead for only a comparatively brief period. Little more than a year after it began airline operation it, too, was entered in the 1934 'MacRobertson' race. It was the third of the competing aircraft to reach Melbourne, but in doing so it took 12¼ hours longer than the DC-2. 'The results of the England-Australia air race', said the London *Morning Post,* 'have fallen like a bomb in the midst of British every-day commercial and military aviation'; and what was true for Britain was almost equally true for the rest of Europe. The paper went on: 'Preconceived ideas of the maximum speed limitations of standard commercial aeroplanes have been blown sky-high. It has suddenly and vividly been brought home that, while the race has been a triumph for the British de Havilland Comet, British *standard* aeroplane development, both commercial and military, has been standing still while America has been going ahead. It has been realised with astonishment that America now has, in hundreds, standard commercial aeroplanes with a higher top speed than the fastest aeroplane in regular service in any squadron in the whole of the Royal Air Force'.

Reaction reached its peak, however, when Douglas produced the DC-3 in late 1935. Prompted by American Airlines, whose lumbering Curtiss Condors and Fokker trimotors were no match for the Boeing 247s and DC-2s of its rivals, Douglas evolved the Douglas Sleeper Transport, which required a wider fuselage than the DC-2 to accommodate 14 sleeping berths. Almost immediately, Douglas realised that, within this wider cabin, the daytime seating capacity of the DC-2 could be increased by 50 per cent – and the DC-3 was born. Already, in 1934, the presence of the DC-2

had caused United Air Lines to transfer its Boeing 247s to less competitive routes, and when the DC-3 entered service they were eclipsed completely. From then until the outbreak of war, airlines ordered DC-3s as fast as Douglas could build them, and their impact upon air transport both inside and outside the United States reached an unparallelled level. Even the appearance of the Lockheed 'twins' – which were faster, but carried a smaller payload – had little effect on the DC-3's progress.

In 1936 the Collier Trophy was awarded to the DC-3 as the outstanding twin-engined commercial transport aeroplane of the year. In words which, in retrospect, seem a masterpiece of understatement, the citation declared that 'this airplane, by reason of its high speed, economy, and quiet passenger comfort, has been generally adopted by transport lines throughout the United States. Its merit has been further recognised by its adoption abroad, and its influence on foreign design is already apparent'. At that time, even the DC-3's most ardent supporters would have found it hard to believe that, thirty-five years later, more than eight hundred examples of this remarkable aeroplane would still be in operation with over two hundred of the world's airlines, having survived innumerable attempts, all abortive, to find a 'DC-3 replacement'. There could have been no more fitting title than that chosen for a full-length book which has been written of the career of the DC-3: *The Plane That Changed The World.*

INTERNATIONAL CIVIL AIRCRAFT REGISTRATION PREFIX LETTERS

Country	*Early 1920s*	*1939*
Afghanistan		YA-
Albania		ZA-
Argentina		*R-
Australia	G-AU	VH-
Austria		*A-

Country	*Early 1920s*	*1939*
Bahamas		VP-B
Barbados		VQ-B
Belgium and Colonies	O-B	OO-
Bermuda		VR-B
Bolivia	C-V	CP-
Brazil	P-B	PP-
British Guiana		VP-G
British Honduras		VP-H
Brunei		VR-U
Bulgaria	LZ-	LZ-
Canada	G-C	CF-
Ceylon		VP-C
Chile		CC-
China	X-C	XT-
Colombia		HJ-, HK-
Costa Rica		TI-
Cuba	C-C	CL-, CM-
Curaçao		PJ-
Cyprus		VQ-C
Czechoslovakia	L-B	OK-
Danzig		YM-
Denmark	T-D	OY-
Ecuador	E-E	HC-
Egypt		SU-
Eire	EI-	EI-
Estonia		ES-
Ethiopia		ET-
Falkland Islands		VP-F
Federated Malay States		VR-R
Fiji		VQ-F
Finland	K-S	OH-
France and Colonies	F-	F-

Country	*Early 1920s*	*1939*
Gambia		VP-X
Germany		D-
Gibraltar		VR-G
Great Britain	G-E	G-
Greece	S-G	SX-
Grenada		VQ-G
Gold Coast		VP-A
Guatemala	L-G	TG-
Haiti	H-H	HH-
Hejaz (Saudi Arabia)	A-H	UH-
Honduras	X-H	HR-
Hong Kong		VR-H
Hungary		HA-
Iceland		TF-
India	G-I	VT-
Iran		RV-
Iraq		YI-
Italy and Colonies	I-	I-
Jamaica		VP-J
Japan	J-	J-
Johore		VR-J
Kenya		
Latvia	B-L	YL-
Leeward Islands		VP-L
Liberia	L-L	EL-
Lithuania		RY-
Luxembourg	L-U	UL-
Malta		VP-M
Mauritius		VQ-M
Mexico		XA-, XB-
Monaco		CZ-
Morocco		CN-

Country	*Early 1920s*	*1939*
Netherlands	H-N	PH-
Netherlands East Indies		PK-
Newfoundland		VO-
New Hebrides		YJ-
New Zealand	G-NZ	ZK-
Nicaragua	A-N	YN-
Nigeria		VR-N
Northern Rhodesia		VP-R
Norway	*N-	LN-
Nyasaland		VP-N
Palestine		VQ-P
Panama	S-P	RX-
Paraguay		ZP-
Peru	O-P	OB-
Poland	P-P	SP-
Portugal	C-P	CS-
Portuguese Colonies		CR-
Romania	C-R	YR-
St Helena		VQ-H
St Lucia		VQ-L
St Vincent		VP-V
Saar Territories	TS-	EZ-
Salvador		YS-
Santo Domingo		HI-
Seychelles		VQ-S
Siam	H-S	HS-
Sierra Leone		VR-L
Southern Rhodesia		VP-Y
Spain	M-A to M-N	EC-
Straits Settlements		VR-S
Surinam		PZ-
Sweden	S-A	SE-
Switzerland	*CH	HB-

Country	*Early 1920s*	*1939*
Tanganyika Territory		VR-T
Trinidad and Tobago		VP-T
Turkey		TC-
Uganda		VP-U
Union of South Africa	G-U	ZS-
Uruguay	C-U	CX-
USA	N-	†*N
USSR		*URSS
Venezuela	††X-S	YV-
Wei-hai-wei (China)		VP-W
Western Pacific Islands		VP-P
Yugoslavia		YU-
Zanzibar		VP-Z

*prefix followed by numerals instead of letters
†followed by second prefix letter indicating certification category :
X (Experimental), C (Commercial) or R (Restricted)
††Serbia, Croatia and Slavonia

THE COLOUR PLATES

As an aid to identification, the colour plates which follow have been arranged in an essentially visual order, with biplanes followed by monoplanes, grouped broadly according to wing position and in ascending order of the number of engines. The reference number of each type corresponds to the appropriate text matter, and an index to all types appears on pp. 185–186.

The 'split' plan view, adopted to give both upper and lower surface markings within a single plan outline, depicts the colour scheme appearing above and below either the port or starboard half of the aircraft, according to whichever aspect is shown in the side elevation.

1

Breguet 14T2 Salon of Compagnie des Messageries Aériennes (CMA), 1920. *Engine:* One 300 h.p. Renault 12Fe twelve-cylinder Vee type. *Span:* 47 ft. 1¼ in. (14.36 m.). *Length:* 29 ft. 6¼ in. (9.00 m.). *Wing area:* 538.2 sq.ft. (50.00 sq.m.). *Take-off weight:* 4,374 lb. (1,984 kg.). *Cruising speed:* 78 m.p.h. (125 km/hr.) at 6,560 ft. (2,000 m.). *Service ceiling:* 14,765 ft. (4,500 m.). *Range:* 286 miles (460 km.)

2

De Havilland D.H.4A *City of York* of Instone Air Line Ltd, *ca* late 1922/early 1923. *Engine:* One 350 h.p. Rolls-Royce Eagle VIII twelve-cylinder Vee type. *Span:* 42 ft. 4⅝ in. (12.92 m.). *Length:* 30 ft. 6 in. (9.30 m.). *Wing area:* 434.0 sq.ft. (40.32 sq.m.). *Take-off weight:* 3,720 lb. (1,687 kg.). *Maximum speed:* 121 m.p.h. (195 km/hr.). *Service ceiling:* approx 20,000 ft. (6,100 m.). *Range:* 250 miles (402 km.).

3

Westland Limousine III, winner in the 1920 Air Ministry Commercial Aeroplane Competition. *Engine:* One 450 h.p. Napier Lion IB twelve-cylinder 'broad arrow' type. *Span:* 54 ft. 0 in. (16.46 m.). *Length:* 33 ft. 6 in. (10.21 m.). *Wing area:* 726.0 sq.ft. (67.45 sq.m.). *Take-off weight:* 5,850 lb. (2,653 kg.). *Cruising speed:* 90 m.p.h. (145 km/hr.). *Service ceiling:* 12,300 ft. (3,750 m.). *Range:* 520 miles (837 km.).

D.H.34 (U.K.)

4

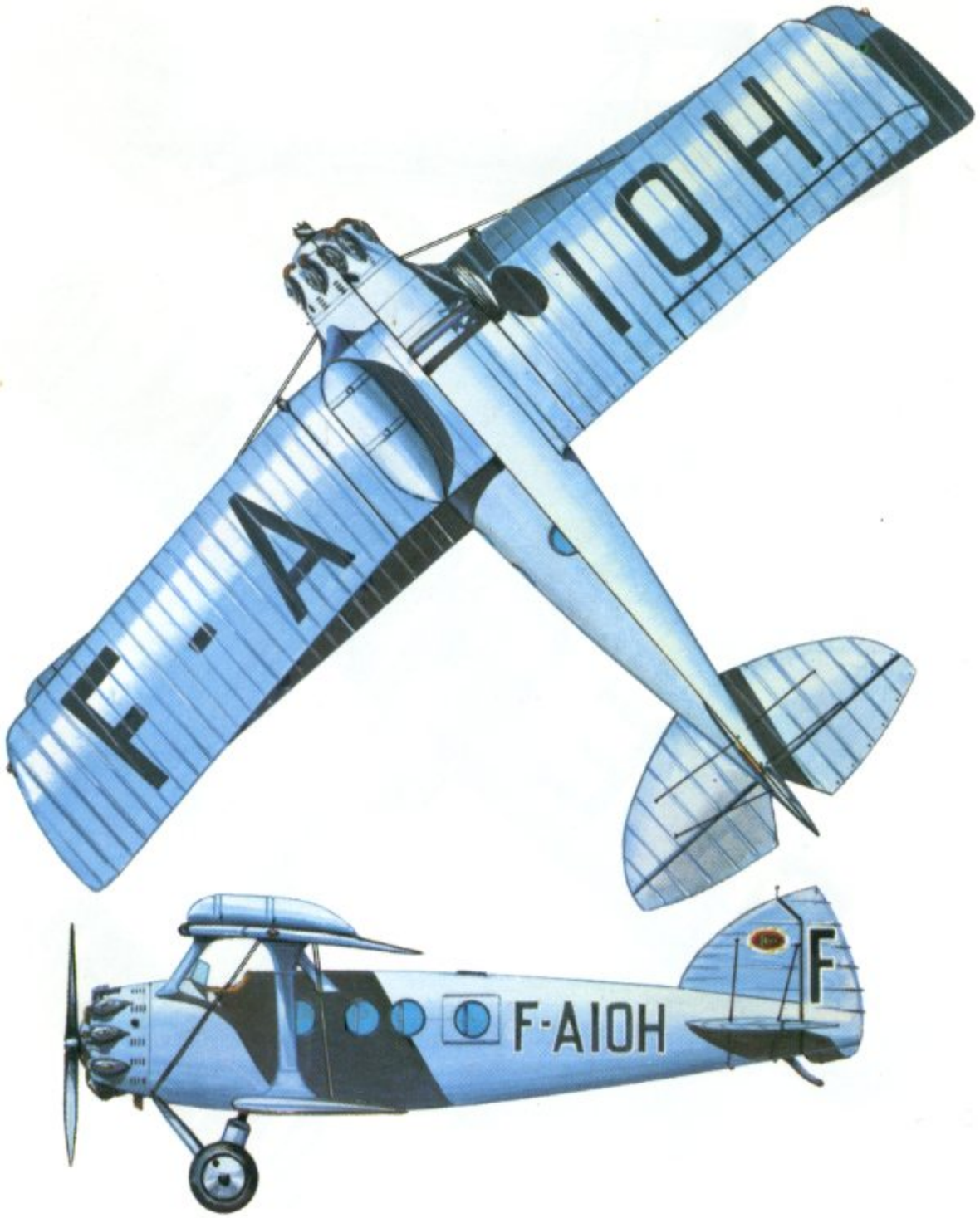
De Havilland D.H.34 of Daimler Hire Ltd, 1922. *Engine:* One 450 h.p. Napier Lion twelve-cylinder 'broad arrow' type. *Span:* 51 ft. 0 in. (15.54 m.). *Length:* 39 ft. 0 in. (11.89 m.). *Wing area:* 590.0 sq.ft. (54.81 sq.m.). *Take-off weight:* 7,200 lb. (3,266 kg.). *Cruising speed:* 105 m.p.h. (169 km/hr.). *Service ceiling:* 14,500 ft. (4,420 m.). *Range:* 365 miles (587 km.).

D.H.50 (U.K.)

5

De Havilland D.H.50 prototype, in the markings of de Havilland Hire Service, *ca* 1924. *Engine:* One 240 h.p. Siddeley Puma six-cylinder in-line. *Span:* 42 ft. 9 in. (13.03 m.). *Length:* 29 ft. 9 in. (9.07 m.). *Wing area:* 434.0 sq.ft. (40.32 sq.m.). *Take-off weight:* 4,200 lb. (1,905 kg.). *Cruising speed:* 95 m.p.h. (153 km/hr.). *Service ceiling:* 14,600 ft. (4,450 m.). *Range:* 380 miles (611 km.).

BLÉRIOT-SPAD (France)



6

Blériot-Spad Type 56-4 of Compagnie Internationale de Navigation Aérienne (CIDNA), *ca* 1927-28. *Engine:* One 420 h.p. Gnome-Rhône (Bristol) Jupiter 9Ac nine-cylinder radial. *Span:* 43 ft. 1 in. (13.13 m.). *Length:* 29 ft. 6¼ in. (9.00 m.). *Wing area:* 523.1 sq.ft. (48.60 sq.m.). *Take-off weight:* 5,979 lb. (2,712 kg).. *Cruising speed:* 99 m.p.h. (160 km/hr.). *Service ceiling:* 13,125 ft. (4,000 m.). *Range:* 301 miles (485 km.).

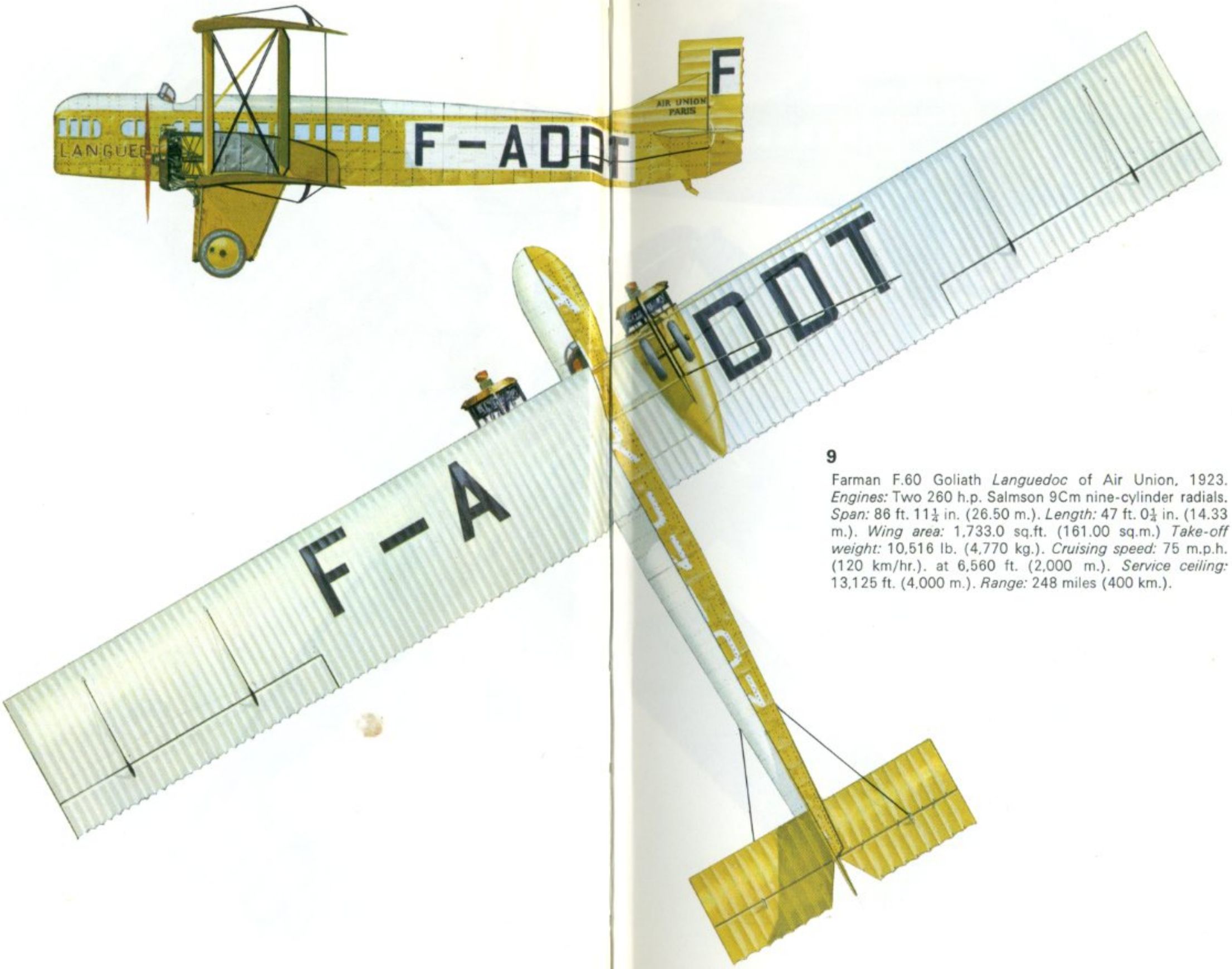
AVIA BH-25 (Czechoslovakia)

7

Avia BH-25 of Ceskoslovenská Letecka Spolecnost (CLS), *ca* 1929. *Engine:* One 450 h.p. Walter (Bristol) Jupiter IV nine-cylinder radial. *Span:* 50 ft. 2¼ in. (15.30 m.). *Length:* 41 ft. 4½ in. (12.61 m.). *Wing area:* 672.7 sq.ft. (62.50 sq.m.). *Take-off weight:* 6,393 lb. (2,900 kg.). *Cruising speed:* 99 m.p.h. (160 km/hr.). *Service ceiling:* 13,450 ft. (4,100 m.). *Range:* 373 miles (600 km.).

8

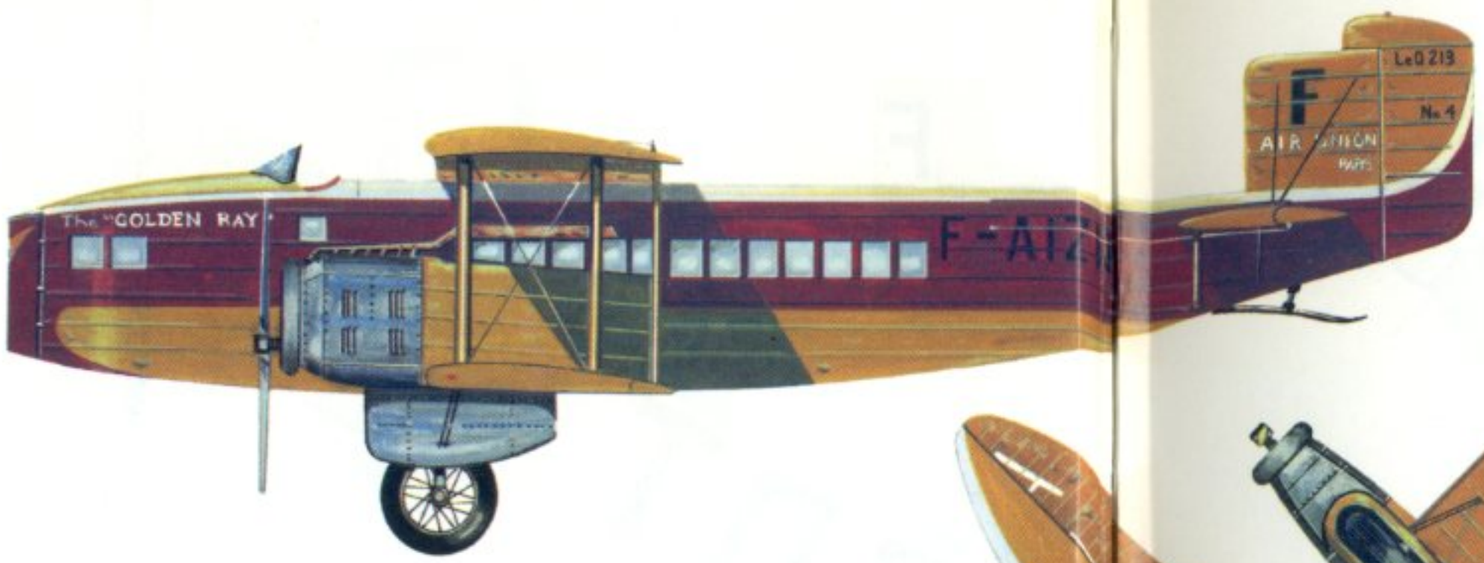
Vickers Vimy Commercial *City of London* of S. Instone & Co. Ltd. Aerial Transport Department, 1920. *Engines:* Two 360 h.p. Rolls-Royce Eagle VIII twelve-cylinder Vee type. *Span:* 67 ft. 2 in. (20. 47 m.). *Length:* 42 ft. 8 in. (13.00 m.). *Wing area:* 1,330.0 sq.ft. (123.56 sq.m.). *Take-off weight:* 12,500 lb. (5,670 kg.). *Cruising speed:* 84 m.p.h. (135 km/hr.). *Service ceiling:* 10,500 ft. (3,200 m.). *Range:* 450 miles (724 km.).



9

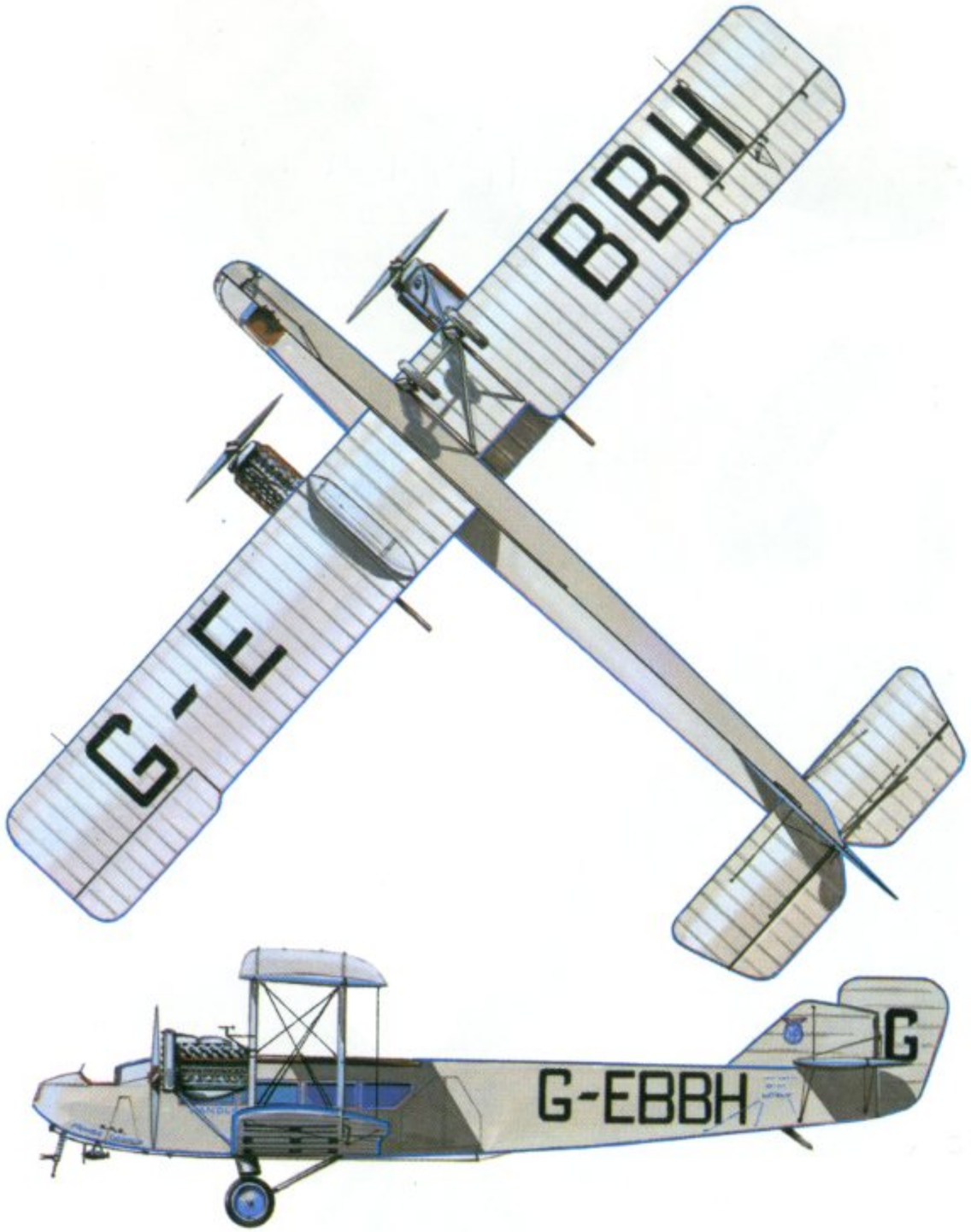
Farman F.60 Goliath *Languedoc* of Air Union, 1923. *Engines:* Two 260 h.p. Salmson 9Cm nine-cylinder radials. *Span:* 86 ft. 11¼ in. (26.50 m.). *Length:* 47 ft. 0¼ in. (14.33 m.). *Wing area:* 1,733.0 sq.ft. (161.00 sq.m.) *Take-off weight:* 10,516 lb. (4,770 kg.). *Cruising speed:* 75 m.p.h. (120 km/hr.). at 6,560 ft. (2,000 m.). *Service ceiling:* 13,125 ft. (4,000 m.). *Range:* 248 miles (400 km.).

LIORÉ et OLIVIER 21 (France)



10

Lioré et Olivier 213 of Air Union, 1931-32. *Engines:* Two 450 h.p. Renault 12Ja twelve-cylinder Vee type. *Span:* 76 ft. 10½ in. (23.43 m.). *Length:* 52 ft. 4 in. (15.95 m.). *Wing area:* 1,167.9 sq.ft. (108.50 sq.m.). *Take-off weight:* 12,566 lb. (5,700 kg.). *Cruising speed:* 109 m.p.h. (175 km/hr.) at 3,280 ft. (1,000 m.). *Service ceiling:* 14,765 ft. (4,500 m.). *Range:* 348 miles (560 km.).



11

Handley Page W.8b *RMA Prince George* of Handley Page Transport Ltd., 1922. *Engines:* Two 360 h.p. Rolls-Royce Eagle VIII twelve-cylinder Vee type. *Span:* 75 ft. 0 in. (22.86 m.). *Length:* 60 ft. 1 in. (18.31 m.). *Wing area:* 1,456.0 sq.ft. (135.26 sq.m.). *Take-off weight:* 12,000 lb. (5,443 kg.). *Maximum cruising speed:* 101 m.p.h. (163 km/hr.). *Service ceiling:* 10,000 ft. (3,050 m.). *Range:* 400 miles (644 km.).

12

Armstrong Whitworth A.W. 155 Argosy I *City of Birmingham* of Imperial Airways Ltd., autumn 1926. *Engines:* Three 385 h.p. Armstrong Siddeley Jaguar III fourteen-cylinder radials. *Span:* 90 ft. 0 in. (27.43 m.). *Length:* 64 ft. 6 in. (19.66 m.). *Wing area:* 1,890.0 sq.ft. (175.59 sq.m.) *Take-off weight:* 18,000 lb. (8,165 kg.). *Cruising speed:* 90 m.p.h. (145 km/hr.). *Range:* 405 miles (652 km.).

13

De Havilland D.H.66 Hercules *City of Cairo* of Imperial Airways Ltd., *ca* 1927. *Engines:* Three 420 h.p. Bristol Jupiter VI nine-cylinder radials. *Span:* 79 ft. 6 in. (24.23 m.). *Length:* 55 ft. 6 in. (16.92 m.). *Wing area:* 1,547.0 sq.ft. (143.72 sq.m.). *Take-off weight:* 15,600 lb. (7,076 kg.). *Cruising speed:* 110 m.p.h. (177 km/hr.). *Service ceiling:* 13,000 ft. (3,960 m.).

14

Boeing Model 80A of Boeing Air Transport Inc, *ca* 1930-31. *Engines:* Three 525 h.p. Pratt & Whitney Hornet B nine-cylinder radials. *Span:* 80 ft. 0 in. (24.38 m.). *Length:* 56 ft. 6 in. (17.22 m.). *Wing area:* 1,220.0 sq.ft. (113.34 sq.m.). *Take-off weight:* 17,500 lb. (7,938 kg.). *Cruising speed:* 125 m.p.h. (201 km/hr.). *Service ceiling:* 14,000 ft. (4,267 m.). *Range:* 460 miles (740 km.).

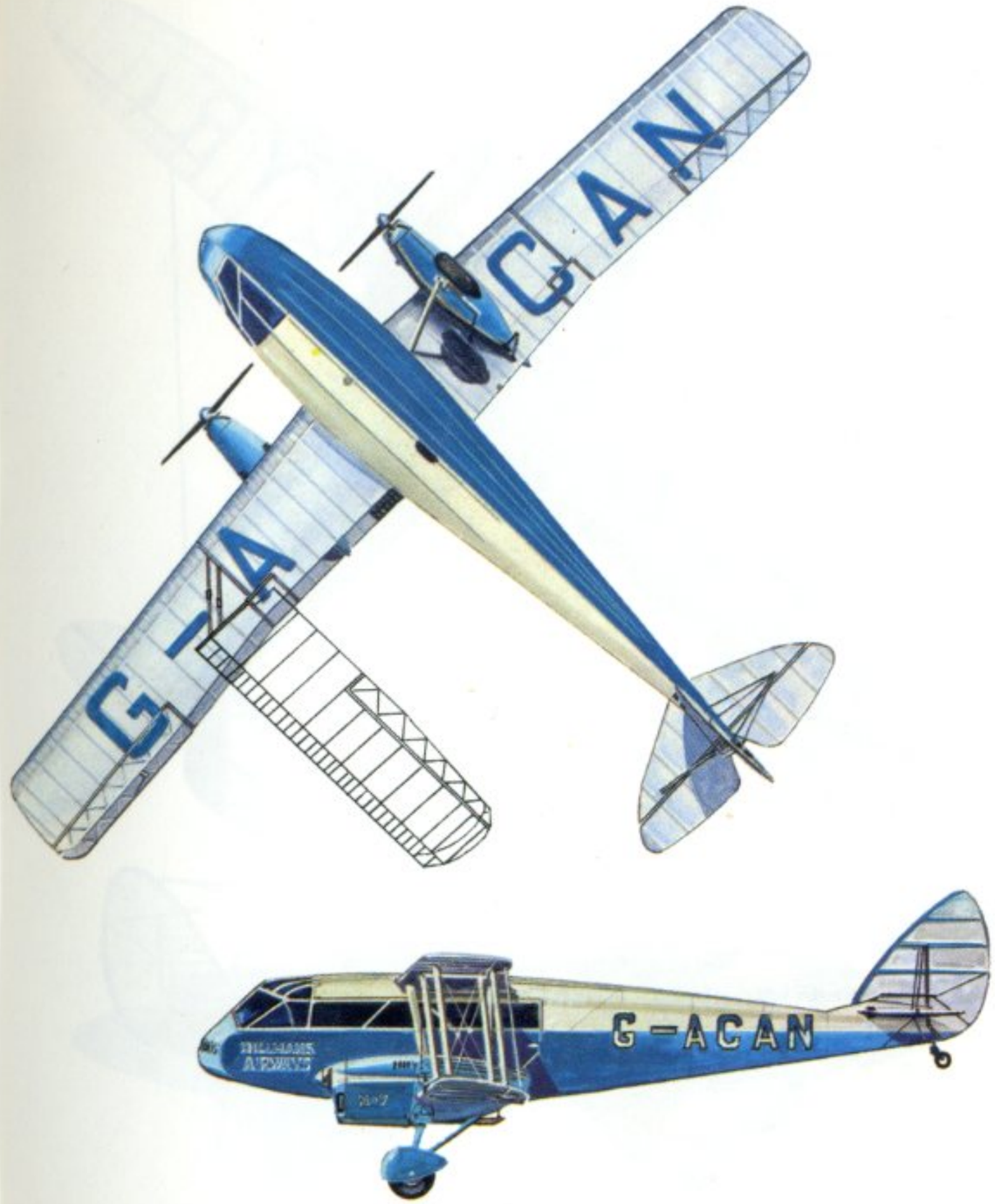
HANDLEY PAGE H.P.42 (U.K.)

15

Handley Page H.P.42W *Horatius* of Imperial Airways Ltd. *ca* 1932. *Engines:* Four 555 h.p. Bristol Jupiter XFBM nine-cylinder radials. *Span:* 130 ft. 0 in. (39.62 m.). *Length:* 89 ft. 9 in. (27.36 m.). *Wing area:* 2,989.0 sq.ft. (227.69 sq.m.). *Take-off weight:* 29,500 lb. (13,381 kg.). *Maximum cruising speed:* 105 m.p.h. (169 km/hr.). *Range:* 250 miles (402 km.).

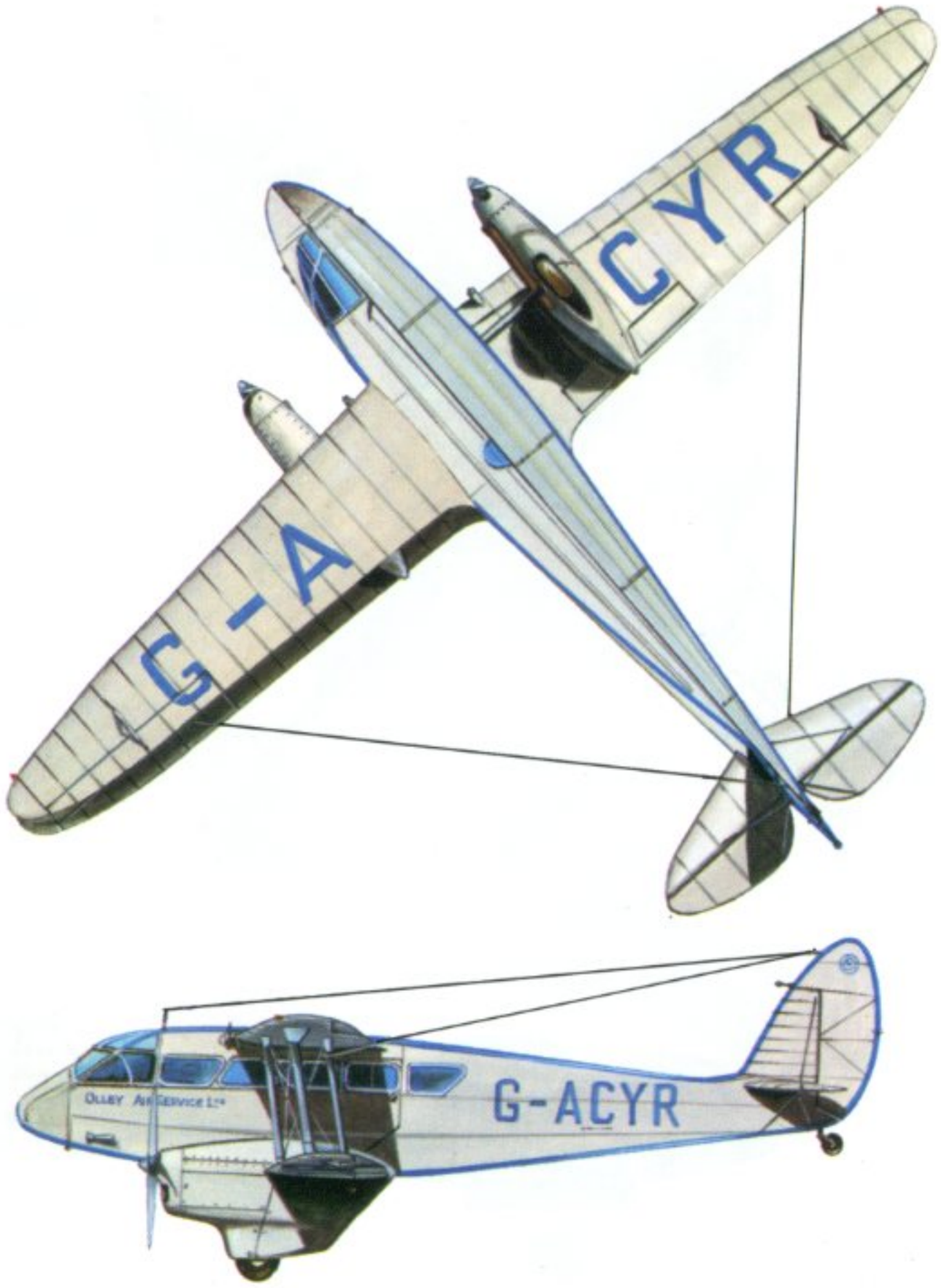
16

Curtiss Model AT-32-A Condor of American Airways, 1934. *Engines:* Two 710 h.p. Wright Cyclone SGR-1820-F3 nine-cylinder radials. *Span:* 82 ft. 0 in. (24.99 m.). *Length:* 48 ft. 7 in. (14.81 m.). *Wing area:* 1,208.0 sq.ft. (112.22 sq.m.). *Take-off weight:* 17,500 lb. (7,938 kg.). *Speed:* 167 m.p.h. (269 km/hr.) at 8,000 ft. (2,438 m.).*Service ceiling:* 23,000 ft. (7,010 m.). *Maximum range:* 716 miles (1,152 km.).



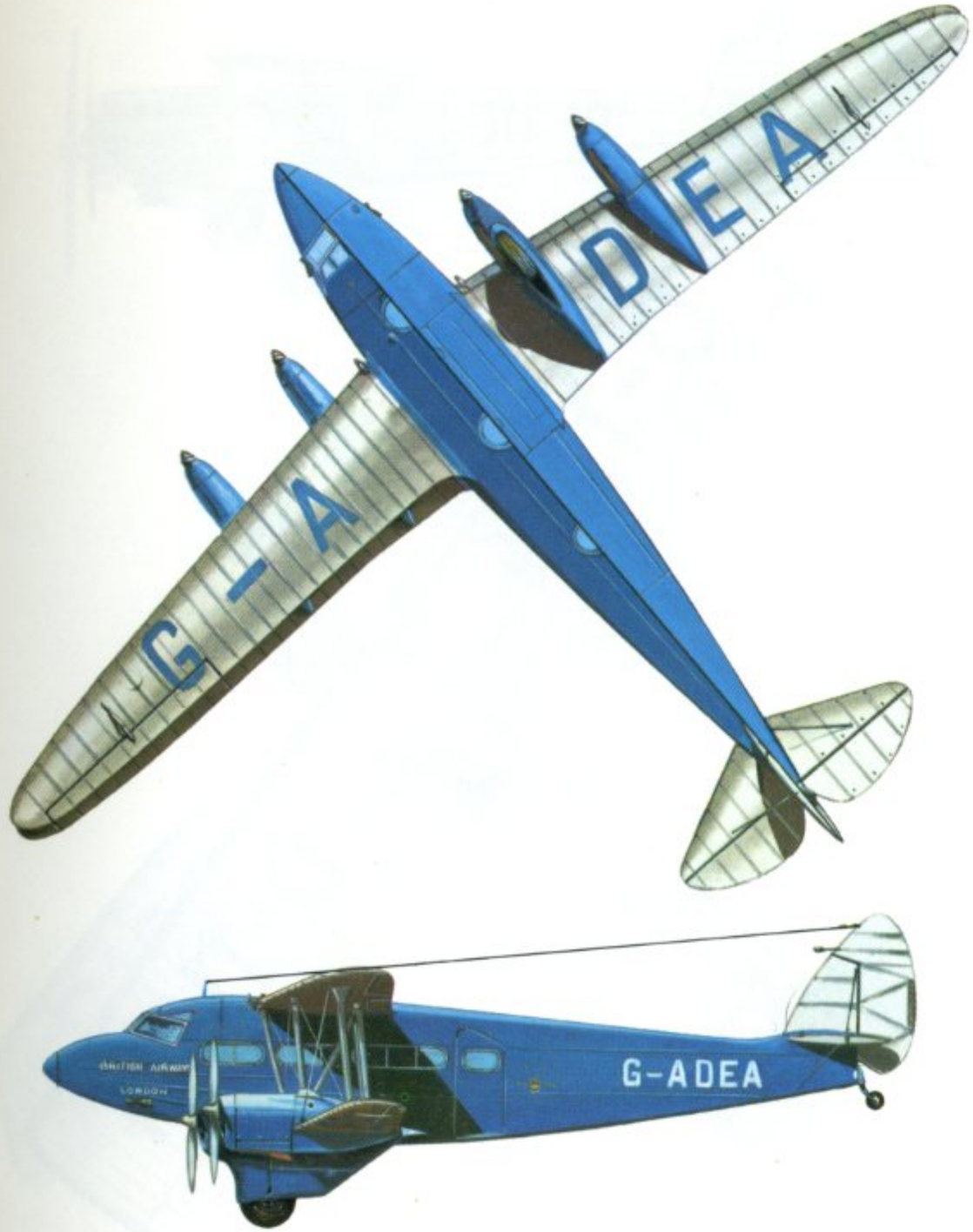
17

Prototype de Havilland D.H.84 Dragon 1, as *Maylands* of Hillman's Airways Ltd, early 1933. *Engines:* Two 130 h.p. de Havilland Gipsy Major I four-cylinder in-lines. *Span:* 47 ft. 4 in. (14.43 m.). *Length:* 34 ft. 6 in. (10.52 m.). *Wing area:* 376.0 sq.ft. (34.93 m.). *Take-off weight:* 4,200 lb. (1,905 kg.). *Cruising speed:* 109 m.p.h. (175 km/hr.) at 1,000 ft. (305 m.). *Service ceiling:* 12,500 ft. (3,810 m.). *Range:* 460 miles (740 km.).



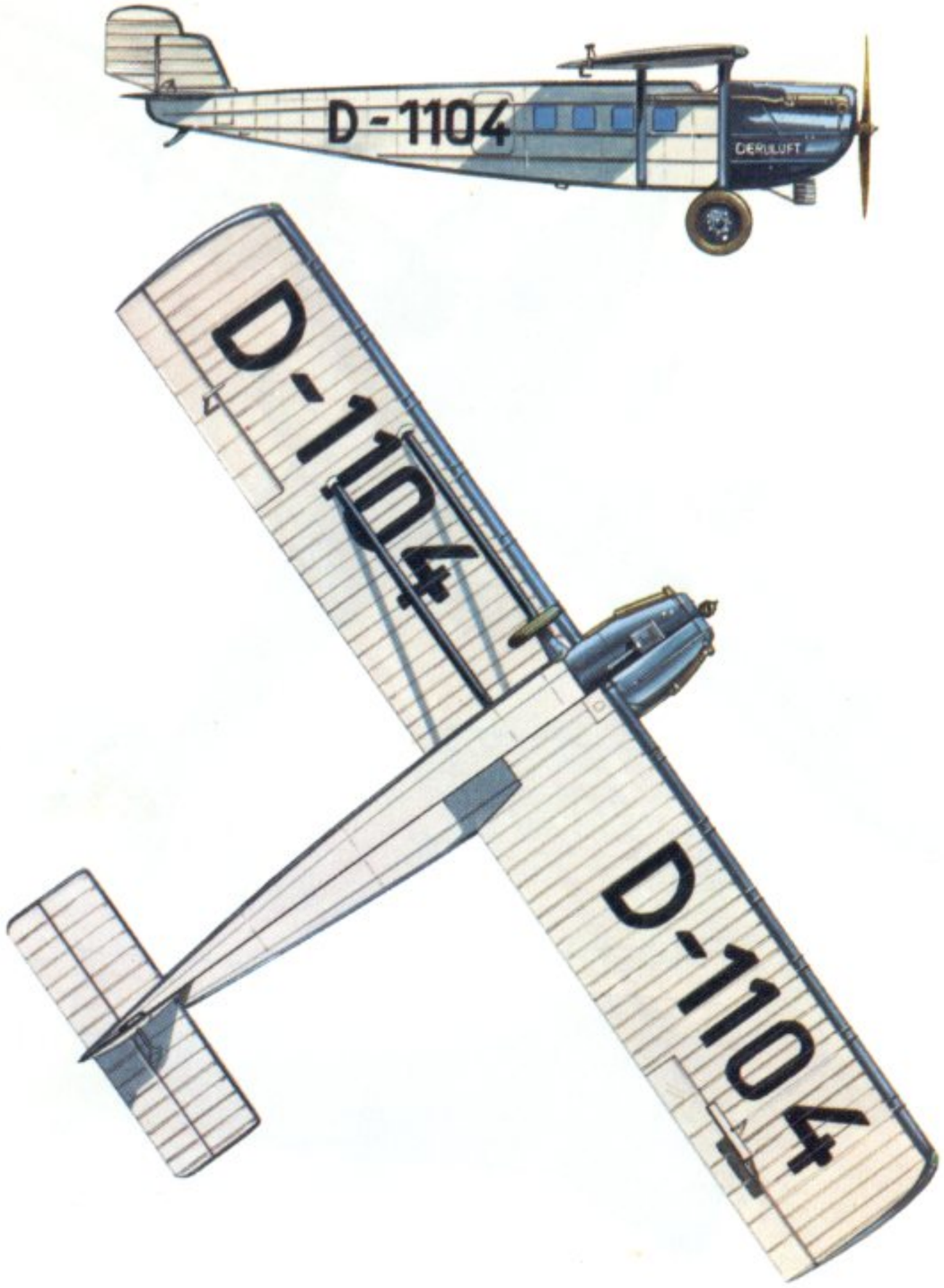
18

De Havilland D.H.89A Dragon Rapide of Olley Air Service Ltd., 1935. *Engines:* Two 200 h.p. de Havilland Gipsy Six I six-cylinder in-lines. *Span:* 48 ft 0 in. (14.63 m.). *Length:* 34 ft. 6 in. (10.52 m.). *Wing area:* 336.0 sq.ft. (31.22 sq.m.). *Take-off weight:* 5,500 lb. (2,495 kg.). *Cruising speed:* 133 m.p.h. (214 km/hr.). *Service ceiling:* 16,700 ft. (5,090 m.). *Range:* 578 miles (930 km.).



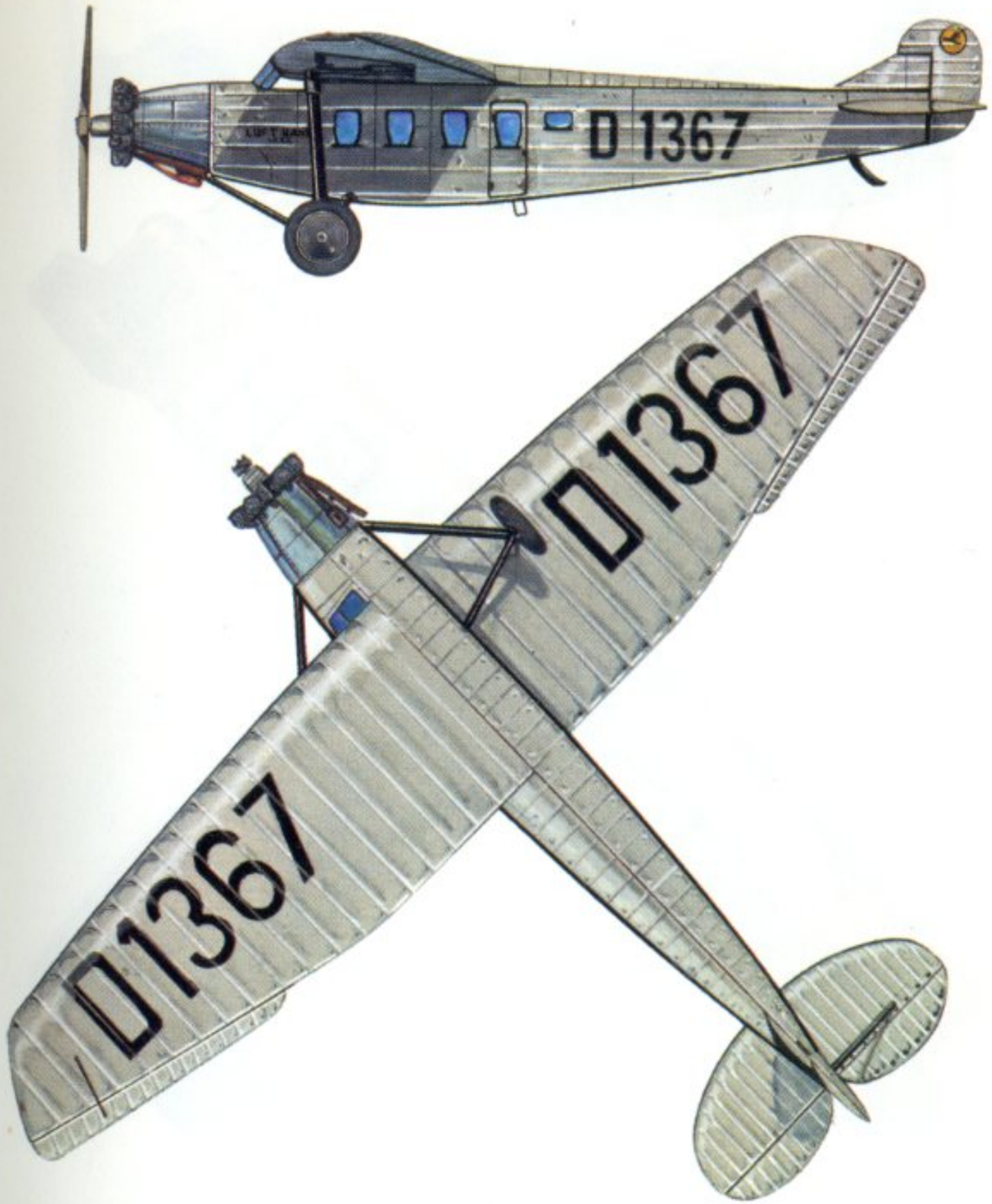
19

De Havilland D.H.86A of British Airways, 1936. *Engines:* Four 200 h.p. de Havilland Gipsy Six I six-cylinder in-lines. *Span:* 64 ft. 6 in. (19.66 m.). *Length:* 46 ft. 1¼ in. (14.05 m.). *Wing area:* 641.0 sq.ft. (59.55 sq.m.). *Take-off weight:* 10,250 lb. (4,650 kg.). *Cruising speed:* 145 m.p.h. (233 km/hr.). *Service ceiling:* 17,400 ft. (5,300 m.). *Range:* 764 miles (1,230 km.).



20

Dornier Merkur of Deruluft, *ca* 1927-28. *Engine:* One 600 h.p. BMW VI twelve-cylinder Vee type. *Span:* 64 ft. 3¾ in. (19.60 m.). *Length:* 41 ft. 0 in. (12.50 m.). *Wing area:* 667.4 sq.ft. (62.00 sq.m.). *Take-off-weight:* 7,936 lb. (3,600 kg.). *Cruising speed:* 112 m.p.h. (180 km/hr.) *Service ceiling:* 17,060 ft. (5,200 m.).



21

Focke-Wulf A 17a Möwe *Leer* of Deutsche Luft Hansa, *ca* 1932. *Engine:* One 480 h.p. Siemens-built Bristol Jupiter VI nine-cylinder radial. *Span:* 65 ft. 7½ in. (20.00 m.) *Length:* 48 ft. 0 in. (14.63 m.). *Wing area:* 672.7 sq.ft. (62.50 sq.m.). *Take-off weight:* 8,818 lb. (4,000 kg.). *Maximum cruising speed:* 109 m.p.h. (175 km/hr.). *Service ceiling:* 16,400 ft. (5,000 m.). *Range:* 497 miles (800 km.).

22

Fokker F.III of Koninklijke Luchtvaart Maatschappij (KLM), 1921-22. *Engine:* One 245 h.p. Siddeley Puma six-cylinder in-line. *Span:* 57 ft. 9¾ in. (17.62 m.). *Length:* 36 ft. 3¾ in. (11.07 m.). *Wing area:* 420.9 sq.ft. (39.10 sq.m.). *Take-off weight:* 4,850 lb. (2,200 kg.). *Cruising speed:* 81 m.p.h. (130 km/hr.). *Endurance:* 5 hours.

23

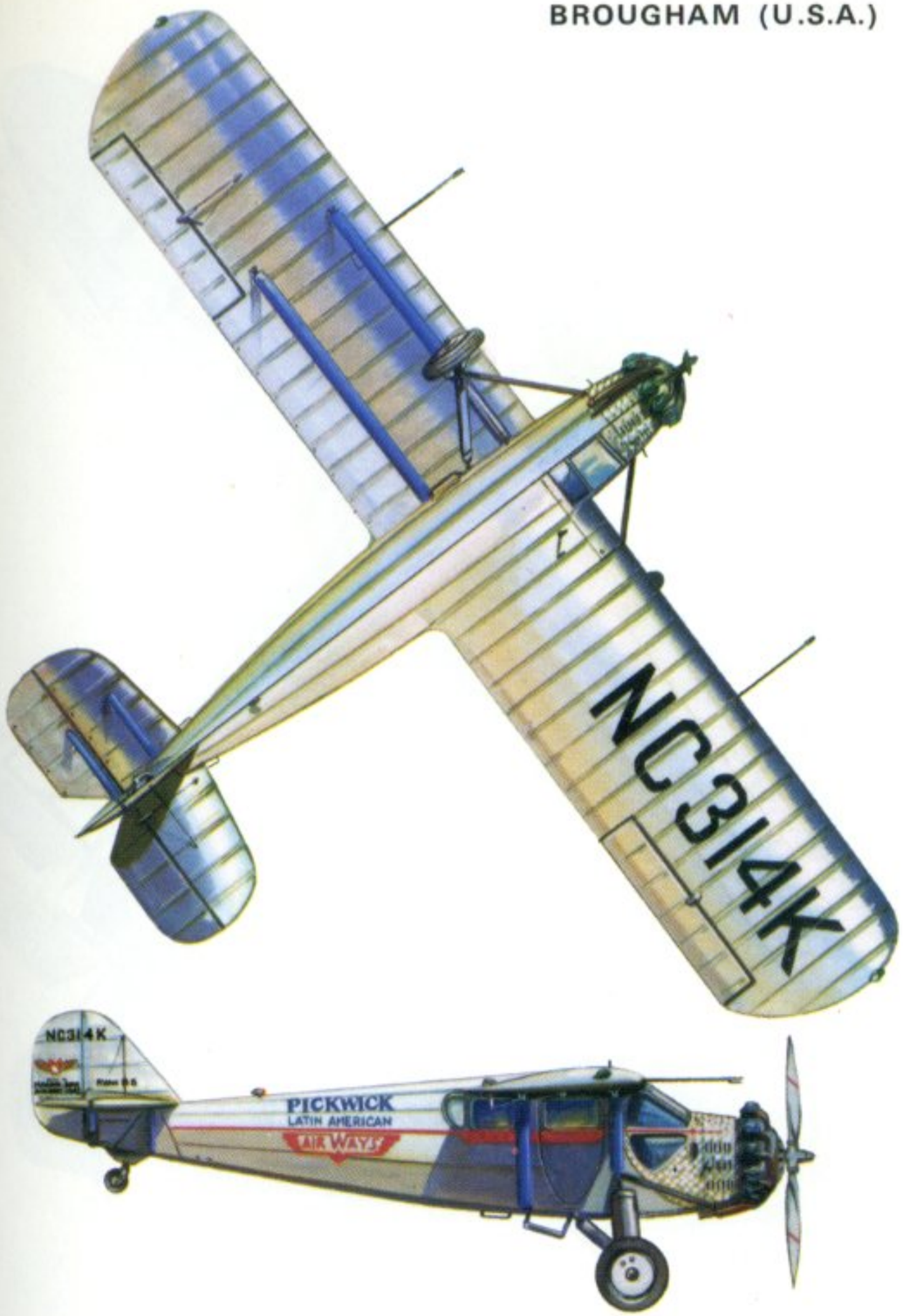
Nakajima-built Fokker Super Universal of the Manchurian Air Transport Company, late 1932. *Engine:* One 450 h.p. Nakajima-built Bristol Jupiter nine-cylinder radial. *Span:* 50 ft. 7¾ in. (15.44 m.). *Length:* 36 ft. 7 in. (11.15 m.). *Wing area:* 370 sq.ft. (34.37 sq. m.). *Take-off weight:* 5,271 lb. (2,391 kg.). *Cruising speed:* 118 m.p.h. (190 km/hr.). *Service ceiling:* 18,000 ft. (5.486 m.). *Range:* 675 miles (1,086 km.).

DETROITER (U.S.A.)

24

Stinson Model SM-1 Detroiter of Braniff Airways, 1928. *Engine:* One 220 h.p. Wright Whirlwind J5C nine-cylinder radial. *Span:* 45 ft. 10 in. (13.97 m.). *Length:* 32 ft. 10 in. (10.01 m.). *Wing area:* 292.0 sq.ft. (27.13 sq.m.). *Take-off weight:* 3,485 lb. (1,580 kg.). *Cruising speed:* 105 m.p.h. (169 km/hr.). *Service ceiling:* 14,000 ft. (4,267 m.). *Range:* 700 miles (1,125 km.).

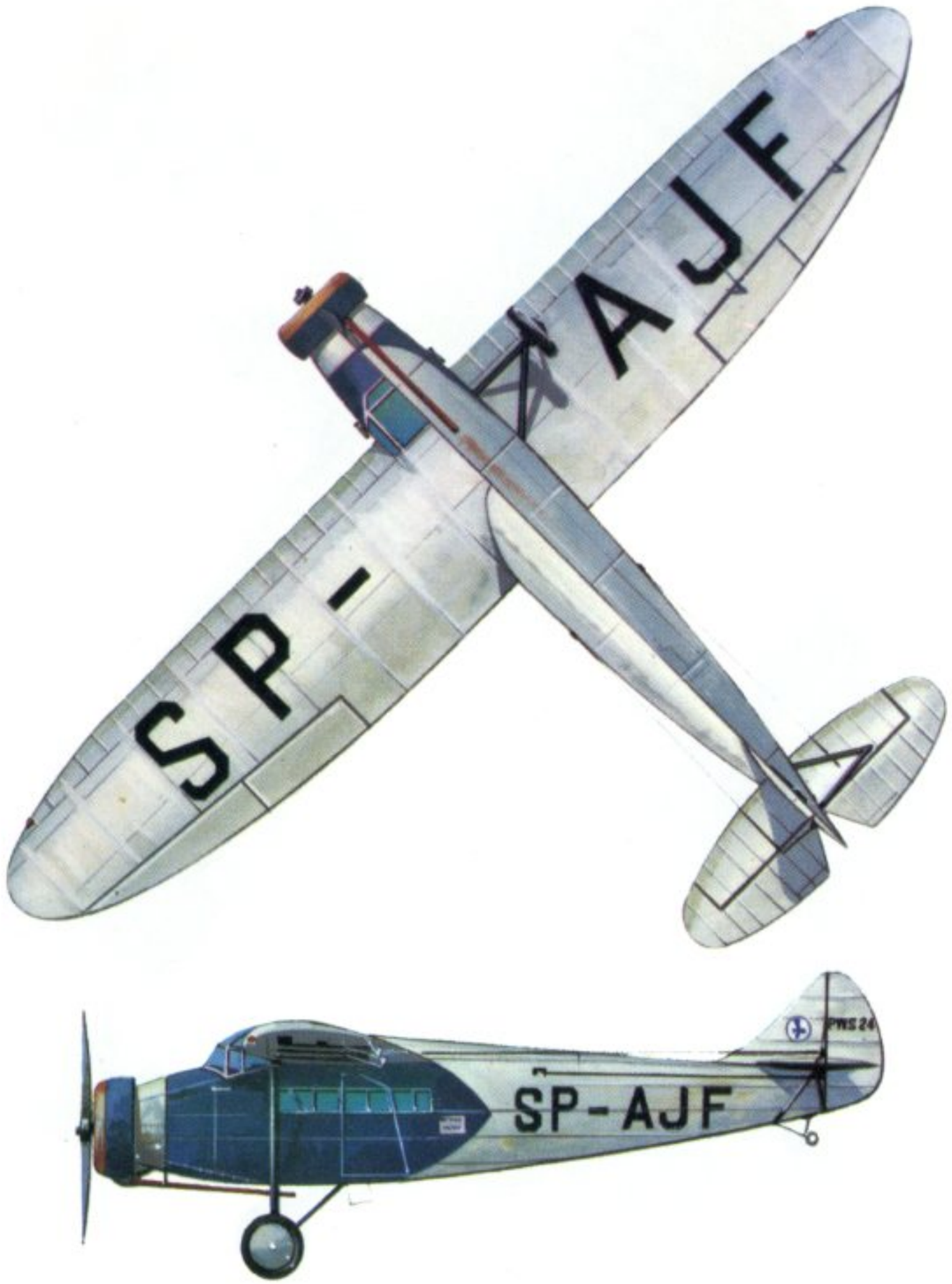
BROUGHAM (U.S.A.)



25

Ryan Model B-5 Brougham of Pickwick Latin American Airways, *ca* 1929-30. *Engine:* One 300 h.p. Wright Whirlwind J6 nine-cylinder radial. *Span:* 42 ft. 4 in. (12.90 m.). *Length:* 28 ft. 4 in. (8.64 m.). *Wing area:* 280.0 sq. ft. (26.01 sq. m.). *Take-off weight:* 4,000 lb. (1,814 kg.). *Cruising speed:* 120 m.p.h. (193 km/hr.). *Service ceiling:* 18,000 ft. (5,486 m.). *Range:* 720 miles (1,158 km).

P.W.S.24 (Poland)



26

Podlaska Wytwornia Samolotow P.W.S.24 *Filip* of Polskie Linie Lotnicze (Lot), 1933. *Engine:* One 220 h.p. Skoda-built Wright J5 Whirlwind seven-cylinder radial. *Span:* 49 ft. 2½ in. (15.00 m.). *Length:* 31 ft. 8 in. (9.65 m.). *Wing area:* 341.7 sq.ft. (31.75 sq.m.). *Normal take-off weight:* 4,078 lb. (1,850 kg.). *Best cruising speed:* 99 m.p.h. (160 km/hr.). *Service ceiling:* 11,480 ft. (3,500 m.). *Range:* 577 miles (930 km.).

KALININ K-5 (U.S.S.R.)

27

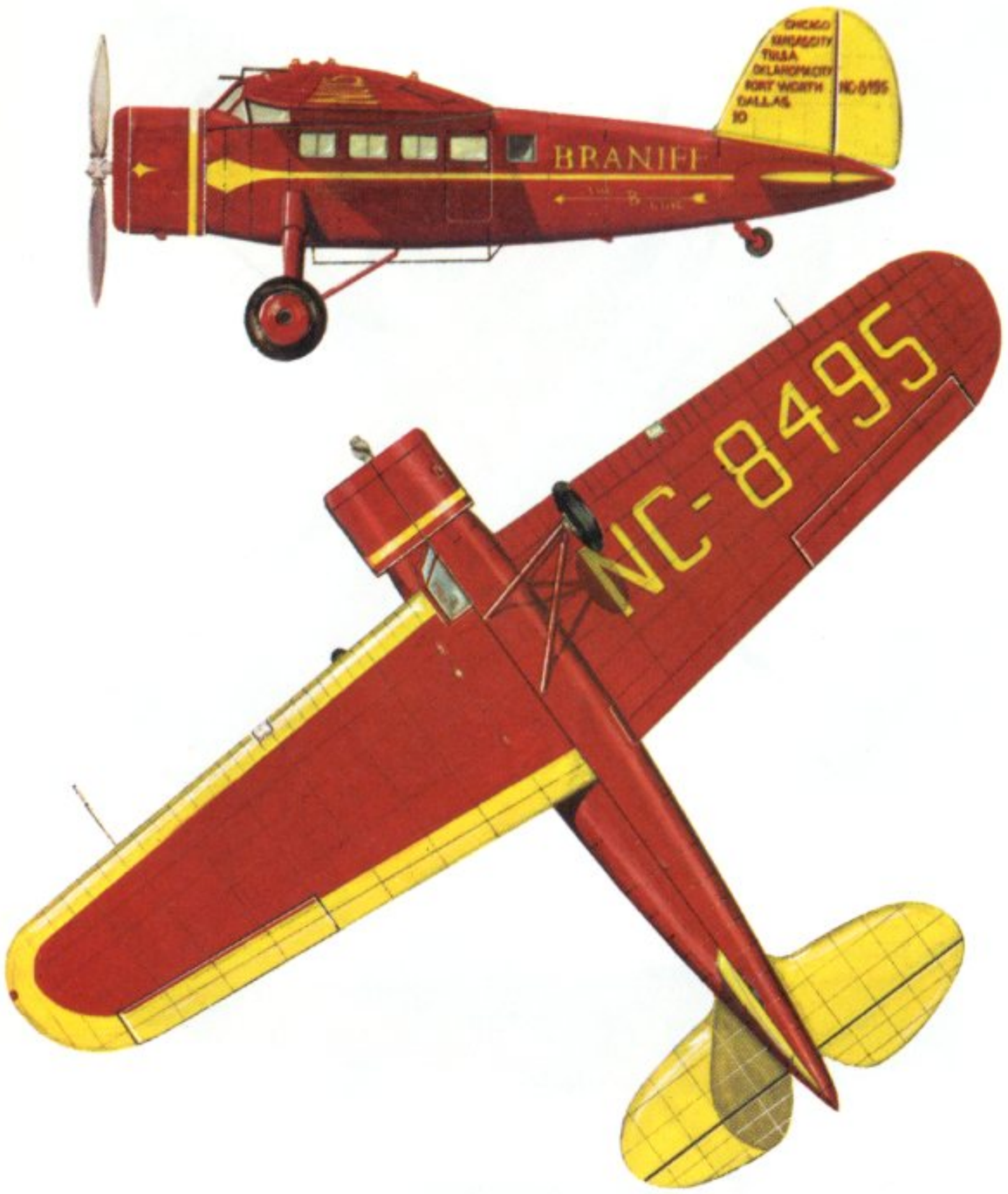
Kalinin K-5 of Dobrolet, *ca* 1930. *Engine:* One 450 h.p. M-15 (Bristol Jupiter) nine-cylinder radial. *Span:* 67 ft. 3 in. (20.50 m.). *Length:* 52 ft. 0¾ in. (15.87 m.). *Wing area:* 710.4 sq.ft. (66.00 sq.m.). *Maximum take-off weight:* 8,267 lb. (3,750 kg.). *Cruising speed:* 97.5 m.p.h. (157 km/hr.). *Service ceiling:* 15,680 ft. (4,780 m.). *Range:* 590 miles (950 km.).

28

Consolidated Model 17 Fleetster floatplane of New York, Rio and Buenos Aires Line Inc, 1930. *Engine:* One 575 h.p. Pratt & Whitney R-1860 Hornet B nine-cylinder radial. *Span:* 45 ft. 0 in. (13.72 m.). *Length* (landplane): 31 ft. 9 in. (9.68 m.). *Wing area:* 313.5 sq.ft. (29.125 sq.m.). *Take-off weight:* 5,570 lb. (2,527 kg.). *Cruising speed:* 145 m.p.h. (233 km/hr.). *Service ceiling:* 17,000 ft. (5,182 m.). *Range:* 600 miles (966 km.).

29

Latécoère 283 *Comte de la Vaulx* of Compagnie Générale Aéropostale, flown by Jean Mermoz, 1930. *Engine:* One 750 h.p. Hispano Suiza 12 Lbr twelve-cylinder Vee type. *Span:* 63 ft. 1¾ in. (19.25 m.). *Length:* 47 ft. 0 in. (14.325 m.) (floatplane); 44 ft. 9¼ in. (13.645 m.) (landplane). *Wing area:* 626.5 sq.ft. (58.20 sq.m.). *Take-off weight:* 11,060 lb. (5,017 kg.). *Cruising speed:* approx 124 m.p.h. (200 km/hr.) at 9,845 ft. (3,000 m.). *Range:* 1,988 miles (3,200 km).

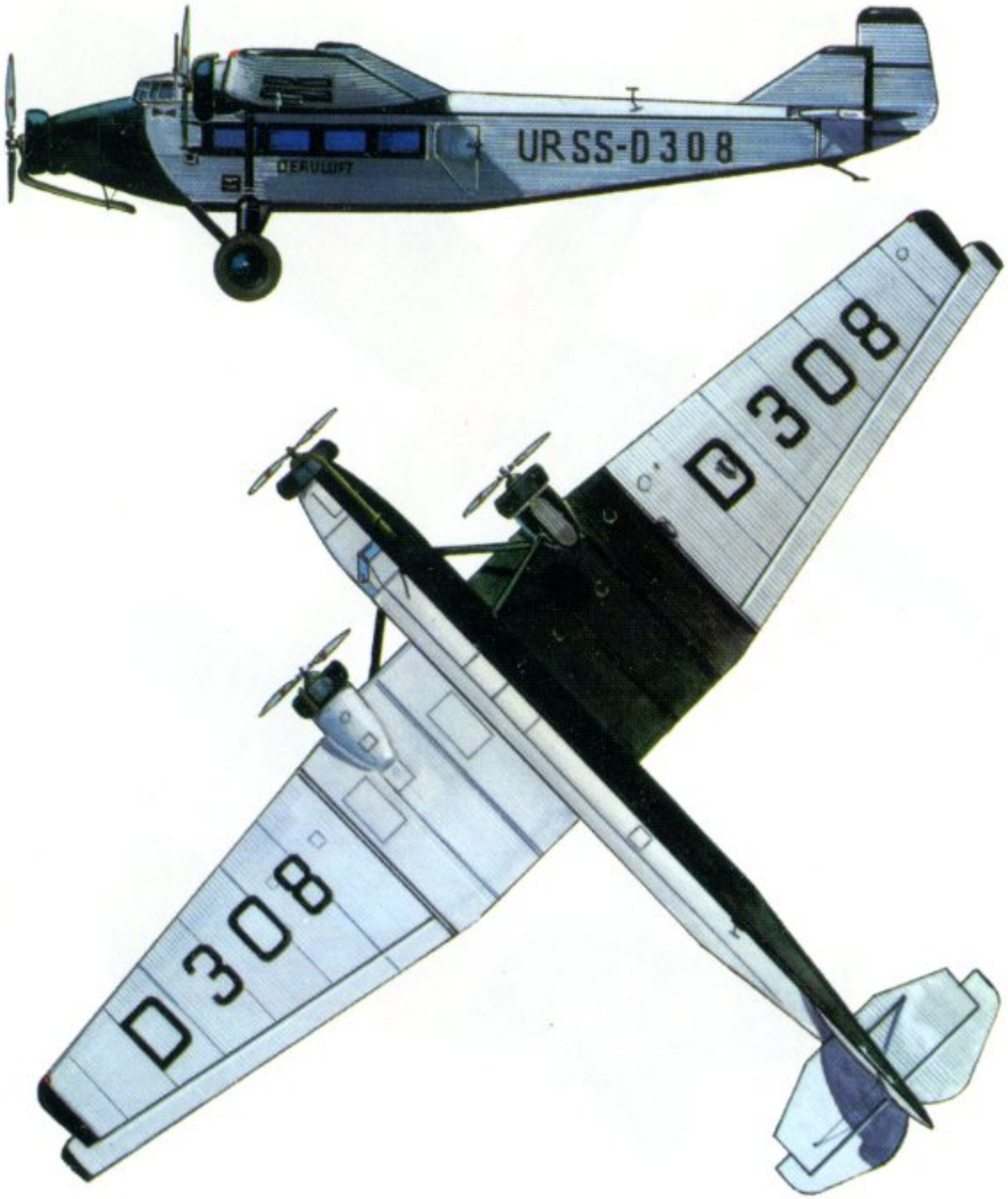


30

Lockheed Vega Model DL-1 of Braniff Airways, *ca* 1934-35. *Engine:* One 450 h.p. Pratt & Whitney Wasp C1 nine-cylinder radial. *Span:* 41 ft. 0 in. (12.50 m.). *Length:* 27 ft. 6 in. (8.38 m.). *Wing area:* 275.0 sq. ft. (25.55 sq. m.). *Take-off weight:* 4,270 lb. (1,937 kg.). *Cruising speed:* 150 m.p.h. (241 km/hr.). *Service ceiling:* approx 22,000 ft. (6,705 m.). *Range:* approx 700 miles (1,126 km.)

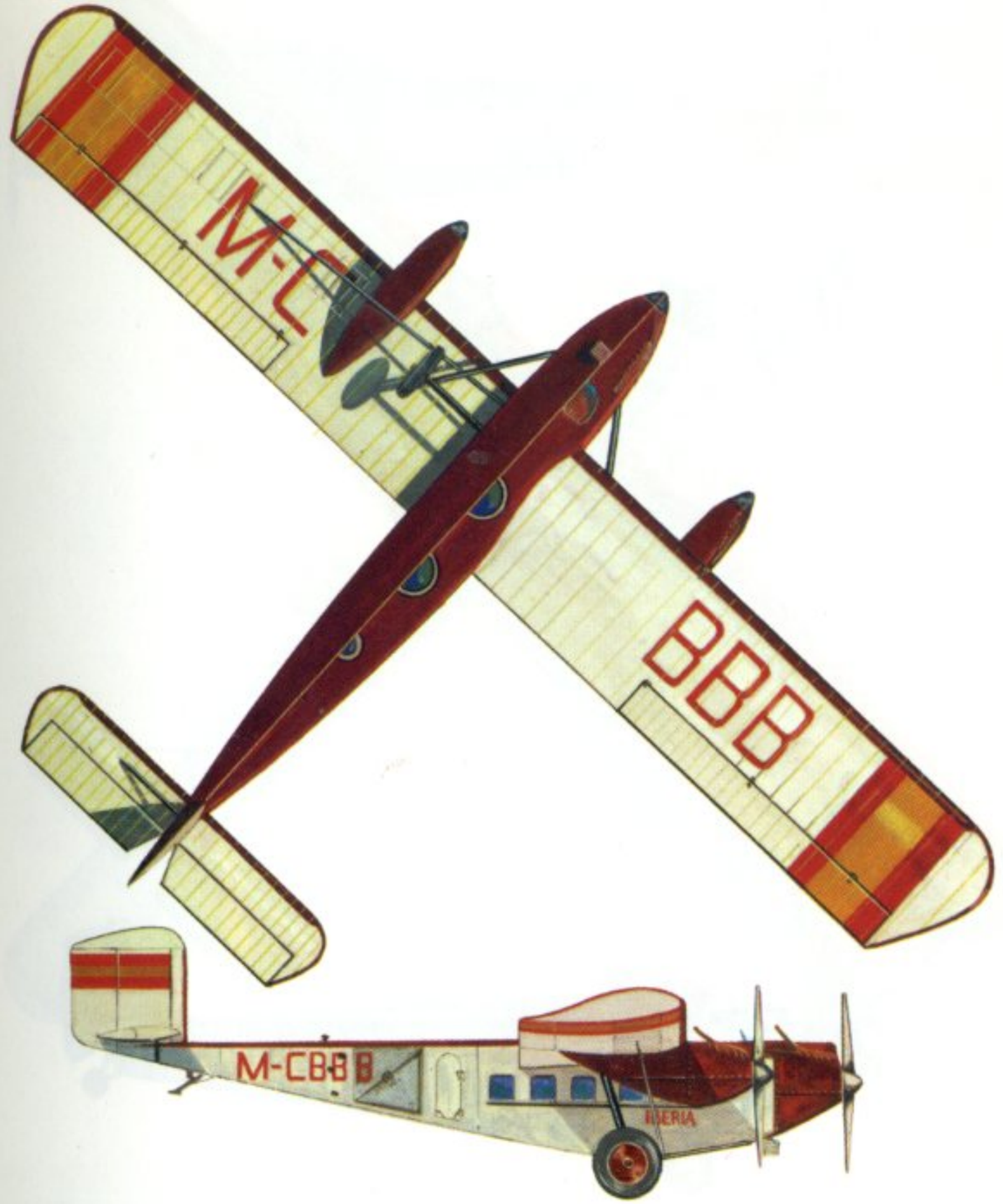
31

Bellanca Model 66-70 Cargo Aircruiser of Mackenzie Air Service Ltd, 1935. *Engine:* One 658 h.p. Canadian-built Wright Cyclone nine-cylinder radial. *Span:* 65 ft. 0 in. (19.81 m.). *Length:* 42 ft. 9 in. (13.03 m.). *Wing area:* 664.0 sq.ft. (61.69 sq.m.). *Take-off weight:* 11,400 lb. (5,171 kg.). *Speed:* 154 m.p.h. (248 km/hr.) at 12,000 ft. (3,658 m.). *Service ceiling:* 20,000 ft. (6,100 m.). *Range with maximum payload of 4,000 lb. (1,814 kg):* 550 miles (885 km.).



32

Tupolev ANT-9 *Chaika* (Seagull) of Deruluft, *ca* 1932-33. *Engines:* Three 300 h.p. M-26 (Wright J6 Whirlwind) seven-cylinder radials *Span:* 77 ft. 10½ in. (23.73 m.). *Length:* 55 ft. 9¼ in. (17.00 m.). *Wing area:* 904.2 sq.ft. (84.00 sq.m.). *Take-off weight:* 13,228 lb. (6,000 kg.). *Cruising speed:* 115 m.p.h. (185 km/hr.) *Service ceiling:* 11,155 ft. (3,400 m.). *Range:* 620 miles (1,000 km.).



33

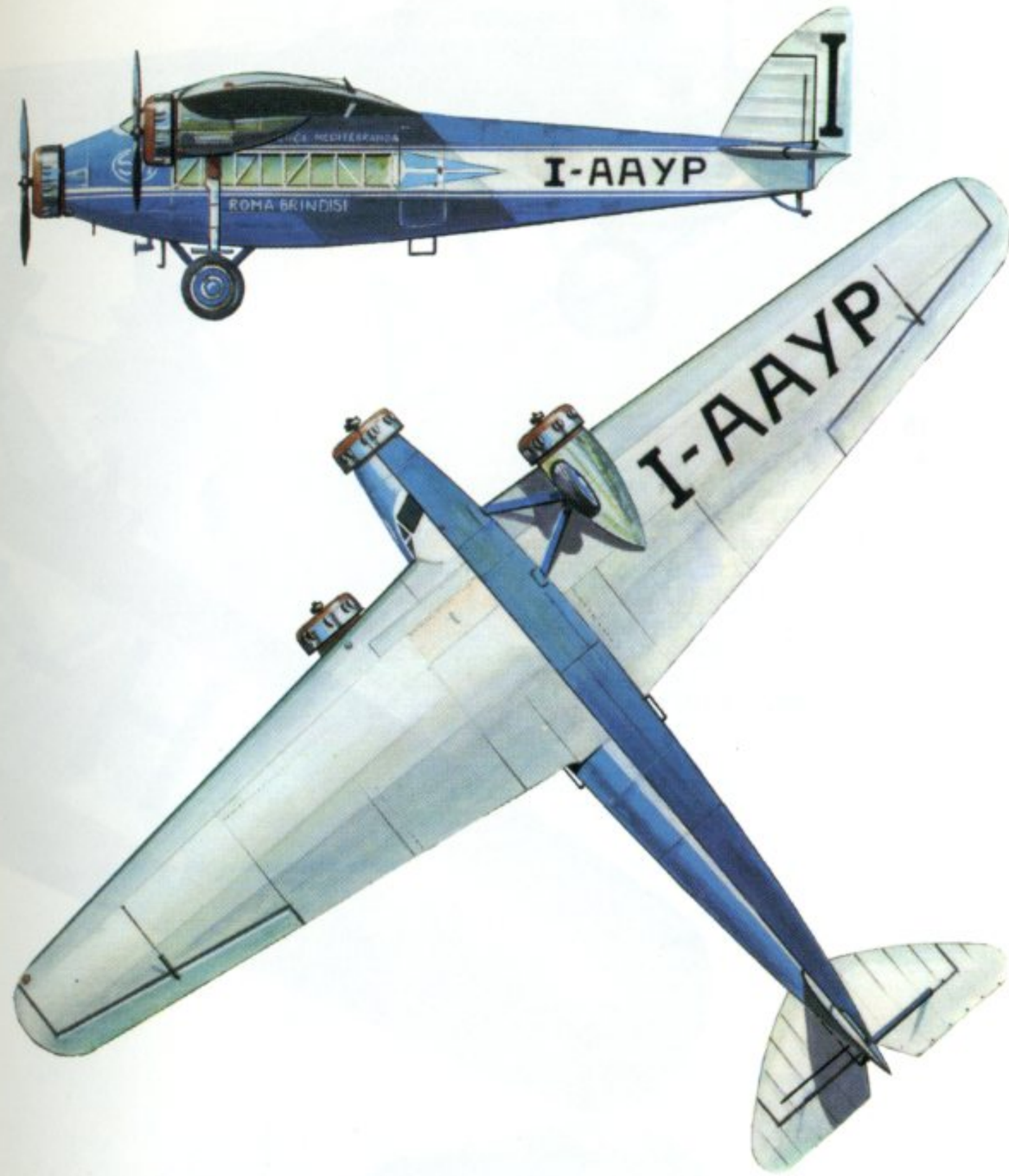
Rohrbach Ro VIII Roland I of Compania Aérea de Transportes (Iberia), *ca* 1928. *Engines:* Three 230 h.p. BMW IV six-cylinder in-lines. *Span:* 86 ft. 3½ in. (26.30 m.). *Length:* 52 ft. 9¾ in. (16.10 m.). *Wing area:* 958.0 sq.ft. (89.00 sq.m.). *Take-off weight:* 15,763 lb. (7,150 kg.). *Cruising speed:* 109 m.p.h. (175 km/hr.). *Service ceiling:* 13,125 ft. (4,000 m.). *Maximum range:* 932 miles (1,500 km.).

FORD TRI-MOTOR (U.S.A.)

34

Ford Model 5-AT-B of American Airways, 1931. *Engines:* Three 420 h.p. Pratt & Whitney Wasp C-1 or SC-1 nine-cylinder radials. *Span:* 77 ft. 10 in. (23.72 m.). *Length:* 49 ft. 10 in. (15.19 m.). *Wing area:* 835.0 sq.ft. (77.57 sq.m.). *Typical take-off weight:* 13,000 lb. (5,897 kg.). *Typical cruising speed:* 122 m.p.h. (196 km/hr.) *Service ceiling:* 18,500 ft. (5,639 m.). *Typical range:* 550 miles (885 km.).

SAVOIA-MARCHETTI S.71 (Italy)



35

Savoia-Marchetti S.71 of Società Aerea Mediterranea, *ca* 1932. *Engines:* Three 240 h.p. Walter Castor seven-cylinder radials. *Span:* 69 ft. 6¾ in. (21.20 m.). *Length:* 45 ft. 11¼ in. (14.00 m.). *Wing area:* 645.8 sq.ft. (60.00 sq.m.). *Take-off weight:* 10,140 lb. (4,600 kg.). *Cruising speed:* 112 m.p.h. (180 km/hr.). *Service ceiling:* 19,685 ft. (6,000 m.). *Maximum range:* 777 miles (1,250 km.).

FOKKER F.VII and F.VIIa/3m (Netherlands)

36

Bottom: Fokker F.VII prototype of Koninklijke Luchtvaart Maatschappij (KLM), 1924. *Engine:* One 360 h.p. Rolls-Royce Eagle IX twelve-cylinder Vee type. *Span:* 72 ft. 2½ in. (22.00 m.). *Length:* 44 ft. 3½ in. (13.50 m.). *Wing area:* 772.5 sq.ft. (71.77 sq.m.). *Take-off weight:* 8,080 lb. (3,665 kg.). *Cruising speed:* 81 m.p.h. (130 km/hr.). *Service ceiling:* 14,765 ft. (4,500 m.).

Fokker F.VIIa/3m of Koninklijke Luchtvaart Maatschappij (KLM), 1926. *Engines:* Three 220 h.p. Armstrong Siddeley Lynx IVC seven-cylinder radials. *Span:* 63 ft. 4¼ in. (19.31 m.). *Length:* 47 ft. 1 in. (14.35 m.). *Wing area:* 627.6 sq. ft. (58.50 sq.m.). *Take-off weight:* 7,937 lb. (3,600 kg.). *Speed:* 106 m.p.h. (170 km/hr.). *Service ceiling:* 15,420 ft. (4,700 m.). *Range:* approx 550 miles (885 km.).

AVRO TEN (U.K.)

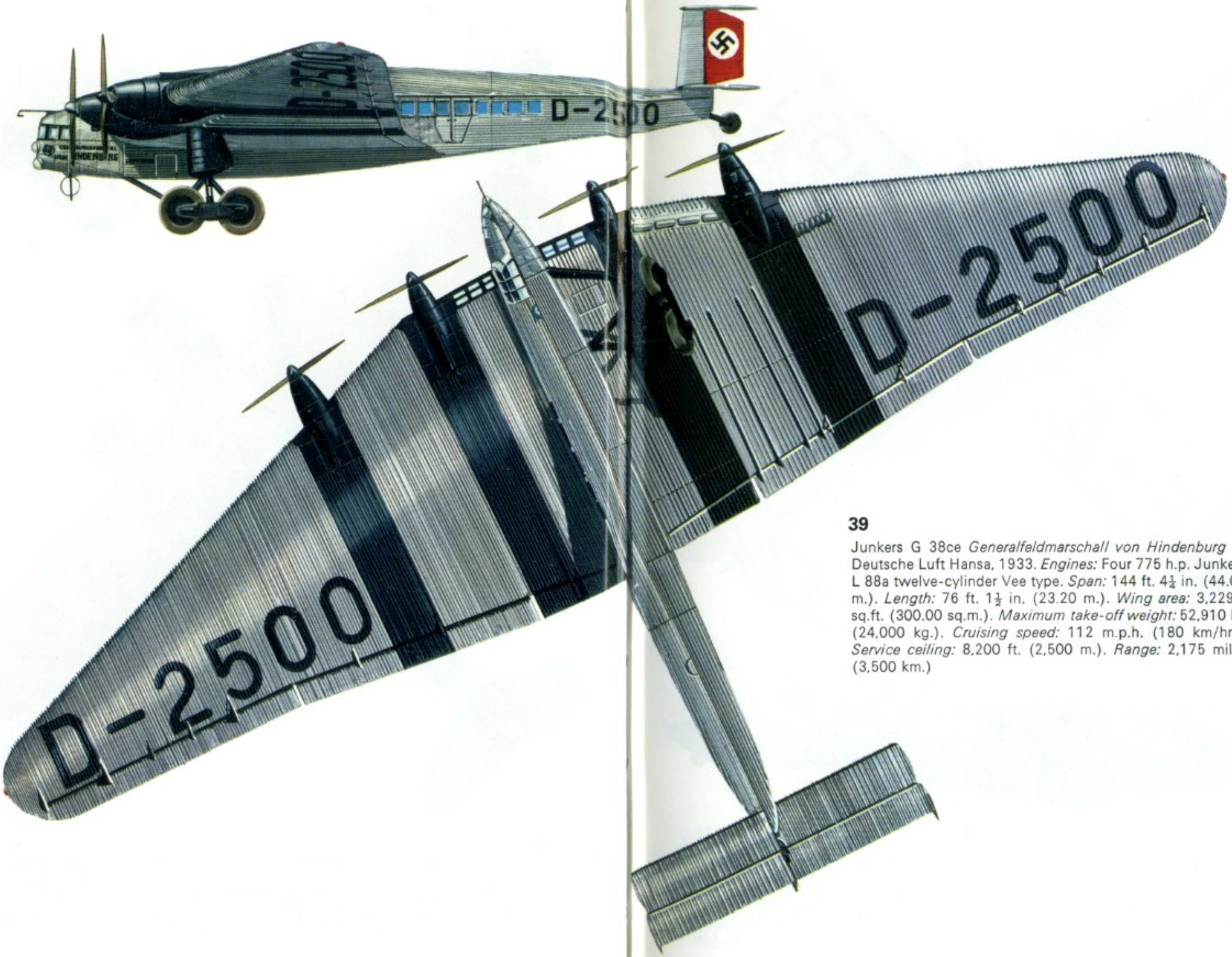
37

Avro Type 618 Ten *Achilles* of Imperial Airways Ltd., 1930-31. *Engines:* Three 215 h.p. Armstrong Siddeley Lynx IVC seven-cylinder radials. *Span:* 71 ft. 3 in. (21.72 m.). *Length:* 47 ft. 6 in. (14.48 m.). *Wing area:* 772.0 sq.ft. (71.72 sq.m.). *Take-off weight:* 10,600 lb. (4,808 kg.). *Cruising speed:* 100 m.p.h. (161 km/hr.). *Service ceiling:* 16,000 ft. (4,880 m.). *Range:* 400 miles (644 km.).

FOKKER F.XII (Netherlands)

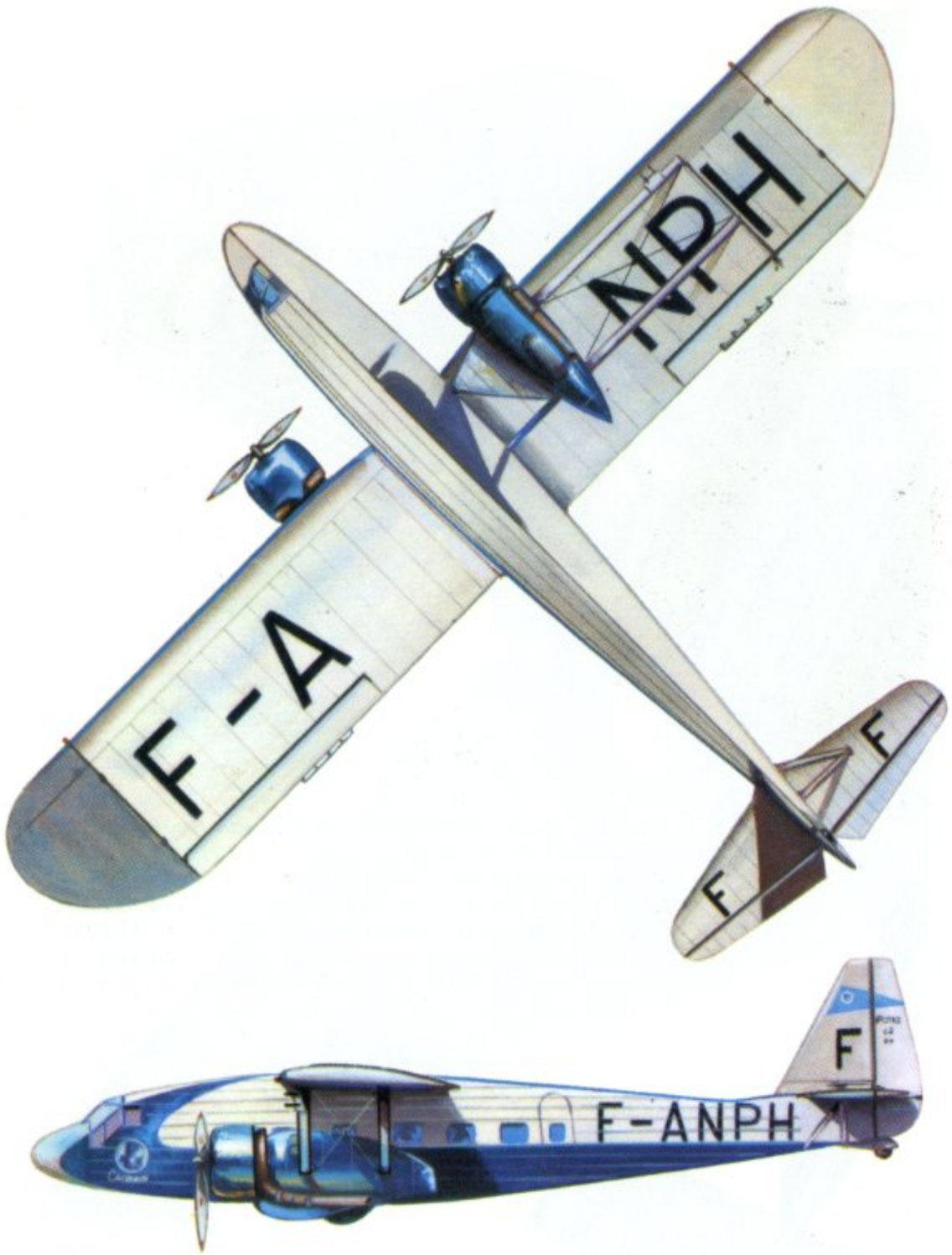
38

Fokker F.XII *Värmland* of AB Aerotransport, 1932-33. *Engines:* Three 500 h.p. Pratt & Whitney Wasp T1D1 nine-cylinder radials. *Span:* 75 ft. 6½ in. (23.02 m.). *Length:* 58 ft. 4¾ in. (17.80 m.). *Wing area:* 893.4 sq.ft. (83.00 sq.m.). *Take-off weight:* 15,983 lb. (7,250 kg.). *Cruising speed:* 130 m.p.h. (210 km/hr.). *Service ceiling:* 11,155 ft. (3,400 m.). *Range with maximum fuel:* 808 miles (1,300 km.).



39

Junkers G 38ce *Generalfeldmarschall von Hindenburg* of Deutsche Luft Hansa, 1933. *Engines:* Four 775 h.p. Junkers L 88a twelve-cylinder Vee type. *Span:* 144 ft. 4¼ in. (44.00 m.). *Length:* 76 ft. 1½ in. (23.20 m.). *Wing area:* 3,229.2 sq.ft. (300.00 sq.m.). *Maximum take-off weight:* 52,910 lb. (24,000 kg.). *Cruising speed:* 112 m.p.h. (180 km/hr.). *Service ceiling:* 8,200 ft. (2,500 m.). *Range:* 2,175 miles (3,500 km.)



40

Potez 62-0 *Cormoran* of Air France, 1935. *Engines:* Two 870 h.p. Gnome-Rhône 14Kdrs Mistral Major fourteen-cylinder radials. *Span:* 73 ft. 7¾ in. (22.45 m.). *Length:* 56 ft. 10 in. (17.32 m.). *Wing area:* 818.1 sq.ft. (76.00 sq.m.). *Normal take-off weight:* 15,785 lb. (7,160 kg.). *Cruising speed:* 174 m.p.h. (280 km/hr.) at 6,560 ft. (2,000 m.). *Absolute ceiling:* 24,605 ft. (7,500 m.). *Normal range:* 620 miles (1,000 km.)

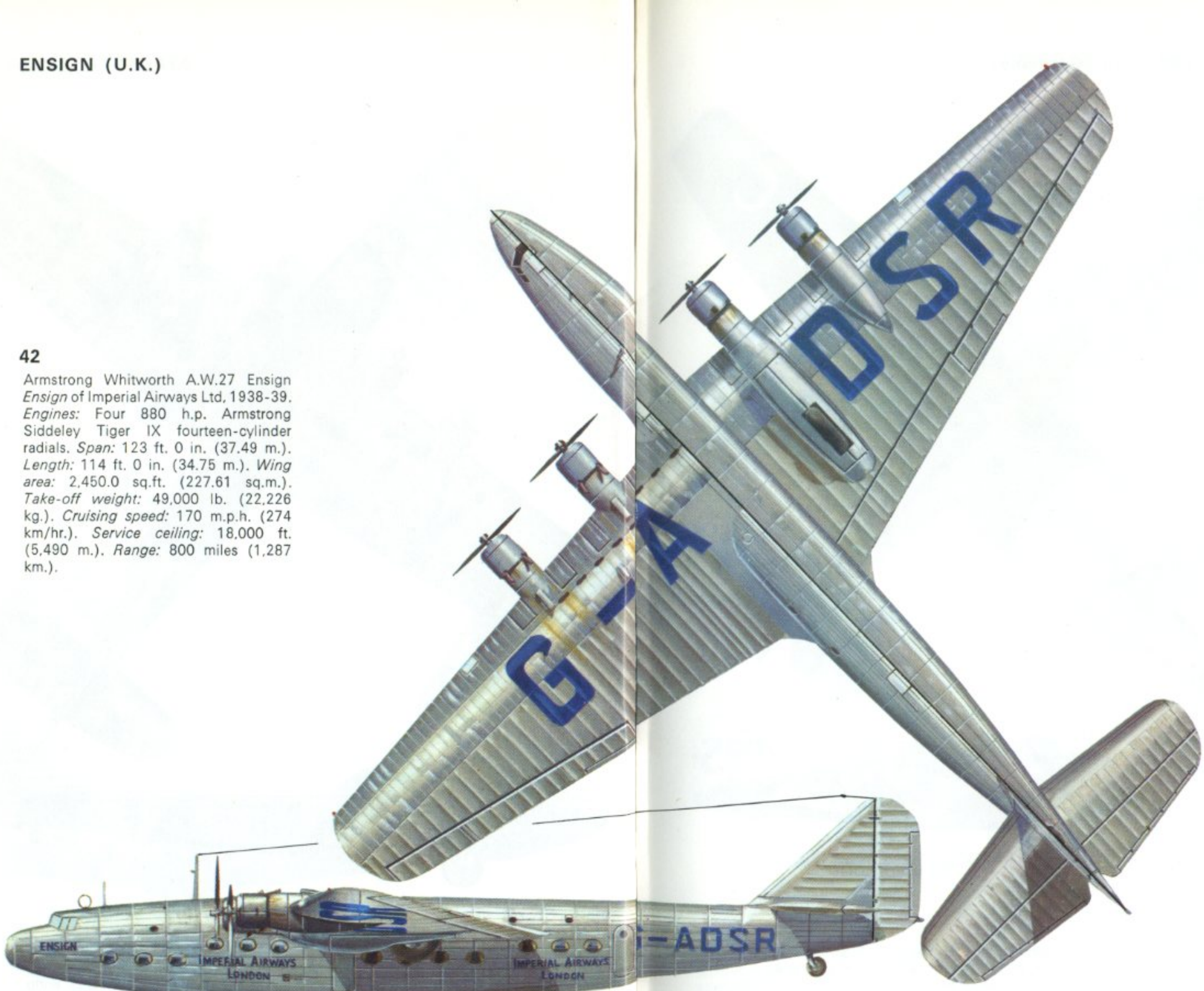
41

Armstrong Whitworth A.W.15 Atalanta *Arethusa* of Indian Trans-Continental Airways, late 1933. *Engines:* Four 340 h.p. Armstrong Siddeley Serval III ten-cylinder radials. *Span:* 90 ft. 0 in. (27.43 m.). *Length:* 71 ft. 6 in. (21.79 m.). *Wing area:* 1,285.0 sq.ft. (119.38 sq.m.). *Take-off weight:* 21,000 lb. (9,525 kg.). *Cruising speed:* 130 m.p.h. (209 km/hr.). *Service ceiling:* 13,000 ft. (3,962 m.). *Range:* 400 miles (644 km.).

ENSIGN (U.K.)

42

Armstrong Whitworth A.W.27 Ensign *Ensign* of Imperial Airways Ltd, 1938-39. *Engines:* Four 880 h.p. Armstrong Siddeley Tiger IX fourteen-cylinder radials. *Span:* 123 ft. 0 in. (37.49 m.). *Length:* 114 ft. 0 in. (34.75 m.). *Wing area:* 2,450.0 sq.ft. (227.61 sq.m.). *Take-off weight:* 49,000 lb. (22,226 kg.). *Cruising speed:* 170 m.p.h. (274 km/hr.). *Service ceiling:* 18,000 ft. (5,490 m.). *Range:* 800 miles (1,287 km.).



JUNKERS F 13 (Germany)

43

Junkers F 13 of AB Aerotransport, 1928. *Engine:* One 310 h.p. Junkers L5 six-cylinder in-line. *Span:* 56 ft. 3¼ in. (17.15 m.). *Length:* 31 ft. 6 in. (9.60 m.). *Wing area*: 430.6 sq. ft. (40.00 sq. m.). *Take-off weight:* 4,244 lb. (1,925 kg.). *Cruising speed:* 99 m.p.h. (160 km/hr.) at 6,560 ft. (2,000 m.). *Service ceiling:* 8,200 ft. (2,500 m.). *Range:* 528 miles (850 km.).

JUNKERS G 24 (Germany)

44

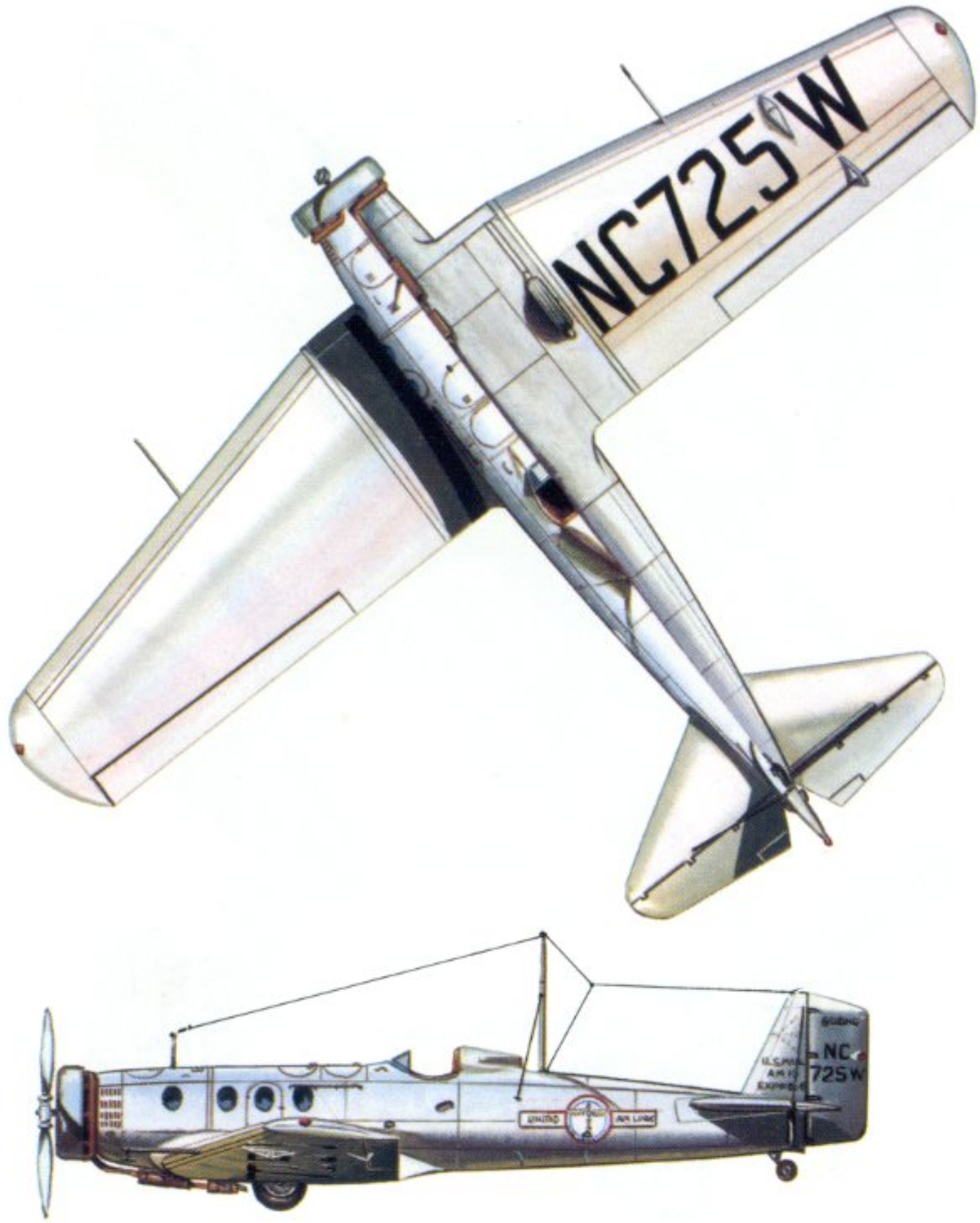
Junkers G 24W *Suomi* of Aero O/Y (Finnair), *ca* 1928. *Engines:* Three 310 h.p. Junkers L5 six-cylinder in-lines. *Span:* 96 ft. 4¼ in. (29.37 m.). *Length:* 54 ft. 9½ in. (16.70 m.). *Wing area:* 1,087.2 sq.ft. (101.00 sq.m.) *Take-off weight:* 14,330 lb. (6,500 kg.). *Cruising speed:* 102.5 m.p.h. (165 km/hr.) at 6,560 ft. (2,000 m.). *Service ceiling:* 14,100 ft. (4,300 m.).

45

Swedish-built Junkers W 34 *Ternen* of Det Norske Luftruter, *ca* 1931. *Engine:* One 600 h.p. BMW Hornet C nine-cylinder radial. *Span:* 60 ft. 7½ in. (18.48 m.). *Length:* 36 ft. 6¼ in. (11.13 m.). *Wing area:* 473.6 sq.ft. (44.00 sq.m.). *Maximum take-off weight:* 7,055 lb. (3,200 kg.). *Maximum cruising speed:* 134 m.p.h. (215 km/hr.) at 3,280 ft. (1,000 m.). *Service ceiling:* 20,340 ft. (6,200 m.).

46

Northrop Delta of Transcontinental and Western Air (TWA), 1933. *Engine:* One 575 h.p. Wright Cyclone nine-cylinder radial. *Span:* 47 ft. 9½ in. (14.57 m.). *Length:* 33 ft. 1 in. (10.08 m.). *Wing area:* 363.0 sq. ft. (33.72 sq. m.). *Take-off weight:* 7,350 lb. (3,334 kg.). *Cruising speed:* 208 m.p.h. (335 km/hr.) at 12,700 ft. (3,870 m.). *Service ceiling:* 23,500 ft. (7,163 m.). *Range:* 1,650 miles (2,655 km.).



47

Boeing Model 221A (originally Model 200) Monomail of United Air Lines (Boeing Air Transport Division), *ca* 1932. *Engine:* One 575 h.p. Pratt & Whitney Hornet B nine-cylinder radial. *Span:* 59 ft. 1½ in. (18.02 m.). *Length:* 44 ft. 1½ in. (13.45 m.). *Wing area:* 535.0 sq.ft. (49.70 sq.m.). *Take-off weight:* 8,000 lb. (3,629 kg.). *Cruising speed:* 137 m.p.h. (220 km/hr.). *Service ceiling:* 14,700 ft. (4,480 m.). *Range:* 540 miles (869 km.).

48

Airspeed A.S.5 Courier prototype, built for non-stop flight to India in 1934 by Sir Alan Cobham. *Engine:* One 240 h.p. Armstrong Siddeley Lynx IVC seven-cylinder radial. *Span:* 47 ft. 0 in. (14.33 m.). *Length:* 28 ft. 6 in. (8.69 m.). *Wing area:* 250.0 sq.ft. (23.23 sq.m.). *Take-off weight:* 3,900 lb. (1,769 kg.). *Cruising speed:* 132 m.p.h. (212 km/hr.) at 1,000 ft. (305 m.). *Service ceiling:* 13,500 ft. (4,115 m.). *Range:* 638 miles (1,027 km.).

ORION (U.S.A.)

49

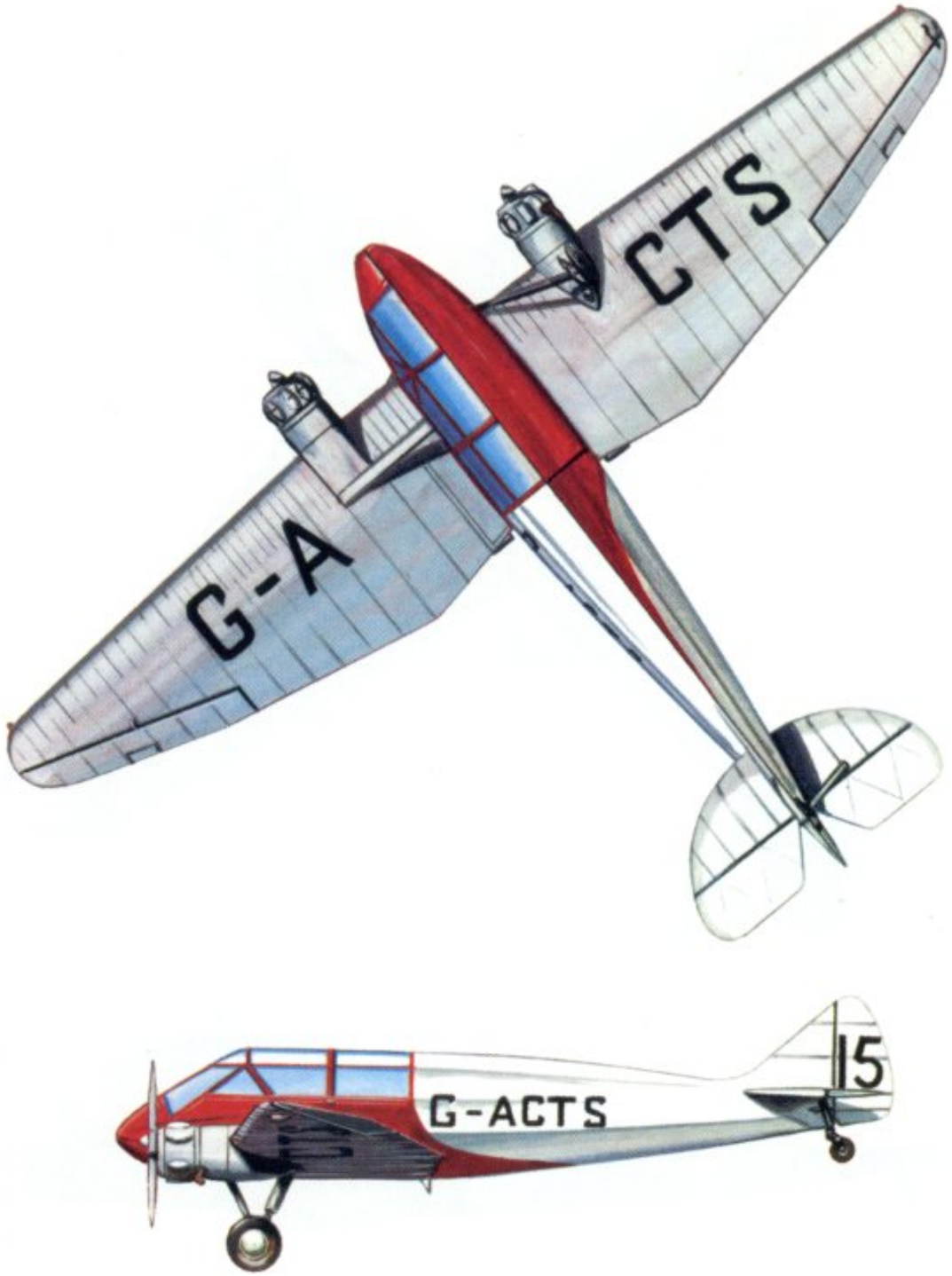
Lockheed Model 9 Orion *South Wind* of Varney Speed Lanes, 1930. *Engine:* One 450 h.p. Pratt & Whitney Wasp S1D1 nine-cylinder radial. *Span:* 42 ft. 9½ in. (13.04 m.). *Length:* 27 ft. 6 in. (8.38 m.). *Wing area:* 294.1 sq.ft. (27.32 sq.m.). *Take-off weight (mail version):* 5,400 lb. (2,449 kg.). *Cruising speed:* 175 m.p.h. (282 km/hr.) at 11,000 ft. (3,353 m.). *Service ceiling:* 22,000 ft. (6,706 m.). *Range:* 750 miles (1,207 km.).

CLARK G.A.43 (U.S.A.)

50

General Aviation (Clark) G.A.43 of Swiss Air Lines (Swissair), *ca* 1934-35. *Engine:* One 700 h.p. Wright GR-1820-F1 Cyclone nine-cylinder radial. *Span:* 53 ft. 0 in. (16.15 m.). *Length:* 43 ft. 1 in (13.13 m.). *Wing area:* 464.0 sq. ft. (43.11 sq. m.). *Take-off weight:* 8,750 lb. (3,969 kg.). *Cruising speed:* 162 m.p.h. (261 km/hr.) at 10,000 ft. (3,050 m.). *Service ceiling:* 18,000 ft. (5,486 m.). *Range:* 850 miles (1,368 km.).

MONOSPAR (U.K.)



51

General Aircraft Monospar ST-10, winner of 1934 King's Cup air race. *Engines:* Two 90 h.p. Pobjoy Niagara I seven-cylinder radials. *Span:* 40 ft. 2 in. (12.24 m.). *Length:* 26 ft. 4 in. (8.03 m.). *Wing area:* 217.0 sq.ft. (20.16 sq.m.). *Take-off weight:* 2,750 lb. (1,451 kg.). *Cruising speed:* 130 m.p.h. (209 km/hr.). *Service ceiling:* 18,000 ft. (2,900 m.). *Range:* 585 miles (941 km.).

BOEING 247 (U.S.A.)

Legend on fuselage reads:
'THIS PLANE CARRIED THE STARS AND STRIPES ACROSS THE FINISHING LINE IN THE WORLD'S GREATEST AIR RACE'

52

United Air Lines' Boeing 247D, flown to third place in the 1934 'MacRobertson race by Roscoe Turner and Clyde Pangborn, after its return to airline service. *Engines:* Two 550 h.p. Pratt & Whitney Wasp S1H1-G nine-cylinder radials. *Span:* 74 ft. 0 in. (22.56 m.). *Length:* 51 ft. 7 in. (15.72 m.). *Wing area:* 836.13 sq.ft. (77.68 sq.m.). *Take-off weight:* 13,650 lb. (6,192 kg.). *Speed:* 189 m.p.h. (304 km/hr.) at 12,000 ft. (3,658 m.). *Service ceiling:* 25,400 ft. (7,742 m.). *Maximum range:* 840 miles (1,352 km.).

53

Douglas DC-2 of Swiss Air Lines (Swissair), *ca* 1935. *Engines:* Two 720 h.p. Wright Cyclone SGR-1820-F2 nine-cylinder radials. *Span:* 85 ft. 0 in. (25.91 m.). *Length:* 61ft. 11¼ in. (18.88 m.). *Wing area:* 939.0 sq.ft. (87.24 sq.m.). *Take-off weight:* 18,000 lb. (8,615 kg.). *Cruising speed:* 196 m.p.h. (315 km/hr.). *Service ceiling:* 23,600 ft. (7,193 m.). *Range:* 1,060 miles (1,706 km.).

54

Douglas DC-3 (DST) prototype, as *Flagship Texas* of American Airlines Inc, 1936. *Engines:* Two 900 h.p. Wright GR-1820-G102A Cyclone nine-cylinder radials. *Span:* 95 ft. 0 in. (28.96 m.). *Length:* 64 ft. 6 in. (19.66 m.). *Wing area:* 987.0 sq.ft. (91.70 sq.m.). *Take-off weight:* 24,000 lb. (10,886 kg.). *Cruising speed:* 185 m.p.h. (298 km/hr.). *Service ceiling:* 23,200 ft. (7,070 m.). *Range:* 1,500 miles (2,414 km.).

MITSUBISHI G3M (Japan)

55

Converted Mitsubishi G3M2 Model 21/22 *Nippon* which made a round-the-world demonstration flight, August-October 1939. *Engines:* Two 900 h.p. Mitsubishi Kinsei 41 fourteen-cylinder radials. *Span:* 82 ft. 0¼ in. (25.00 m.). *Length:* 53 ft. 11¾ in. (16.45 m.). *Wing area:* 807.3 sq.ft. (75.00 sq.m.). *Take-off weight:* 20,282 lb. (9,200 kg.). *Cruising speed:* 174 m.p.h. (280 km/hr.) *Service ceiling:* 26,250 ft. (8,000 m.). *Range:* 2,175 miles (3,500 km.).

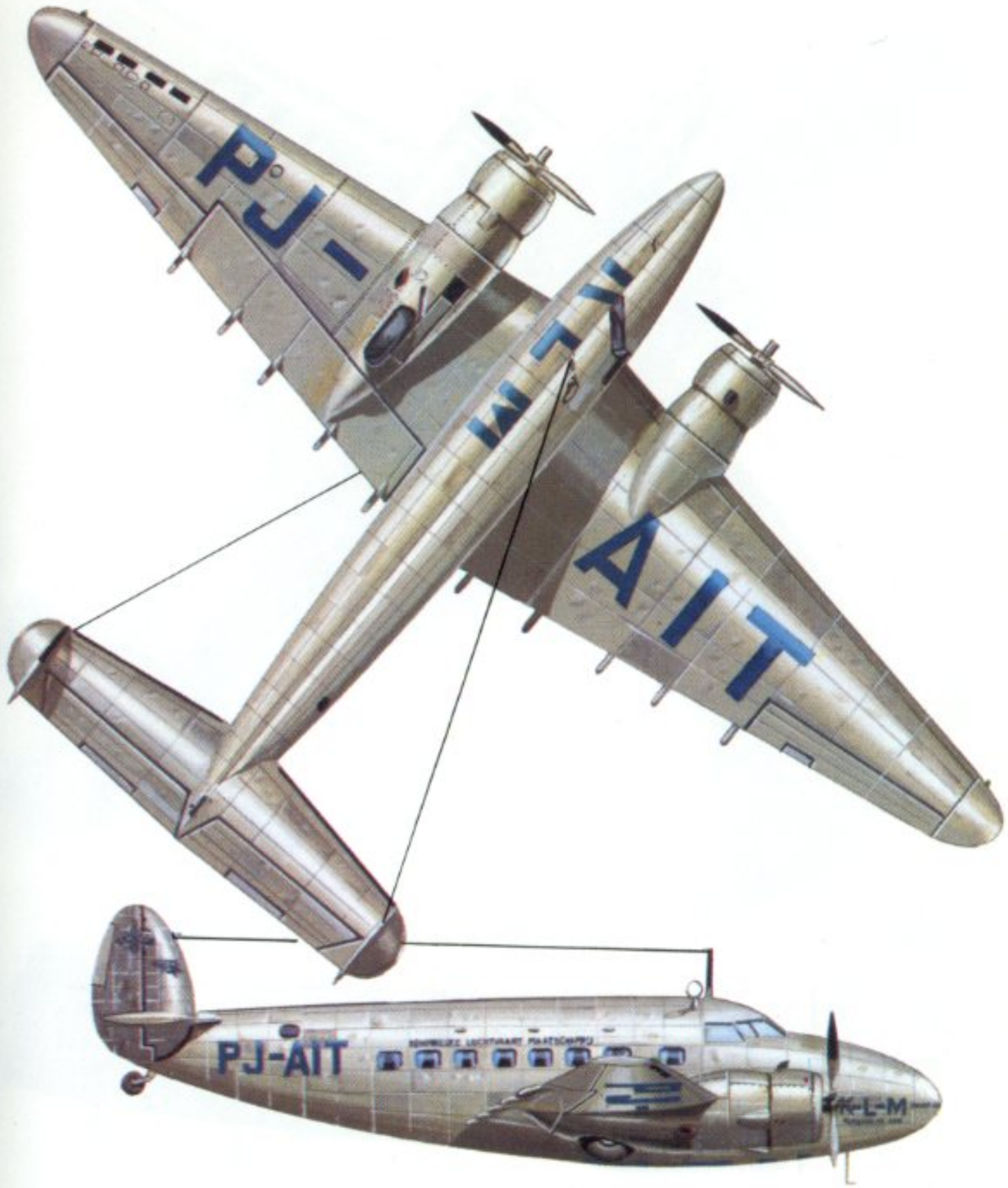
JUNKERS Ju 86 (Germany)

56

Junkers Ju 86 *Ryk Tulbagh* in 1936, with 745 h.p. Rolls-Royce Kestrel XVI twelve-cylinder Vee-type engines, prior to delivery to South African Airways. Later converted to Ju 86Z-7 standard, to which the following data apply. *Engines:* Two 800 h.p. Pratt & Whitney Hornet S1E-G nine-cylinder radials. *Span:* 73 ft. 9¾ in. (22.50 m.). *Length:* 57 ft. 5 in. (17.50 m.). *Wing area:* 882.6 sq. ft. (82.00 sq. m.). *Take-off weight:* 17,637 lb. (8,000 kg.). *Maximum cruising speed:* 224 m.p.h. (360 km/hr.) at 11,480 ft. (3,500 m.). *Service ceiling:* 25,590 ft. (7,800 m.). *Range:* 932 miles (1,500 km.).

57

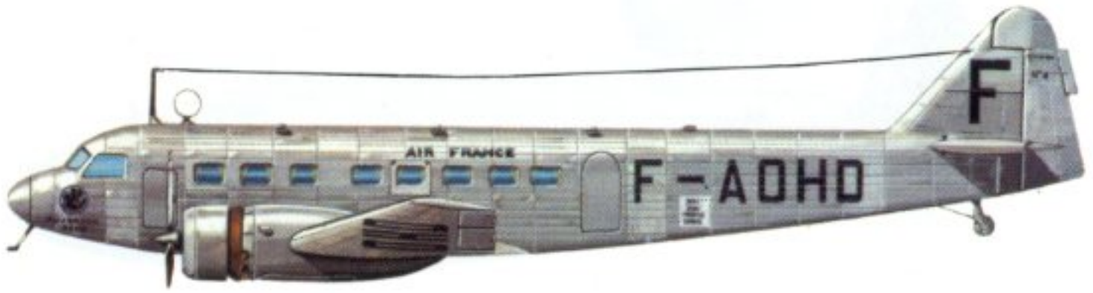
Lockheed Model 10 Electra of Eastern Air Lines, *ca* 1934-35. *Engines:* Two 440 h.p. Wright R-975-E3 Whirlwind nine-cylinder radials. *Span:* 55 ft. 0 in. (16.76 m.). *Length:* 38 ft. 7 in. (11.76 m.). *Wing area:* 458.5 sq.ft. (42.60 sq.m.). *Take-off weight:* 9,750 lb. (4,423 kg.). *Cruising speed:* 182 m.p.h. (293 km/hr.) at 5,000 ft. (1,524 m.). *Service ceiling:* 21,650 ft. (6,600 m.). *Range:* 810 miles (1,304 km.).



58

Lockheed Model 14 of Koninklijke Luchtvaart Maatschappij (KLM), 1938. *Engines.* Two 860 h.p. Wright Cyclone GR-1820-F62 nine-cylinder radials. *Span:* 65 ft. 6 in: (19.96 m.). *Length:* 44 ft. 4 in. (13.51 m.). *Wing area:* 551.0 sq.ft. (51.19 sq.m.). *Take-off weight:* 17,500 lb. (7,938 kg.). *Cruising speed:* 225 m.p.h. (362 km/hr.) at 13,000 ft. (3,962 m.). *Service ceiling:* 21,500 ft. (6,553 m.). *Range:* 1,590 miles (2,560 km.).

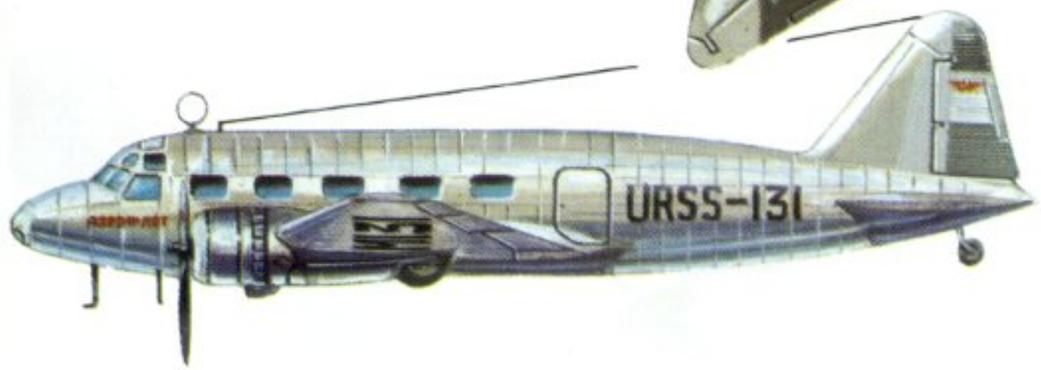
BLOCH 220 (France)



59

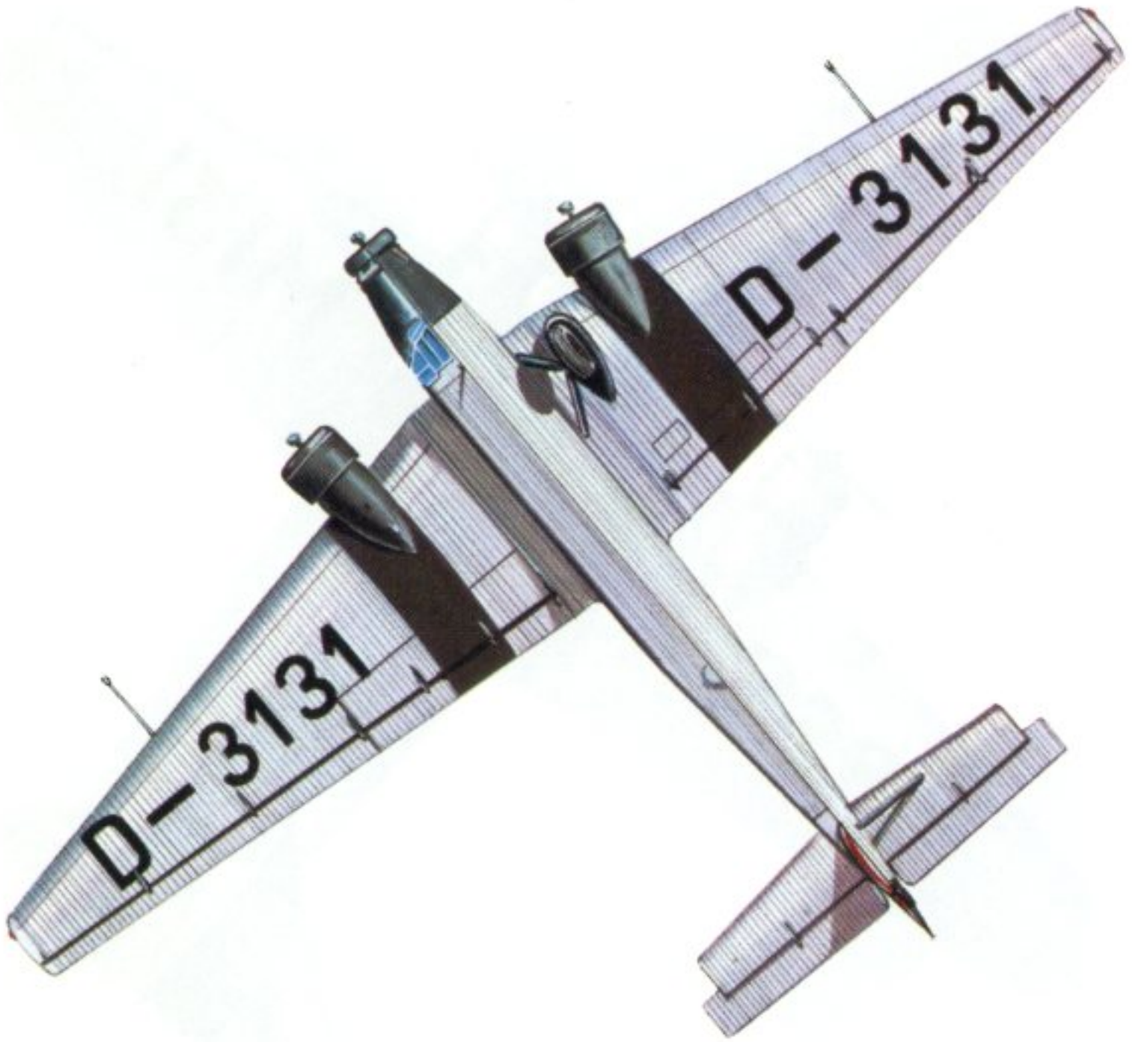
Bloch 220 *Auvergne* of Air France, *ca* 1937-38. *Engines:* Two 985 h.p. Gnome-Rhône 14N 16/17 fourteen-cylinder radials. *Span:* 74 ft. 10½ in. (22.82 m.). *Length:* 63 ft. 1¾ in. (19.25 m.). *Wing area:* 807.3 sq.ft. (75.00 sq.m.). *Take-off weight:* 20,944 lb. (9,500 kg.). *Cruising speed:* 174 m.p.h. (280 km/hr.). *Service ceiling:* 22,965 ft. (7,000 m.). *Range:* 870 miles (1,400 km.).

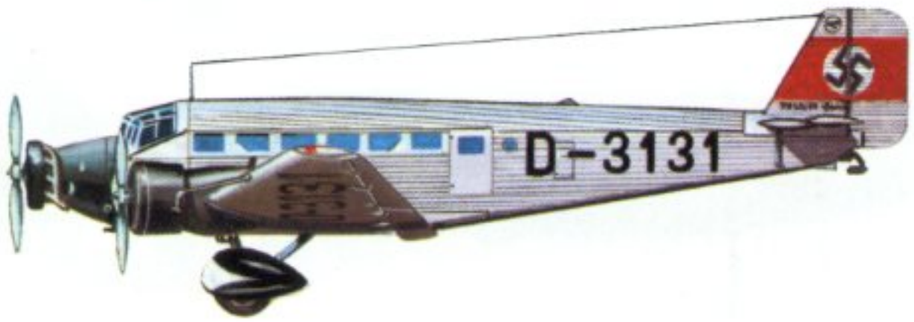
TUPOLEV ANT-35 (U.S.S.R.)



60

Tupolev ANT-35 (PS-35) of Aeroflot, early 1938. *Engines:* Two 850 h.p. M-85 (Gnome-Rhône 14N) fourteen-cylinder radials. *Span:* 68 ft. 3 in. (20.80 m.). *Length:* 49 ft. 0½ in. (14.95 m.). *Wing area:* 624.3 sq.ft. (58.00 sq.m.). *Take-off weight:* 14,594 lb. (6,620 kg.). *Cruising speed:* approx 217 m.p.h. (350 km/hr.). *Service ceiling:* 27,890 ft. (8,500 m.). *Range:* 1,243 miles (2,000 km.).





61

Junkers Ju 52/3m ge *Werner Voss* of Deutsche Luft Hansa, *ca* 1933. *Engines:* Three 660 h.p. BMW 132A-1 nine-cylinder radials. *Span:* 95 ft. 11½ in. (29.25 m.). *Length:* 62 ft. 0 in. (18.90 m.). *Wing area:* 1,189.4 sq.ft. (110.50 sq.m.). *Normal take-off weight:* 20,282 lb. (9,200 kg.). *Cruising speed:* 152 m.p.h. (245 km/hr.). *Service ceiling:* 17,060 ft. (5,200 m.). *Range:* 568 miles (915 km.).

62

Spartan Cruiser II *Faithful City* of Spartan Air Lines Ltd, 1933. *Engines:* Three 130 h.p. de Havilland Gipsy Major six-cylinder in-lines. *Span:* 54 ft. 0 in. (16.46 m.). *Length:* 39 ft. 2 in. (11.94 m.). *Wing area:* 436.0 sq.ft. (40.50 sq.m.). *Take-off weight:* 6,200 lb. (2,812 kg.). *Cruising speed:* 115 m.p.h. (185 km/hr.). *Service ceiling:* 15,000 ft. (4,570 m.). *Range:* 310 miles (499 km.).

STINSON MODEL A (U.S.A.)

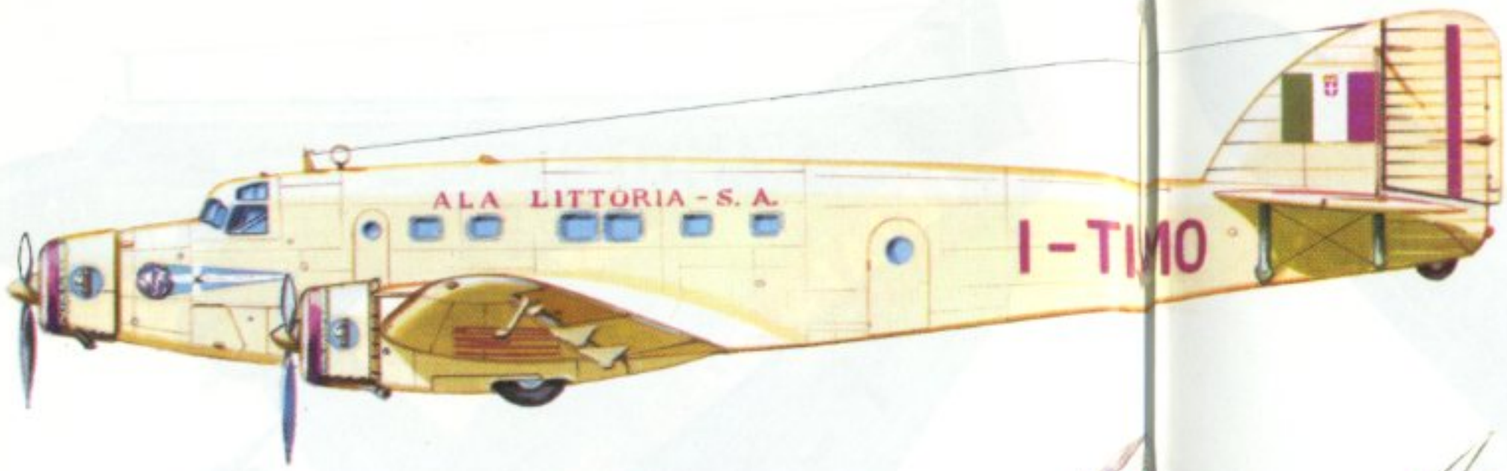
63

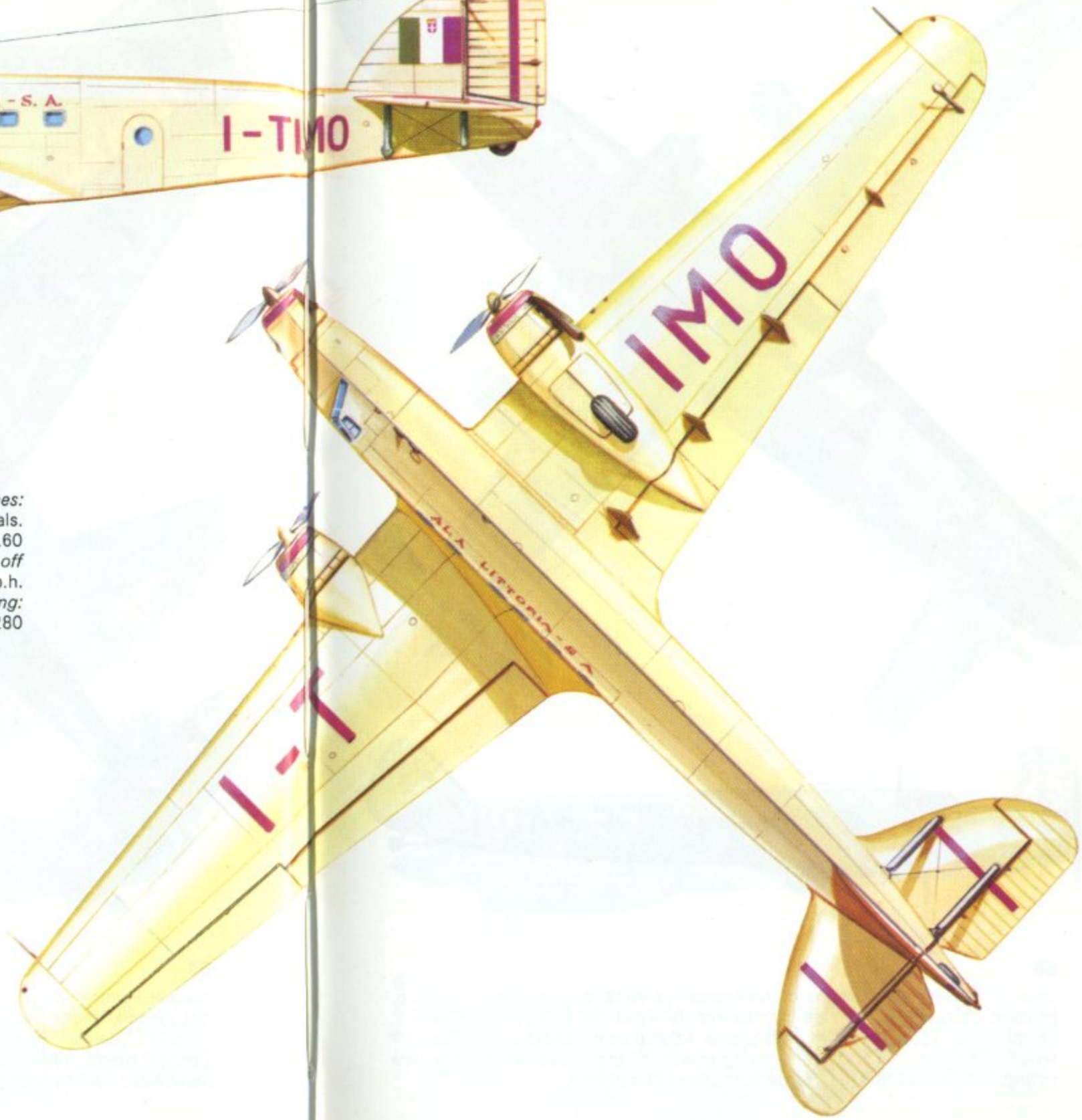
Stinson Model A of American Airlines Inc., *ca* 1936. *Engines:* Three 260 h.p. Lycoming R-680-5 nine-cylinder radials. *Span:* 60 ft. 0 in. (18.29 m.). *Length:* 36 ft. 10 in. (11.23 m.). *Wing area:* 500.0 sq.ft. (46.45 sq.m.). *Take-off weight:* 9,875 lb. (4,479 kg.). *Cruising speed:* 162 m.p.h. (261 km/hr.) at 5,000 ft. (1,524 m.). *Service ceiling:* 15,000 ft. (4,572 m.). *Range:* 400 miles (644 km.).

WIBAULT-PENHOËT 28 (France)

64

Wibault-Penhoët 283.T12 *Le Glorieux* of Air France, *ca* 1934. *Engines:* Three 350 h.p. Gnome-Rhône Titan Major 7Kd seven-cylinder radials. *Span:* 74 ft. 2¼ in. (22.61 m.). *Length:* 55 ft. 9¼ in. (17.00 m.). *Wing area:* 693.2 sq.ft. (64.40 sq.m.). *Take-off weight:* 14,000 lb. (6,350 kg.). *Cruising speed:* 143 m.p.h. (230 km/hr.). *Service ceiling:* 17,060 ft. (5,200 m.). *Range:* 620 miles (1,000 km.).

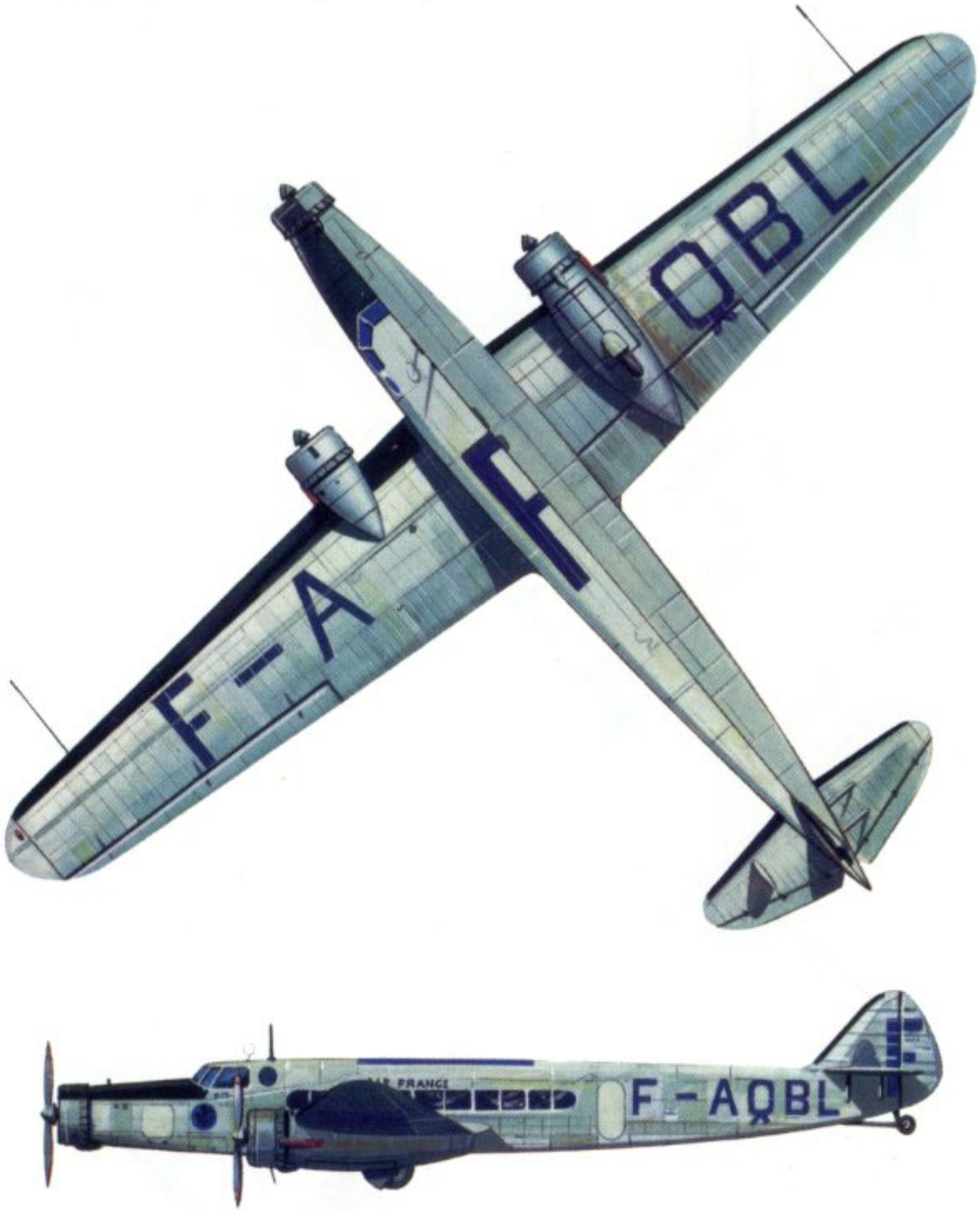




65

Savoia-Marchetti S.M.75 of Ala Littoria SA, 1938. *Engines:* Three 750 h.p. Alfa Romeo 126 RC 34 nine-cylinder radials. *Span:* 97 ft. 5½ in. (29.70 m.). *Length:* 70 ft. 10½ in. (21.60 m.). *Wing area:* 1,276.6 sq.ft. (118.60 sq.m.). *Take-off weight:* 31,967 lb. (14,500 kg.). *Cruising speed:* 202 m.p.h. (325 km/hr.) at 13,125 ft. (4,000 m.). *Service ceiling:* 22,965 ft. (7,000 m.). *Maximum range:* 1,417 miles (2,280 km.).

DEWOITINE 338 (France)



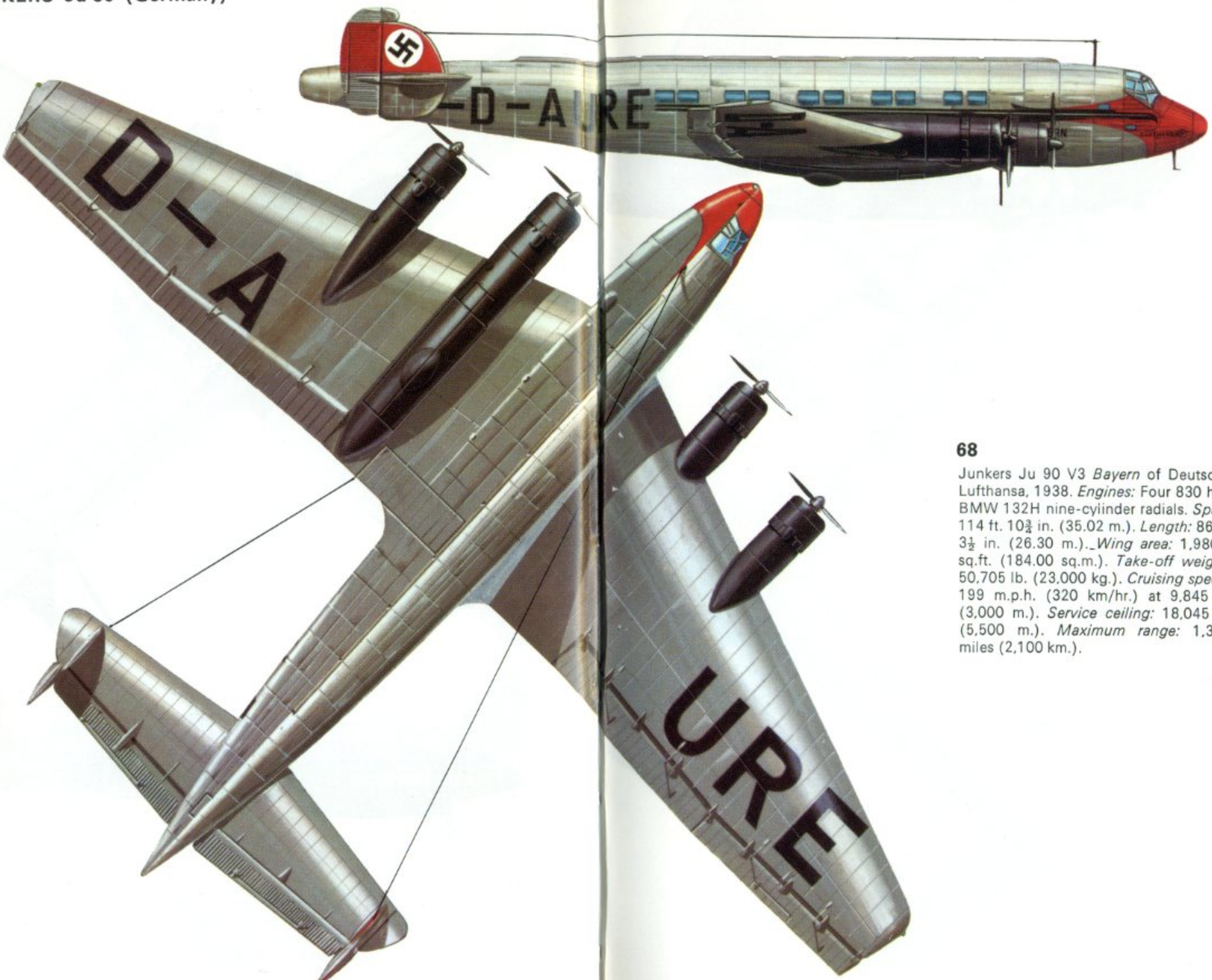
66

Dewoitine 338 *Ville d'Orléans* of Air France, *ca* 1938. *Engines:* Three 650 h.p. Hispano Suiza 9V 16/17 nine-cylinder radials. *Span:* 96 ft. 4¾ in. (29.38 m.). *Length:* 72 ft. 7½ in. (22.13 m.). *Wing area:* 1,065.6 sq.ft. (99.00 sq.m.). *Take-off weight:* 24,582 lb. (11,150 kg.). *Cruising speed:* 162 m.p.h. (260 km/hr.). *Service ceiling:* 16,075 ft. (4,900 m.). *Range:* 1,212 miles (1,950 km.).

CONDOR (Germany)

67

Focke-Wulf Fw 200 V2 Condor *Westfalen* of Deutsche Lufthansa, 1938. *Engines:* Four 720 h.p. BMW 132G-1 nine-cylinder radials. *Span(V2):* 107 ft. 9 in. (32.84 m.); *span (production version):* 108 ft. 3¼ in. (33.00 m.). *Length:* 78 ft. 3 in. (23.85 m.). *Wing area (V2):* 1,270.1 sq.ft. (118.00 sq.m.); *wing area (production version):* 1,291.7 sq.ft. (120.00 sq.m.). *Take-off weight:* 32,188 lb. (14,600 kg.). *Cruising speed:* 202 m.p.h. (325 km/hr.) at 9,845 ft. (3,000 m.). *Service ceiling:* 21,980 ft. (6,700 m.). *Normal range:* 777 miles (1,250 km.).



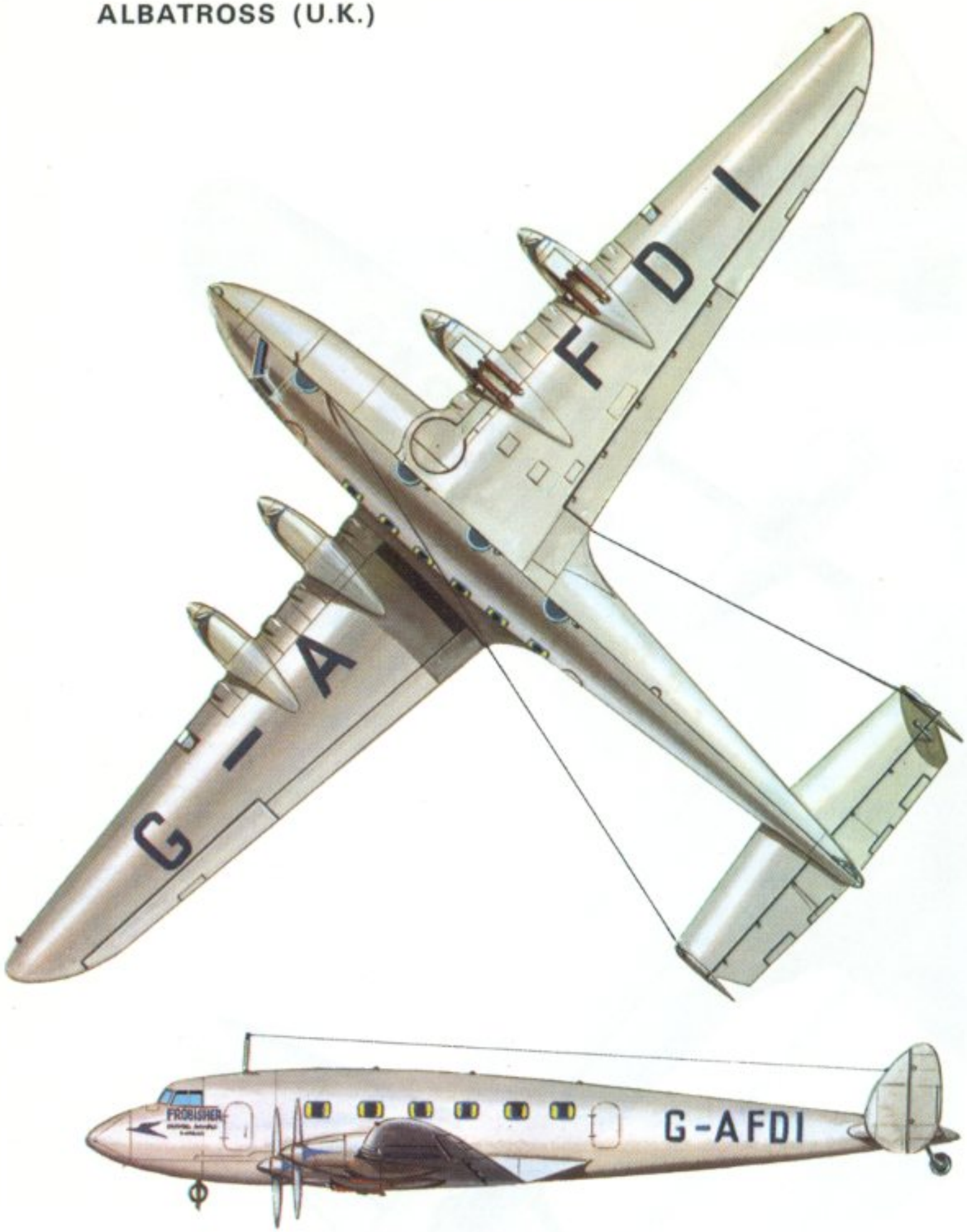
68

Junkers Ju 90 V3 *Bayern* of Deutsche Lufthansa, 1938. *Engines:* Four 830 h.p. BMW 132H nine-cylinder radials. *Span:* 114 ft. 10¾ in. (35.02 m.). *Length:* 86 ft. 3½ in. (26.30 m.). *Wing area:* 1,980.6 sq.ft. (184.00 sq.m.). *Take-off weight:* 50,705 lb. (23,000 kg.). *Cruising speed:* 199 m.p.h. (320 km/hr.) at 9,845 ft. (3,000 m.). *Service ceiling:* 18,045 ft. (5,500 m.). *Maximum range:* 1,305 miles (2,100 km.).

STRATOLINER (U.S.A.)

69

Boeing Model SA-307B Stratoliner of Transcontinental and Western Air (TWA), 1940. *Engines:* Four 1,100 h.p. Wright GR-1820-G105A Cyclone nine-cylinder radials. *Span:* 107 ft. 3 in. (32.69 m.). *Length:* 74 ft. 4 in. (22.66 m.). *Wing area:* 1,485.8 sq.ft. (138.03 sq.m.). *Take-off weight:* 45,000 lb. (20,412 kg.). *Cruising speed:* 222 m.p.h. (357 km/hr.) at 19,000 ft. (5,790 m.). *Service ceiling:* 23,800 ft. (7,255 m.). *Range with maximum payload:* 1,675 miles (2,695 km.).



70

De Havilland D.H.91 Albatross *Frobisher* of Imperial Airways Ltd, 1939. *Engines:* Four 525 h.p. de Havilland Gipsy Twelve Series I twelve-cylinder inverted-Vee type. *Span:* 105 ft. 0 in. (32.00 m.). *Length:* 71 ft. 6 in. (21.79 m.). *Wing area:* 1,078.0 sq.ft. (100.15 sq.m.). *Normal take-off weight:* 29,500 lb. (13,381 kg.). *Maximum cruising speed:* 210 m.p.h. (338 km/hr.) at 11,000 ft. (3,355 m.). *Service ceiling:* 17,900 ft. (5,455 m.). *Normal range:* 1,040 miles (1,674 km.).

1 Breguet 14

The Breguet 14, one of France's finest bomber and reconnaissance aircraft of World War 1, remained in production until 1926, by which time about eight thousand had been built. These were mostly for military use, and the Breguet 14's wartime use is described in the *Bombers 1914–19* volume. After the war somewhere in the region of a hundred and fifty served in a civilian role, including many converted specially for the carriage of mails, passengers or cargo. The first, and by far the largest, commercial operator of the Breguet 14 was Lignes Aériennes Latécoère, which opened its first service, from Toulouse to Barcelona, on 25 December 1918. This was but the first stage in a prolonged and courageous movement to establish a regular scheduled service between France and South America. In September 1919 the network was extended to Rabat, in April 1920 to Casablanca, in October 1922 to Oran, and in June 1925 to Dakar. In all, 'The Line' acquired no fewer than one hundred and six Breguet 14's, most of them of the standard Br.14A2 (military 2-seat reconnaissance) type with minimal modification. The Latécoère fleet also included a few ex-bomber Br.14B2's, and some civil Breguet 14T and 14T*bis*.

The second-largest operator, with twenty-five Breguet 14T/14T2/14T*bis*, was Compagnie des Messageries Aériennes (CMA). This was formed in early 1919 by a consortium which included some of the most famous names in French aviation history – Louis Blériot, Louis Breguet, René Caudron, Henry Farman, Robert Morane, Louis Renault and L. Saulnier – and it began operations on 18 April 1919 with a cargo service between Paris and Lille. With subsequent expansion it, too, carried passengers and mail, and extended its services from Paris to Brussels (August 1919), London (September 1919), Amsterdam (June 1921) and Marseilles (May 1922). The first passenger service was flown on 19 September 1919. Subsequent CMA disposals included two or more to Latécoère, but at least ten were absorbed into the fleet of Air Union, formed in January 1923 from a merger of CMA and CGEA. Breguet 14's were also operated in small numbers by the Belgian airline SNETA, which had three Fiat-engined Br.14A2's; by Compagnie des Transports Aériens Guyanais in French Guiana, which used five or more on a short-lived service from St Laurent to Cayenne and Inihi in 1919–20; by the Thailand Royal Aeronautical Service, which operated a non-scheduled mail service between Korat and Ubol, starting in 1922, and possibly passenger services thereafter; by Compania Rioplatense de Aviacion in Argentina, which (also in 1922) flew a service between Buenos Aires and Montevideo for a short period; and in 1928 by Aeroposta Argentinas, a subsidiary of the Latécoère successor, Aéropostale. One Breguet 14, possibly Italian-built, was operated by SA Navigazione Aerea in 1925, and two Breguet 14T*bis* were flown by the Swedish Red Cross.

The precise designation of the civil Breguet 14 versions is not entirely clear. The standard A2 and B2 military versions seated 2 persons, in separate open cockpits in tandem aft of the wings. The Latécoère fleet included at least eighty-one A2's and four B2's; there were at least five examples of a version

known as the Torpédo, a name signifying 'open tourer' which is believed to apply also to the A2 in its civilian form. There were two aircraft, possibly more, known as Limousines, a designation which may relate to a known Latécoère conversion which provided a crude cabin enclosure over the rear cockpit. Latécoère carried out considerable overhaul and modification of his Breguet fleet, most of which were purchased as war-surplus military machines. The principal conversion was made for the mail-carrying operations which constituted the bulk of the airline's business. For these operations the aircraft were at first flown as single-seaters, and the mail carried in two streamlined containers, one attached beneath each lower wing. Later, as the network extended across French North Africa, the mail was often stowed in the rear fuselage. This provided a somewhat lumpy seat in the rear cockpit for a Moorish interpreter, whose presence was deemed necessary after a number of Aéropostale's Breguets had been destroyed in the desert by marauding tribesmen.

The true cabin versions of the Breguet 14 seem to have originated with the 14T2 Salon, a 2-passenger version which first appeared (F-CMAA) in 1919. This housed the passenger within the forward fuselage, with small rectangular windows provided in the upper decking. Breguet also produced in 1919 the Br.18T Berline, a larger aircraft based on the Br.16 bomber, powered by a 450 hp Renault 12Ja engine and seating 4 passengers. So far as is known only one (F-CMAX) was built, though a 3-seat version of the T2 appeared later. The final model, the 14T*bis*, combined features of both the Br.18T and the 14T2. The prototype, F-CMAL, was flown for the first time on 13 September 1921, and a military ambulance version was also developed. Many Breguet 14's were operated, at some period during their lives, on a float landing gear, and in the case of the Swedish ambulance aircraft a ski gear was also in use at times.

2 de Havilland D.H.4A, D.H.9, D.H.16 and D.H.18

The British government authorised the post-war resumption of civil flying to and from the UK with effect from 15 July 1919, and on that day Britain's first airline carried its first fare-paying passenger. It was a charter flight, from London to Paris, and was made in a de Havilland D.H.9B. Just over a month later, on 25 August, Captain Bill Lawford of Air Transport and Travel Ltd flew with another passenger to Paris, this time in a D.H.4A, in what was probably a positioning flight for the departure flight later that day from Paris to London. The true inaugural flight by AT & T, of the first regular daily international service, was made in yet another de Havilland type: a D.H.16, piloted by Major Cyril Patteson, who left London at 12.30 pm on 25 August carrying 4 passengers for Le Bourget.

AT & T, before it went out of business at the end of 1920, had on charge two D.H.4's, four D.H.4A's, sixteen D.H.9's or D.H.9B's, eight D.H.16's and three D.H.18's. The D.H.4's were simply ex-RAF machines with their armament removed and a 2-seat open rear cockpit, but the D.H.4A was a genuine civil conversion with an enclosed 2-seat passenger cabin aft

of the front cockpit. In addition to those converted for AT & T, two were completed for Handley Page Transport Ltd, for services to Paris and Schiphol, and one other was operated by The Instone Air Line Ltd. This last-named aircraft, G-EAMU, was originally an ex-RAF D.H.4 and bore the Instone fleet name *City of Cardiff* when it began operation on 12 October 1919. Sixteen months later it was converted to D.H.4A standard and placed in service between Croydon and Paris as *City of York*; it survived to be taken over – though not operated – by Imperial Airways in 1924.

In addition to the AT & T D.H.9's, ten others formed part of the Handley Page Transport fleet from 1920, and AT & T sold four of its D.H.9's to KLM, on whose behalf it had previously flown them on services to Amsterdam. Another 2-seat cabin conversion, recognisable by its sweptback wings, was the D.H.9C, five of which were operated on charter and taxi flights by the de Havilland Aeroplane Hire Service. The cabin conversion approach was taken a stage further with the D.H.16, which was based on the airframe and powerplant of the wartime D.H.9A but had the rear fuselage enlarged to seat 4 passengers in the cabin. Nine were built, five of the AT & T aircraft having 320 hp Rolls-Royce Eagle VIII engines and the other three having 450 hp Napier Lions. The remaining aircraft was sold to Compania Rioplatense de Aviacion in Argentina.

The first de Havilland type designed from the outset for airline work was the D.H.18, whose prototype (G-EARI) flew for the first time in early 1920. This was also Lion-powered, had a gross weight of 7,116 lb (3,228 kg) and a cabin seating up to 8 passengers. The pilot occupied an open cockpit aft of the cabin. Wing span and area were, respectively, 51 ft 3 in (15.62 m) and 621.0 sq ft (57.69 sq m), overall length was 39 ft 0 in (11.89 m), and the D.H.18 had a cruising range of 400 miles (644 km). The three AT & T D.H.18's passed in 1921 to Instone, which also acquired a fourth. One of these, G-EAWO, was loaned to The Daimler Airway in 1922 and promptly became the victim of a head-on collision with a Farman Goliath while on its first flight for its new operator. The three surviving Instone D.H.18's were retired from airline service in 1923.

3 Westland Limousine

As its name suggests, the Limousine was an attempt, by the Westland design staff led by Arthur Davenport, to introduce saloon-car comfort as an improvement upon the often crudely-furnished converted World War 1 aeroplanes that were the first post-war entrants into the field of air transport. The prototype Limousine I (K-126) made its first flight in July 1919, powered by a 275 hp Rolls-Royce Falcon III fitted with a circular radiator – an installation closely resembling that in the Bristol Fighter. Access was gained via a door on the starboard side. The interior was arranged with separate, well-upholstered armchair seats in two side-by-side pairs. The front starboard seat faced rearward, the other three forward, and there was a small table in front of the forward seat on the port side. The pilot occupied the rear port-side seat, elevated 2 ft 6 in (0.76 m) above the others to enable his head and shoulders to

protrude through a hole in the roof. With the passenger seats removed, the aircraft could carry 540 lb (245 kg) of cargo. The Limousine I, later re-registered G-EAFO, was Westland's first civil product, and made many demonstration appearances during its first year. While doing so it featured in one of the earliest recorded uses of an aeroplane as a business executive transport when Robert J. Norton, Westland's commercial manager, dictated letters to his secretary during a flight and had them typed, signed and ready to post when the Limousine landed. In October 1919 Westland completed a prototype (G-EAJL) of the Limousine II – still a 4-seater, but with the Falcon III engine fitted with a rectangular radiator and other structural changes which included a slightly shorter wing span and an increase in the fin and rudder area. During the summer and autumn of 1920 these two Limousines were loaned to Air Post of Banks Ltd for an experimental mail service between Croydon and Paris. Afterwards, G-EAFO went back to Westland as company communications aircraft until September 1925, when it was destroyed at RAF Netheravon.

Four other Limousine II's (G-EAMV, G-EARE, G-EARF and G-EARG) were built in 1920; the registration G-EARH was also allotted, but this sixth Limousine II is not thought to have been completed. Of the others, G-EAMV, first flown in April 1920, was initially completed as a testbed for the Cosmos Jupiter III radial engine (later to become the famous Bristol Jupiter), but subsequently became a standard Falcon-engined machine, as was G-EARG. The other two Limousine II's were leased to The Instone Air Line in late 1920. They were powered by 300 hp Hispano-Suiza engines and carried their fuel in tanks beneath the lower wings, a safety factor to permit passengers to smoke in the cabin during a flight. Instone bought the two aircraft outright in June 1922, and kept them in operation until about a year later.

Meanwhile, Westland had also produced in 1920 an enlarged, 6-seat Limousine III, powered by a 450 hp Napier Lion engine. The prototype, G-EARV, was entered in 1920 in an Air Ministry competition to find safe, comfortable commercial aircraft to operate European services. The Limousine III had main-wheel braking and a pair of small anti-noseover wheels ahead of the main gear; the underwing fuel system, as on the Instone Limousine II's, was retained. The Limousine III won the £7,500 first prize in the small aeroplane class, but the expected commercial demand did not materialise and only one other (G-EAWF) was built. This was sold in April 1921 to the Air Council, which loaned it to Instone until 1923 as a reserve aircraft; it was scrapped at the end of 1925. The original Limousine III had, in the meantime, been sold to F. S. (Sidney) Cotton, of 'Sidcot' flying suit fame, in January 1921. Cotton's Aerial Survey Company operated it in Newfoundland as a seal- and fish-spotting aircraft, fitting it with a ski landing gear during the winter months. Later, it took part in a 'gold rush', when a strike was reported at Stag Bay, Labrador. Cotton, at least, was evidently impressed with the Limousine's capabilities, for in 1922 he also purchased the three Falcon-engined Limousine II's for similar duties.

4 de Havilland D.H.34

Succeeding the D.H.18 as de Havilland's next production airliner, the D.H.34 also utilised the reliable Napier Lion as powerplant, and had cabin seating for up to 9 passengers in individual chairs. The cockpit, however, was moved to a new position ahead of the wings, and seated 2 pilots side by side. Provision was made to carry a spare engine, stowed athwart the fuselage behind the rear seats; the cabin door was shaped so as to permit straight-in loading of the engine, and the propeller shaft protruded through a hole in the starboard cabin wall which was covered by a plate when no spare engine was carried.

First airline customer was Daimler Hire Ltd, owner and operator of The Daimler Airway, which placed an initial order for two. The first D.H.34 to fly, G-EBBQ, on 26 March 1922, was one of this pair, the other being G-EBBS; it was delivered to the airline five days later, and flew its first operational service, to Paris, on 2 April 1922. Under the purchasing policy prevalent at the time the Air Council also ordered seven D.H.34's (later increased to nine), and four of the first batch (G-EBBR *City of Glasgow*, G-EBBT *City of New York*, G-EBBV *City of Washington* and G-EBBW *City of Chicago*) were loaned to Instone Air Line, which flew its inaugural D.H.34 service to Paris on the same day as Daimler. Four of the others (G-EBBU, G-EBBX, G-EBBY and G-EBCX), were loaned to Daimler, the final Air Council machine (G-EBCY) being allocated to the Royal Aircraft Establishment at Farnborough. One other D.H.34, bringing the total built to twelve, was completed and delivered to the Soviet airline Dobrolet.

In the early post-war years there was much wasteful competition between the small, struggling British airlines in the form of unnecessary route duplication. In 1922 this was regularised by the allocation of specific routes to particular airlines, and thereafter Instone was allotted the Brussels and Cologne service while Daimler operated a new service to Berlin via Amsterdam and either Hanover or Hamburg, opened by G-EBBS on 30 April 1923. By the time the two fleets became part of Imperial Airways in 1924, Instone had lost one D.H.34 and Daimler three in crashes; in 1926 the four Imperial Airways survivors (two more having been lost in crashes in the meantime) were scrapped.

5 de Havilland D.H.50

The satisfactory service given by civil D.H.9's on short-range scheduled services and aerial taxi work led to the development of the D.H.50 as a peacetime successor. The D.H.50 bore many similarities to the D.H.9, had the same 230 hp Siddeley Puma engine, and could accommodate 4 passengers in an enclosed cabin. The pilot occupied an open cockpit aft of this cabin. It proved extremely economical and reliable and was built under licence in three countries. It was also the aircraft flown by Alan Cobham on several long-distance flights which not only earned their pilot a well-deserved knighthood but pioneered some of the Empire routes later to be flown by Imperial Airways.

The prototype D.H.50 (G-EBFN *Galatea*) was flown for the first time in early August 1923, and served for some 2½ years with the de Havilland Hire Service before being

sold in February 1926 to West Australian Airways as G-AUEY. The second D.H.50, G-EBFO, was used by Cobham for the Empire flights, which began with a 17,000 mile (27,360 km) journey from England to Rangoon between 20 November 1924 and 18 March 1925. The aircraft was refitted with an uncowled 385 hp Armstrong Siddeley Jaguar III radial engine, giving it the new designation D.H.50J, before undertaking a 16,000 mile (25,750 km) survey flight from Croydon to Cape Town between 16 November 1925 and 17 February 1926. It underwent a third major change, to a twin-float landing gear, before leaving Rochester on 30 June 1926 for Melbourne. The final landing back in London, on 1 October 1926, was made on the Thames at Westminster, opposite the Houses of Parliament. These flights covered, in all, a distance of some 62,000 miles (99,780 km).

Fourteen of the remaining fifteen aircraft built by de Havilland were D.H.50A's, these having a slightly longer cabin, greater radiator area for the Puma engine and minor changes to the centre-section strutting and landing gear position. They were built for Imperial Airways for charter operations (G-EBFP and G-EBKZ); for Air Taxis (G-EBQI); for West Australian Airways' Wyndham-Perth-Adelaide service (G-AUEL and G-AUEM); QANTAS (G-AUER); Australian Aerial Services for the Adelaide-Sydney air mail run (G-AUEI, G-AUEJ and G-AUEK); the Royal Australian Air Force (G-AUAB and A8-1); Australia's Controller of Civil Aviation (G-AUAY); the New Zealand Air Force (serial number 135); and the Czechoslovak government (L-BAHG). The British total was made up by G-EBOP *Pelican*, built for the North Sea Aerial and General Transport Co as a D.H.50J floatplane, the J suffix in this case denoting installation of a 420 hp Bristol Jupiter IV engine. West Australian Airways added a fourth British-built D.H.50 to its fleet in January 1929 by acquiring Cobham's famous G-EBFO, refitted with a 300 hp ADC Nimbus engine; it also built three D.H.50A's (G-AUFD, 'FE, and 'FN) under licence at Perth in 1927. In all, twenty-one D.H.50's were built under foreign licence, to bring total production of the type to thirty-eight. QANTAS (Queensland And Northern Territory Aerial Services), having passed on G-AUER to become *Hermes* (later *Victory*), the first aircraft of the Australian Flying Doctor Service, built at Longreach between 1926 and 1929 four Puma-engined D.H.50A's (G-AUFA/FW/GD/HE) and three D.H.50J's (G-AUHI and 'JS and VH-ULG) with 450 hp Bristol Jupiter VI engines. One other D.H.50A was built in Australia, this being VH-UMN, completed by the Larkin Aircraft Supply Co for Australian Aerial Services. A number of the D.H.50A's operating in Australia were subsequently fitted with Jupiter powerplants. The delivery of L-BAHG to Czechoslovakia in early 1925 was followed in 1926 by the licence manufacture of seven more D.H.50A's (L-BALA to 'LG) by Aero, which were powered by 240 hp Walter W-4 in-line engines and operated by CLS (Ceskoslovenská Letecka Spolecnost). Three others (O-BAHV, 'HW and 'HX) were built in Belgium by SABCA in 1925 and operated on Sabena's Congo route between Kinshasa and Stanleyville.

Many D.H.50's continued in service until the mid-1930s, and a few were still extant at and after the outbreak of World War 2.

6 Spad 27/33/46/50/56 series

If the celebrated Spad fighters of World War 1 are indissolubly associated with the name of their chief designer, Louis Béchereau, then the family of Spad biplanes and monoplanes which appeared in the 1920s and 1930s are no less of a tribute to André Herbemont, who inherited from Béchereau the continued development of Spad aeroplanes. Herbemont's first association was with the Spad XX 2-seat fighter, from which stemmed a line of military types typified by the Spad 510 described in the volume on *Fighters 1919–39*; and there is a detectable family resemblance between these and the series of commercial passenger-carrying 'berlines' which emanated from the same design source during the 1920s.

Built by the Société Anonyme Blériot-Aéronautique, these began with the appearance of the Spad 27, flown for the first time in November 1919. Built for Compagnie des Messageries Aériennes (CMA), the Spad 27 was in essence a 'limousine' version of the Spad XX, having an open single cockpit for the pilot and an enclosed cabin for 2 passengers in the rear fuselage. Powered by a 270 hp Hispano-Suiza 8Fa engine, it was capable of a maximum speed of 155 mph (250 km/hr), and on 24 December 1919 a Spad 27 with a pilot and one passenger on board was flown to a world altitude record of 24,770 ft (7,550 m). The Spad 27 was operated by CMA between Paris and London, and it is believed that ten examples were built, although comparatively few can be confirmed by known registrations. One of these, F-CMAW, was a version with 3 passenger seats in open cockpits, known as the Spad 37.

The first major production 'berline' was the Spad 33, whose prototype (F-CMAZ) made its first flight on 12 December 1920. Forty production aircraft were built, to fulfil orders from CMA (fifteen), Compagnie Franco-Roumaine de Navigation Aérienne (twenty) and the Belgian airline SNETA (five). The aircraft operated by CMA, which included the prototype, had 250 hp Salmson 9Z water-cooled radial engines, the remainder being fitted with the Salmson 9Cm of 260 hp. Four passengers were accommodated in the cabin in the front of the fuselage, and aft of this were two side-by-side open cockpits for the pilot and a fifth passenger. A small number of Spad 33's were used for experimental purposes. One CIDNA aircraft (F-AICC) was fitted with enlarged wings and dual controls as an airline trainer for blind-flying instruction, and in 1922 another CIDNA machine became a Spad 33*bis* (later redesignated Spad 47) when fitted with a 300 hp Salmson engine. One of CFRNA's aircraft (F-FRAU) became, in 1921, the sole Spad 48 when fitted with a 275 hp Lorraine engine. Studies were undertaken, on behalf of SNETA, for a Spad 49 version powered by a 350 hp Rolls-Royce Eagle VIII engine, but no such aircraft was built. The production career of the Spad commercials continued with the Spad 46, manufacture of which also amounted to forty examples, excluding the prototype. Of the same seating capacity as the Spad 33, it had a wing span

increased from 38 ft 3 in (11.66 m) to 41 ft 5½ in (12.64 m) and was powered by a 370 hp Lorraine-Dietrich 12Da Vee-type engine, increasing the maximum speed from 112 mph (180 km/hr) to 133 mph (214 km/hr). This speed increase was at some cost in range, which dropped from 670 miles (1,080 km) in the Spad 33 to 497 miles (800 km) in the Spad 46. The prototype Spad 46 (F-AGFD) was flown on 16 June 1921; this machine and thirty-eight of the production aircraft were delivered to CFRNA, which became CIDNA (Compagnie Internationale de Navigation Aérienne) on 1 January 1925. More than forty of CIDNA's Spad 33's and 46's later underwent detail improvements, after which they were redesignated Spad 66. Another, F-AEHH, was refitted with a 450 hp Renault 12Ja to become the sole Spad 116. One aircraft (F-AHDI) became the Spad 86 when fitted with an early example of 450 hp Lorraine-Dietrich W-type engine in 1922, and Spad 126 in 1929 after refitting with a 450 hp Hispano-Suiza 12Ha. Neither version attained production status, and proposals for a strut-braced monoplane version of the former, as the Spad 86*bis*, were not pursued.

Two prototypes were built of the Spad 50, the first of which (F-ESAX, later F-ADAR) was flown on 23 December 1921. This was, essentially, the Spad 33 airframe fitted with a 275 hp Hispano-Suiza 8Fg or 8Fd engine. No production was undertaken, although three Spad 33's were re-engined to the same standard. All five became part of the Air Union fleet. The final production model was the Spad 56, which appeared in six versions, all powered by Gnome-Rhône-built Bristol Jupiter engines. Representing the sole Spad 56-1, the prototype which flew first (3 February 1923) was F-AGEO, powered by a 380 hp Jupiter 9Aa. This version had metal-structure wings, with the span increased to 42 ft 11 in (13.08 m); maximum speed was 122 mph (196 km/hr). Total passenger capacity remained as before, but the twin open cockpits were merged into one and there was an additional door to the cabin. The Spad 56-2 (F-AIDC, first flight 28 September 1925) was a single example, with a 400 hp Jupiter 9Ab, equipped for the personal use of Louis Blériot. The next airframe change came with the Spad 56-3, in which the wing span was further increased to 43 ft 1 in (13.13 m). Six with 380 hp Jupiter 9Aa engines were built for CIDNA (first flight 14 June 1926, by F-AIEE), and two with 420 hp Jupiter 9Ac engines for Air Union. The Spad 56-4, first flown on 25 October 1926 (possibly F-AIMN), was, although retaining the same overall dimensions, a version with more power (420 hp Jupiter 9Ac), cabin accommodation for 6 persons, and a single cockpit located forward of a raised upper wing. Five were built for Air Union and three for CIDNA, the latter airline also converting two of its Spad 56-3's to this standard. The Spad 56-5 was a convertible passenger/cargo version, in which the cabin was partitioned aft of the 4 front seats, the rear compartment being usable either for 2 more passengers or for freight. It flew for the first time in 1928, the prototype being converted from the Spad 56-3 F-AIEM. The only operator was CIDNA, which had seven, produced by converting six of its 56-3's and one 56-4. The final version of the Spad 56 was the 56-6, which had a 380 hp Jupiter and a 4-passenger cabin. Two were built, the first example (F-AJVA) being flown on 6 September 1929, but neither of these was for airline use.

The Blériot-Spad 'berlines' operated through many of the countries of Europe throughout the 1920s, and some were still in service as late as 1930. With CMA, and later with Air Union, they were used on services from Paris to London, Amsterdam, Brussels, Marseilles and elsewhere; CFRNA/CIDNA routes included Paris to Bucharest (via Strasbourg, Zurich, Innsbruck, Vienna, Budapest and Belgrade) and branches from Vienna to Warsaw (via Prague) and Bucharest to Constantinople; SNETA shared some early routes with CMA.

7 Avia BH-25

The output of nationally-designed transport aircraft by the Czechoslovak aircraft industry between 1919 and 1939 was extremely small, both in terms of individual types and of overall production. Of eight native designs known to have operated in regular airline service – most of them with CSA, the national carrier – none, so far as can be ascertained, achieved a production run that went into double figures. Only two types – the Aero A-35 and Letov S-32 – were monoplanes, and only these two and the Aero A-38 had enclosed cockpits for the crew. All were single-engined except the S-32, which was a tri-motor, and passenger seating capacity ranged from 3 in the Aero A-10 (Czechoslovakia's first commercial transport type) and A-22 to 8 in the A-38.

Typical of the industry's products of the period was the BH-25, designed by Paul Benes and Miroslav Hajn and manufactured by Avia at Prague-Cakovice. It was unusual in that the lower wings were of slightly greater span than the upper one. Forward of the wings was an open cockpit, with side-by-side seating for the crew. The enclosed passenger cabin had seats for 6 persons and space for up to 220 lb (100 kg) of baggage, equivalent to a total useful load of 1,278 lb (580 kg). All 6 circular cabin windows could be opened in flight, and an escape hatch was provided in the top of the fuselage.

The BH-25 prototype (L-BABA) was powered by a 450 hp Skoda-built Lorraine-Dietrich water-cooled 'W' engine, and first flew in July 1926. After flight testing, a number of major airframe modifications were made before production began. These included a change of powerplant, to the 420 hp Walter-built Bristol Jupiter IV radial; an increase in the length of the nose section of the fuselage; the addition of a vertical fin with a non-balanced rudder (the aircraft having originally had a balanced rudder and no fin); and the transfer of the twin fuel tanks from beneath to above the centre-section of the upper wing. Production BH-25's were similar except that the fuel was housed in a wider but shallower single tank.

Two airline operators of the BH-25 are known. The Czechoslovak airline CLS (Ceskoslovenská Letecka Spolecnost) operated the prototype and four other aircraft (L-BABA/B/C/E/F, later re-registered OK-ABA/B/C/E/F) on services from Prague to Berlin and Rotterdam; and SNNA (Serviciul National de Navigatie Aeriana) of Romania operated four aircraft

(YR-AAA/B/C/D) on internal services in about 1928.

8 **Vickers Vimy (civil) and Vimy Commercial**

As described in the *Bombers 1914–19* volume in this series, the Vickers F.B.27 Vimy twin-engined bomber was developed too late to perform operational service during World War 1, although it was to remain a standard RAF post-war type until the early 1930s (see *Bombers 1919–39*). Within a matter of months after the Armistice, however, the name Vimy was to achieve a prominence that by the end of 1919 was literally world-wide. First came the non-stop trans-Atlantic flight by Capt John Alcock and Lt Arthur Whitten-Brown, made in a specially-modified standard Eagle-engined Vimy that had been flown for the first time (by Alcock) on 18 April 1919. With modified seating, and carrying extra fuel tanks in the fuselage, this aircraft was flown on 14–15 June 1919 from St Johns, Newfoundland, to Clifden, on the west coast of Ireland, to win the £10,000 prize offered by the *Daily Mail* for the first non-stop aeroplane crossing of the Atlantic Ocean. Earlier that year, in March, the Australian government had offered a prize of £A10,000 for the first flight from England to Australia by an Australian crew in a British aeroplane. After Alcock and Brown's success, the Vimy was a natural choice for the attempt, which was made by two brothers, Capt Ross and Lt Keith Smith of the Australian Flying Corps, with two fellow-Australians, Sgts J. M. Bennett and W. H. Shiers, as mechanics. The Vimy used for the flight was an ex-RAF machine, F8630; it received the civil registration G-EAOU, which a would-be wit was prompted to suggest stood for 'God 'Elp All Of Us'. His pessimism was unjustified, however, for G-EAOU achieved its goal in the remarkable space of 135 hours 55 minutes flying time. It left Hounslow on 12 November 1919, and arrived at Fanny Bay, Darwin, on 10 December. Both of these historic aircraft may still be seen, the trans-Atlantic Vimy in the Science Museum in London and the England-Australia aircraft in Adelaide. The other historic Vimys of 1919–20 did not, unfortunately, survive for posterity. The first of these was G-UABA *Silver Queen*, built for an attempt to win another £10,000 *Daily Mail* prize, for a flight from Cairo to Cape Town. Flown by Lt Col Pierre van Ryneveld and Major C. J. Quintin Brand, with two mechanics, it left Cairo on 10 February 1920 but crashed at Korosko in Upper Egypt. The crew borrowed another Vimy from the RAF in Egypt, named it *Silver Queen II* and tried again on 22 February. This time they reached Bulawayo, but their aircraft then crashed during take-off. They were, however, finally awarded the prize after completing the journey in a borrowed D.H.9. Another attempt for the same prize was made in G-EAAV, the prototype Vimy Commercial, sponsored by *The Times* and piloted by two Vickers test pilots, Capts S. Cockerell and F. C. G. Broome; but this ended when the aircraft crashed on take-off at Tabora, Tanganyika, on 27 February 1920. Two other standard Vimys were allocated British civil registrations. That of G-EAAR, for an early Vickers demonstrator, was never worn; the aircraft carried instead

its constructor's number C-105, during its brief career in 1919–20. The other aircraft was G-EAOL (formerly F8625 of the RAF), which flew to Madrid for evaluation by the Spanish government and apparently remained in that country.

First flown on 13 April 1919, the Vimy Commercial prototype was originally registered K-107, changed to G-EAAV prior to its attempt for the Cairo-Cape Town prize. It retained the wings, powerplant, landing gear and tail assembly of the standard Vimy bomber, but the fuselage was an entirely new structure, of ample proportions, accommodating a crew of 2 in open cockpits and 10 passengers inside the cabin. The loss of the prototype did not affect a substantial order, for forty aircraft, placed by the Chinese government. These were built at Weybridge, beginning in April 1920. There is reason to doubt whether many were actually assembled and flown after their arrival in China, but at least two were used, and an air mail service between Peking and Tsinan was inaugurated on 1 July 1921 with aircraft of this type. Those delivered to China may have included two Vimy Commercials which appeared on the British Civil Register as G-EAUL and G-EAUY. Of these, the former was runner-up in the Air Ministry competition at Martlesham in August 1921 for heavy commercial aircraft. The most famous Vimy Commercial, without doubt, was 'old go-easy' – G-EASI *City of London*, built for the Air Transport Department of S. Instone & Co and used to inaugurate Instone's Croydon-Brussels service on 9 May 1920. It has been said of G-EASI that it flew 'continuously, almost relentlessly' on Instone's Paris, Brussels and Cologne services, and when absorbed into the Imperial Airways fleet on 1 April 1924 it had flown a total of 107,950 miles (173,728 km). It continued in service with Imperial Airways until scrapped in 1926. Two other Vimy Commercials are known, both powered by 450 hp Napier Lion engines. One was operated in France by Grands Express Aériens as F-ADER, and the other was delivered in September 1922 to the USSR. The latter, which may have been operated for a time by Dobrolet from 1924, was a hybrid aircraft, having some features of the Vimy Ambulance (five of which were built for the RAF) and being, in effect, prototype for the Vernon bomber-transport built for the RAF – whose career included operation of the Cairo-Baghdad air mail in 1926.

9 **Farman F.50P and F.60 Goliath series**

One of the stalwarts of early French airline operation, the Farman Goliath originated as a design for a 2-seat, twin-engined night bomber, but was not developed in time to serve operationally in World War 1. It was preceded in the bomber role by the F.50, a somewhat smaller aircraft of similar general appearance, which saw limited service with the French and American forces in France during 1918, and after the war three were converted for use as F.50P public transport aircraft. They were powered by a pair of 275 hp Lorraine-Dietrich 8Bd eight-cylinder Vee-type engines, had a wing span of 74 ft 11½ in (22.85 m), and could cruise at about 62 mph (100 km/hr) at a gross weight of

6,856 lb (3,110 kg). The Farman brothers had the appropriately registered F-HMFO, which apparently was not placed in airline service; it may perhaps have been a transport trials aircraft. Compagnie des Grands Express Aériens operated F-GEAV on its services from Paris to Brussels and Amsterdam in 1920; this aircraft evidently did not remain long in regular operation with CGEA, but it was acquired in 1923 by Air Union, which was also the owner of the third F.50P, F-AECK.

The larger Goliath first appeared in 1918 as the FF.60, a bomber prototype powered by two 230 hp Salmson 9Z water-cooled radial engines. Soon after the Armistice the fuselage was converted by having a well-lit passenger cabin and an extended nose. At this stage it still bore its original overhanging balanced ailerons, but production Goliaths had square-tipped wings with inset ailerons and were re-engined with 260 hp Salmson 9Cm radials. The 2-man crew were seated side by side in an elevated open cockpit between the front (4-seat) and rear (8-seat) passenger compartments. The passenger accommodation, at first primitive in the extreme, improved considerably later as competing airlines strove to improve their 'image' to the travelling public.

The major early operators of the Goliath were the Farmans' own airline, Lignes Aériennes Farman (approx eighteen), CMA (sixteen or more) and CGEA (twelve); others were delivered to SNETA of Belgium (six) and CSA of Czechoslovakia (six, licence-built by Avia and Letov), and Goliaths are known to have operated also in Romania and Latin America. Air Union, upon its creation in 1923, inherited at least fifteen from CMA and CGEA; it still numbered four Farmans in its fleet as late as 1931, and the Goliath appears to have remained in service with this operator and some others for at least two years after that. The fuselage of Air Union's F-HMFU *Ile de France* can still be seen in the Musée de l'Air in Paris.

It appears that somewhere in the region of sixty Goliaths were operated in airline service. During their career versions with several different powerplants appeared, some of which may have been conversions, and production was integrated with military bomber or ambulance versions, which makes a detailed list of variants difficult. Known designations for civil Goliaths include the F.60*bis* (300 hp Salmson 9Az), F.61 (300 hp Renault 12Fe), F.62, F.63, F.63*bis* (380 hp Gnome-Rhône Jupiter 9A), F.63*ter* (also Jupiter-powered), and there were versions with Lorraine-Dietrich or Maybach engines. The Czech-built Goliaths had Lorraine or Jupiter engines built by Skoda and Walter respectively. One Goliath set up three world load-to-height records in 1919, the best of which was for reaching 16,732 ft (5,100 m) carrying 25 passengers; later that year a non-stop distance record of 1,274 miles (2,050 km) was set up on a flight from Paris to Casablanca. Farman produced a four-engined 'Super Goliath', the F.140, in 1923, which in November 1925 captured 12 world records for height and endurance with payloads of 8,818 lb (4,000 kg) and 13,228 lb (6,000 kg). Six were ordered for experimental flights, but the F.140 was not built for commercial service.

10 Lioré et Olivier LeO 21

From the LeO 12 twin-engined bomber biplane, which first flew in June 1924, Lioré et Olivier evolved in 1925–26 two modified versions, with Gnome-Rhône (Bristol) Jupiter engines in place of the original Lorraine-Dietrich powerplant. These were the LeO 121 12-passenger commercial transport and the LeO 122 bomber. From the latter was developed the LeO 20 4/5-seat night bomber, described in the *Bombers 1919–39* volume; in similar fashion, the LeO 121 design was developed into the larger LeO 21 passenger transport.

Two prototype LeO 21's were built (F-AIFD and F-AIFE), each originally powered by two 420 hp Gnome-Rhône Jupiter 9Ab uncowled radial engines. Certification was received in August 1926, and in the following month the LeO 21 was awarded the highest marks in a competition for transport aircraft staged by the Service Technique Aéronautique. It took first place in the transport class at two meetings during 1927, and the two prototypes, named *Capitaine Ferber* and *L. P. Mouillard* respectively, were introduced on Air Union's Paris-London route on 30 July 1927. The second machine was refitted with two 450 hp Renault 12Ja twelve-cylinder Vee-type engines (with which it was redesignated LeO 212), and this became the standard powerplant for the LeO 213 production version, of which the first example (F-AIVG) was built in 1928. The LeO 21 was flown by a 2-man crew, seated side by side in a communal open cockpit just forward of the wings. Internal accommodation was for 6 passengers in a forward cabin in the nose, which was connected by a corridor to the 12-passenger main cabin at the rear. The first LeO 21 was converted in 1929, to become the LeO 211, equipped with a bar and barman; the LeO 212's main cabin was converted, in collaboration with the Compagnie des Wagons-Lits, into a 12-seat restaurant complete with bar and barman.

Ten further LeO 213's were built in 1929–31, registered F-AIZN and 'ZO, F-AJBE and 'NS and F-ALCS/CY/GF/GG/GH/GI; all were delivered to Air Union. Unlike the original pair, the production aircraft were not allocated individual fleet names, but all thirteen aircraft operated by Air Union bore the fleet title 'le Rayon d'Or' on the starboard side of the nose, with its English equivalent, 'The Golden Ray', on the port side. (The name was corrupted by the LeO 213's ground crews into 'Les Gueules de Raies' – 'the red stripes'.) The LeO 213 had a greater span and wing area than the original LeO 21's and a longer fuselage with a corresponding increase in the size of the main cabin. The front cabin was then taken over as an additional baggage compartment, and the windows in the extreme nose were omitted. The 2-man crew sat in separate open cockpits, which were equipped with dual controls. Air Union operated these aircraft on Paris-London, Paris-Lyons-Marseilles and Paris-Geneva services. All eleven LeO 213's were passed on to Air France in August 1933, and at the end of their commercial career they had amassed some 20,000 flying hours. F-AIVG, destroyed when it flew into a pylon during a flight to Croydon on 31 May 1934, had completed 1,461 hours of flying. The two LeO 21 prototypes were converted again, in

1931 and 1932, for an all-cargo role; F-AIVG was also on a mail cargo flight when it was lost, and F-AIZO (and perhaps other LeO 213's) were similarly converted. Some were converted for night flying (designation LeO 213N), these having an enlarged cabin door, strengthened cabin floor, non-openable cabin windows and a modified fuel system. In 1932 F-AJNS was fitted with 500 hp Renault 12Jb engines, with reduction gearing, and another attempt to 'improve the breed' was the proposed LeO 214, with 500 hp Renault 12Jc engines and accommodation for 16 passengers. Neither this nor the projected LeO 21S (Sanitaire) ambulance version was built.

In 1934 Air France began to replace its LeO 213's with the Potez 62, and during the year passed on nine of its LeO's to the Armée de l'Air.

11 Handley Page W8, W9 and W10

Handley Page was involved in the very beginnings of transport aircraft development in Britain, for two of its O/400 bombers were engaged in 1918 in bringing back ferry pilots from France, and eight converted O/400's of the RAF's No 1 (Communications) Squadron flew a regular service between London and Paris during the peace talks of 1919. It formed its own separate operating company, Handley Page Transport Ltd – later to become one of the major constituents of Imperial Airways Ltd – on 14 June 1919. The first-ever British Certificates of Airworthiness for civil operation were awarded to four Handley Page O/400's on 1 May 1919, and HPT's early services – mostly to Le Bourget, Brussels or Amsterdam – were flown with aircraft of this type, either with minimal conversion from their original bomber configuration or as fully-converted all-passenger O/7's and O/10's or mixed passenger/cargo O/11's. These converted aircraft were, however, far from competitive, and by 1923 those which had not been lost in crashes (of which there were several) were sold, scrapped or otherwise disposed of.

Well before this, however, Handley Page had foreseen the need for a tailor-made commercial transport aircraft, and soon after the end of World War 1 had initiated such a design. This was the W8, which was flown for the first time (G-EAPJ) on 4 December 1919, powered by two 450 hp Napier Lion engines. On 4 May 1920 it set up a British height-with-payload record by lifting 3,690 lb (1,674 kg) to an altitude of 14,000 ft (4,267 m), and in the following August was declared by the Air Ministry to be the best heavy commercial aircraft then developed in terms of comfort, speed and reliability. It operated a London-Paris service from 21 October 1921, but was destroyed in a bad-weather landing just over two years later. A W8a version was proposed, but was not built, although the registration G-EAVJ was reserved for the prototype. The next version to appear was thus the W8b, of which three were ordered to Air Ministry Specification 16/21. They were powered by 360 hp Rolls-Royce Eagle VIII engines, and conformed to Air Ministry requirements in having the passenger capacity limited to 12 (the original W8 had been designed

to seat 15) and in having the fuel tanks located above the top wing instead of in the rear of extended engine nacelles. The first W8b was G-EBBG *Bombay*; this aircraft was renamed *Princess Mary* in May 1922, when Handley Page Transport also took delivery of G-EBBH *Prince George* and G-EBBI *Prince Henry*. This trio operated on HPT's Paris and Brussels services until the absorption into Imperial Airways on 1 April 1924; G-EBBG eventually crashed in February 1928, and 'BH and 'BI were scrapped in February 1931 and October 1932 respectively. The remaining W8 civil variants were tri-motors, the first to appear being the W8e, with a single 360 hp Eagle IX in the nose and two 240 hp Siddeley Pumas. The first and only British-built example was delivered to Sabena as O-BAHG in May 1924, and four similar aircraft were built in Belgium by SABCA for the same airline later that year. The W8f Hamilton (G-EBIX), first flown on 20 June 1924, was built for Imperial Airways as *City of Washington* and was generally similar to the W8e except in having a cabin heating system. Ten aircraft of the same type were built by SABCA for Sabena, which employed them on its Belgian Congo network for many years from April 1925. In later years G-EBIX was given vertical tail surfaces similar to the W10 (see below), and in November 1929 was redesignated W8g when the nose engine was deleted and the two outboard engines were replaced by Rolls-Royce F.IX's.

This trial-and-error experimentation with various twin- and triple-engined layouts was symptomatic of the W types' chief failing, and the next version to appear was the only member of the whole W8/9/10 family capable of maintaining height with one engine cut. This was the tri-motor W9a Hampstead, a 14-seater powered initially by three 385 hp Armstrong Siddeley Jaguar IV radials and flown for the first time on 1 October 1925. Only one example, G-EBLE *City of New York*, was built; this entered service with Imperial Airways on 3 November 1925. In the following April it was refitted with 450 hp Bristol Jupiter VI radials, and was sold in New Guinea in 1929 as VH-ULK.

Last of the W types was the W10, which seated 14 passengers and reverted to twin-engined configuration with a pair of 450 hp Napier Lions. During development of the W8 series, a bomber version had emerged as the W8d Hyderabad, of which a distinguishing feature was a more angular-shaped vertical tail. (This is illustrated on pages 56–57 of the *Bombers 1919–39* volume.) This and other design aspects of the Hyderabad were incorporated in the W10, four of which were built for Imperial Airways. The first flight was made by G-EBMM *City of Melbourne* on 10 February 1926; the others were G-EBMR *City of Pretoria*, G-EBMS *City of London* and G-EBMT *City of Ottawa*. All four had been delivered by the end of March 1926, but 'MS was lost through engine failure in October of that year and 'MT suffered a similar fate in June 1929. Like G-EBBI, the remaining pair survived until replacement by the H.P.42 in 1931. In September 1934 they were used by Sir Alan Cobham to refuel his Airspeed Courier G-ABXN on its attempted flight to India; 'MM was lost in a crash later the same month.

12 **Armstrong Whitworth Argosy**
Upon its formation on 1 April 1924, Imperial Airways inherited a fleet which included quite a number of single-engined aircraft. One of its first actions was to stipulate that its future acquisitions should all be multi-engined types, as an earnest of its intent to place passenger safety high on its list of priorities. This policy was first put into practice in the designs of the de Havilland Hercules (which see) and the Argosy. The Argosy was Armstrong Whitworth's first venture into the commercial transport aircraft market, and was built exclusively for Imperial Airways, which eventually acquired seven. The first of these to fly, in the spring of 1926, was G-EBLF, first of an initial order for three Argosies. It was later named *City of Glasgow*, and was delivered to the airline in the following September. Prior to this, on 5 August 1926, the first London-Paris Argosy service had been opened by the second aircraft, G-EBLO *City of Birmingham*, a service eventually extended to include Brussels, Cologne and Basle. The third Argosy, G-EBOZ, was named *City of Wellington*, and later *City of Arundel*, in airline service. These first three aircraft were designated Argosy I, and were powered by 385 hp Jaguar III radial engines. Accommodation included side-by-side seats in an open cockpit for the crew of 2, and cabin seating for up to 20 passengers, with toilet and baggage space at the rear. On 1 May 1927 the Argosy inaugurated Imperial Airways', and the world's, first named air service – Silver Wing – in which a steward was carried and the 2 rear passenger seats were removed to make room for a bar.

During the first half of 1929 the airline took delivery of a second batch of three Argosies, these being designated Argosy II. They were powered by 420 hp geared Jaguar IVA engines, installed in conical nacelles and fitted with Townend cowling rings; Handley Page wing slats were fitted, and the passenger accommodation was increased to 28. The three Argosy II's were G-AACH *City of Edinburgh*, G-AACI *City of Liverpool* and G-AACJ *City of Manchester*; a fourth, G-AAEJ *City of Coventry*, joined the fleet later. In 1930 the Argosy I's were re-engined to the same standard, two being sent overseas to operate the Cairo-Khartoum sector of the route to South Africa; G-EBLO was lost, in June 1931, when it crashed at Aswan. This was the second Argosy casualty, G-AACH having crashed at Croydon in the previous April. G-EBLF was flown out to replace 'LO, but both it and 'OZ had been reallocated to Europe-only operation by the end of 1931. There was one other casualty in Imperial Airways service – G-AACI, which crashed near Dixmude in March 1933 – but by this time the H.P.42 had begun to appear on the European routes and the four surviving Argosies were withdrawn at the end of 1934. Three were scrapped in 1935, and the fourth (after brief ownership by United Airways and used for joy-riding at Blackpool) at the end of summer 1936.

13 **de Havilland D.H.66 Hercules**
The formation of Imperial Airways in 1924 was a major step towards a unified British national air transport policy. One of the major tasks of the new airline was the carriage

of all Empire mails by air, and although this ambition was not achieved to the full until the mid-1930s the first steps were taken not long after the end of World War 1. In the Middle East, the RAF built up a highly successful desert air mail service between Cairo and Baghdad. This was inaugurated in 1920, and the RAF continued to operate it until 1926, but in 1925 it was decided that responsibility should eventually pass to Imperial Airways, which was to develop and extend it into a regular fortnightly service as far eastward as Karachi.

None of the aircraft then in the Imperial Airways fleet had either the structural ruggedness or the reserve of power necessary for arduous operation over such difficult terrain in tropical weather; a new type was clearly needed. This need was met by the D.H.66 Hercules. Imperial Airways ordered an initial fleet of five, and the first of these (G-EBMW) was flown for the first time on 30 September 1926, powered by three 420 hp Bristol Jupiter VI radial engines. The 2 pilots sat side by side in a communal cockpit ahead of the wings; inside the cabin were seats for the wireless operator and 7 passengers, plus a 465 cu ft (13.2 cu m) compartment for mail or cargo, and there was an additional 155 cu ft (4.4 cu m) of mail/cargo space in the rear of the fuselage. In mid-December 1926, G-EBMW flew to Cairo, from where, after being named *City of Cairo*, it made the first eastbound scheduled flight of the new service on 12 January 1927. Shortly before this, on 8 January, the second Hercules (G-EBMX) had arrived in Delhi to mark the official hand-over of the air mail service from the RAF to Imperial Airways. Carrying the Secretary of State for Air (Sir Samuel Hoare) and his wife, G-EBMX left Croydon on 27 December 1926, and was christened *City of Delhi* upon its arrival in India. The three other Imperial Airways Hercules (G-EBMY *City of Baghdad*, G-EBMZ *City of Jerusalem* and G-EBNA *City of Teheran*) had all been delivered by the spring of 1927, but for the first two years the desert service flew eastward only as far as Basra. It was extended to Karachi in April 1929, and to Jodhpur and Delhi later the same year.

Meanwhile, in 1928, a second Hercules customer had materialised. West Australian Airways had been chosen to operate a new passenger/mail service between Perth and Adelaide, a route with conditions comparable to those flown by Imperial Airways in the Middle East. The D.H.66 was therefore an obvious choice, and WAA ordered four, which were delivered in the spring of 1929 as G-AUJO *City of Perth*, G-AUJP *City of Adelaide*, G-AUJQ and G-AUJR. The Australian Hercules had a number of modifications compared with the original five aircraft, the principal ones being a cockpit enclosure for the 2 pilots and seating for up to 14 passengers in addition to the mail load. The first Perth-Adelaide service of WAA was flown on 2 June 1929 by G-AUJO, with a payload which included 856 lb (388 kg) of mail.

Imperial Airways ordered a sixth D.H.66, G-AAJH *City of Basra*, which joined the fleet in Cairo in June 1929. It was fitted with the enclosed flight deck of the Australian machines, and this feature was

added retrospectively to the earlier examples. The difficult flying conditions of the Cairo-Delhi route, however, soon began to take their toll of the original fleet, from which three were lost in crashes: G-EBMZ in September 1929, G-EBNA in February 1930 and G-EBMW in April 1931. To replace 'MZ the airline ordered a seventh aircraft, G-AARY *City of Karachi*, from de Havilland, so bringing the number built to eleven. By the time of the losses of G-EBNA and G-EBMW, however, the production line had closed, but the airline made up the deficiency by purchasing the third and fourth WAA Hercules, which became G-ABMT *City of Cape Town* and G-ABCP *Cty of Jodhpur* respectively. The loss of G-EBMW on 13 April 1931 was doubly unfortunate, for it came when the aircraft was en route from Karachi to Darwin with the first experimental through air mail service between Croydon and Melbourne. The crew were lost, but the mail was salvaged and was flown to Darwin by the Australian pilot Charles Kingsford Smith in his celebrated Fokker tri-motor *Southern Cross*. The naming of G-ABMT acknowledged the extension of Imperial Airways' African services southwards to Cape Town. These services were not flown by Hercules, but the preliminary survey flight for the route was made in the Hercules G-AARY in late 1931. Imperial Airways lost G-ABCP in a crash in November 1935, but by then its Hercules fleet had reached virtually the end of its useful life. In the following month G-EBMY and G-AARY were withdrawn and scrapped; and G-AAJH, G-ABMT and G-EBMX were sold to the South African Air Force.

14 **Boeing Model 40 and Model 80**

Most of the scheduled air services in the United States during the first half of the 1920s were devoted to the carriage of the mails under government contract, an area which Boeing first entered as early as March 1919. The standard type on most US Post Office Department routes was for many years the British-designed, American-built DH-4, and in 1925 the Department held a design competition to find its successor. Boeing entered an elegant biplane, the Model 40, powered (as specified) by a neatly-installed 400 hp Liberty engine. The Post Office purchased the unregistered Model 40 prototype, which made its first flight on 7 July 1925, but placed no production contract. Since there was, at that time, no other possible US customer for the aircraft, Boeing temporarily shelved the project, but later in 1925 it was announced that from July 1927 all domestic trans-continental air mail contracts would be placed with private operators. Accordingly, under the design leadership of Phil G. Johnson, Boeing updated the original proposal into the Model 40A, replacing the smooth wood-veneer fuselage covering with fabric and substituting for the Liberty a 420 hp uncowled Pratt & Whitney Wasp radial engine. As a result, the aeroplane lost much of its outward elegance, but it was a more viable product economically. There were two mail compartments in the fuselage, and between them was a small cabin to seat 2 passengers; the pilot occupied an open cockpit well behind the wings, aft of the rear mail compartment. With the 40A Boeing won from the Post Office a contract to operate the San Francisco-

Chicago mail route, which enabled it to initiate production of twenty-five Model 40A's and to form a new company, Boeing Air Transport Inc, to operate the service. The first production aircraft was flown on 20 May 1927, and the BAT service opened on 1 July 1927, with a fleet of twenty-four aircraft. Data for the Model 40A were as follows: wing span 44 ft 2 in (13.46 m); wing area 547.0 sq ft (50.82 sq m); length 33 ft 0 in (10.06 m); gross weight 6,000 lb (2,722 kg); cruising speed 105 mph (169 km/hr); range 650 miles (1,046 km). The twenty-fifth Model 40A went to Pratt & Whitney as an engine testbed, and when the new 525 hp Hornet radial became available in early 1928 nineteen surviving airline 40A's were fitted with these engines and redesignated Model 40B. Gross weight was then 6,079 lb (2,758 kg) and cruising speed 110 mph (177 km/hr). Two aircraft were also modified to have a second cockpit, in tandem, and dual controls. In mid-1928, Boeing produced the Model 40C, a version with a 450 hp Wasp engine and enlarged cabin to seat 4 passengers. Nine were built for Pacific Air Transport and a tenth was delivered to National Park Airways. Two other specially-modified 40C's, designated 40X and 40Y, were built for Associated Oil and Standard Oil. In July 1929 type certification was awarded to the final production model, an improved version of the 40B seating 4 passengers. Powered by the 525 hp Hornet engine, it was designated 40B-4, the original 2-seat version then being redesignated 40B-2. The first 40B-4 was flown on 5 October 1929. Thirty-eight Model 40B-4's were built, twenty having Townend cowling rings, radio and steerable tailwheels. One other was completed as an engine testbed for Pratt & Whitney, and four 40H-4's were built by Boeing's Canadian factory. Customers included BAT, Varney Air Lines, Western Airlines and Western Canada Airways.

As evidenced by the modest increase in the passenger-carrying capacity of the Model 40 series, the potential of this side of the transport business was beginning to expand by the late 1920s. The extent of this expansion encouraged Boeing to design a new and much larger biplane primarily for passenger-carrying, and this emerged as the Model 80. It was powered by three 410 hp Wasp engines, and the first of four examples was flown in early August 1928. The 2-man crew occupied an enclosed cockpit just behind the nose engine, and the main cabin accommodated 12 passengers in a 3-abreast seating layout. In 1929 the Model 80 was followed by ten examples of the Model 80A, an improved version with Hornet B engines, increased fuel capacity, modified fin and rudder contours, and a cabin large enough to accommodate 18 passengers. There was a 39 cu ft (1.10 cu m) baggage compartment beneath the pilot's cabin floor. The Models 80 and 80A were employed by Boeing Air Transport, and by mid-1930 were flying a daily round-trip service between Chicago and San Francisco. In passenger service, travellers' comforts were at first attended to by male 'couriers', but, beginning on the Golden Gate-Lake Michigan route (which it later extended to New York), BAT introduced eight trained nurses as the world's first airline stewardesses. The Model 80A's were in due course converted

to Model 80A-1 standard, this being a mixed-traffic layout for 12 passengers and up to 1,145 lb (519 kg) of mail or cargo. A reduced fuel load was carried, and in a further tail modification small auxiliary fins and rudders were mounted on the tailplane. With these aircraft, BAT inaugurated scheduled night mail services between Salt Lake City and Oakland, California, with the passenger seats removed and the cabin equipped as an airborne post office and sorting office. One other aircraft, designated 80B-1, was built for BAT, whose crews did not at first take kindly to an enclosed cockpit. This aircraft, powered by Hornet engines, had an open cockpit, elevated over a built-up nose so that the crew could see rearward over the upper wing. Later, after pilots grew accustomed to the advantages of an enclosed flight deck, it was converted to an 80A-1. Boeing also built one 6-seat Model 226 executive aircraft for the Standard Oil Company of California, based on the Model 80A. The 80C was a proposed all-freight version, but was not built. The Model 80 series was withdrawn from United (BAT) regular services in 1933, following the appearance of the twin-engined Boeing 247 monoplane (which see).

15 **Handley Page H.P.42**

The first four-engined airliner in the world to go into regular passenger service, the H.P.42 was one of the small band of aeroplanes which became a legend in its own lifetime. It was not without its critics, and one need only consider the huge wings with their heavy Warren-type bracing, the two-up, two-down arrangement of the uncowled engines, and the triple-finned biplane tail unit, to understand those who made fun of its 'built-in headwinds'. Yet, somehow, these and other features, which individually may have justified the criticism that they invoked, blended to give the H.P.42 a gentle, lumbering grace that was all its own. In time, the image of the H.P.42 came to be equated with that of Imperial Airways itself: 'safe, reliable – and slow'; and even this, in the prevailing climate of British civil aviation in the early 1930s, was construed virtually as a compliment. Nearly a decade after it was designed, when in most respects it had been far outclassed by the rising generation of smooth-skinned all-metal monoplane airliners, the H.P42 still had something to offer, as *The Aeroplane Spotter* recorded in its issue of 16 December 1943:

'As late as 1938, one could stand on the tarmac at Croydon in the morning and watch Wibault, Douglas, Lockheed, Bloch, Focke-Wulf and other modern monoplanes taking half the aerodrome to become airborne while *Heracles* left the ground on occasions without running over the Customs apron'.

The H.P.42 was designed for service on the European and the eastern sectors of the Empire routes of Imperial Airways. A cabin mock-up was exhibited at the Olympia Aero Show in July 1929, and on 17 November 1930 the prototype, G-AAGX *Hannibal,* made its maiden flight from Handley Page's airfield at Radlett, Hertfordshire. From the outset, attention was paid to a high standard of comfort for the passengers. The location of the Jupiter engines – two on the upper wing and one in each angle

of the inverted-gull lower wings – was intended to minimise noise and vibration in the passenger cabins, which were situated forward and aft of the wings. They were separated by a large area accommodating the mail and baggage holds, kitchen and toilets. The crew comprised captain, first officer, radio officer and 2 cabin stewards.

There were two basic models, the H.P.42E (for Eastern services) and H.P.42W (for Western, i.e. European, services), differing only in powerplant and cabin arrangement, and four aircraft were completed initially to each configuration. The H.P.42E's (G-AAGX, G-AAUC *Horsa,* G-AAUD *Hanno* and G-AAUE *Hadrian*) were powered by Bristol Jupiter XI.F engines, and seated 6 (later 12) passengers in the forward cabin and 12 in the rear cabin, with 500 cu ft (14.2 cu m) of mail/baggage space between. Power unit for the H.P.42W's (G-AAXC *Heracles,* G-AAXD *Horatius,* G-AAXE *Hengist* and G-AAXF *Helena*) was the Jupiter X.FBM with a reduced fuel load; the forward and rear cabins seated 18 and 20 respectively, and were separated by a smaller mail/baggage space of 250 cu ft (7.1 cu m).

The first proving flight, from London to Paris, was made by *Hannibal* on 9 June 1931, and two days later this aircraft inaugurated a scheduled service on this route. In August it left for Cairo, to take up its proper duty as one of the Eastern quartet, and was joined by the other three H.P.42E's by the end of the year. By January 1932 the last of the H.P.42W's had also been delivered, and on 20 January *Helena* flew to Paris on the first leg of the first through air mail service to Cape Town. The Western models eventually flew on services from Croydon to Brussels, Cologne, Le Touquet, Basle and Zurich, while the Cairo-based Eastern models (later, but erroneously, described as H.P.45's) flew southwards to Kisumu and eastwards to Karachi and Delhi. Utilisation was high – during their lifetime, none of the eight flew less than 12,000 hours, and their aggregate mileage exceeded 10 million (16,093,400 km). The individual record was set by *Heracles,* which in 8½ years of operation flew 1,318,990 miles (2,122,660 km) and carried more than 160,000 passengers. On 8 December 1934 *Hengist,* emulating *Helena* nearly three years earlier, flew to Paris on the first leg of the first through air mail service to Australia. Early in 1935 it was converted to Eastern standard, but its career ended on 31 May 1937, when it was burned out in a hangar fire at Karachi. To replace *Hengist* on the European routes, *Hanno* was converted to an H.P.42W, and *Helena* was converted from Western to Eastern standard.

Up to the outbreak of World War 2, *Hengist* was the only casualty from the fleet of eight aircraft, but on 7 November 1939 *Horatius* was wrecked. Ironically, after their thousands of hours of safe, reliable peacetime flying, all but one of the six remaining aircraft were lost during 1940. The last survivor, *Helena,* was dismantled in August 1941 at RNAS Donibristle.

16 **Curtiss Condor**

Two separate types of Condor airliner were built by Curtiss, the first being the Model 18, a derivative

of the XB-2 Condor bomber of 1927. First flown in the summer of 1929 (probably July), the Model 18 Condor was powered by two 600 hp Curtiss GV-1570 Conqueror twelve-cylinder Vee-type engines, carried a crew of 3 and had accommodation for 18 passengers in three 6-seat cabins. Chief designer was George R. Page Jr, assisted by T. P. Wright and Alexander Noble, and six examples were built at Garden City, Long Island. They entered service in 1930 with Eastern Air Transport and Transcontinental Air Transport. The Model 18 had a wing span of 91 ft 8 in (27.94 m), length of 57 ft 1 in (17.40 m), wing area of 1,512 sq ft (140.46 sq m), gross weight of 17,378 lb (7,882 kg) and cruising speed of 116 mph (187 km/hr).

By 1932 Curtiss, in common with the rest of the US aviation industry, urgently needed a new, saleable, short-term product to spur its recovery from the effects of the recent economic depression. George Page and his colleagues were therefore given the task of designing a new transport aircraft. Design work began in April 1932, using as a basis an earlier project, the XT-32. From this there emerged the T-32, for which the name Condor was retained. The T-32 was for a time referred to as the Condor II, but despite a superficial outward resemblance it bore little or no design connection with the Model 18. The first T-32, registered 12353, was flown for the first time on 30 January 1933. Immediately-detectable differences between the new Condor and the Model 18 were the more portly fuselage, the elegant single-fin-and-rudder tail assembly (the Model 18 had a biplane tail with twin fins and rudders), and the neat nacelles of its two 750 hp Wright SGR-1820-3 Cyclone radial engines, into which the main landing gear could be almost fully retracted. Eastern Air Transport and American Airways each placed initial orders for five T-32's, each subsequently increasing its order to nine. Delivery began in the spring of 1933, and they entered service shortly after the award of a type certificate in March 1933. Twenty-one T-32 Condors were built, the remaining three consisting of two YC-30 transports for the US Army Air Corps and one specially-equipped Condor for the 1933–35 Byrd Antarctic Expedition.

The performance of the T-32 had been somewhat hampered by the necessity to use propellers whose pitch could only be adjusted on the ground. With the availability in 1934 of variable-pitch propellers, Curtiss took the opportunity to introduce a new model, the AT-32, which had such additional improvements as supercharged Cyclone engines, in more streamlined nacelles, and increased fuel tankage. Thirteen AT-32's were built, ten going to American Airways (renamed American Airlines in 1934) in the form of three AT-32-A's, three AT-32-B's and four AT-32-D's. These sub-types were, respectively, 12-passenger daytime/sleeper transports with 710 hp SGR-1820-F3 or 720 hp SGR-1820-F2 engines, and a 15-seat day passenger model with -F2 engines. American subsequently had eight of its original T-32's brought up to AT-32 standard; these were then redesignated T-32C. One AT-32-C, for Swissair, was generally similar to the -D model; it was delivered in spring 1934 and used on the Zurich-Berlin service, but was lost in a crash in July of the same year. The other two AT-32's were 12-seat daytime transport AT-32-E's, delivered to the US Navy as R4C-1's. The forty-five Condors built – production ended in September 1934 – were completed by five BT-32 bombers, three CT-32 naval transports and three T-32 military transports; a description of these appears in the *Bombers 1919–39* volume.

Although ousted from the fleets of Eastern and American by the new Douglas and Lockheed monoplane airliners by the mid-1930s, the Condor enjoyed a long and far-reaching career in subsequent years, with operators as far afield as Alaska, Burma, Canada, Central and South America, China and Mexico. In addition to the Swissair Condor, four others also served briefly in Europe. These were ex-Eastern T-32's, acquired in 1937 by the UK operator International Air Freight Ltd as G-AEWD/WE/WF/ZE. Until the autumn of 1938 they were used on freight services from Croydon to Brussels, Amsterdam and other points in Europe. They were then purchased by the Air Ministry, were stored until November 1939 and then scrapped. A number of Condors survived the war, some by several years; the last known operational Condor, belonging to the Peruvian Air Force, was not withdrawn and scrapped until the autumn of 1956.

17 de Havilland D.H.84 Dragon

At first sight it might seem unlikely that a desert light bomber and an economical feeder-line transport would have very much in common, yet such was the dual requirement which produced the D.H.84 Dragon in 1932. On the one hand the Iraqi government had asked de Havilland for a twin-engined military aircraft, armed with three machine-guns and able to carry up to sixteen 20 lb (9 kg) bombs; on the other, Edward Hillman of Hillman's Airways, impressed by the operating economics of de Havilland's single-engined 4-passenger Fox Moth, wanted a 6-passenger twin-engined transport with which to open a service to Paris in the spring of 1933. To meet the two requirements a de Havilland team led by A. E. Hagg designed the D.H.84, the prototype of which flew on 24 November 1932. A little less than a month later, as G-ACAN, it was delivered to Hillman's and given the fleet name *Maylands*. The Hillman's Romford-Paris service was opened on 1 April 1933, the fleet by then including three more Dragons, G-ACAO, 'AP and 'BW. Such was their popularity, and the amount of traffic engendered, that Hillman ordered two more (G-ACEU and 'EV), and had all six aircraft converted to 8-seaters. The eight military Dragons, characterised by their gun mountings and a curved dorsal fin, were delivered to Iraq in May 1933.

Commercially, the Dragon proved an instant success, its operating economics being even better than those of the Fox Moth and its cruising speed some 10 mph (16 km/hr) higher. It rapidly attracted orders from small airline, air taxi and charter operators at home and abroad, which kept it in steady production until 1936. Altogether, de Havilland built one hundred and fifteen Dragons, comprising sixty-two Mk 1's and fifty-three Mk 2's

Differences were comparatively slight, the Mk 2 being distinguishable by individually-framed cabin windows, larger main-wheel spats and fully-faired undercarriage legs and struts. The first aircraft of Mk 2 standard to fly was G-ACKU in the autumn of 1933.

Sixty-eight appeared on the British civil register, most of them with airline or charter/taxi operators. They were particularly prominent in Scotland and the north of England, and original customers for the Mk 1 included Highland Airways (one); Hillman's Airways (six); Jersey Airways (one); The King's Flight (one); Midland and Scottish Air Ferries (three); Northern and Scottish Airways (two); Railway Air Services (one); and the Scottish Motor Traction Company (three). The Mk 2 was purchased by Aberdeen Airways (two); Blackpool and West Coast Air Services (two); Highland Airways (one); Jersey Airways (six); Portsmouth, Southsea and Isle of Wight Aviation (one); and Railway Air Services (seven). A number of these operators subsequently increased their D.H.84 fleets by the purchase of second-hand aircraft. Exports of the Dragon Mk 1 were made to African Air Transport, South Africa (three); Automobiles Fernandez, Spain (one); Canadian Airways (one); Indian National Airways (two); Misr Airwork, Egypt (three); West Australian Airways (one); and Wilson Airways, Kenya (two). Foreign sales of the Mk 2 were made to Aer Lingus (one); Canadian Airways (one); East Coast Airways, New Zealand (two); Indian National Airways (one); MacRobertson - Miller Aviation, Australia (three); VASP, Brazil (one); and West Australian Airways (one). Additional military sales were two Mk 1's to the Royal Danish Army Aviation and three Mk 2's to the Portuguese Air Force. In 1942 the Dragon went back into production, this time by de Havilland Australia, which built eighty-seven for the RAAF for use as radio/navigation trainers and communications aircraft.

18 **de Havilland D.H.89 Dragon Rapide**

The D.H.89 was, in essence, an updating of the D.H.84 with increases in speed and passenger comfort, making use of the six-cylinder Gipsy Six engine produced for the four-engined D.H.86. The new design, like that of its predecessor, was the responsibility of A. E. Hagg, and to denote the change of powerplant it was known originally as the Dragon Six. In early 1935 this was changed to Dragon Rapide, and before long the 'Dragon' part of the name was dropped in everyday usage and the aircraft became known simply as the Rapide. It was powered initially by two 200 hp de Havilland Gipsy Six and flew for the first time on 17 April 1934. Like the Dragon, it was flown by one pilot only, but had a larger cabin which could seat up to 8 passengers, although 6 was a more usual number.

The first commercial order came from Hillman's Airways, which, with seven Rapides, was one of the two largest pre-war operators of these aircraft. More than a dozen scheduled operators in the UK, and many air charter and taxi concerns, were customers for the Rapide before 1939. The principal British airlines were

Aberdeen Airways (two); Blackpool and West Coast Air Services (three); British Continental Airways (three); Jersey Airways (two); North Eastern Airways (four); Personal Airways (three); Railway Air Services (eight); Scottish Airways (two); United Airways (two); and Wrightways (two). Overseas operators included Canadian Airways (three); Quebec Airways (four); Misr Airwork, Egypt (five); Société de Transports du Proche-Orient (two); Tata Airlines, India (three); Ala Littoria, Italy (one); Wilson Airways, Kenya (five); Rhodesia and Nyasaland Airways (four); LARES, Romania (four); Wearne's Air Services, Singapore (two); LAPE, Spain (one); Alpar, Switzerland (two); and Devlet Hava Yollari, Turkey (four).

Production continued up to the outbreak of World War 2, during which time two hundred and five were built at Hatfield. Many were impressed for military service with the RAF, RAAF and Air Transport Auxiliary, and production continued in wartime of the military Dominie Mk I and Mk II, of which one hundred and eighty-six were built by de Havilland and three hundred and thirty-five by Brush Coachworks Ltd. Two additional Rapides were assembled from spares in 1947, to bring overall D.H.89 production to seven hundred and twenty-eight.

A number of detail and styling improvements were introduced in the pre-war Rapides. After about sixty had been built, a range of modifications introduced in early 1936 included lengthened cabin rear windows, provision of a landing light in the nose, thicker wingtips, a rearranged cabin interior with 5-passenger seating and a toilet, and a cabin heating system. The first aircraft with these improvements was G-ADWZ. In November 1936 a D.H.89 was flown with small split flaps on each side of the engine nacelles, to improve the landing characteristics. This feature was adopted for subsequent production Rapides, the designation of this version being D.H.89A, and most earlier Rapides were brought up to a similar standard. The designation D.H.89B was allotted to the wartime Dominies, many of which were released on to the civil market at the end of World War 2. These, and the post-war career of the Rapide, are described further in the volume *Private, Business and General Purpose Aircraft since 1946*.

19 **de Havilland D.H.86**

Although, from its general appearance and from the name 'Dragon Express' often applied to it, the D.H.86 appeared to belong to the same family as the D.H.84 and D.H.89, it was produced to meet a very different and more stringent requirement. It was agreed between the governments of Great Britain, India and Australia that a through passenger service between England and Australia should be inaugurated in 1934, and a new aircraft was required to operate the route sector between Singapore and Brisbane. With large stretches of water to be covered, and tropical weather conditions to be endured, the requirement was as demanding as that which had resulted in the D.H.66 for the desert air routes some 8 years earlier, and the same priorities were afforded – plenty of cabin space and comfort, multi-

engine configuration for maximum safety, and ample reserve power. To meet the last of these conditions Major Frank Halford of the de Havilland Engine Co evolved the 200 hp Gipsy Six engine, which, as its name implied, was an enlarged version of the four-cylinder Gipsy Major in-line with two extra cylinders. Four of these engines were fitted in the D.H.86, which otherwise was in appearance and construction a scaled-up D.H.84. It had the same narrow nose, with a seat for one pilot only; the wireless operator sat in front of the 10 passengers in the main cabin, and there was a mail compartment at the rear.

The first D.H.86 was flown on 14 January 1934, only some four months from the start of design work. It gained its C of A on 30 January, after which, with a few detail improvements, it was delivered to Railway Air Services as G-ACPL. Two other D.H.86's were acquired by RAS, and in August 1934 they inaugurated the airline's Croydon-Belfast-Renfrew service. As a result of Australian government requirements, all subsequent aircraft had a 2-pilot layout, with a captain and first officer seated side by side in an elongated nose, and increased fuel capacity. Another improvement introduced at this stage was the provision of split trailing-edge flaps. Twenty-nine 2-pilot D.H.86's were built, these being delivered to Imperial Airways (four, for operation in Europe and Africa); Jersey Airways (six); Hillman's Airways (three); and Wrightways (one), all in the UK. The remainder were delivered to Misr Airwork in Egypt (two); to Holyman's Airways (four) and Qantas Empire Airways (six), both in Australia; and the last three to Union Airways in New Zealand.

The early loss of two Qantas D.H.86's led to further exploratory flight trials during the 1934–35 winter. These disclosed no basic faults in design or construction, but some modification and strengthening of the tail surfaces was carried out as a precautionary measure. Towards the end of 1935 further improvements were introduced, with which the aircraft became designated D.H.86A. A metal-framed rudder, larger tailwheel, pneumatic shock-absortion and improved brakes on the main landing gear, and a less steeply-sloped cockpit windscreen were the principal modifications. Twenty D.H.86A's were built, including one tested briefly with 205 hp Gipsy Six II engines. They were delivered to British Airways (eight); Imperial Airways (seven); Blackpool and West Coast Air Services (two); and one each to Railway Air Services, Wrightways and Misr Airwork. All were brought up to D.H.86B standard in 1937 by the addition of a small elliptical fin at each extremity of the tailplane. Production of D.H.86 variants, which totalled sixty-two aircraft, came to an end in 1937 after the completion of ten new D.H.86B's which, in addition to the auxiliary fins, had tailplanes with increased tip chord and an improved system of aileron control. Allied Airways, Blackpool and West Coast Air Services, and Railway Air Services, each received one new D.H.86B; the others were exported to DHY, the Turkish national airline (four), and W. R. Carpenter and Co in Australia (three).

About half of the D.H.86's saw wartime service with the RAF or RAAF; comparatively few survived the war, but one ex-Jersey Airways machine, after much renovation, did so until September 1958.

20 **Dornier Komet and Merkur**

The Dornier Do C III Komet I, first flown in 1921, was a single-engined transport which clearly shared some design ancestry with the Do Cs II Delphin flying-boat. A noteworthy feature was its very large wing, which spanned 55 ft 9¼ in (17.00 m) and whose constant chord of 9 ft 10 in (3.00 m) represented almost one-third of the aeroplane's overall length of 29 ft 10¼ in (9.10 m). Dornier's pride in the rigidity and strength of this structure was expressed in a publicity photograph showing no fewer than 69 persons standing or sitting on the wing! The actual accommodation of the aircraft, however, was much more modest, the Komet I having a single open cockpit for the pilot and an enclosed cabin for 4 passengers, in fore-and-aft facing pairs. Production Komet I's powered either by a 180 hp BMW III or 185 hp BMW IIIa engine, were supplied in small numbers to Deutsche Luft-Reederei, later serving with Deutscher Aero Lloyd in 1924 and eventually with Deutsche Luft Hansa upon its formation two years later. Meanwhile Dornier had produced a modified version, utilising the same wings but having a 250 hp BMW IV and an overall length of 33 ft 9½ in (10.30 m); this made its first flight on 9 October 1922. Seating capacity remained the same, despite the increase in overall length. The Ukrainian airline Ukrvozdukhput ordered six Komet II's, which were delivered in 1923, and others were sold to airline operators in Colombia, Spain (Union Aérea Espanola), Switzerland (Ad Astra Aero) and the USSR. The DLH fleet also numbered some Komet II's, though some were probably converted from existing Komet I's. The German airline ceased to operate the Komet II in the autumn of 1928.

Well before this, there had appeared the Komet III, first flown on 7 December 1924, which was an enlarged version capable of seating 6 passengers and having a crew of 1 or 2 men, still in an open cockpit. It was powered originally by a 360 hp Rolls-Royce Eagle IX engine, although offered later with either the 400 hp Liberty or the 450 hp Napier Lion. Surviving records make it impossible to judge the number of Komet III's built, particularly as many later underwent conversion to become Merkurs. However, seven were ordered by Ukrvozdukhput in 1925 for its Moscow-Kharkov-Odessa-Kiev-Rostov services, one was sold to DDL of Denmark, at least two others went to a Swiss customer, and operators of eleven known German-registered Komet III's included Deutscher Aero Lloyd, DVL and DVS. A small batch was built under licence by Kawasaki in Japan, including three used by Tozai Teiki Kokukai on services between Tokyo and Osaka.

The Merkur, or Dornier Do B, first flown on 10 February 1925, was outwardly little different from the Komet III, and the subsequent conversion of several Komet III's into Merkurs took place. The main airframe changes were to be seen in the enlarged vertical tail surfaces, unbraced tailplane, and a cut-out in the centre-section

trailing-edge of the wings, whose span was slightly increased by 1 ft 11½ in (0.60 m). The powerplant was a 600 hp BMW VI engine. Later production aircraft, with increased take-off weight and BMW VIu engines, were designated Merkur II. The largest Merkur operator was undoubtedly Deutsche Luft Hansa, which employed twenty-two of these aircraft on its night service between Berlin and Königsberg, and may have had some three dozen in all, including at least seven converted from Komet III's. Deruluft, the Russo-German airline, inaugurated a Berlin - Königsberg - Riga - Moscow service with Merkurs on 15 July 1927, and a Tashkent-Kabul service later the same year; it had at least nine Merkurs, possibly more. Exported examples included two to Ad Astra Aero, which later served with Swissair; one each to the Chilean Air Force and Tozai Teiki Kokukai in Japan; and two floatplane versions – one each to Sindicato Condor in Brazil and SCADTA in Colombia. Notable demonstration or proving flights by Merkurs included one in September 1926 of some 4,350 miles (7,000 km) over the route Friedrichshafen-Berlin - Königsberg - Moscow - Kharkov - Tiflis - Baku - Kharkov, and shortly afterwards, with 6 passengers and baggage representing a payload of 3,527 lb (1,600 kg), the first aeroplane crossing of the Caucasus mountains, made between Elbruz and Kasbek at an altitude of 17,720 ft (5,400 m). One of the Swissair Merkurs, flown by Walter Mittelholzer, flew from Zurich to Cape Town between 7 December 1926 and 21 February 1927, in 100 hr flying time, on an aerial survey flight.

21 **Focke-Wulf A 17, A 29 and A38 Möwe (Seagull)**

The Focke-Wulf Möwe series of short-range transports were produced in limited numbers in Germany during the late 1920s and early 1930s.

The first to appear was the A 17, powered by a 420 hp Gnome-Rhône (Bristol) Jupiter 9Ab uncowled radial engine. The prototype (D-1149) flew for the first time in 1927. The 2-man crew sat side by side in an enclosed cockpit, with one double and 6 single passenger seats to the rear. Maximum payload was 8 passengers and up to 440 lb (200 kg) of baggage and/or mail. The prototype was followed by eleven production A 17's, of which ten (D-1342 *Emden,* D-1358 *Aurich,* D-1367 *Leer,* D-1380 *Oldenburg,* D-1388 *Stade,* D-1403 *Lüneburg,* D-1416 *Osnabrück,* D-1430 *Hannover,* D-1444 *Münster* and D-1484 *Bielefeld*) were delivered to Deutsche Luft Hansa for internal and foreign services. These had slightly larger rudders and modified landing gear; several were later redesignated A 17a after being refitted with 480 hp Siemens-built Jupiter VI engines. The prototype, after service with Nord Deutscher Luftverkehr and Nordbayerische Verkehrsflugzeug, eventually joined the DLH fleet and was given the name *Bremen.* The eleventh A 17 was used for a time by DVL (Deutsche Versuchsanstalt für Luftfahrt); D-1444 was redesignated A 17c after being modified with an enlarged fin and a 520 hp Junkers Jumo 5 engine.

The A 29 Möwe, which appeared in 1929, had basically the same airframe and accommodation as the A 17, though the overall length was increased to 48 ft 6¾ in (14.80 m) and it was powered by a 750 hp BMW Vee-type engine. Five were built, four of them (D-1757 *Friesland,* D-1775 *Jeverland,* D-1867 *Westfalen* and D-1922 *Saarland*) being delivered to Deutsche Luft Hansa in 1929–30. The fifth was used for airline training at the Deutsche Verkehrsfliegerschüle (DVS).

The A 38 Möwe had a somewhat more extensively redesigned fuselage and tail assembly. Overall length was increased to 50 ft 6¼ in (15.40 m), permitting the carriage of a wireless operator and 2 additional passengers. Rudder area was substantially increased, and a tailwheel was fitted instead of the former tailskid. The A 38 also reverted to a radial engine installation, originally the 400 hp Siemens-built Jupiter. Later, the 500 hp Siemens Sh 20u was substituted, the aircraft then being known as the A 38b. Only four were produced, and delivered to DLH as D-2073 *Bückeburg,* D-2082 *Hessen,* D-2107 *Lipper* and D-2114 *Thüringen.*

Most DLH routes on which the Möwe series was flown were those radiating from Berlin to Berne, Cologne, Königsberg, Marienbad, Munich, Paris, Saarbrucken and Vienna. The A 17a was also used for cargo services between Cologne and Nuremberg, and the A 38 over part of DLH's Berlin-Oslo route. Most A 29's and A 38's had been retired by 1933 or 1934; two A 17a's survived until 1936 before being scrapped.

22 **Fokker F.II and F.III**

The F.II was produced before the Fokker company became established in Holland. At the end of World War 1 Fokker's chief designer, Reinhold Platz, produced two single-engined transport designs, V44 and V45. The former, a 6-seater with open cockpits, was not built, but a prototype of the V45, or Fokker F.II, flew for the first time in October 1919, powered by a 185 hp BMW IIIa in-line engine. Two more F.II's were built at Schwerin, the prototype and one of these going to KLM as H-NABC and 'BD and the other to Deutsche Luft-Reederei. Ultimately, about two dozen F.II's were completed, most of them assembled at Staaken under the supervision of Dr Ing Karl Grulich, Technical Manager of DLR, and known as Fokker-Grulich F.II's. This operator was the customer for nineteen or more of the F.II's that were built; they passed to Deutscher Aero Lloyd upon its formation in 1924, and into Deutsche Luft Hansa ownership in 1926; except for one (sold to Balair in Switzerland), they remained in full service until 1934-35. The two KLM F.II's, which entered service in September 1920, were sold to Sabena in 1927; one later returned to Holland and was still in existence at the outbreak of World War 2. The original Fokker-designed F.II had an enclosed cabin for 4 passengers and an open cockpit at the front for a pilot and one passenger seated side by side. Wing span and area were 52 ft 9¾ in (16.10 m) and 452.1 sq ft (42.00 sq m), and overall length 38 ft 2¾ in (11.65 m). At a gross weight of 4,188 lb (1,900 kg), it had a cruising speed of 75 mph (120 km/hr) at sea level and a maximum range of 745 miles (1,200 km). The Fokker-Grulich F.II's were powered by 250 hp BMW IV engines and had modifica-

tions to the cockpits, cabin windows and landing gear.

The F.III was essentially a slightly enlarged version of the F.II, with all 5 passengers accommodated in a bigger cabin, a single-seat cockpit and an increased-span wing which, unlike the F.II, was fully cantilevered. Other improvements were made to the rear fuselage and the rudder. The prototype, also utilising the BMW IIIa as powerplant, flew in April 1921. During 1921–22 twelve F.III's, powered by 240 hp Siddeley Puma in-line engines, were built for KLM. One or two others were built, from spares, by the airline itself; five of the KLM aircraft were later sold to Balair, which resold two to Italy. Six were delivered to Malert, four with BMW IIIa's and two with 230 hp Hiero IVH engines. At least ten were built for Deruluft, all powered by 360 hp Rolls-Royce Eagle VIII engines; some of these were modified as parasol monoplanes. Two Eagle-engined parasol F.III's were delivered to KLM in 1922. These were the last of about thirty-one F.III's built by Fokker, but the DLR/DAL organisation at Staaken also built the type as the Fokker-Grulich F.III, primarily for German operation. Standard powerplant for these was the 250 hp BMW IV, although the Siddeley Puma was fitted to some aircraft, and others were later refitted with 320 hp BMW Va's. The major operator of the Fokker-Grulich F.III was Deutscher Aero Lloyd, which had about twenty, of which sixteen passed into DLH ownership in 1926.

Total F.III production was probably about fifty to sixty aircraft. They were widely used throughout Europe, though two went to the United States, two to the UK, and others found their way in later years to Canada and New Guinea.

23 **Fokker Universal and Super Universal**

The Universal and Super Universal, produced by Fokker Aircraft Corporation and Atlantic Aircraft Corporation, were the first types bearing the Fokker name to be designed entirely in the United States. The Model 4 Universal, designed by Robert Noorduyn, first appeared in late 1925, and was powered initially by a 200 hp Wright J4 uncowled radial engine. Structure was generally similar to contemporary Dutch-built Fokker transports, but the wings had strut bracing. The first production Universal (N-AABA) was delivered to Colonial Air Transport in May 1926, and forty-five were built before production ended in the spring of 1931. About half of these were J4-powered, but an improved version appeared from 1928, having a 220 hp Wright J5 engine, and some late-production Universals were fitted with a 330 hp J6. There was accommodation for a crew of 1 or 2 in open cockpits, and 4 passengers on individual staggered seats in the cabin. Dimensions included a wing span and area of 47 ft 9 in (14.55 m) and 330.0 sq ft (30.66 sq m), and an overall length of 35 ft 6 in (10.82 m). Performance of the J5-engined version included a maximum speed of 118 mph (190 km/hr) at a gross weight of 3,810 lb (1,728 kg). Principal airline customers were Western Canada Airways (seven or more) and Standard Air Lines (four). Other North American operators included California Airways, Continental Air Express, Dominion Airways, Northwest Air Service, Northwest Airways, Reynolds Airways, and St Tammany Gulf Coast Airways.

In late 1927 the first example (3318) appeared of the Model 8 Super Universal, known originally as the Universal Special. This was a much-improved model, the prototype having an enclosed cockpit for the crew, increased overall dimensions, a more powerful engine (420 hp Wasp) and higher operating weights and performance. The cabin was lengthened to accommodate 6 passengers. Further improvements in the production version, of which eighty were built in the US, included the elimination of the wing bracing struts, straight-tapered wings with inset instead of overhung ailerons, modified main landing gear similar to that of the Fokker F.VIIa, and an improved crew enclosure. The first production Super Universal became the Byrd Antarctic Expedition's *Virginia*, and fourteen others were exported. Major North American operators were National Parks Airways (six); St Tammany (five); Standard Air Lines (three); Universal Air Lines (two); Western Air Express (five); and Western Canada Airways (nine). Other Universals and Super Universals served with operators in Argentina, Australia, Canada, Colombia, Mexico, South Africa and the UK. In addition to US production, fourteen Super Universals were licence-built in Canada by Canadian Vickers; Nakajima in Japan built nine civil examples (with 450 hp Jupiter engines) and about twenty others for military use. Fokker in Holland built three examples of the basically similar F.XI Universal in 1929, these going to Alpar (one, with 240 hp Lorraine 7Aa engine) and Malert (two, with 480 hp Gnome-Rhône Jupiters).

24 **Stinson Detroiter**

One of the best-known and best-liked American cabin transports of the inter-war years, the Detroiter did not attract a great number of airline customers, and the bulk of those built were employed by business corporations, aerial taxi operators and wealthy private owners.

The first Detroiter, the SB-1, was a biplane. Designed by Edward A. Stinson and Frederick Verville, it flew for the first time on 25 January 1926. Interest shown by local businessmen prompted the formation of the Stinson Airplane Corporation some four months later, and the first production SB-1 was completed in the following August. Powered by either a J4 or J5 Wright Whirlwind seven-cylinder radial engine, the 4-seat SB-1 had a wing span and area of 35 ft 10 in (10.92 m) and 350.0 sq ft (32.52 sq m) and an overall length of 28 ft 10 in (8.79 m). At a gross weight of 2,900 lb (1,315 kg) it had a range of 600 miles (965 km), and the J4-powered version could cruise at 100 mph (161 km/hr). Operable for passenger and/or mail services, it entered service in September 1926 with Florida Airways. Other airline customers included Northwest Airways (three), Wien Airlines and Patricia Airways. Total SB-1 production, which ended in June 1927, amounted to about twenty-two.

The Detroiter achieved its principal fame as a high-wing monoplane, the first and major version of which was the SM-1, certificated in November 1927. This was a 6-seater (pilot and 5 passengers), and was

powered by a 225 hp J5 Whirlwind engine. Seventy-four were built, including the SM-1B, which had a wider-track landing gear. Airline customers included Paul R. Braniff Inc, which flew its first-ever scheduled service on 20 June 1928 wth a single SM-1 (NC1929) and was soon flying three round trips a day between Oklahoma City and Tulsa. Later in 1928 Braniff acquired a second Detroiter monoplane, and in early 1929 the line was extended to Wichita Falls. During 1929–30 Stinson produced, mostly in small quantities, various modified versions which included the SM-1D, SM-1DA and SM-1DB (minor improvements to landing gear, brakes, engine cowling and interior); SM-1DC and SM-1DD (2-seaters for record flights and cargo-carrying); SM-1F (6-seater with 300 hp J6 Whirlwind); and SM-1FS (twin-float version of the SM-1F). Of these, only the SM-1F achieved substantial production status. About twenty-six are believed to have been built, including four which, in 1928, operated the first regular air mail service in China. The largest Detroiter monoplane was the SM-6B, which appeared in mid-1929. Powered by a 450 hp Wasp C1 engine, it could accommodate 7 or 8 passengers or a 954 lb (432 kg) load of mail or cargo. About a dozen were built.

By this time, however, Stinson had begun to concentrate on production and marketing of the smaller Detroiter Junior, which first appeared as the SM-2 in early 1928. Scaled down to a 3/4-seater, the SM-2 was powered by a 110 hp seven-cylinder Warner Scarab engine and was aimed primarily at the business and general aviation market.

52 **Ryan Brougham**

The career of the Ryan Brougham appears to have been – by comparison with other and less noteworthy types – a singularly unobtrusive one. This is the more remarkable in a type of which more than two hundred examples were built and which was, moreover, a sister-ship of Charles Lindbergh's world-famous trans-Atlantic monoplane *Spirit of St Louis*.

In early 1926 T. Claude Ryan began the manufacture of the first aeroplane of his own design, the M-1, an open-cockpit 3-seat high-wing monoplane intended for the expanding air mail business in the United States. Customers included Pacific Air Transport, which operated a service from Seattle to Los Angeles via San Francisco, one of the longest and most difficult of the early routes. The Brougham was foreshadowed later in 1926 by the Ryan M-2 Bluebird, an improved M-1 seating a pilot and 4 passengers in fully-enclosed accommodation.

About twenty-eight M-1/M-2's were built. The M-2, normally powered by a Hispano-Suiza engine, was used from 1927-29 by Yukon Airways in north-western Canada to fly a service between Whitehorse and Dawson. The first Brougham was, essentially, an M-2 airframe powered by a 220 hp Wright J5 Whirlwind seven-cylinder radial engine, and was under construction at the time the company undertook to build the special NYP (New York-Paris) monoplane for Lindbergh.

Lessons learned with the NYP were incorporated into the initial production model, the B-1, and the Brougham quickly became a success. Frank Hawks flew a B-1 to eighth place in the 1927 Ford Air Tour, and later won the speed prize in the National Air Races, and with such achievements as these, coupled with the attention attracted by the Lindbergh flight, the Brougham was soon in demand. By the latter part of 1928 one hundred and fifty B-1 Broughams had been built. In October of that year Mahoney sold his interest in the company to the Detroit Aircraft Corporation, which transferred the production centre to Lambert Field, St Louis. The next airline version was the B-3, with the same seating capacity as the B-1 (pilot and 4 passengers) but increased baggage capacity, improved main landing gear struts, enlarged tail surfaces, modified engine cowling and wider cabin. Standard powerplant was the 220 hp Wright J5, though the 300 hp J6 was fitted in some aircraft. Only eight more B-3's were built, in 1929, including one converted to B-3A with additional fuel capacity.

The first version built from the outset at Lambert Field was the B-5, which adopted the 300 hp J6 Whirlwind as standard and had cabin accommodation for 5 passengers and 73 lb (33 kg) of baggage. All-round performance included a take-off run of less than 300 ft (91 m). Forty-eight B-5's were completed, nine of them for China. The next model to appear, the B-7, was the last true Brougham type to be built. This also seated 5 passengers, with a baggage allowance increased to 100 lb (45 kg), and was basically a slightly bigger B-5 with a longer fuselage, enlarged tail surfaces, and a 420 hp Wasp C1 engine. However, the fortunes of the Detroit Aircraft Corporation were by this time showing a marked downward trend, and only six B-7's were built. The Brougham line ended in 1931 with three Brougham-type aircraft bearing the Model number C-1. Known variously as the Foursome or Baby Brougham, the C-1 was a smaller edition of the Brougham having a 225 hp J6 Whirlwind engine. Seating 3 passengers only, it was intended for the business executive or rich private owner rather than for airline use, as reflected by the more luxurious furnishing and larger cabin door.

Overall production of the Brougham, excluding the C-1, thus amounted to two hundred and twelve aircraft. By no means all of those built were for airline customers, and it is virtually impossible to state just how many were used in airline service, or even how many air transport companies included Broughams in their fleets. Ryan Airlines itself was naturally a regular operator, and Pickwick Latin American Airways was among the major users. Its services extended from Los Angeles to Mexico City, Guatemala City and San Salvador, and it may have had as many as a dozen Broughams altogether. Other known operators (not all of scheduled passenger services) included Aeronautica del Sur of Tabasco, Mexico (about ten); Bowman Airways of Alaska; Corporacion Aeronautica de Transportes of Coahuilla, Mexico; Embry-Riddle (Chicago-Cincinnati on air mail route 24); National Airlines Air Taxi Service (St Petersburg-Tampa-Lakeland-Orlando-Daytona Beach); Pike's Peak Air Lines; Robertson Airplane Service (Kansas City-Minneapolis); Thompson Flying Service (Chicago-Bay City-Pontiac); and Tri-State Airlines of Sioux City, Iowa.

26 **P.W.S.24**

Upon its formation on 1 January 1929 the Polish national airline, Polskie Linie Lotnicze (Lot) formulated a requirement for an aircraft to replace the Junkers F 13 on its internal network. Two competing designs were approved for comparative evaluation: the Lublin R-XI, and the P.W.S.21 designed under the leadership of Stanislaw Cywinski of the Podlaska Wytwornia Samolotow Sp Akc. Neither was accepted, but three new prototypes, the Lublin R-XVI, P.Z.L.16 and P.W.S.24T, were developed in late 1930 to a less rigid specification. Of these, the choice was made in favour of the P.W.S. design, the prototype of which (SP-AGR) made its first flight in August 1931, powered by a 220 hp Skoda-built Wright Whirlwind J5 radial engine. With detail modifications, SP-AGR was handed over to the airline in April 1932 for route-proving, by which time an initial batch of five P.W.S.24's had been ordered. Accommodation was for a pilot and 4 passengers, and the aircraft had a cruising speed of 100 mph (160 km/hr). Further modifications were introduced to the production aircraft (SP-AJF/G/H/J/K), delivery of which began in early 1933. On 1 May 1933 these five aircraft, together with the prototype, began scheduled operations, initially on the service between Warsaw and Poznan.

Lot, however, had already suggested that performance could be improved by the use of a more powerful engine, and P.W.S. first refitted the prototype with a 387 hp Lorraine 9Na engine. In this form it was test-flown extensively during the early weeks of 1933, after which it underwent further trials with a 420 hp Pratt & Whitney Wasp Junior radial. This latter engine was ultimately chosen to power a second production batch of five aircraft (SP-AMN/O/P/R/S), which received the designation P.W.S.24*bis*. The P.W.S.24*bis* went into service in the spring of 1935, being joined a few months later by a seventh aircraft (SP-AJH) brought up to similar standard and re-registered SP-ASY. However, despite the improvement in speed, the aircraft's range and payload were modest in the extreme, and all were withdrawn from passenger service in the spring of 1936.

27 **Kalinin K types**

Konstantin Alexievich Kalinin was among the more talented Soviet designers of the inter-war period and, prior to his arrest and the disbandment of his design bureau in 1938, had designed no fewer than 16 individual aircraft types in almost as many years. Kalinin was among the first to appreciate the aerodynamic attractions of an elliptical wing planform, for which he took out a patent in 1923, and most of his subsequent aircraft designs were based upon wings of this shape. The first to appear, in 1925, was the K-1 (also known as the RBZ-6), a small high-wing monoplane with seating for 3 passengers. Powered by a 170 hp Salmson engine, it had a speed of 100 mph (161 km/hr) and was used for a time on feeder services between Moscow and Nishnii Novgorod. A year later this was succeeded by the K-2, essentially similar to the K-1 but with a 240 hp BMW IV engine giving sufficient power to enable 4 passengers to be carried. A variant, with the same powerplant and a cabin modified to accommodate 3 stretchers, was designated K-3. The first flight was made in 1928 of the prototype K-4, which was registered RRUAX. This 4-passenger aircraft was reportedly powered by a 300 hp BMW VI engine, but the 240 hp BMW IV remained standard for the first production examples, which appeared on the internal services of Dobrolet and the Ukrainian airline Ukrvozdukhput. An ambulance version, carrying 2 stretchers and having a starboard-side rear loading door, was powered by a 300 hp M-6 engine, and the 310 hp Junkers L 5 engine was available as a third choice. Twenty-two K-4's are believed to have been built at Kharkov, including a small number for aerial photography duties.

The most successful type was the K-5, which was essentially a scaled-up K-4. It first appeared in 1929, and some two hundred and sixty were built during 1930–34. The first examples had M-15 (Bristol Jupiter) or Pratt & Whitney Hornet radial engines, but later series were powered by 480 hp M-22 or 500 hp M-17F engines. Improvements included an enclosed cockpit for the 2-man crew, cabin accommodation for up to 8 passengers, and vertical tail surfaces closely resembling those of contemporary Fokker airliners. The K-5 was used by Dobrolet on services within the USSR. A slightly smaller development was the K-6, a parasol-wing mailplane powered by a 420 hp Gnome-Rhône Jupiter VI engine, but this is not thought to have been produced in quantity.

28 **Consolidated Models 17 and 20 Fleetster**

A contemporary of the Lockheed Air Express and Vega, which it closely resembled, the Fleetster did not achieve the same eminence, although the score or so examples built were popular with pilots and passengers alike. The Fleetster owed its inception, and its name, to Rueben H. Fleet, president and general manager of Consolidated Aircraft Corporation, who was also one of the prime movers in forming the New York, Rio and Buenos Aires Line to operate air services between North and South America. The main sectors of NYRBA's network were flown initially by Consolidated Commodore flying-boats, but Fleet wanted a small, fast aeroplane to fly supporting feeder services between the principal South American stopovers and the hinterland areas, and to meet this requirement the Fleetster was produced.

Designed by I. M. Laddon, the prototype Model 17 Fleetster (X657M) flew for the first time in October 1929, and test flying was conducted with both Wasp and Hornet engines. The 575 hp Hornet B was selected, and after certification in January 1930 three Fleetsters were delivered to NYRBA: the prototype (re-registered NC657M), NC671M and NC672M. Typical routes were Rio de Janeiro-Puerto Allegre (Brazil), and from Buenos Aires into Bolivia, Paraguay, Uruguay and Chile. The original machine was operated for part of its career as a twin-float seaplane, and the other pair may have been similarly equipped. One passenger sat beside the pilot, and 5 more were accommodated in the cabin, which could be stripped for cargo-carrying. When NYRBA became part of the Pan American Airways System in September 1930, NC657M was sold; the other two were scrapped by Pan American in October 1934. One other Model 17 was built as the personal transport

of the US Assistant Secretary for War.

There were two variants of the original Fleetster, the first being the Model 17-2C, one example of which (NC750V) was built in 1930 for a private owner but passed in 1933 to Pacific International Airways for operation in Alaska. Possibly the only Model 17-2C built, it had a 575 hp Wright Cyclone engine and forward-facing passenger seats. The last Model 17 variant, the 17-AF, was powered by a 575 hp R-1820-E Cyclone, with the 650 hp R-1820-F available as an alternative. It had an enclosed cockpit forward of the wing, accommodation for 9 passengers, a new low-drag main landing gear and enlarged wings of 50 ft 0 in (15.24 m) span. Three Model 17-AF's (NC703Y to NC705Y) were built for Ludington Airlines; the first was delivered in June 1932, and they were used for a fast shuttle service between New York and Washington, DC, making four round trips per day. All three were acquired by Pan American in June 1933, one being resold to Pacific-Alaska Airways in 1934.

Meanwhile, Consolidated had evolved in 1930 another version of the Fleetster, known as the Model 20 and also produced initially for NYRBA. To make better use of the available fuselage space, the Model 20 adopted a parasol-wing layout. The cockpit, which was open, was repositioned aft of the wings, enabling a 60 cu ft (1.7 cu m) cargo hold to be accommodated in the deep forward fuselage between the passenger cabin and the engine bay. The Model 20, like the Model 17, was operable either in mixed passenger/cargo configuration or as an all-cargo aircraft. Two Model 20's (NC673M) and NC674M) were built for NYRBA, passing in late 1930 to Pan American, which purchased a third as NC675M. A fourth was supplied to a Canadian operator as CF-AIP.

The final Fleetster, the Model 20-A, was essentially an alliance of the parasol-wing Model 20 with the longer wings, modified undercarriage and other improvements of the Model 17-AF. It had seating for up to 7 passengers, or fewer passengers with enhanced cargo load. In 1932 seven were built (NC13208 to NC13214) for Transcontinental and Western Air (TWA), to operate a Detroit-Toledo-Fort Wayne-Indianapolis service to connect with westbound trunk routes. They entered service in October 1932 and, except for one lost in a crash, operated until February 1935 before being withdrawn. Three were later sold privately; the other three (NC13208, '211 and '213) found their way to Spain, where they were used on transport duties by the Republican forces in the Civil War.

29 Latécoère 28

Pierre G. Latécoère, founder of Lignes Aériennes Latécoère, one of France's first airlines, also set up in 1919 his own aircraft manufacturing company, Forges et Ateliers de Construction Latécoère, to manufacture aircraft of its own design for the airline's air mail service. At the Paris Salon in December 1919 it exhibited the first such aeroplane to appear, the Latécoère 3, powered by a 260 hp Salmson 9Z radial engine. Two years later there appeared the 5-seat Latécoère 8, an ugly, square-cut biplane with a 300 hp Renault engine. Whether either of these achieved production status is uncertain, but in 1925 about ten or a dozen examples were built of

the Latécoère 15, a parasol monoplane powered by two 275 hp Lorraine-Dietrich engines and as ugly as its predecessor. These were operated by 'The Line', probably between Toulouse and Casablanca; some were equipped as twin-float seaplanes.

Aesthetically, at least, the company's aircraft designs began to take a turn for the better with the appearance in the mid-1920s of the Latécoère 17, 25 and 26 series of single-engined parasol monoplanes. Somewhere in the region of a hundred and twenty were built, the Laté 26 predominating. When Aéropostale gave way to Air France in 1933 the latter inherited thirty-eight Laté 25's (some of which were conversions from Laté 17's) and forty-one Laté 26's.

The single-engine formula was continued in 1929 with the considerably more attractive Latécoère 28. Two initial versions appeared, the Laté 28-0 (500 hp Renault 12Jb) and Laté 28-1 (500 hp Hispano-Suiza 12Hbr). Apart from their powerplants they were apparently alike, each having accommodation for up to 8 passengers and an enclosed cockpit for a 2-man crew.

There was a certain amount of conversion from one model to another, making it impossible to establish exactly how many of each individual version were manufactured. At least thirty-eight were built for Aéropostale, three were delivered to Aviacion Nacional Venezolana, two to Linea Aeropostal Venezolana and four to Aeroposta Argentina. In addition to the two passenger-carrying models already mentioned, other designations included twin-float mailplane versions with greater wing area and either a 600 hp Hispano-Suiza 12Lbr engine (Laté 28-3) or a 650 hp Hispano-Suiza 12Nb (Laté 28-5); the ANV trio were designated Laté 28-6. The Latécoère 28-5 was a special aircraft, flown under French Navy auspices and named *La Frégate*. Piloted by Lt de Vaisseau Paris, it set up in 1930 nine world speed, endurance and distance records with payloads ranging from 500 kg (1,102 lb) to 2,000 kg (4,409 lb). Undoubtedly the most historic flight by a Laté 28, however, was that by the 28-3 F-AJNQ *Comte de la Vaulx*, which crossed the South Atlantic from St Louis, Senegal, to Natal, Brazil, as part of the first experimental through air mail route from Toulouse to Rio de Janeiro. The crossing, made on 12/13 May 1930, took 21 hours, and was made by one of France's most celebrated pilots, Jean Mermoz, with crew members J. Dabry and L. Gimié.

30 Lockheed Vega and Air Express

Allan and Malcolm Loughead designed their first aeroplane, the Model G, in 1913, but were unable to compete with the glut of war-surplus military aircraft that flooded the civilian market, and their company was disbanded in 1921. The aeroplane which brought it together again, in 1926 in a Hollywood garage, was a highly attractive little high-wing monoplane designed by a former associate, John K. Northrop – the Lockheed Vega. When production ended 8 years later Lockheed had not only built and sold one hundred and twenty-eight Vegas but had evolved from the original design a whole family of fast transport and racing aircraft – 'Lockheed's plywood bullets', they

have been called – which firmly established the new Lockheed Aircraft Company on the road to future success.

The original Vega, which made its first flight on 4 July 1927, was sold to the US newspaper magnate George Hearst Jr, who named it *Golden Eagle* and entered it in the Dole race from Oakland, California, to Hawaii. Flown by John W. Frost, with Gordon Scott as navigator, it took off from Oakland on 16 August 1927, but disappeared en route and was never heard of again. Despite this inauspicious start to its career, the Vega was an almost instant success. Lockheed retained the second Vega as a demonstrator, and the third was purchased by Captain G. H. (later Sir Hubert) Wilkins for his 1928 Arctic Expedition. The secret of the Vega's attraction, and of its excellent performance, lay in the beautifully streamlined fuselage, which was an extremely smooth semi-monocoque, built in two halves inside a concrete mould. Many early Vegas achieved renown as race-winners and record-setters. The initial version, the Vega Model 1, was powered by a 220 hp Wright J5 Whirlwind radial engine. It seated a pilot and up to 4 passengers, and at a gross weight of 3,470 lb (1,574 kg) was capable of 135 mph (217 km/hr). Twenty-eight of this version were built. The next to appear was the Vega Model 5, with the same dimensions and seating capacity but a 450 hp Pratt & Whitney Wasp B engine, gross weight of 4,033 lb (1,829 kg) in landplane form, and top speed of 185 mph (298 km/hr). Forty-two were completed, including seven converted from other models. Five of these seven were twin-float seaplanes, with 4,698 lb (2,131 kg) gross weight and a top speed of 172 mph (277 km/hr). Two Vega 5's were converted to 6-seaters for operation by Pan American-Grace Airways, and nine others were built as executive Vega 5A's.

The next version to appear was the Vega 2, a 5-seater with a 300 hp Whirlwind J6 engine, of which six were built including one converted from a Vega 1. One other was built as a 6-passenger Vega 2A. The most celebrated version was the Vega 5B, with a 450 hp Wasp C engine and passenger seating for 6. Thirty-four were completed, including three landplane and two floatplane conversions from other models. The Vega 5B served widely with many US domestic, Mexican and foreign airlines, and one became the famous *Winnie Mae* in which Wiley Post and Harold Gatty made their round-the-world flight in June/July 1931, the first such flight by a commercial aeroplane. Two years later, after its conversion to a Vega 5C (Wasp C1 engine and enlarged tail surfaces), Post flew *Winnie Mae* on the first solo flight round the world. Twenty-seven Vegas were in due course converted to 5C standard, and six others were built from the outset as 5C's. Apart from eight custom-built Vega 'Specials' (of various models), the only remaining Vega was the DL-1, with duralumin instead of plywood for the fuselage skin. With 6-passenger seating and a Wasp C1 engine, the DL-1 was built by Detroit Aircraft Corporation, which obtained financial control of Lockheed in early 1929, only to go into receivership in October 1931. Northrop, who left Lockheed in June 1928, was succeeded by Gerard F. Vultee,

who was responsible for development of the later Vega models until his own departure in early 1930. Ten DL-1's were built, including three DL-1B's and three 'Specials'.

Very early in the life of the Vega, Lockheed had also developed a similar aircraft, using Northrop's basic fuselage design with a parasol wing of slightly greater span than the Vega. This was the Model 3 Air Express, designed to meet the requirements of Western Air Express. Seven Air Expresses were built for airline customers, the first being delivered to WAE in March 1928. Other operators were NYRBA and Pan American (two each), and American Airways and Texas Air Transport (one each). An eighth aircraft was completed as a 'Special'.

Airline use of the Vega during the late 1920s and early 1930s was widespread. About three dozen US domestic scheduled operators, or their heirs or successors, operated Vegas with outstanding success. Most had small fleets of four or less, but among the larger fleets were those of Braniff (ten); Alaska-Washington Airways (seven); Hanford Tri-State Airlines (six); Varney Speed Lines (five); and Wedell-Williams Air Service (five). Thirty-one Vegas at some time bore Mexican registrations, the major fleets being those of Lineas Aéreas Mineras (eleven) and Corporación Aéronautica de Transportes (ten). Other airline Vegas served with operators in Argentina, Australia, Canada, Costa Rica, Nicaragua, Norway, Panama and the UK.

31 **Bellanca Airbus and Aircruiser** Giuseppe Mario Bellanca was rightly held in high esteem in the US aircraft industry of the 1920s and 1930s. Born in Italy, where he built his first aeroplane in 1908, Bellanca emigrated to the United States in 1911 and later opened a flying school at Mineola. During World War 1 he was an aircraft designer, and after the war was engaged to design an aircraft to be powered by the new 200 hp Wright J4 Whirlwind engine. The result, the 1925 Wright-Bellanca WB-1, was followed by the WB-2, which became the *Columbia* in which Chamberlin and Levine flew across the North Atlantic to Germany a month after Lindbergh's epic flight to Paris in the *Spirit of St Louis* in 1927. Bellanca parted company with Wright in 1927, but by that time he was already known as a designer of light cabin monoplanes, his first having been the Air Sedan of 1923, which carried 5 people and had a 100 hp Anzani engine. Bellanca had a passionate belief in making his designs aerodynamically efficient: he appreciated, better than most, that an aeroplane is a vehicle for transporting a useful load from A to B, and every ingredient of his designs was aimed at doing this in the most efficient way. He was, also, not generally in favour of multi-engined aircraft, taking the view that one powerful, well-maintained engine was to be preferred wherever possible.

This philosophy was in evidence from the very start of Bellanca's career, for the prominent aerofoil struts and 'bow-legged' main landing gear were to be seen in the WB-1. Bellanca's first big commercial success was the Pacemaker series of general-purpose aircraft, in which the high-mounted wings were braced on each side by two struts with wide, aerofoil-section fairings

contributing to the total lift.

Bellanca's concept of the single-engined, high-efficiency load-carrier reached its peak in the Airbus and Aircruiser, which could carry a payload comparable with that of many three-engined transports of their day. These were, in effect, sesquiplanes, with a pattern of faired-in undercarriage and wing bracing struts that gave additional lifting area to supplement that of the main high-mounted wing. They consisted of a parallel-section stub-wing inboard of each main undercarriage unit and an inverted 'V' section outboard. The inboard sections were of sufficient depth to be utilised as storage compartments for baggage, mail or freight. The first Airbus to appear was the Model P-100, which flew in May 1930, although its ancestry was traceable to the long-range Model K built some two years earlier. Unfortunately for the P-100, its airframe qualities were not matched by those of its 600 hp Curtiss Conqueror liquid-cooled engine, and only one (NC684W) was built. Nevertheless, even in this form the Airbus could lift a 3,000 lb (1,360 kg) payload, and had an outstanding short-field performance. Once fitted with a satisfactory powerplant – usually the Wright Cyclone or Pratt & Whitney Hornet – it became much more viable economically. Unfortunately, the Airbus/Aircruiser was offered when the US market was still suffering from the effects of the economic depression, and did not achieve the sales which it deserved. The Airbus existed in two major production models, the 12-passenger P-200 (to which standard the P-100 was converted) and the 15-passenger P-300. Only a small number of civil Airbuses were built, including one, with a twin-float landing gear, used on a commuter service in the summer of 1934 by New York and Suburban Airlines. Fourteen were, however, built for the US Army Air Corps as four Y1C-27's and ten C-27A's. The Model 66 Aircruiser was a cargo-carrying equivalent of the Airbus, with the same basic dimensions but slightly increased wing area. In one of its later forms the Aircruiser had an 850 hp GR-1820-G3 Cyclone engine and a gross weight of 11,400 lb (5,171 kg), of which 4,021 lb (1,825 kg) was payload. Aircruiser operators included Central Northern Airways and Mackenzie Air Service in Canada.

32 **Tupolev ANT-9**

As head of the design department of the TsAGI (Central Aero and Hydrodynamic Institute) from 1920, and chairman of the Soviet aviation committee formed to develop all-metal aircraft, Andrei N. Tupolev was ideally placed to be among the first Soviet designers to incorporate the latest techniques in this field into aircraft of his own design. Russian domestic production of aluminium (Kolchugalumin) and duralumin began in 1922 and, as might be expected, was at first adopted for military purposes. However, in 1929 there appeared the prototype (URSS-309) of the ANT-9 tri-motor passenger transport. (Available records describe this as being 'completed' on 28 April 1929; whether this was the date on which it first flew has not been established.) Eventually to become one of the most successful Soviet transports of the inter-war period, the prototype ANT-9 was powered by three 230 hp Gnome-Rhône Titan uncowled radial engines. It had a wing span of 77 ft 9 in (23.70 m), an overall length of 55 ft 9¼ in (17.00 m), a maximum speed of 130 mph (209 km/hr) and a range of 620 miles (1,000 km). On 6–12 June 1929 it made a demonstration tour within the Soviet Union (Moscow-Odessa-Sevastopol - Odessa - Kiev - Moscow); subsequently, with the name *Krilya Sovetov* (Wings of the Soviets), it set out on 10 July 1929 on a tour of European cities, flying from Moscow to Travemünde, Berlin, Paris, Rome, Marseilles, London, Paris, Berlin and Warsaw before returning to Moscow on 8 August, a total distance of 5,615 miles (9,037 km), covered at an average flying speed of 110 mph (117 km/hr).

There were two production versions of the ANT-9, the first of similar overall dimensions to the prototype and powered by three 300 hp M-26 radial engines. An alternative version was available with 300 hp Wright J6 Whirlwind engines, offering a maximum speed of 127.4 mph (205 km/hr) – 12.4 mph (20 km/hr) better than the M-26 version – but with range reduced from 620 miles (1,000 km) to 435 miles (700 km). The Whirlwind-engined ANT-9 had a slightly-increased wing span of 78 ft 3 in (23.85 m), though wing area remained the same, and the overall length was reduced to 54 ft 7½ in (16.65 m). Accommodation in both versions was for a crew of 2, in an enclosed cockpit, and 9 passengers in the main cabin, which also incorporated a rear baggage compartment and toilet. The wheeled landing gear could be exchanged for skis for winter operation. As many as sixty ANT-9's may have been built, including nine Whirlwind-engined aircraft operated by Deruluft on Berlin-Moscow and other services.

The designation PS-9, indicating *Passazhirskii* (Passenger) or *Pochtovii Samolet* (Postal Aircraft), has been applied generally to the ANT-9, but there is reason to believe that this should be applied only to the twin-engined version which appeared in 1933. Due to the much-increased power available from two 680 hp M-17 (licence BMW VI) Vee-type engines, the nose-mounted third engine could be dispensed with, despite an increase in gross weight to 13,668 lb (6,200 kg), and still give a maximum speed of 134 mph (215 km/hr). Overall dimensions remained similar to those of the Whirlwind-engined ANT-9. Dobrolet and Aeroflot had a total of about seventy ANT-9's, among which the twin-engined version was predominant. One PS-9, named *Krokodil,* was painted to resemble its saurian namesake and used by the Maxim Gorki propaganda squadron.

33 **Rohrbach Ro VIII Roland**

The Roland was a product of the Rohrbach-Metall-Flugzeugbau GmbH, established in Berlin in 1922 by Dr Ing Adolf Rohrbach, formerly of the wartime Zeppelin-Werke GmbH. Like Prof Hugo Junkers, Dr Rohrbach was an early protagonist of metal construction and cantilever wings, and both features were reflected in the Roland prototype (D-991) which flew in 1926. It was powered by three 230 hp BMW IV six--cylinder in-line engines and accommodated a crew of 2 and up to 10 passengers. Construction was entirely of metal,

with a covering of duralumin sheet. The crew cockpit, with side-by-side seats, was enclosed on the prototype but open on the Roland I initial production version. Passengers occupied individual seats on each side of a central aisle; aft of the final pair of seats were a toilet and a mail/baggage hold.

In 1926–27 Deutsche Luft Hansa took delivery of the prototype, which it named *Zugspitze,* and five production Ro VIII Roland I's (D-999 *Watzmann,* D-1124 *Schneekoppe,* D-1280 *Feldberg,* D-1292 *Brocken* and D-1297 *Wasserkuppe*), which entered service in 1927 from Berlin to London via Hanover and Amsterdam. During July 1927 a Roland set up an international endurance record by flying for 14 hours 23 minutes 40 seconds over a closed circuit with a 2,205 lb (1,000 kg) payload, covering a total distance of 1,438 miles (2,315 km). In 1927–28 three of the Roland I's (D-999, D-1280 and D-1292) were acquired by Iberia and, as M-CBBB, M-CAEE and M-CCCC respectively, inaugurated a service between Madrid and Barcelona.

Their place in the DLH fleet was taken in 1928 by three Rolands of an improved type: D-1314 *Jnselberg,* D-1327 *Hohentwiel* and D-1338 *Zugspitze*; the naming of the third aircraft (which later became Iberia's M-CADD) suggests that the prototype may have been disposed of or lost. The Ro VIIIa had an $11\frac{3}{4}$ in (0.30 m) longer fuselage than the Ro VIII and a slightly higher gross weight, but the major difference from its predecessor lay in the improved powerplant of three 320 hp BMW Va engines. The remaining DLH Ro VIII's had themselves been refitted by this time with 250 hp BMW IVa engines; later still, they were brought up to BMW V standard. The airline crews had come to accept the virtues of an enclosed cockpit, too; this feature was built into the Ro VIIIa and fitted retrospectively to the earlier machines.

The final production version was the Roland II, which had a much-redesigned crew cabin with generous window area. Another major structural change concerned the wing, now positioned on top of the fuselage with less dihedral than that of the earlier Rolands. Powerplant was the same as for the Ro VIIIa. Nine Roland II's were delivered to DLH in 1929: D-1692 *Stolzenfels,* D-1710 *Rheinstein,* D-1712 *Schönburg,* D-1720 *Niederwald,* D-1727 *Freienfels,* D-1729 *Drachenfels,* D-1735 *Marksburg,* D-1745 *Siegburg* and D-1756 *Rolandseck*. At the peak of their service, in 1931, the DLH Rolands were operating, wholly or partially, seven routes of the airline's large central European network, and Hamburg - Malmö and Berlin - Munich were still being flown by Rolands in 1936. By this time the DLH fleet had been reduced by the transfer of at least three Roland II's (D-1712, D-1729 and D-1735) to Deruluft, and most of the remaining aircraft, including one Ro VIIIa (probably D-1314), had been refitted with 280 hp Junkers L 5 engines.

34 **Ford 4-AT and 5-AT Tri-motor**
One of the immortals of air transport history, the Ford Tri-motor, 'Tin Lizzie' or 'Tin Goose' has more than 40 years of hard work to justify the esteem and affection in which it is rightly held by pilots and passengers the world over. Seldom can an aeroplane of its type have been subjected to such onerous demands during its lifetime, ranging from snap rolls, low-level loops and other barnstorming aerobatics to heavy-duty freight transportation and fire-fighting. It has served with more than 100 air transport operators in the US, Australia, Canada, China, Mexico, and Central and South America, and its career runs through virtually the entire story of pre-war airline development in the United States. To list here all of the original and subsequent owners of the one hundred and ninety-eight production Tri-motors would be impossible, but even to record the principal original airline customers is more than adequate to make the point. These were, in alphabetical order: American Airways (one 5-AT-C); British Columbia Airways (one 4-AT-B); CLASSA (one 4-AT-E and one 4-AT-F); Colonial Air Transport (three 5-AT-B); Colonial Western Airways (one 4-AT-B and one 5-AT-C); Compania Mexicana de Aviacion (five 5-AT-B); Curtiss Flying Service (four 4-AT-B); Eastern Air Transport (two 4-AT-E); Jefferson Airways (one 4-AT-B); Maddux Air Lines (two 4-AT-A, six 4-AT-B, six 5-AT-B and two 5-AT-C); Mamer Flying Service (two 4-AT-E); Mohawk Airways (one 4-AT-E); National Air Transport (one 4-AT-A, eight 5-AT-C and three 5-AT-D); Northwest Airways (two 5-AT-A and two 5-AT-C); NYRBA (one 4-AT-A and three 5-AT-C); Pacific Air Transport (six 5-AT-D); Pan American Airways (six 5-AT-B, one 5-AT-C and two 5-AT-D); Pan American-Grace Airways (three 5-AT-C and one 5-AT-D); Pennsylvania Air Lines (one 4-AT-E); Pitcairn Aviation (one 4-AT-E); Queen City Air Lines (one 4-AT-B); Rapid Air Lines (one 4-AT-B); Robertson Aircraft Corporation (three 4-AT-B and one 5-AT-B); SCADTA (one 5-AT-D); Southwest Air Fast Express (six 5-AT-B and two 5-AT-C); Spokane Airways (one 4-AT-B); Stout Air Services (two 4-AT-A, three 4-AT-B, two 5-AT-B and two 5-AT-C); Transcontinental Air Transport (ten 5-AT-B and one 5-AT-C); and Universal Flyers (two 4-AT-D).

There has been an element of controversy concerning who truly designed the Ford Tri-motor, but credit for inspiring it is generally given to William B. Stout, owner of the Stout Metal Airplane Company, which produced in the early 1920s two single-engined cantilever high-wing monoplanes, the 4-seat Air Sedan and the Model 2-AT mailplane. Both were of all-metal construction, with a corrugated metal skin, and when, in August 1925, the Stout company was purchased by the Ford Motor Company, work was begun on developing the 2-AT into a three-engined design. The resulting 3-AT prototype was both ugly and ungainly, and was destroyed in a hangar fire early in its career. A drastic redesign was undertaken, led by Harold Hicks and Thomas Towle, which emerged in 1926 as the 4-AT. The prototype, which first flew on 11 June 1926, was powered by three 200 hp Wright J4 Whirlwind uncowled engines and had accommodation for a crew of 2, in an open cockpit, and 8 passengers. The initial production model, of which fourteen were built, was designated 4-AT-A. In 1927 there followed the 4-AT-B,

an improved model with 220 hp J5 Whirlwinds, increased wing span and seating for up to 12 passengers. Thirty-five of this version were built. The 4-AT-C (one built) was a variant of the 4-AT-B with the nose engine replaced by a 400 hp Wasp radial, and three 4-AT-D's (all different) were built with various powerplants and other modifications. The last major 4-AT model was the 4-AT-E (twenty-four built), powered by three 300 hp J6 Whirlwinds. Production of the 4-AT series was brought to a total of seventy-eight with a single 4-AT-F, built in 1931 and differing only in detail from the E model.

Apart from the 4-AT-F, production of the 4-AT series had ended in 1929, but by that time a new basic Tri-motor had appeared in the form of the Model 5-AT. This had the wing span increased from 74 ft 0 in (22.56 m) to 77 ft 10 in (23.72 m), the cabin enlarged to seat 13 passengers, and the power increased to three 420 hp Pratt & Whitney Wasp radials. Three were built in 1928 as Model 5-AT-A, after which seating capacity was further increased in the 15-seat 5-AT-B (forty-two built) and 17-seat 5-AT-C (forty-eight built) and 5-AT-D (twenty-four built).

During its career the 'Tin Goose' inevitably underwent both official and unofficial modification to meet the needs of particular operators. It was flown with wheel, float and ski landing gear, and several aircraft were subjected to changes in equipment, interior layout, door sizes and so on. Development by no means ended with the 5-AT series. Later designations included the 6-AT-A (5-AT-C with 300 hp J6 engines; three built); 7-AT-A (conversion of one 6-AT-A with a 420 hp Wasp in the nose; later converted back to 5-AT-C); 9-AT (conversion of one 4-AT-B with three 300 hp Wasp Juniors); 11-AT (conversion of one 4-AT-E with three 225 hp Packard Diesel engines; originally designated 4-AT-G, later converted to 4-AT-B); and 13-A (conversion of one 5-AT-D with a 575 hp Cyclone in the nose and two 300 hp J6's; later restored to 5-AT-D). The Model 8-AT was a one-off single-engined freighter, later sold to Pacific Alaska Airways, and was a 5-AT-C with the outer engines removed; Models 10-AT and 12-A were unbuilt projects. The final development, built in February 1932, was the Model 14-A, a 40-passenger machine powered by Hispano-Suiza engines (1,100 hp in the nose and two 715 hp outer engines), but this was never flown.

35 **Savoia-Marchetti S.71**

The Società Idrovolanti Alta Italia originally specialised in the design and manufacture of flying-boats and seaplanes, several of which achieved prominence in the 1920s. During the second post-war decade it became better known for its multi-engined landplanes designed for commercial transport and bomber roles. The first such transport design was the S.71, designed by Ing Alessandro Marchetti. The first S.71, I-AAYP, was flown in late 1930 and on 29 January 1931 Sandro Passaleva set up a world load-to-height record at Cameri by reaching an altitude of 21,457 ft (6,540 m) in this aircraft while carrying a payload of 4,409 lb (2,000 kg). The first four S.71's

(the others being I-SIAI, I-EOLO and I-PALO) were powered by three 240 hp Walter Castor seven-cylinder radial engines, and were followed by two more (I-ROMA and I-ALPI) with 370 hp Piaggio Stella VII radials. All six were delivered to Società Aerea Mediterranea (SAM), which inaugurated a service between Rome and Brindisi with the S.71 on 6 July 1931. When SAM became part of Ala Littoria in October 1934 its S.71 fleet continued to be employed, eventually operating a through service from Rome to Salonika. The Ala Littoria fleet still included four S.71's as late as 1937, though with the advent of the later S.73 and S.M.75 (which see) they may by then have been relegated to the company's services in Italian East Africa. A seventh S.71, the Stella-engined I-ABIV, was specially adapted as a mail transport.

The standard version was designed to seat a crew of 3 and up to 10 passengers, although it is likely that 8 was a more usual load.

36 **Fokker F.VII and F.VII-3m series**

From the modest initial batch of five F.VII's built for KLM in 1924–25, there grew up a family of single- and three-engined high-wing transport aircraft whose influence was world-wide, and which was eventually to realise a production total well in excess of two hundred and fifty aircraft. In mid-1921, to US requirements, Fokker built two examples of the F.IV, which was essentially an enlarged version of the F.III powered by a 400 hp Packard Liberty engine. They were evaluated by the US Army Air Service in the transport (T-2) and ambulance (A-2) roles, though no production order was placed. Fokker's next transport was the one-off F.V, first flown in December 1922, a parasol-wing monoplane that could be converted quickly into a biplane by adding a lower pair of wings. It seated a crew of 2 and 8 passengers, was powered by a 360 hp Rolls-Royce Eagle IX engine, and was eventually acquired by Olag, the Austrian airline.

The F.VII, which first flew (H-NACC) in 1924, had the same powerplant and seating capacity as the F.V, except for the final example, which was fitted with a 450 hp Napier Lion engine. Three of the five were later refitted with Bristol Jupiter engines. The F.VII was used primarily on KLM's European and domestic network; two were lost in accidents in 1926, one was resold via Fokker in 1927 to Standard Air Lines in the US, and one in 1931 to Pacific Aerial Transport in New Guinea.

A year after the appearance of the F.VII, Fokker produced a refined version known as the F.VIIa. Powered by a 400 hp Packard Liberty engine, the prototype (H-NACZ) flew for the first time on 12 March 1925 and was subsequently demonstrated in the United States. While in America Anthony Fokker heard about the Ford Reliability Tour to be staged later that year, and decided to compete. The obvious way to improve the reliability of the F.VIIa was to provide it with additional engines, and an example was quickly converted by fitting it with three 200 hp Wright J4 Whirlwind engines, one in the nose and two slung beneath the wings. This, the first trimotor Fokker, flew for the first time on 4 September 1925. It won the

Ford contest easily, and of some sixty-three or more F. VIIa's and F.VIIa-3m's eventually built, eighteen were exported to the United States. The original tri-motor was acquired by the Byrd Arctic Expedition and named *Josephine Ford*; on 9 May 1926 it became the first aeroplane ever to fly over the North Pole, and is today preserved as an exhibit in the Ford Museum at Dearborn, Michigan. Other preserved Fokkers include the F.VIIa *Alaskan*, now in the Liberty Museum, and another tri-motor, the famous *Southern Cross* flown by Charles Kingsford Smith on the first trans-Pacific flight (from Oakland to Brisbane) in May/June 1928, which is now on display in Brisbane. The latter aircraft had longer-span wings than previous tri-motors; it was originally built with three Whirlwind engines as *Detroiter* for the 1926 Arctic Expedition led by Hubert Wilkins, and was refitted with 220 hp Whirlwinds and a modified rudder to become the *Southern Cross*. Single-engined F.VIIa's were built for Balair, CIDNA (seven), DDL (two), KLM (eleven), Lot (six), Malert (two) and STAR (three); those for KLM and Balair were powered by 400 hp Gnome-Rhône Jupiter radial engines, while the aircraft for Lot and STAR had French Lorraines. Tri-motor F.VIIa-3m's were sold to Pan American (five), Reynolds Airways (two) and Western Air Express (one) in the United States, where this version was built by Fokker's American company, Atlantic Aircraft Corporation, for civil and military customers.

The production total of the F.VIIa and F.VIIa-3m was more than doubled by that of the slightly larger F.VIIb-3m, which was the most widely-built of any pre-war Fokker commercial transport. The F.VIIb-3m flew with at least a dozen alternative types of powerplant, ranging in output from the 215 hp Armstrong Siddeley Lynx to the 365 hp Gnome-Rhône Titan Major. Other engines, of intermediate ratings, included the 220 hp Wright J5, 240 hp Gnome-Rhône Titan, 250 hp Avia DR 14, 260 hp Walter Castor, 300 hp Wright J6, 300 hp Pratt & Whitney Wasp Junior, and 340 hp Armstong Siddeley Serval. The standard F.VIIb-3m airframe differed primarily from the F.VIIa-3m in having the longer-span wings first seen on the *Detroiter*, but with the taper interrupted inboard of the wing engines by a section with its trailing-edge at right-angles to the fuselage. It has been estimated that Fokker built about fifty-seven F.VIIb-3m's, including a few early examples with shorter-span wings. The overall total, excluding US production (see below), was about one hundred and forty-five, and included licence-built batches by Avia (fourteen), Avro (thirteen as Avro Ten, which see), Meridionali (two or more), Plage and Laskiewicz (eighteen) and SABCA (twenty-eight). Customers included Air Orient (two); Avio Linee Italiane (six or more); Balair (five); CIDNA (six); CLASSA (four); CLS (eight); CSA (five); Japan Air Transport (ten); KLM (eight); KNILM (seven); LAPE (three); Lot (eighteen); Sabena (thirty); Swissair (three); and Western Canada Airways (one). By resale and/or reformation of airlines, the total number of operators was, of course, considerably greater, ranging throughout Europe, Africa and the Middle and Far East. The

F.VIIb-3m carried a crew of 2 (sometimes 3), and had standard accommodation for 8 passengers, although the latter figure varied according to circumstances.

Developed versions were also built in the United States in 1928–29 as the F-10 and F-10A. The F-10, developed to meet a requirement of Western Air Express, had Dutch-built F.VIIb-3m wings, a US-built fuselage seating 12 passengers, and 420 hp Wasp engines. Seven were built, of which five were delivered to WAE, entering service in May 1928; four of these were later inherited by TWA. The other two were converted to F-10A standard, which introduced extended-span, US-built wings (with unbroken trailing-edge taper) and had higher operating weights and an improved performance. The F-10A could be powered by 420 hp or 450 hp Wasp engines. Approximately sixty civil F-10A's were built (plus others to military contracts); the principal initial customers were Pan American (twelve); Standard Air Lines (six); Universal Airlines (fifteen); West Coast Air Transport (three); and Western Air Express (twenty-one). Six of the WAE F-10A's passed into TWA ownership; another major operator was American Airways, which purchased sixteen from other airlines.

37 **Avro Ten, Five, Six and Eighteen**

These four types, combined production of which totalled twenty-one aircraft, stemmed from a licence acquired by A.V. Roe and Co in 1928 to build the Fokker F.VIIb-3m in the UK. Their names reflected the number of people, including crew, which each could carry.

The first to enter production was the Avro Ten (Type 618, seating a crew of 2 and 8 passengers). This differed only slightly from the standard Dutch-built F.VIIb-3m, and twelve were built between 1929 and 1933 for Australian National Airways (seven); Imperial Airways (two, for charter operations); Midland and Scottish Air Ferries (one); and the Egyptian Air Force (two). One of the Egyptian pair was sold in 1935 to Indian National Airways.

In 1930 a smaller version, redesigned by Avro, appeared as the Avro Five (Type 619), seating a pilot and 4 passengers and powered by three 105 hp Armstrong Siddeley Genet Major 1 radial engines. Wilson Airways of Kenya ordered two, later adding a third to replace one that had been lost. Two other Fives were built.

The Avro Six (Type 624) carried one more passenger than the Five. It had the same powerplant, and the gross weight was increased from 4,420 lb (2,005 kg) to 5,000 lb (2,268 kg). Two Sixes were built, both sold eventually to the Chinese government.

The Avro Eighteen (Type 642/2m, seating 2 crew and 16 passengers), which appeared in 1934, represented a considerable redesign and bore little resemblance to the Fokker F.VIIb-3m. It utilised wings of the same span as the Avro Ten, though of slightly greater area, but the fuselage was completely new and considerably more streamlined. Only one was built, built, powered by two 460 hp Armstrong Siddeley Jaguar VID radial engines; it was operated for a short period in 1934 by Midland and

Scottish Air Ferries, and later as a freighter, first in Europe and eventually in New Guinea. Avro also built one four-engined Type 642/4m for an operator in India.

38 **Fokker F.VIII, F.IX, F.XII and F.XVIII**

Except for the twin-engined F.VIII, these four airliners all represented variations on the Fokker tri-motor theme of the late 1920s and early 1930s. The F.VIII, which first flew (H-NADU) on 12 March 1927, was developed to meet a KLM requirement for a transport with greater capacity than the single-engined F.VII, and was powered by two uncowled underslung 480 hp Gnome-Rhône Jupiter VI radial engines. The cabin was designed to accommodate 15 persons, although actual loads varied between 10 and 24 passengers. The F.VIII carried a crew of 2, and there was a spacious hold for baggage, mail or freight in the nose section, which could be swung open for loading. The prototype served only briefly with KLM before being lost in a crash in August 1927, but during the following year six others (H-NAED/E/F/G/H/I) were delivered for service on the airline's European network. In addition, Fokker supplied one F.VIII (H-MFNA) to Malert, and two 13-passenger examples (H-MFNB and 'NC) were built under licence in Hungary in 1929–30 by Manfred Weiss. The KLM aircraft remained in service for several years, undergoing various refits with 500 hp Wasp or 690 hp Cyclone engines and receiving PH- registrations. One of the KLM aircraft went to the Netherlands West Indies, one to AB Aerotransport in Sweden (1934) and two to British Airways in 1936; one of the British-registered F.VIII's was sold to a Swedish customer in 1939.

The F.IX, only two of which were built in Holland, was Fokker's largest tri-motor transport, and was intended to carry up to 6 passengers in sleeper accommodation over the route from Amsterdam to the Netherlands East Indies. In fact, although a proving flight was made in late 1930, it was used only on European services (mostly Amsterdam-London) with seating for up to 17 daytime passengers. The prototype (PH-AGA *Adelaar*) flew on 26 August 1929; it was delivered to KLM in May 1930 and remained in service until the autumn of 1936. The second Fokker-built F.IX (PH-AFK), also powered by three 480 hp Gnome-Rhône Jupiter VI engines, had a longer and more spacious fuselage which could accommodate up to 20 passengers. It served with KLM only from January to August 1931 before being lost in a crash. Avia in Czechoslovakia, which built a bomber development of the F.IX known as the Avia F.39, developed from the latter a transport version designated F.IXD. This also seated 20 passengers, and apart from having three 580 hp Walter-built Bristol Pegasus IIM2 engines was generally similar to the Dutch-built version. Two Avia F.IXD's (OK-AFF and 'AFG) were built for CSA in 1935.

The F.XII, though smaller than the F.IX, was also of larger capacity than the F.VII-3m series and was basically a three-engined development of the F.VIII. The prototype (PH-AFL) flew in early 1931, and during 1931–32 eleven

F.XII's were built by Fokker: two for KNILM (PK-AFH and 'AFI), one for AB Aerotransport (SE-ACZ *Värmland*), and eight for KLM (PH-AFL *Leeuwerik*, PH-AFU *Uil*, PH-AFV *Valk*, PH-AID *Duif*, PH-AIE *Ekster*, PH-AIH *Havik*, PH-AII *Ibis* and PH-AIJ *Ijsvogel*). The KLM aircraft, used for the Amsterdam-Batavia service, seated 16 passengers and were powered by three 425 hp Wasp C engines; the Swedish example had 500 hp Wasp T1D1's and seated 14 passengers. The F.XII entered service with KLM in March 1931 and continued until 1936, when six were sold to Crilly Airways and British Airways in the UK and one to Air Tropic in France. Two additional F.XII's, OY-DIG *Merkur* (1933) and OY-DAJ *Kronprinsesse Ingrid* (1935), were manufactured under licence by Orlogsvaerftet in Denmark and operated by DDL, initially on services from Copenhagen to Berlin, Hamburg and Hanover.

The last tri-motor to follow the traditional Fokker pattern of the period was the F.XVIII, built in 1932 to replace the twin-engined F.VIII on the KLM Amsterdam-Batavia route, with sleeper-type accommodation for 4 passengers. Five were built, and were delivered as PH-AIO *Oehoe*, PH-AIP *Pelikaan*, PH-AIQ *Kwartel*, PH-AIR *Rijstvogel* and PH-AIS *Snip*. They were powered originally by three 420 hp Wasp engines. After 2 or 3 years on this route, *Oehoe* and *Snip* were allocated to the West Indies network, the other three serving on for a while as 13-passenger day transports on KLM's European routes. In 1935–36 PH-AIQ and 'AIR were sold to CLS in Czechoslovakia, and 'AIP to Air Tropic.

36 **Junkers G 38**

On 12 December 1915 the first flight took place of the Junkers J 1, an all-metal cantilever monoplane which represented the first practical application of a patent taken out five years previously by Prof Hugo Junkers for a thick-section aerofoil with a load-bearing metal skin. For many years thereafter Prof Junkers pursued studies for large transport aircraft which would be virtually flying wings, with the main powerplant, fuel and passenger loads housed almost entirely within the wings. This ambition was approached very closely by the G 38, designed in 1928 by a team under Dipl Ing Ernst Zindel and flown for the first time at Dessau on 6 November 1929.

Everything about the G 38 was huge. Its wings were 6 ft $7\frac{1}{2}$ in (2.02 m) deep at their thickest point and had a root chord of 35 ft $5\frac{1}{4}$ in (10.80 m), decreasing to 9 ft $5\frac{3}{4}$ in (2.89 m) at the tip. The maximum depth of the fuselage was 11 ft $9\frac{3}{4}$ in (3.60 m), and the biplane tail unit spanned 30 ft $9\frac{1}{4}$ in (9.38 m). Within the multi-spar wings were the engines, fuel load, part of the passenger accommodation and a large freight storage area. It has been said that the first G 38 (D-2000) was powered originally by two L 88 and two L 8 Junkers petrol engines, but an account of a visit to Dessau during construction of the prototype, published in *l'Aéronautique* in March 1930, describes the inboard pair as Junkers L 55 twelve-cylinder Vee-type engines of 650 hp, each driving a four-blade propeller, and the outboard pair as 400 hp Junkers L 8 six-cylinder in-lines, each driving a two-blade propeller. A change to 800 hp L 88's in the inboard posi-

tions was perhaps made during the early months of 1930. All propellers were of 14 ft 9¼ in (4.50 m) diameter, coupled to the engines through a gearbox and shafting. A small diesel APU in the port wing provided compressed air for the main-wheel brakes, engine starting and fire extinguishing system. There was complete accessibility to all engines during flight. Between the two engines in each wing was a machine-room, into whose space the underwing radiators could be retracted, and aft of the engine bays was a continuous tunnel running from port to starboard through the wing between the two outer engines. Aft of this tunnel, and astern of the two machine-rooms, fuel for up to 20 hours' flying was contained in 28 interconnected tanks. Inboard of the fuel area (i.e. in the wing roots) and underneath the fuselage cabin floor were compartments capable of housing a total of 6,614 lb (3,000 kg) of freight. Passenger accommodation was for 30 persons, 26 seated in successive cabins within the single-level fuselage and 2 each in the wing leading-edges inboard of the inner engines. The forward fuselage cabin, virtually buried within the wing centre-section, had four circular skylights in the roof, and for long flights there was provision to convert part of the fuselage accommodation to sleeper configuration. A further engine change in 1932 replaced the two L 8 engines by 800 hp L 88a's, the aircraft then having four-blade propellers on all engines and being redesignated G 38a.

Junkers built a second G 38, which received the registration D-2500. This was apparently powered at the outset by the L 8/L 88 engine combination, but was redesignated G 38ce in 1932 after being refitted with four L 88a's. It introduced some major structural alterations, primarily in connection with the flying control surfaces and passenger accommodation. The wings of the first G 38 had no flaps, but were fitted with long-span ailerons which terminated just outboard of the outer engines. The second G 38 had the full Junkers 'double wing' system, with three-section movable surfaces over virtually the whole of each trailing-edge. These improved airfield performance to the extent that D-2500, despite its higher gross weight, could take off and land over a 66 ft (20 m) obstacle in 1,890 ft (575 m) and 1,495 ft (455 m), compared with 2,510 ft (765 m) and 2,020 ft (615 m) for D-2000. The vertical tail surfaces comprised three fins and three rudders, as compared with three rudders and a single centre fin on the first G 38. The forward section of the fuselage was built up above the wing centre-section, permitting a substantial increase in the number of side windows; the fuselage was laid out to seat 11 passengers in the elevated forward cabin, 11 in the lower centre cabin and 4 in a third compartment for smokers only. Aft of this was a toilet; a second toilet was located in the starboard wing root, and there was a pantry on the port side of the fuselage ahead of the forward passenger cabin. Passenger accommodation was brought up to a total of 34 by seating 3 persons in each of the wing leading-edge cabins and 2 in the extreme nose. Provision was made for a 7-man crew, consisting of a captain, two pilots, two flight engineers, a wireless operator and a steward. In due course, D-2000 was

brought up to a similar standard.

Both G 38's were acquired by Deutsche Lufthansa, D-2000 in 1930 and D-2500 in the following year. The former entered service on 1 July 1931, followed by the latter on 1 September 1931. The two aircraft were named *Deutschland* (D-2000) and *Hindenburg* (D-2500, re-christened *Generalfeldmarschall von Hindenburg* in April 1933), and when all-letter civil registrations were introduced in Germany their identities became D-AZUR and D-APIS respectively. In 1934 each was re-engined with four 750 hp Junkers Jumo 204 engines. D-2000/D-AZUR appears to have been used on an ad hoc basis rather than on regular scheduled services, but between them the two aircraft took part in DLH operations on routes from Berlin to Frankfurt, Königsberg, Munich, Rome, Stockholm and London. The original aircraft was lost in a take-off crash at Dessau in 1936, but D-APIS survived to be taken over by the Luftwaffe in September 1939.

40 **Potez 62**

Perhaps the most noticeable external feature of the Potez 62 was its fuselage, which in profile had been carefully contoured to reproduce that of an aerofoil cross-section. This resulted in an aeroplane of considerably more attractive appearance than the Potez 540 bomber (see *Bombers 1919–39*), from which the commercial transport was developed. Design of the Potez 62 was undertaken in 1934, and the prototype (F-ANPG) was flown for the first time on 28 January 1935, powered by two 870 hp Gnome-Rhône 14 Kirs Mistral Major fourteen-cylinder radial engines. The wing/powerplant/landing gear arrangement was generally similar to that of the Potez 540, with the main wheels retracting backward into the rear of the engine nacelles. A roomy flight deck, with generous window area, was provided for the 2-man flight crew, while the fuselage was divided into two cabins accommodating 6 persons forward and 8 aft in individual seats. Up to 16 passengers could be carried. Toilet and pantry were located between the flight deck and forward cabin, and there were compartments for baggage, mail or small freight in the nose and aft of the rear cabin.

The prototype, and eleven generally similar Potez 62-0's, were delivered to Air France, one (F-AOTZ) being an executive aircraft for the French Air Minister. The remainder, which began to enter service in June 1935, included F-ANPG, named *Albatros*, and F-ANPH *Cormoran*, F-ANPI *Cigogne*, F-ANPJ *Courlis*, F-ANQK *Gypaété*, F-ANQL *Ramier*, F-ANQM *Martinet*, F-ANQO *La Berceuse*, F-AOTU *La Séduisante*, F-AOUA *Flamant* and F-AOUE *Ibis*. Initially they were employed on services from Paris to Madrid, Marseilles and Rome. Nine were refitted in 1937 with 900 hp Gnome-Rhône 14N 16/17 engines.

Prior to this, there had appeared in 1935 the Potez 62-1 (first example F-ANQN *Aguila*), which had 720 hp Hispano-Suiza 12Xrs engines and very slight sweepback to the wings. Air France took delivery of F-ANQN (later renamed *Flamant*) and ten other Potez 62-1's comprising F-ANQP *L'Etourdie*, F-ANQQ *Falcon* (later *La Capricieuse*), F-ANQR *La Tapageuse* F-ANQS *La Fidèle*, F-AOTT

L'Entreprenante, F-AOTV *Alcyon*, F-AOTX, F-AOTY *Magoary*, F-APOC *Héron* and F-APOD *Pluvier*. In addition, three of its Potez 62-0's were modified to 62-1 standard.

With the build-up of its Potez 62 fleet, Air France gradually increased the number of routes on which these aircraft were employed. They began to operate to Scandinavia and other European centres, on the Far Eastern routes which Air France had inherited from the former Air Orient, and (in 1936) on South American routes across the Andes between Buenos Aires and Santiago. On the latter routes it is believed that the three 62-0/62-1 converted aircraft were operated in a mixed-payload capacity, carrying a cargo of mail and up to 7 passengers. Most Potez 62's had been retired by the outbreak of World War 2, but at least one is known to have been operated by the Free French forces.

41 Armstrong Whitworth A.W.15 Atalanta

The Atalanta did not attract the same publicity as some of its more illustrious companions in the Imperial Airways fleet of the 1930s, yet its adaptability and safe operating record were no less deserving of attention. It has been said that its career was one of 'unobtrusive efficiency'. It is a measure of that efficiency that, of the small batch of eight Atalantas built, only one was lost in a flying accident in the first 6½ years of service; three continued to operate until 1942, and two others until 1944.

Designed in 1931 under the leadership of J. Lloyd, the Atalanta was evolved to meet the specific needs of Imperial Airways' African and Far Eastern routes. Particular attention was paid to the provision of adequate reserve power for flight in 'hot and high' conditions, the comfort of passengers during long flights in tropical temperatures, and a healthy cruising speed. The Atalanta carried a crew of three, and could accommodate various combinations of passengers and mail or other freight, or 17 persons in all-passenger configuration. The prototype (G-ABPI), named *Atalanta*, made its first flight on 20 June 1932; the streamlined fairings over the main wheels were later removed. The prototype was awarded its C of A in August 1932, and was then renamed *Arethusa*. The name *Atalanta* was re-allocated to a later aircraft, G-ABTI, which on 31 December 1932, piloted by H. G. Brackley, left on the first proving flight to Cape Town, where it arrived on 14 February 1933. All eight Atalantas had been delivered by the end of April 1933, and on 29 May the seventh aircraft, G-ABTL *Astraea*, left on the first proving flight to Australia. Fitted with auxiliary fuel tanks, it reached Melbourne on 30 June 1933.

The Atalantas were intended primarily for employment on the Karachi-Singapore and Nairobi-Cape Town sectors of Imperial Airways' Far Eastern and South African routes, and the former service was opened by G-ABPI on 7 July 1933. From Singapore, passengers were taken on to Australia by QANTAS aircraft. The Karachi-Singapore service continued until 1 March 1938, when it terminated at Calcutta, and was suspended in mid-1939. One of the four Far Eastern Atalantas, G-ABTK *Athena*, was burnt out in a hangar fire at Delhi in September

1936, and G-ABTH *Andromeda* was withdrawn from service in June 1939. The other two, G-ABPI and G-ABTM *Aurora*, had operated since August 1933 as VT-AEF and VT-AEG in the colours of Indian Transcontinental Airways (ITCA), an associate airline formed on 21 June 1933 in which Imperial Airways had a 51 per cent holding. The two ITCA Atalantas, and G-ABTI, G-ABTJ *Artemis* and G-ABTL from the African service (G-ABTG *Amalthea* having been lost in a crash at Kisumu in July 1938), were impressed in April 1941 for service with the Indian Air Force.

42 Armstrong Whitworth A.W.27 Ensign

Following the decision in 1934 to inaugurate the Empire Air Mail Scheme, two major new aircraft types were ordered by Imperial Airways with particular emphasis on greater range and payload than the types then in its fleet. Of these two, unquestionably the more successful was the Short 'C' class flying-boat, described in the companion volume *Flying-Boats and Seaplanes since 1910*. The other was the Armstrong Whitworth Ensign, which, although representing less of a gamble on the part of the airline, was the largest British landplane of its time. As events turned out, it was something of a disappointment, and had performed little useful airline service before the outbreak of war.

The airline made its requirements known early in 1934, and a design team led by J. Lloyd of Armstrong Whitworth evolved a four-engined monoplane with a thick, shoulder-mounted cantilever wing, and accommodation for up to 40 passengers in an elegantly-contoured fuselage. In 1935 Imperial Airways ordered twelve aircraft, including the prototype, but it was nearly three more years before the first aircraft (G-ADSR) made its first flight at Hamble on 24 January 1938. The second A.W.27 flew for the first time on 26 May of that year. Preliminary test flights revealed shortcomings in the rudder control and fuel feed system, but the chief problem lay in the unreliability of the four 880 hp Armstrong Siddeley Tiger IX engines. Nevertheless, Imperial Airways initiated route-proving flights with the Ensign in October 1938, and with the approach of Christmas assigned three to fly the heavy seasonal mail to Australia. The results were, to say the least, unfortunate: two of the aircraft succumbed to engine trouble, and the third to a fault in the landing gear. The Ensigns were returned for modification, from which they emerged refitted with 920 hp Tiger VIII or IXc engines and de Havilland constant-speed propellers. From mid-June 1939 they began to be re-delivered to Imperial Airways, flying on European routes on a limited basis until the outbreak of war, and all twelve were back with the airline by October 1939. During 1940 four of the twelve were lost: two to enemy action, one in a forced landing, and one scrapped. However, in late 1936 the original order for twelve aircraft had been increased by two, which had not been delivered prior to the outbreak of war. Moreover, Imperial Airways had in 1939 suggested a refit with 1,100 hp Wright GR-1820-G102A Cyclone engines. These were fitted in the two final aircraft in 1941, the first flight being made by G-AFZU as the

prototype Ensign II on 20 June 1941, and the surviving Ensign Is were also brought up to Mk II standard. Four of the original dozen were completed to 'European' configuration, seating up to 40 passengers in three main cabins and an optional rear cabin. The 'Empire' version, using only the three main cabins, had daytime seating for 27 passengers (9 per cabin), or could be converted as a sleeper transport with 20 bunks. There was a flight crew of 3, and 2 stewards. Between the first and second cabins, beneath the wing centre-section, was a promenade deck (on the port side), a galley and 2 toilets. It was planned at one time that the four 'Empire' aircraft should be operated by Indian Transcontinental Airways, but this plan was abandoned after the outbreak of World War 2.

43 **Junkers F 13**

A Junkers policy of encouraging airline growth by making it so freely available, combined with its own undoubted merits, made the Junkers F 13 one of the real pioneers of early commercial air transport. It was in production from 1919 to 1932, during which time three hundred and twenty-two were built, and these served in two dozen or more countries, including almost every major state in South America. The origins of the F 13 can be traced back to the Junkers J 10 all-metal attack monoplane, described under its military designation CL.I in the *Fighters 1914–19* volume. Immediately after the end of World War 1 Junkers' chief designer, Dipl Ing Otto Reuter, was instructed to develop a transport aircraft using the same constructional techniques and materials. Two designs were produced – the J 12, which was little more than a modified J 10 (and was not built), and the J 13, subsequently redesignated F 13. The identity of the prototype is not absolutely certain, but it seems possible that this was the aircraft registered D183 and named *Herta*, after the eldest daughter of Prof Junkers. The first flight, with a 160 hp Mercedes D.IIIa engine, was made on 25 June 1919, and on 13 September 1919 a Junkers F 13 – possibly the prototype – carrying 8 people flew to an altitude of 22,145 ft (6,750 m). Germany was excluded at the time from membership of the FAI, which precluded the flight from being recognised as an offical international class record. It is probable that, for this flight, the aircraft was to production standard with increased wing span and a 185 hp BMW IIIa engine.

Major airline operators of the Junkers F 13 included AB Aerotransport (Sweden); Ad Astra Aero (Switzerland); Aero-Express (Hungary); Aerolot (Poland); Aeronaut (Estonia); Aero O/Y (Finland); Aero Traffic (Switzerland); CSA (Czechoslovakia); Deruluft (Germany-USSR); Deutscher Aero Lloyd; Deutsche Luft Hansa; Dobrolet (USSR); Junkers Luftverkehr; LARES (Romania); Lloyd Aereo Boliviano; Ölag (Austria); Pacific Airways (Canada); Sabena (Belgium); SAM (Italy); SAP (Portugal); SCADTA (Colombia); Sindicato Condor (Brazil); Transadriatica (Italy); UAE (Spain); Union Airways/South African Airways; Varig (Brazil); and Western Canada Airways. Eight were also operated by the US Post Office Department. Between them these carriers operated about two hundred F 13's, of which easily the largest fleets were those of Junkers Luftverkehr (sixty) and DLH (fifty-five). The former organisation, which existed from 1921 to 1926, served both to operate and to market the F 13, often making these aircraft available at extremely low rates, and sometimes entirely free of charge, to embryo airlines whose growth it wished to encourage.

The F 13 lived fully up to the description 'all-metal', having a metal-framed fuselage, multi-spar metal wings, and a complete covering, including the movable surfaces, of corrugated duralumin sheet. Standard accommodation was for a crew of 2 and 4 passengers. The crew cabin had a semi-enclosed appearance, but was without windows. Proof of the ruggedness of its airframe can be illustrated by the example depicted in the colour section. Delivered to AB Aerotransport in 1924, it was used initially on a Stockholm-Helsinki passenger service. In 1928 it was put into service for night mail operations on the Stockholm-Malmö-Amsterdam-London route, with fuselage letterbox and carrying a postal sorter in addition to the pilot. It was withdrawn from service in 1935 and presented to the Tekniska Museet (Science Museum) in Stockholm, where, except for a period in underground storage during World War 2, it stood outside in Nordic winter conditions for more than 30 years. Restored and repainted by SAS engineers in 1971, it now hangs inside the museum.

The system of designating variants of the F 13 was complicated, though apparently systematic. The original production version, with 185 hp BMW IIIa engine, was designated F 13a; subsequent changes to structure, gross weight etc, produced variants with suffix letters b, c, d, f, g, h, and k. To these were added a second suffix letter denoting the major types of powerplant fitted to later production batches; these were the 200 hp Junkers L 2 (suffix a); 310 hp Junkers L 5 (suffix e); 300 hp BMW IV (suffix i); 380 hp BMW Va (suffix o); and 480 hp Bristol, Gnome-Rhône or Siemens Jupiter VI (suffix ä). Other powerplants fitted at different times are reported to have included the Armstrong Siddeley Jaguar and Puma and the Pratt & Whitney Wasp. It seems that virtually any permutation of airframe standard and engine was possible, resulting in some 60 to 70 different variants of the F 13 during its lifetime. In addition, it was often referred to in a more general form as the F 13L, S or W, according to whether it was fitted with a wheel, ski or twin-float landing gear.

44 **Junkers G 23 and G 24**

These two closely-similar tri-motor transports were essentially scaled-up developments of the single-engined Junkers F 13. The same basic system of designating variants, by small suffix letters denoting changes in structure, weight and powerplant, seems to have been followed, but since much of the early flight testing and subsequent production could not be done openly in Germany the records of such activities are far from complete. The G 23, first flown in 1924, suffered particularly from these restrictions, which doubtless explains why the principal type was the larger and more adequately powered G 24. Dimensions of the

G 23 included a wing span and area of 92 ft 6 in (28.50 m) and 958.0 sq ft (89.00 sq m) and an overall length of 49 ft 11½ in (15.23 m). The prototype, with a 195 hp Junkers L 2 nose engine and a 100 hp Mercedes D.IIIa on each wing, was notably underpowered; but with a more realistic production installation of two wing-mounted L 2's and a 110 hp L 5 in the nose the G 23 had a cruising speed of 93 mph (150 km/hr) at a gross weight of 12,015 lb (5,450 kg).

The G 23 was clearly regarded as an interim model, and production seems unlikely to have exceeded about ten or a dozen aircraft, of which at least six are known to have been built in Sweden by AB Flygindustri. The principal operators were AB Aerotransport of Sweden and Ad Astra Aero of Switzerland, each of which had four. Two of the Swedish-built G 23's later went to UAE of Spain, and in Poland Aero Lloyd operated one twin-float G 23W. The G 23 entered service with ABA in May 1925 on its Malmö-Hamburg-Amsterdam route, later being relegated to night mail services.

The G 24, first flown in the summer of 1925, had wings of greater span and area than the G 23, but was otherwise similar externally. It had accommodation for 2 pilots, a wireless operator, and 9 passengers in individual armchair seats on each side of a central aisle. Behind the cabin were a toilet and a small baggage compartment, and aft of these a further baggage/freight compartment the full width of the fuselage. There was additional storage space in each wing, the total volume of all four compartments being some 156.4 cu ft (4.43 cu m). The G 24 was flown originally with three 230 hp Junkers L 2a engines; more common was the use of three 310 hp L 5's or one L 5 and two L 2a's. Other installations, offered or reported, included a 500 hp Isotta-Fraschini nose engine (with what wing engines is not known); three 380 hp Bristol- or licence-built Jupiter radials; three 500 hp BMW Va's; and three 425 hp Pratt & Whitney Wasp or 525 hp Hornet radials.

Known constructor's numbers account for seventeen G 24's built in Sweden (three being conversions of G 23's) and twenty-seven in Germany; it is probable that the total built was about sixty, though it may have been as high as seventy. The principal operator was Deutsche Luft Hansa, which received up to twenty-eight between 1926–27 and kept the type in full-scale operation on its European routes until the end of 1933. In smaller numbers, G 24's were operated by AB Aerotransport (one); Aero O/Y of Finland (one); in Afghanistan (one); Chile (three); by Helleniki Eteria Enaerion Synghinonion in Greece (four); Ölag in Austria (two); Sindicato Condor in Brazil (three); Transadriatica in Italy (three); Turkey (one); and Union Aerea Espanola (four or five). In 1927–28 nine G 24's of DLH and one of the Spanish aircraft were converted to single-engined F 24's with shortened wings and, initially, 750 hp BMW VIu engines. An eleventh F 24 was built and used to flight-test the Junkers Jumo engine.

45 **Junkers W 33 and W 34**

The W 33 and W 34 (W for Werkflugzeug, or general-purpose aeroplane) were, respectively, inline- and radial-engined refinements of the passenger-carrying Junkers F 13 intended for a wide range of duties. Many of these duties were military, and both types were produced in substantial numbers. One hundred and ninety-nine W 33's were built during 1927–34, and production of the W 34 and its military counterpart, the K 43, reached one thousand seven hundred and ninety-one.

The W 33 prototype (D-921), which first flew in 1926, was a converted F 13, powered by a 310 hp Junkers L 5 engine, the standard powerplant for most production aircraft. The W 33 was used by the under-cover Luftwaffe for communications and as a patrol seaplane; commercially-operated examples flew in 6-passenger, 2,205 lb (1,000 kg) cargo or mixed-payload configurations and were also used for aerial work. Airline operators included AB Aerotransport (two); Deruluft (one); Deutsche Luft Hansa (fifteen); Junkers Luftverkehr Persien (four or five); Lot (two, converted from F 13); Pacific Aerial Transport (one); and SCADTA (one). In early 1927 two landplane W 33's, D-1167 *Bremen* and D-1197 *Europa*, were prepared for an attempt to make the first east-west aeroplane crossing of the North Atlantic. They were powered by specially-boosted L 5G engines and the fuel load was increased to 660 Imp gallons (3,000 litres) by installing four additional tanks in the cabin. Both aircraft took off from Dessau on 14 August 1927, but had to abandon their attempts because of bad weather. Eventually, *Bremen*, flown by Kohl and von Hühnefeld, made a successful 37-hour crossing on 12/13 April 1928 between Baldonnel, near Dublin, and Greenly Island, Newfoundland.

Although it was used much more widely by airlines, commercial exploitation represented a comparatively small proportion of the large number of W 34/K 43 aircraft built. Operators included AB Aerotransport (two); Canadian Airways (five); Canadian Pacific Air Lines (three); China (one); Deutsche Lufthansa (ten or more); DNL (one); Guinea Airways (four or five); Lloyd Aereo Boliviano (two or more); Pacific Western Airlines (four); SCADTA (one); SETA (one); Sindicato Condor (five); Transadriatica (one); Union Airways/South African Airways (one); and Western Canada Airways (one). The prototype (probably D-922) was powered by a 420 hp Gnome-Rhône Jupiter VI radial engine and flew for the first time in 1926. Production began in the following year, and powerplants for later versions included the 540 hp Siemens Sh 20, 600 hp BMW Hornet C, Armstrong Siddeley Panther and Bristol Mercury VI.

46 **Northrop Alpha, Gamma and Delta**

Except that it lacked a retractable landing gear, the Northrop Alpha was as advanced a design as the Boeing Model 200 Monomail, of which it was a close contemporary. An all-metal, cantilever low-wing monoplane, the Alpha was designed in 1929 by John K. Northrop, and the prototype (X-2W) flew for the first time in April or May 1930, about the same time as the original Monomail. It was powered by a 420 hp Pratt & Whitney R-1340-C Wasp C nine-cylinder radial engine, and the original model, designated Alpha 2, was designed to carry 6

passengers in a fully-enclosed cabin in the front half of the fuselage. The pilot occupied a single open cockpit aft of the wing trailing-edge. An alternative model, the Alpha 3, was a mixed-payload version capable of carrying 3 passengers and 465 lb (211 kg) of mail or other cargo. Dimensions included a wing span and area of 41 ft 10 in (12.75 m) and 295.0 sq ft (27.41 sq m), and an overall length of 28 ft 5 in (8.66 m). At a gross weight of 4,500 lb (2,041 kg), the Alpha had a cruising speed of 145 mph (233 km/hr) and a range of 600 miles (965 km). It had a good airfield performance, including the ability to take off and land in 600 ft (183 m) or less. Production began in late 1930, and a Type Approval certificate was issued in November of that year. One aircraft, probably the prototype, was delivered to National Air Transport, and another (registered NS-1) was built as a personal transport for the US Assistant Secretary of Commerce for Aeronautics. The major customer, however, was TWA (Transcontinental and Western Air), which purchased three Alpha 2's (NC127W, NC11Y and NC966Y) and six Alpha 3's (NC933Y, NC942Y, NC947Y, NC961Y, NC993Y and NC999Y); these entered service in 1931. To these TWA added four examples (NC985Y, NC986Y, NC992Y and NC994Y) of a mail-only version known as the Alpha 4. This carried a pilot only, with a 1,060 lb (480 kg) cargo; it differed in having only a single cabin window on each side, and cantilever main undercarriage units enclosed in 'trouser' fairings. Eventually TWA brought all of its Alpha 2's and 3's (except NC966Y, which was converted to an Alpha 3) up to the standard of the Alpha 4 or the generally similar 4A. By the time TWA flew its last Alpha service, on 19 February 1935, the fleet had amassed a total of 5,413,736 miles (8,712,545 km) in some four years of operation. Three other Alphas were delivered to the US Army Air Corps for evaluation as a YC-19 and two Y1C-19's, but no military orders ensued.

The next major development of the design was the Gamma (the Beta having been a scaled-down Alpha for the private-owner and sport-flying market). The Gamma was essentially an extension of the mail/freight-carrying Alpha 4, produced in 1933. Among the thirty-eight built were NC12269, used by the Ellsworth trans-Antarctic Flight, and one British-registered example, G-AFBT, used as a testbed for a 1,400 hp Bristol Hercules fourteen-cylinder radial engine. An early Gamma was X12265, powered by a 700 hp Wright Cyclone. Named *Sky Chief*, it was flown by racing pilot Frank Hawks from San Diego to New York on 3 June 1933 in a time of 13 hours 27 minutes, at an average speed of 183 mph (294 km/hr). Three Gamma 2-D's (NR13757, NR13758 and NC13759) were delivered to TWA, and in the first of these the airline's vice-president, Jack Frye, set a new US cargo transport record on 13/14 May 1934 by flying from Los Angeles to Newark in 11 hours 31 minutes with a payload of 440 lb (200 kg). Though its commercial service was less extensive than that of its predecessor, the Gamma did much useful work in exploring the conditions later to be met by new generations of higher-flying transport aircraft travelling 'over the weather'. TWA's NR13758 had an Army turbo-supercharger fitted to its engine, with which it was able to explore icing, turbulence and other high-altitude weather phenomena at heights of up to 35,000 ft (10,670 m).

The final member of this Northrop family was the Delta, originally intended as an 8-passenger development of the Gamma, with the pilot seated in a fully-enclosed cockpit at the forward end of the fuselage. Comparatively few Deltas were built for commercial use. TWA had one only, a Model 1-A (NC12292), which had been in service (as a trans-continental express mailplane) for only three months before it was lost following an engine fire in November 1933. At least one (Model 1-B?) was supplied to Aerovias Centrales SA of Mexico in 1933, as X-ABED; and the third production Delta, designated Model 1-C, was sold to AB Aerotransport of Sweden as SE-ADI. It was intended as an entrant in the 1934 'MacRobertson' race, but did not after all compete and went eventually to a customer in Iraq. Canadian Vickers of Montreal acquired a manufacturing licence for the Model 1-D, derived from the Gamma 1-D, and in 1936–37 built three Mk I and seventeen Mk II Deltas for the Royal Canadian Air Force.

47 **Boeing Monomail**

Although it did not achieve production status, the Boeing Monomail represented, for its time, an advance in state-of-the-art design and construction techniques which foreshadowed the appearance of the true modern airliners typified later by the Boeing 247, the Douglas DC types and the twin-engined Lockheeds. When the original Model 200 Monomail (NX725W) made its first flight on 6 May 1930, the production of a smooth-skinned, all-metal cantilever low-wing monoplane with a neatly-cowled engine and semi-retractable main landing gear would have been a bold enough step for any manufacturer in the world. For Boeing, to thus break away from the safe tradition of wood-and-fabric-covered biplanes in the midst of the economic depression which followed the 1929 stock market collapse, it was doubly so. In one sense, perhaps, the Monomail was too far ahead of its time for its own good, for it appeared before the development of the variable-pitch propeller, which would have enabled it to make the fullest use of its engine power. As it was, the only propellers then available had to have their pitch pre-set before a flight, which meant that an operator could select for either a take-off with full payload or a high cruising speed once airborne, but not both. By the time that variable-pitch propellers were available, the Monomail was about to be superseded by aircraft of later design.

In one respect, which strikes an odd note in the light of its many other advanced features, the Monomail did retain what was soon to become an outworn concept. The pilot still sat in an open cockpit well back along the fuselage, aft of the centrally-located 220 cu ft (6.23 cu m) mail/cargo compartment in the fuselage. This was exactly the same layout as in the Boeing Model 40 biplane of 5 years earlier, and one of two links with the older design, for the Model 200 also had the same powerplant

as the Model 40B, a 575 hp Pratt & Whitney Hornet B radial.

Boeing built a second Monomail, the Model 221, shortly after the Model 200. Registered NC10225, it was flown for the first time on 18 August 1930 and was identical to the Model 200 except in one respect. By adding 8 in (20.3 cm) to the length of the fuselage, and reducing the size of the mail compartment, Boeing was able to insert between the engine bay and the mail compartment a cabin to seat 6 passengers. Although this was endowed with four large oval windows on each side, access via the small forward door cannot have been easy and the small cross-sectional area of the fuselage must have made conditions in the cabin somewhat claustrophobic. Nevertheless Boeing put the Model 221 into commercial service with its own operating company, Boeing Air Transport. Eventually both Monomails underwent further modification, in which an additional 2 ft 3 in (0.69 m) was added to the overall length, allowing the carriage of up to 8 passengers and a 750 lb (340 kg) load of mail or cargo. In this configuration the aircraft were designated Model 221A, both serving for a time with Boeing Air Transport and the original aircraft later with United Air Lines.

48 **Airspeed Courier**

The Courier, a small, single-engined feeder-line transport, was not built in great numbers, but made a number of contributions to the advancement of aircraft design and operating techniques during the 1930s. Among British aircraft, it was the first type with a retractable landing gear to go into series production – yet, paradoxically, this feature was eliminated from many Couriers later in their service. Designed by A. H. Tiltman, the prototype A.S.5 Courier (G-ABXN) was completed in 1932, and made its first flight on 11 April 1933, powered by a 240 hp Amstrong Siddeley Lynx IVc engine. It was designed for use by Sir Alan Cobham in an attempt to make a non-stop flight from England to India, using the technique of aerial refuelling, and the cabin space was occupied by additional fuel tanks. The attempt, in September 1924, had to be called off after the aircraft reached the Sudan, though a successful refuelling from a Handley Page W10 tanker aircraft had been made over the English Channel.

A production line of fifteen Couriers was laid down, and twelve of these were eventually completed as A.S.5A's, having the same powerplant as the prototype but increased normal fuel tankage and a tailwheel instead of the prototype's tailskid. Standard accommodation was for a pilot and 5 passengers, equivalent to a payload of 881 lb (400 kg). The first production Courier, G-ACJL, was entered for the 1934 'MacRobertson' race from England to Australia; it gained fourth place in the handicap section, and at the end of the year was sold to an Australian buyer to become VH-UUF. First airline customer was Portsmouth, Southsea and Isle of Wight Aviation, which initially flew two Couriers (G-ACLR and 'LT) on its ferry service across the Solent in 1934. Two other A.S.5A's (G-ACSY and 'SZ) were delivered at about the same time to London, Scottish and Provincial Airways, which opened a Leeds-London-Paris service on 6 August 1934 but lost G-ACSY in an accident at the

end of the following month. Another Courier, G-ACLS of Air Taxis Ltd, suffered a crash in October 1934, LSPA lost its second Courier in May 1937, and another aircraft, G-ACVE, was crashed in August 1936 in an attempted hijacking by its ground crew, who intended to fly it to Spain to take part in the Civil War. All of the other ten British-based Couriers survived until the outbreak of World War 2, eight of them (G-ABXN, G-ACLF, G-ACLR, G-ACLT, G-ACVF, G-ACZL, G-ADAX and G-ADAY) having spent most of the intervening period in the service of North Eastern Airways and/or Portsmouth, Southsea and Isle of Wight Aviation. The latter operator, finding the retractable undercarriage an unnecessary refinement for the short distances involved in its Ryde ferry service, had its aircraft converted to a fixed landing gear.

Of the eight Couriers listed above, G-ACLF differed in being an A.S.5B, having a 275 hp Armstrong Siddeley Cheetah V engine. One other A.S.5B (VT-AFY) was built in 1934 for the Maharajah of Jaipur. There were two other 'special' Couriers, the first being K4047, an A.S.5A used by the Royal Aircraft Establishment at Farnborough for anti-icing experiments and for testing with various wing and under-fuselage flap systems. The other was G-ACNZ, the sole A.S.5C, which was purchased by Napier for tests with the 325 hp Rapier IV sixteen-cylinder H-type engine. This Courier achieved an average speed of 166 mph (267 km/hr), as compared with the 132 mph (212 km/hr) cruising speed of the standard A.S.5A. It, too, later joined the PSIOW fleet. In 1940 all nine civil-registered British Couriers were impressed into the RAF.

49 **Lockheed Orion**

Last in the family that stemmed from J. K. Northrop's original Vega design (which see), the Lockheed Model 9 Orion was one of four low-wing derivatives of this famous line. These began with the Model 4 and Model 7 Explorers of 1929 and 1930, single-seat racers with a 450 hp Wasp engine and a top speed of 165 mph (265.5 km/hr). From the Explorer Gerard Vultee developed a long-range 2-seater, the Model 8 Sirius. The first customer for this was Charles Lindbergh who, with his wife as passenger, set up a new US trans-continental west-to-east flight record of 14 hours 45 minutes between Glendale, California, and New York on 20 April 1930. In 1931 and 1933, after it had been converted to a twin-float seaplane, Lindbergh flew it on many survey flights over the North and South Atlantic and the North Pacific on behalf of Pan American Airways. This Sirius, named *Tingmissartoq*, is now in the National Air Museum in Washington. In all, Lockheed built fourteen Sirius (five Model 8, eight Model 8A and one metal-fuselage Model DL-2), of which Bowen Air Lines and Wedell-Williams Air Service each had one. Sirius development continued with the Altair, six of which were built including two DL-2A's with metal-skinned fuselages. Six other Altairs were produced by converting Sirius airframes.

The fourth and last low-wing version, the Orion, was also the most numerous, thirty-five original Orions being built and an additional five produced by conversion.

Major models were the Model 9 (eighteen, including three conversions and one 'Special'), with a 450 hp Wasp SC and seating for 6 passengers inside the front fuselage; and the Model 9D (thirteen built, including one 'Special'), with the same seating capacity but fitted with wing flaps and a 550 hp Wasp S1D1 engine. Other Orion designations signified chiefly a difference in powerplant and included the Models 9B (575 hp Cyclone R-1820-E), 9E (450 hp Wasp SC1), 9F (645 hp Cyclone R-1820-F2) and 9F-1 (650 hp Cyclone SR-1820-F2).

In US domestic service the Orion was in operation at various times with American Airways and Varney Air Service (six each); Northwest Airways, Transcontinental & Western Air, and Wyoming Air Service (three each); Air Express, Bowen, Continental Airways, Inland Air Lines, New York & Western Airlines, and Pan American (two each); and New York, Philadelphia & Washington Airway (one). Outside of the US the major operators were Swissair, which had two, and three Mexican airlines: Trasportes Aéreos de Chiapas (five), Aerovias Centrales (three) and Compania Mexicana de Aviación (two).

50 **Clark** (**General Aviation**) **G.A.43**

Relatively unknown among transport aircraft of the inter-war years, the G.A.43 was nevertheless among the first of the breed of cantilever low-wing, all-metal, retractable landing gear airliners to appear in the early 1930s. Its precise origin is obscure, but the concept of the G.A.43 appears to have begun in about 1929–30 with its designer, Col Virginius Clark, whose name is best known in connection with the Clark aerofoil. Development of the design was somewhat protracted; it was undertaken by the American Airplane and Engine Corporation at Farmingdale, New York, until late 1932, when responsibility for continuing its development was transferred to the General Aviation Manufacturing Corporation of Dundalk, Maryland. The prototype (X775N), then known as the Pilgrim 150, almost certainly made its first flight in 1933, and originally had fabric-covered wingtips and a non-retractable landing gear with streamlined fairings over the main legs and all three wheels. So clean was the design aerodynamically that it was decided to make the main gear capable of retracting backwards into streamlined underwing fairings, and on production aircraft the outer wings had the same aluminium skinning as the rest of the aircraft. Only the wing and tail movable surfaces were fabric-covered.

So far as is known only five G.A.43's, including the prototype, were built. One was fitted with a 575 hp Pratt & Whitney Hornet C radial engine, the others having one version or another of the Wright Cyclone ranging from 625 to 700 hp. The enclosed cockpit seated a crew of 2 side by side, usually with dual controls, and the main cabin could accommodate 10 passengers in individual seats on each side of the central aisle, with a toilet at the rear. After being modified to production standard and serving as a demonstrator, X775N was delivered in 1934 to the Mitsui Bussan in Japan, where it was handed over to the Nakajima company and re-registered J-BAEP. It is believed that the aircraft was dissected, to give the Japanese industry an insight into American techniques of all-metal aircraft construction, later being reassembled and sold to the para-military transport force of Manchukuo.

Airline service of the G.A.43 was limited to the four production aircraft, the first of which was Swissair's CH 169, delivered in March 1934 and operated on the Zurich-Frankfurt night mail service and on passenger services to Vienna and between Zurich, Basle and Geneva. The fourth production aircraft was also operated by Swissair, over the same routes, as HB-ITU. Ordered in March 1935, it was lost in April of the following year when it flew into a mountainside in central Switzerland; fortunately, no passengers were on board at the time. Later in 1936 Swissair sold its original G.A.43 to a French organisation which then made it available to the Republican forces during the Spanish Civil War.

The other two G.A.43's were both sold to US customers, Western Air Express operating the second (NC13903) between Cheyenne and Albuquerque. The third (NC13904) was purchased by Pan American Aviation Supply Corporation and operated by SCADTA on a route along the Magdalena River in Colombia. Given the fleet name *Bolivar,* this was the Hornet-powered machine; it was designated G.A.43-J and differed also from the other examples in having twin Edo floats and an enlarged main fin; a small underfin was fitted initially, but was later removed.

51 **General Aircraft Monospars**

The original Mono-Spar concept, developed by H. J. Steiger, was an ingenious attempt to produce a strong but light cantilever wing at a time when most other wings of this type were both thick and heavy. As its name implied, it was built around a single main spar, which was of the Warren girder type, made of duralumin and braced by a series of load-bearing tie-rods, the whole structure being fabric-covered. The designations ST-1 and ST-2 were given to two sets of experimental wings built to this formula at the request of the Air Ministry, which flight-tested the latter set on a Fokker F.VIIb-3m.

The first complete aircraft built to the Monospar principle was the ST-3, the sole example of which (G-AARP) made its maiden flight during the first half of 1931, powered by two 45 hp ABC Salmson 9Ad radial engines. It was a 3-seat low-wing monoplane, constructed on behalf of the Monospar Wing Company by Gloster Aircraft Ltd, and had a maximum speed of 110 mph (177 km/hr). Although scrapped in September 1932, its flight performance was successful enough to lead to the formation of General Aircraft Ltd to build further aircraft to the Monospar formula. These began with six ST-4's, the first of which (G-ABUZ) was flown in May 1932. The ST-4 was basically a scaled-up ST-3, with two 85 hp Pobjoy R radial engines and accommodation for 4 persons. Two went into airline service: one with Alpar Bern of Switzerland and one in the UK with Portsmouth, Southsea and Isle of Wight Aviation, which used it for a ferry service between Portsmouth, Ryde and Shanklin. From 1933 there followed twenty-four ST-4 Mk II's, with detail improvements including a nose-mounted landing light. Most of these went to private owners, but

airline customers included Highland Airways, International Airlines and Lundy and Atlantic Coast Air Lines. The next Monospar was the 5-seat ST-6, which had an enlarged cabin, restyled forward fuselage, improved engine cowlings and a manually-retractable main landing gear. Two were built, the first (G-ACGI) flying for a time with Southern Airways and the other being fitted with 90 hp Pobjoy Niagara I seven-cylinder radial engines. A third ST-6 was produced by converting one of the ST-4 Mk II's. The Niagara I was also the powerplant for the Monospar ST-10. This reverted to a fixed undercarriage, but had a much-redesigned fuselage, taller cabin, more pointed nose and restyled fin and rudder. Despite its greater frontal area, improvements in body shape and flying attitude gave the ST-10 an extra 10 mph (16 km/hr) on its top speed, which enabled G-ACTS to achieve a convincing win in the King's Cup air race on 13/14 July 1934. Flown by H. M. Schofield, with Steiger as passenger, the ST-10 completed the course at an average speed of 134.16 mph (215.91 km/hr). In later years it served with PSIOW on the Ryde ferry service and on the route to Heston. One other ST-10 was built; this was for an Australian customer, as were the two retractable-undercarriage ST-11's delivered to Eastern Air Transport for its Sydney-Canberra service in 1935. The ST-12 was a developed version with 130 hp Gipsy Major in-line engines, which gave it improved speed, ceiling and climb performance despite a slightly higher gross weight. Total production of this version is not known, but none of the four British-registered examples was built for an airline customer.

Two new Monospar designs appeared in 1935, the first of which was the ST-18 Croydon. This was a 10-passenger transport, with two 450 hp Pratt & Whitney Wasp Junior SB-9 radial engines and a fully-retractable undercarriage. Its sweptback wings, strut-braced to the top of the fuselage, had a span of 59 ft 6 in (18.14 m), and at a gross weight of 9,000 lb (4,082 kg) it had a maximum cruising speed of 176 mph (283 km/hr) at 9,700 ft (2,956 m) and a maximum range of 880 miles (1,416 km). Only one (G-AECB) was built, which was lost in October 1936 on a return flight from Australia.

The final Monospar built in quantity was the ST-25, a developed version of the ST-10 with 90 hp Niagara II engines. The prototype (G-ADIV) first appeared in mid-1935, and the initial 5-seat version was known as the ST-25 Jubilee. British airline operators included Crilly Airways (three), PSIOW (two) and Air Commerce (one). The ST-25 De Luxe, which appeared in March 1936 (prototype G-AEDY), had 4 seats, 95 hp Niagara III engines and an enlarged fin. This aircraft was later rebuilt as the prototype ST-25 Universal, and the only other De Luxe, G-AEGX, was converted from a Jubilee to ambulance configuration for the British Red Cross. The ST-25 Universal differed from all previous Monospars in having a twin-fin-and-rudder tail assembly, to improve directional control with one engine shut down, and 1 ft 0 in (0.31 m) shorter overall length. The outer wing panels could be folded, reducing the overall span to only 14 ft 11 in (4.55 m). The Universal could maintain an

altitude of 4,500 ft (1,372 m) on one engine for prolonged periods. The original De Luxe, G-AEDY, was rebuilt to serve as the Universal prototype, and this twin-finned version entered production in the autumn of 1936. It was offered as a standard passenger transport (pilot, 3 passengers and baggage), ambulance, or freighter. Twenty-six Universals were built (a little less than half the total ST-25 production between 1936 and 1939), and several of these – mostly freighters – found their way into airline service. Seven went to Eastern Canada Air Lines, and others were operated by Utility Airways in the UK and Airlines (WA) in Australia. Other ST-25's were used for various experimental purposes, including cabin pressurisation, one with a nosewheel landing gear and another fitted with Cirrus Minor 1 engines. In the spring of 1940, twenty Monospars (three ST-4's, one ST-6, one ST-10, two ST-12's, four ST-25 Jubilees and nine Universals) were impressed for wartime duties with the RAF.

52 **Boeing Model 247**

The design and structural innovations introduced by Boeing with the single-engined Monomail first found their full commercial expression in the twin-engined Model 247, the first example of which (X13301) made its first flight on 8 February 1933. Prior to this, in 1931-32, Boeing and the potential operating members of United Aircraft and Transport Corporation had discussed a number of other proposals for a replacement for the ageing Boeing Model 80's and Ford Trimotors in their current fleets. These included a biplane (Model 239) and two high-wing monoplanes (Models 238 and 243), but all were rejected and Boeing instead developed a new aeroplane, the Model 247, based on the B-9 (Model 215) twin-engined bomber. The 247 introduced some innovations of its own, among them wing and tail deicing and an aileron and elevator trim-tab system; and it was 50 mph (80.5 km/hr) or more faster than the standard types of airliner then in service. It carried a crew of 2 pilots and a stewardess, and the 10 passengers sat in individual armchair seats, at a comfortable 40 in (103 cm) pitch, on each side of the central aisle. There were a galley and toilet at the rear of the cabin, and nose and rear-fuselage compartments of 60 and 65 cu ft (1.70 and 1.84 cu m) for up to 400 lb (181 kg) of baggage and mail. Powerplant was two 550 hp Pratt & Whitney Wasp S1D1 nine-cylinder radial engines, fitted with Townend ring cowlings.

There was no separate prototype of the Model 247. The first flight had been made by a production aircraft, of which the airline members of UATC (Boeing Air Transport, Pacific Air Transport, National Air Transport and Varney Air Lines) had ordered no fewer than fifty-nine in early 1932, while the project was still in the mock-up stage. A sixtieth aircraft was delivered in November 1933 to Pratt & Whitney, which used it both as an executive aircraft and for research. Designated Model 247A, it was powered by two 625 hp Twin Wasp Junior radial engines, with narrow-chord NACA cowlings. Two other airline 247's were ordered, by Deutsche Luft Hansa. These were delivered in 1934 and operated as D-AGAR and D-AKIN. The first 247 delivery to a member

of UATC was made on 30 March 1933, and by 1 January 1934 fifty-four of the fifty-nine ordered had been delivered. The four separate airlines combined to form United Air Lines, which became effective under the new title on 1 May 1934.

The next (and only other major) version was the Model 247D, of which thirteen were built. Ten of these, all delivered by November 1934, were for United, which then began to dispose of some of its original 247's to other American operators. The Model 247D had Wasp S1H1-G geared engines, with deep-chord NACA cowlings and variable-pitch propellers, fabric (instead of metal) covering on the rudder and elevators, and a conventionally-sloped cockpit windscreen instead of the undercut one of the initial production version. These modifications resulted in a notable improvement in all-round performance, and were later applied (except, in some cases, that to the windscreen), to most of the American-owned Model 247's. The UAL aircraft were used between points on the west coast, ranging from Vancouver down to San Francisco, Los Angeles and Aguascalientes (Mexico); and to New York and Philadelphia in the eastern United States, by way of Salt Lake City, Cheyenne, Omaha, Chicago and Cleveland. By January 1938 the United fleet had dwindled to twenty-four 247/247D's, thirty-six others having been sold to other operators during 1935–37. Prior to the outbreak of World War 2 they were to be seen in the colours of National Parks Airlines, Pennsylvania-Central Airlines, Western Air lines, Wyoming Air Service and Zimmerley Airlines in the US, and SCADTA in Colombia. One of the three non-United 247D's had been exported as a 6-seat executive transport for the Chinese warlord Marshal Chang Hsueh-liang, and in January 1937 Boeing acquired an ex-United 247D for delivery to the same customer. This aircraft had two 0.50 in Colt machine-guns in the nose and a third on a ring mounting in a dorsal 'greenhouse' aft of the cockpit; it was then redesignated 247Y.

United Air Lines continued to operate its Boeings until early 1942, when a total of twenty-seven 247D's, including all except one of the UAL fleet which existed at that time, were impressed into the USAAF under the designation C-73.

53 **Douglas DC-1 and DC-2**

The United States air transport scene in the early 1930s was dominated by large, not particularly cost-effective and generally obsolescent types such as the Fokker and Ford tri-motor monoplanes and the Curtiss Condor twin-engined biplane. The injection into this scene of the smooth-skinned, all-metal Boeing 247, as the exclusive property of United Air Lines, naturally aroused an instinct of survival among UAL's competitors, and in particular at Transcontinental and Western Air Inc. In 1932 TWA's vice-president in charge of operations, Jack Frye, invited five US manufacturers to tender a design to compete with the Boeing 247. Frye specified a three-engined aircraft, to preserve the 'one engine out' safety factor of his existing fleet, but the twin-engined DC-1 (Douglas Commercial No 1) design promised to maintain this safety margin to TWA's satisfaction, and the DC-1 proposal was accepted. The basic configuration,

worked out by James 'Dutch' Kindelberger and Arthur Raymond, was left to John K. Northrop to translate into structural terms, which Northrop did by utilising the same basic multi-cellular system of construction that had proved successful in his earlier Gamma and Delta monoplanes.

Construction of the DC-1 began early in the following year, and the prototype (X223Y) flew for the first time on 1 July 1933, powered by two 700 hp Pratt & Whitney Hornet radial engines. Between the nacelles and the fuselage, forward of the wing leading-edge, were two slim struts. These were fairings over the leads of certain test equipment, and were soon removed. The Hornet-engined DC-1 received CAA Type Approval in November 1933, which was extended in the following February to cover the new installation of two 710 hp Wright SGR-1820-F3 Cyclone radials. In this form the DC-1 not only carried 12 passengers – 2 more than the Boeing 247 – but had a 35 mph (56 km/hr) faster cruising speed and a considerably better range. It was delivered to TWA in September 1933, and on 19 February 1934 set a new US trans-continental speed record between Los Angeles and Newark – the first of 11 US and 8 world speed and distance records which it was to set up within the next few months.

With this kind of performance margin over its nearest rival, it was clear that the DC-1 design was capable of being stretched further without surrendering its overall advantage. Accordingly, TWA decided instead not to order the DC-1 at all, but to purchase a slightly enlarged version, the DC-2. This had more powerful (720 hp) Cyclone engines and a longer fuselage with an enlarged cabin, enabling it to accommodate 14 passengers and 1,740 lb (789 kg) of baggage and freight. Despite a 500 lb (227 kg) increase in gross weight, the DC-2's cruising speed was 6 mph (9.7 km/hr) faster than the DC-1 and its range was increased by 60 miles (97 km). The only other major differences from the DC-1 were a redesigned rudder and the provision of wheel brakes. An initial order for twenty DC-2's was placed by TWA, which eventually operated thirty-two. The first example, NC13711 *City of Chicago,* was delivered in May 1934, and scheduled DC-2 services began in the following August, between New York and Los Angeles. They remained on this service until their replacement by DC-3's in 1936, when they were relegated to shorter routes. Other US customers to operate the DC-2 included American Airlines (eighteen); Eastern Air Lines (ten); General Airlines (four); Pan American (ten); and Panagra (three).

One other event in 1934 was to have a profound effect upon the DC-2's success in the export market. This resulted from the decision by KLM to enter a DC-2, carrying a standard transport payload, in the 'MacRobertson' air race from England to Australia. When PH-AJU *Uiver,* carrying a cargo of 3 passengers and 30,000 air mail letters, came first in the transport class and second only (to the D.H.88 Comet) in the overall speed class, there was no denying the Douglas transport's capabilities. Eventually, KLM operated a fleet of nineteen DC-2's on its Amsterdam-Batavia service, while its subsidiary KNILM used three more on

the Netherlands East Indies domestic network. Other customers included Amtorg, the Russian purchasing organisation, which had one; Australian National Airways (two); the Austrian government (one); Avio Linee Italiane (one); China (six, used by CNAC and Canton Airlines); CLS in Czechoslovakia (five); Deutsche Lufthansa (one); the French government (one); Holyman's Airways in Australia (two); Iberia (one); Japan (six); LAPE in Spain (three); Lot in Poland (two); and Swissair (four). Authorities differ over the exact number of DC-2's built, but the best estimate appears to be two hundred, this total including one hundred and thirty for civil customers, fifty-seven for the USAAC, five for the US Navy and eight others assembled from spares. There were four basic powerplants – 710 or 770 hp Cyclones, and 700 or 720 hp Pratt & Whitney Hornets – though some aircraft were fitted with 690 hp Bristol Pegasus VI engines. In the US, the DC-2 design was also the basis for the Douglas B-18 bomber; in Europe, DC-2 manufacturing licences were acquired by Airspeed and Fokker. Neither licence was taken up, but Fokker acted as European marketing agent for both the DC-2 and its successor, the DC-3.

54 **Douglas DC-3**

The birth of the DC-3 arose from circumstances similar to those which resulted in the creation of the DC-1 and DC-2. This time the airline chief involved was C. R. Smith, president of American Airlines, who was operating a substantial number of night sleeper services with ageing Fokker trimotors and Curtiss Condor biplanes. To remain competitive, Smith sought an equivalent to the DC-2, which could carry as many passengers in sleeping berths as the DC-2 did in daytime seating. John Northrop of Douglas, working closely with William Littlewood, American's chief engineer, solved the problem by stretching his original DC-1/DC-2 design still further, this time extending the girth as well as the length of the fuselage by making it 3 in (7.6 cm) deeper and 2 ft 2 in (0.66 m) wider. The resulting aircraft, known as the DST (Douglas Sleeper Transport), was thus able to accommodate 7 upper and 7 lower sleeping berths, plus a 'honeymoon suite' at the forward end of the cabin. Wing span was extended, compared with the DC-2, and the fin and rudder were restyled and enlarged. The prototype (X14988) was flown for the first time on 17 December 1935.

The career of the DC-3 during and after World War 2 is described in three other volumes in this series; this volume is concerned only with its career as a pre-war airliner, which it is convenient to regard as continuing to the end of 1941. Up to this time a total of four hundred and fifty-five had been built, of which only thirty-eight were DST's – half of them powered by 1,000 hp Wright SGR-1820-G102 Cyclone engines and the other half by Pratt & Whitney R-1830-SB3G Twin Wasps of comparable power. The remaining four hundred and seventeen DC-3's were built as conventional day-passenger transports, and the DST's were eventually converted to this standard as well. The reason is a simple one of basic

economics. While the DST was evolved to meet a relatively specialised requirement, Douglas was quick to realise that, by removing the sleeping berths, the larger DC-3 fuselage would accommodate a third row of seats, so giving an increase of 50 per cent in capacity over the DC-2. Airline customers were already impressed with the DC-2's operating costs; when offered a larger aircraft with costs only two-thirds those of the DC-2, even with more powerful (1,200 hp) Cyclone or Twin Wasp engines, they soon produced a flood of orders. Such was the impact of the DC-3 that by 1938 it was carrying 95 per cent of all US airline traffic, and was in service with 30 foreign airlines; a year later, 90 per cent of the world's airline trade was being flown by DC-3's.

The DST/DC-3 entered service on American Airlines' New York-Chicago service in June 1936. American eventually operated the largest pre-war DC-3 fleet, receiving sixty-six. Second largest operator (forty-five aircraft) was United Air Lines, which had to admit the eclipse of its Boeing 247 fleet, now losing money to its Douglas-equipped rivals. UAL began its DC-3 services in June 1937. Other US customers for the DC-3 included Braniff (ten); Delta (six); Eastern (thirty-one); Hawaiian (three); Northeast (two); Northwest (eleven); Pan American (twenty); Panagra (twelve); Pennsylvania-Central (fifteen); TWA (thirty-one); and Western (five). The major foreign customers included AB Aerotransport of Sweden (five); Aeroflot (eighteen); Air France (one); Australian National Airways (four); Canadian Colonial Airways (four); CLS (four or more); Compania Mexicana de Aviacion; KLM (the first European operator, twenty-four); LAV of Venezuela; Lot of Poland; Malert of Hungary; Panair do Brasil; Sabena of Belgium (two); and Swissair (five). Licence manufacture was undertaken by Nakajima in Japan from 1938, for Dai Nippon K.K.K. (Greater Japan Air Lines), and Soviet licence production as the PS-84 (later Lisunov Li-2) began in 1940. Huge numbers were ordered in September 1940 (and later) for the US Army Air Corps (as the C-47 and C-53) and US Navy (as the R4D-1), and large numbers of civil DC-3's were impressed for military service with designations from C-48 to C-52 inclusive. Many were supplied to the RAF and other Allied air forces during World War 2. About five or six were acquired by advancing German forces in Europe, and were handed over to Deutsche Lufthansa.

55 **Mitsubishi G3M2**

The G3M was evolved in 1934–35 as a land-based, long-range medium bomber for the Imperial Japanese Navy, making its maiden flight in the summer of 1935. By the end of 1937 it was in full production as the G3M1 and G3M2, and an account of its military career is given in the *Bombers 1919–39* volume. In 1938, Mitsubishi also began the conversion of about two dozen G3M2's as commercial transports, with armament deleted and the interior furnished as a cabin for 8 passengers. Most of these were delivered to Greater Japan Air Lines (Dai Nippon Koku K.K.), by whom they were operated on an internal network and on services to China, Formosa, Korea, Thailand and various Japanese-held Pacific islands. Known members of the Dai

Nippon fleet included J-BEOA *Soyokaze*, J-BEOC *Yamato*, J-BEOE and J-BEOG *Matukaze*.

One other well-known civil G3M2 was J-BACI *Nippon*, which was acquired from the JNAF in late 1938 by the Mainichi Shimbun newspaper group. Originally a G3M2 Model 21, it was brought up to Model 22 standard with improved fuselage contours; the interior was modified in similar fashion to the airline G3M2's, and internal fuel capacity was substantially increased. Between 26 August and 20 October 1939 *Nippon* made a much-publicised world tour via Alaska, Canada, the USA, Central and South America, Dakar, Casablanca, Rome, the Middle East, south-east Asia and Formosa, covering 32,845 miles (52,860 km) in a total of 194 hours' flying. Europe had to be avoided owing to the outbreak of war, cancelling original plans to fly by way of Madrid, Paris, London and Berlin. After Japan's own entry into World War 2 the civil G3M2's were operated by Dai Nippon on military duties, together with a number of similar, but armed, conversions of G3M1's and G3M2's as L3Y1 and L3Y2 military transports.

56 **Junkers Ju 86**

Although it achieved greater prominence in its military guise (see *Bombers 1919–39*), the Ju 86 also achieved some status as a commercial transport during the 1930s, nearly fifty seeing service with eight operators in as many countries. Like its contemporary, the Heinkel He 111, the Ju 86 was designed in 1934 to a joint Lufthansa/RLM specification for a multi-engined aircraft for use both as a bomber and as a commercial transport. The design team was led by Dipl Ing Ernst Zindel, and the two civil prototypes were the Ju 86 V2 (D-ABUK) and V4 (D-AREV), which made their first flights on 22 March and 24 August 1935 respectively.

From the outset, the Ju 86's development was affected by problems with the Jumo engines selected to power it, but production began in 1935 of the initial commercial version, the Ju 86B, equipped with two 600 hp Jumo 205C-4 engines. At least eight examples were built of the pre-production Ju 86B-0, of which HB-IXI, in April 1936, was the first to be delivered to a customer airline (Swissair); five others were delivered to Deutsche Lufthansa, which put them into service in mid-1936 from Berlin to Gleiwitz, Bremen and Cologne and from Cologne to Breslau. The Swissair example, used for a night mail service between Zurich and Frankfurt, was damaged in a crash-landing in August 1936, but six months later was replaced by the Ju 86Z-1 HB-IXE (redesignated Ju 86Z-2 and re-registered HB-IXA after being re-engined with BMW 132 engines). Standard accommodation was for a flight crew of 3, and 10 passengers in individual seats, with a baggage compartment aft of the main cabin.

DLH became one of the two major airline operators of the Ju 86. In addition to accepting the V2, V4 and five B-0's, it also received six Ju 86C-1's, two Ju 86Z-2's and the Ju 86 V24, to make a total of sixteen altogether. By 1937 they were serving on 18 Lufthansa routes, and the Ju 86 fleet remained in service until 1939. In 1940 it was disposed of, probably for use by the Luftwaffe. The C-1 version retained the Jumo 205C

powerplant, but featured an extended rear fuselage. The 'Z' designation suffix for civil variants, introduced in 1936, was allocated to three models: the Jumo-engined Z-1 (corresponding to the former B-0 or C-1), sold to Swissair (one, as described above), Airlines of Australia (one) and LAN-Chile (three); the BMW 132H-engined Z-2 for Lufthansa (two) and the para-military Manchuria Air Transport (five or more); and the Hornet-engined Z-7, delivered to AB Aerotransport of Sweden (one, for use on mail services), Lloyd Aereo Boliviano (three) and South African Airways (seventeen). The ABA aircraft was later transferred to the Swedish Air Force, with which it served, under the designation Tp 9, until 1958.

SAA's original intention had been to have its Ju 86's powered by 745 hp Rolls-Royce Kestrel Vee-type engines. Six aircraft for SAA, flown with these engines, were refitted with Hornets before being delivered, and the remainder also were Hornet-powered. The fleet was impressed for service with the South African Air Force in 1939, joining an eighteenth aircraft (a Ju 86K-1 bomber) already acquired by the SAAF for evaluation.

In addition to the forty-eight known airline examples described above, at least ten other Ju 86's bore German civil registrations. Some were military development aircraft, but they included three owned by Hansa Luftbild, an aerial photography company, and D-AXEQ, a Ju 86A Junkers demonstrator.

57 **Lockheed Model 10 Electra and Model 12**

Just as the Vega and its derivatives formed the foundation on which Lockheed fortunes were based in the late 1920s, so the Electra was the aircraft on which its hopes were built anew after those fortunes suffered a near-fatal blow in the post-depression years of 1929–32. As related in the Vega description, the Detroit Aircraft Corporation acquired a controlling interest in the Lockheed Aircraft Co in July 1929. In October 1931 Detroit and its Lockheed division at Burbank went into receivership, and for eight months Lockheed was kept barely alive with orders for a handful of aircraft, until in June 1932 a small group of businessmen, including Robert E. Gross, airline owner Walter Varney and aircraft manufacturer Lloyd C. Stearman, acquired the company's assets for $40,000. It was re-formed, with Stearman as president, under the new title Lockheed Aircraft Corporation, and by the end of the year had resolved to base its return to world markets on a new, all-metal transport aircraft. At Stearman's instigation, the original proposal was to continue the previous Lockheed pattern of single-engined aircraft, but – probably prompted by the appearance of the Boeing 247, which had made its first flight in February 1933 – it was subsequently decided to change to a twin-engined, retractable-undercarriage project. In its original form this was designed with a single fin and rudder, but when wind-tunnel tests revealed a lack of control for flight on one engine the eventual twin-tailed configuration was evolved instead. The new aircraft, continuing the earlier Lockheed type-numbering sequence, was designated Model 10 and named Electra. It was designed for fast, economical airline operation carry-

ing a crew of 2 and 10 passengers and their baggage. The prototype (X-233-Y) flew for the first time on 23 February 1934, by which time seven Electras had already been ordered, by Northwest Airlines and Pan American; by the following summer orders had increased to twenty-two. The first recipient was Northwest, which carried out proving flights from June 1934 and put the Electra into regular service some two months later. Including small quantities for the USAAC and US Navy, a total of one hundred and forty-nine Electras was built, and up to the outbreak of World War 2 they served widely in the USA, Canada, South America, Europe and Australasia. There were three basic versions: the Model 10A which, like the prototype, had 400 hp Wasp Junior SB2 engines; the Model 10B, with 420 hp R-975-E3 Whirlwinds; and the Model 10E with 450 hp R-1340-S3H1 Wasps and additional fuel capacity. US domestic and international operators included, in addition to the two original customers, Boston - Maine / Northeast, Delta, Eastern, Mid-Continent, National and Pacific Alaska. Elsewhere in the Americas, Electras were operated by Trans Canada Air Lines, Compania Mexicana de Aviacion, Linea Aeropostal Venezolana and Panair do Brasil, and by KLM in the West Indies. On the other side of the Pacific they were to be found in the fleets of MacRobertson Miller Aviation (Australia), Guinea Airways and Union Airways of New Zealand. In Europe, they were operated by British Airways (seven), Lot in Poland (ten), the Romanian airline LARES (eleven) and Aeroput in Yugoslavia (four). Those of British Airways entered service in March 1937 on the Viking Mail Service (Croydon-Hamburg-Copenhagen-Malmö-Stockholm) and were also used between Croydon and Le Bourget.

Many Electras served during the war, after impressment by the USAAC and RAF or, in the case of some Polish escapees, after seizure in Romania by the Luftwaffe. One other military Electra, which flew before the war, deserves mention for its significance in the subsequent development of both civil and military aircraft design. This was the XC-35 (serial number 36-353), sponsored by the USAAC and first flown on 7 May 1937. This had 550 hp XR-1340-43 turbocharged Wasp engines and a modified, circular-section fuselage with a fully-pressurised cabin. It had a service ceiling of 32,000 ft (9,754 m), and won for the Army the 1937 Collier Trophy for its work in high-altitude flight research.

With Electra production in full swing, Lockheed turned in 1936 to the development of a scaled-down version for the feeder-line and business aviation market. This was the Model 12, sometimes known as the Electra Junior. It had the same powerplant as the Model 10A, but seated 6 passengers instead of 10. The Model 12 prototype flew for the first time on 27 June 1936, shortly afterwards winning both the first and second prizes in a design competition staged by the US Department of Commerce. It was built as the Model 12A, a total of one hundred and fourteen being completed, including small quantities for the US Army and Navy. Among just over a dozen which came on to the British Civil Register were two pre-war examples (G-AFKR and G-AFTL) owned by

Sidney Cotton, the latter being used for clandestine aerial photography of German naval installations in the early weeks of World War 2.

58 Lockheed Model 14 and Model 18 Lodestar

The Models 14 and 18 were, in essence, scaled-up developments of the Lockheed Model 10 Electra, the former seating 12 passengers and the latter 14. Each carried a 2-man flight crew and a stewardess. Noteworthy innovations in the Model 14, which earned designer Clarence L. Johnson the 1937 Lawrence Sperry Award, were the introduction of Fowler wing trailing-edge flaps and the use of 'letter-box' slots near the outer wing leading-edges. The first Model 14 was flown in July 1937, and one hundred and twelve were built by Lockheed in three main versions: the 14-H2 (750 hp Hornet S1E2G engines), 14-F62 (760 hp Cyclone GR-1820-F62's) and 14-G3B (820 hp Cyclone GR-1820-G3B's). In 1942, by which time US production of the Model 14 had ended, three were impressed into the USAAC and designated C-111, and one was built as the R4O, a staff transport for the US Navy. Commercial orders were received from a number of US domestic airlines, notably Continental Air Lines and Northwest Airlines, and foreign operators included Aer Lingus, British Airways/BOAC, DNL, Flugfelag, Greater Japan Air Lines, Guinea Airways, KLM (the first European operator), KNILM, Lot, Sabena, Trans Canada Air Lines, and Wideroe's. Most of these were already in service before the outbreak of war in Europe, and the British Airways fleet included G-AFGN, the aircraft used by Prime Minister Neville Chamberlain to fly to his meeting in Munich with Hitler in 1938. A flight of happier import took place in July 1938, when Howard Hughes and a crew of 4 flew NX18973 on a round-the-world flight of 14,791 miles (23,804 km) in 3 days 19 hours 8 minutes. Thirty Model 14-G3B's were exported in 1938 to Japan, where a further one hundred and nineteen, with 900 hp Mitsubishi Ha-26-I engines, were built as military transports for the JAAF by Kawasaki and Tachikawa. Kawasaki also built a similar quantity of a developed version as the Ki-56. BOAC inherited or acquired nine Model 14's: six from British Airways, two ex-Lot and one ex-KLM; they were used chiefly in north-eastern and central Africa during the war years.

The prototype Model 18 Lodestar, converted from a Model 14, made its first flight on 21 September 1939, and differed chiefly in having a lengthened fuselage, to seat up to 14 passengers, and a wing with compound taper. A small number of Model 14's later underwent similar conversion. Total Lodestar production was six hundred and twenty-five, of which four hundred and eighty were to US Army or US Navy wartime contracts (see *Bombers 1939–45*). The civil Lodestar was produced in six principal versions: Models 18-07 (750 hp Hornet S1E3G engines), 18-08 (900 hp Twin Wasp SC3G's), 18-14 (1,050 hp Twin Wasp S4C4G's), 18-40 (900 hp Cyclone GR-1820-G102A's), 18-50 (1,000 hp Cyclone GR-1820-G202A's) and 18-56 (1,000 hp Cyclone GR-1820-G205A's). United States operators included Continental, Mid-Continent (the first Lodestar operator),

National, United, and Western Air Express. In Latin America, Lodestars went into service with Panair do Brasil and LAV of Venezuela, and from October 1942 Sabena considerably extended its Congo network with a mixed fleet of Model 14's and 18's. Another substantial order was placed by South African Airways. Perhaps the largest single airline operator was BOAC, which had in all (though not all at the same time) thirty-eight Lodestars, comprising fifteen Model 18-07's and twenty-three Model 18-08's. This fleet eventually took over all BOAC wartime services in Africa and the Near East, and played a prominent part in running the enemy blockade of Malta.

From the Model 14 and Model 18 were developed, respectively, the Hudson and Ventura bomber and reconnaissance aircraft of World War 2, described in the *Bombers, Patrol and Transport Aircraft 1939–45* volume.

59 **Bloch 220**

The company headed by Marcel Bloch (better known today as Marcel Dassault) produced two commercial transport designs in 1935 to meet the requirements of Air France. The larger of these, the Bloch 300 Pacifique, a 30-passenger airliner powered by three Gnome-Rhône 14K radial engines, underwent testing in 1935, but was not adopted. Bloch was more successful with the twin-engined Bloch 220, which flew for the first time in December 1935. The wings and horizontal tail surfaces were essentially those of the Bloch 210 bomber, flown a year or so earlier and in production for the Armée de l'Air. The Bloch 220 prototype (F-AOHA) apparently did not go into airline service, but sixteen production Bloch 220's were built for Air France, to replace its existing Potez 62's and Wibault 282's.

The Bloch 220 carried a crew of 1 or 2 pilots, a wireless operator and a steward. Passenger accommodation was divided into 6-seat forward and 10-seat rear cabins, with a toilet and bar at the rear of the latter and a main baggage/freight compartment in the rear fuselage. The passengers were provided with individual seats, each beside a window, on either side of a central aisle. On 11 August 1936 came the decision to nationalise the major constituents of the French aircraft industry, and the Bloch factories were incorporated in the new Société Nationale de Constructions Aéronautiques du Sud-Ouest, formed on 16 November of that year. In the following month Bloch formed a new company, Société des Avions Marcel Bloch, of which he was the sole administrator and shareholder, and gained the right to receive royalties from the state for his previous designs and to continue to provide, via the SNCASO, certain military prototypes, engines and other equipment of which his company was the constructor.

These administrative rearrangements were no doubt one main reason why Air France did not receive its first five Bloch 220's (F-AOHB *Gascogne*, F-AOHC *Guyenne*, F-AOHD *Auvergne*, F-AOHE *Aunis* and F-AOHF *Saintonge*) until the latter part of 1937. By the following summer another five had been delivered, and when delivery was completed the fleet included F-AOHG *Flandre*, F-AOHH *Savoie*, F-AOHI *Berry*, F-AOHJ *Poitou*, F-AQNK *Anjou*, F-AQNL *Languedoc*, F-AQNM *Provence*, F-AQNN *Champagne*, F-AQNO *Alsace*, F-AQNP *Lorraine* and F-ARIQ *Roussillon*. Their first airline operations were in late 1937/early 1938 on Air France's Paris-Marseilles service, followed by the Paris-London service from 27 March 1938 and others to Amsterdam, Bucharest, Prague, Stockholm and Zurich by the end of that year, completely replacing the Potez 62 and Wibault 282 on all Air France European primary routes. An 'every hour, on the hour' service between London and Paris began in the summer of 1939. During World War 2 at least three Bloch 220's were commandeered by the German authorities and allocated to Deutsche Lufthansa.

60 **Tupolev ANT-35**

Although outwardly of modern appearance for its day – it was designed in 1935 – the ANT-35 did not prove particularly outstanding, and remains a comparatively obscure type. It was designed by a Tupolev design team led by A. A. Archangelski, and the first flight was made in the spring or summer of 1936. On 15 September of that year the prototype (URSS No35) made a demonstration flight from Moscow to Leningrad and back, a round trip of 787 miles (1,266 km) covered in 3 hours 38 minutes at an average speed of 216 mph (348 km/hr). In December 1936 it was displayed statically at the Salon de l'Aéronautique in Paris. Reporters noted, among other things, a poor overall standard of workmanship in its all-metal construction. The wings appear to have been essentially similar to those of the Tupolev SB-2 twin-engined bomber. The main landing gear retracted rearward into the engine nacelles, the tailwheel being non-retractable. Accommodation was for a crew of 2 or 3 and up to 10 passengers, the cabin being air-conditioned and insulated against external noise. There were baggage compartments under the floor and to the rear of the cabin. Observers were surprised to note the absence of any de-icing provision, and the only concessions to the wintry conditions in which the aircraft later operated were the fitting of spinners to the propellers and perforated baffle-plates in the cowlings in front of the engine cylinders.

Production of the ANT-35 was initiated in 1937, and introduction into regular Aeroflot service came on 1 July of that year from Moscow to Stockholm via Riga. Powerplant for production aircraft was two 850 hp M-85 (Gnome-Rhône 14N) radials which, although each nominally capable of developing some 50 hp more than the engines in the prototype, were not satisfactory in service. As a result the maximum speed of the ANT-35 (alternatively known as the PS-35) was well below the expected 268 mph (432 km/hr).

The total number of ANT-35's built is not known, but is unlikely to have been high; production ended in 1938. The only known operator was Aeroflot, whose fleet included aircraft registered URSS-M131 and -M134. The presence in the Aeroflot fleet at about this time of a Douglas DC-3 registered URSS-M132, and the acquisition in 1938 of a Soviet licence to manufacture the American transport (later designated Li-2), would appear to indicate a fairly short life for the ANT-35, although some may have been used for military transport duties during World War 2.

61 **Junkers Ju 52/3m**

In the field of commercial aviation between 1919 and 1939, three tri-motor types stand out for their particularly prominent contribution to the world-wide development of air transport: the Fokker F.VIIb-3m, the Ford Tri-motor and the Junkers Ju 52/3m. Of these the German design was eventually built in far greater numbers, though production was predominantly for military purposes. Nevertheless, the pre-war employment of close on two hundred Ju 52/3m's by nearly 30 airlines is a measure of the type's importance in the commercial transport scene.

The original Ju 52 was a single-engined aircraft, designed as a cargo transport and having a 590 cu ft (16.7 cu m) cabin capable of accommodating a 4,067 lb (1,845 kg) payload. The prototype (D-1974), which first flew on 13 October 1930, was powered initially by an 800 hp Junkers L 88 engine, but among the five Ju 52's known to have been built numerous alternative engines were fitted at different stages of their careers. One of these aircraft was operated by Deutsche Verkehrsfliegerschule (DVS) and another by Canadian Airways.

The seventh Ju 52 was fitted with three 575 hp BMW (Pratt & Whitney) Hornet radial engines, with which it flew for the first time in April 1931, and all subsequent aircraft were completed as tri-motor Ju 52/3m's. Accommodation was for a crew of 2 or 3 and up to 17 passengers, with a toilet and a baggage/freight compartment at the rear of the passenger cabin. Like the other Junkers transports described in this volume, it was produced in many variants, with distinguishing suffix letters signifying changes of powerplant, interior layout and so on. Production of the Ju 52/3m began in 1932, the first two examples being delivered to Lloyd Aereo Boliviano. Most pre-war Ju 52/3m's were powered by one version or another of the Hornet engine or its German counterpart, the BMW 132, but other powerplants included Pratt & Whitney Wasp or Bristol Pegasus radials and Hispano-Suiza Vee-type engines. Predictably, the largest single commercial operator was Deutsche Lufthansa. By the end of World War 2 no fewer than two hundred and thirty-one Ju 52/3m's had appeared in the DLH inventory, although the majority of these were operated in wartime on behalf of the Luftwaffe. The highest known DLH peacetime total is fifty-nine, the number taken on charge by the Luftwaffe prior to the outbreak of war in 1939. Other Ju 52/3m's were operated on an almost world-wide basis, by AB Aerotransport (seven); Aero O/Y (five); Aeroposta Argentina (four); AGO, Estonia (one); Ala Littoria (five); British Airways (three); CAUSA (two); the Colombian government (three); DDL (three); Deruluft (five or more); DETA (three); DNL (eight); Eurasia Aviation Corporation, China (five); Iberia; LARES (one); Lloyd Aereo Boliviano (seven); Lot (one); Malert (five); Ölag (three); Sabena (nine); Servicos Aereos Portugueses (one); SEDTA, Ecuador (two); SHCA, Greece (three); Sindicato Condor (seventeen); South African Airways (fifteen); Varig (one); and VASP (three).

62 **Spartan Cruiser**

Developed from the 1931 Saro-Percival (later Spartan) Mailplane, the Cruiser, which appeared in the following spring, was a small feeder-line transport which served on several British and foreign internal routes during the 1930s. The original Percival-designed aircraft, G-ABLI, was built by Saunders-Roe; its development was subsequently transferred to Spartan Aircraft Ltd. It was powered by three 120 hp de Havilland Gipsy III engines. The original single fin and rudder was replaced by a twin assembly in 1932, when the aircraft was named *Blackpool*, but there was no demand for an all-mail aircraft and G-ABLI was scrapped in early 1933.

Spartan, however, continued to develop the design as a passenger transport, and in May 1932 flew the prototype Cruiser I (G-ABTY), which retained the Gipsy III powerplant but was slightly smaller and had an all-metal fuselage. The accommodation provided for a total of 8 persons, including 1 or 2 pilots. After a number of demonstration flights in Britain and Europe, Spartan initiated a modest production line in 1933 which by May 1935 turned out twelve Cruiser II's and three Cruiser III's. The Cruiser II was generally similar to the Cruiser I, except in the type of engines installed. Standard powerplant, fitted in nine of the twelve aircraft built, was three 130 hp Gipsy Majors; two others, including G-ACBM, the first Cruiser II, had 130 hp Cirrus Hermes IV's, and one was equipped with Walter Major 4's, also of 130 hp. Six of the Cruiser II's were built for foreign customers, G-ACBM being operated by Iraq Airwork as YI-AAA between Baghdad and Mosul. Two were delivered (as YU-SAN and YU-SAO) to the Yugoslav airline Aeroput, two others to the Bata Shoe Company in Czechoslovakia, and one to the Maharajah of Patiala. The manufacturer set up its own operating company, Spartan Air Lines, which on 1 April 1933 opened a service between Heston and Cowes (later Ryde) using, initially, the sole Cruiser I and the Cruiser III's G-ACDW and G-ACDX. After control of Spartan Air Lines had been acquired by the Southern Railway, operation continued under the name Southern Air Services. By that time G-ACDW had been sold (in April 1934) to Misr Airwork of Egypt as SU-ABL, and when G-ACDX (which had briefly borne the fleet name *Hampshire*) was destroyed in a crash in October 1935 its place was filled by the repurchase of G-ACBM from Iraq. Three other Cruiser II's were built for Spartan Air Lines/Southern Air Services: G-ACSM *Sussex*, G-ACVT and G-ACZM. These, together with the single Cruiser II G-ACYL built for United Airways, and two of the three Cruiser III's, passed into British Airways ownership in late 1935.

The Cruiser III was a development of the Cruiser II, with an aerodynamically-refined fuselage, modified windscreen and tail unit, and fully-faired 'trousered' main landing gear. The overall length was increased to 41 ft 0 in (12.50 m) and the cabin redesigned to seat up to 8 passengers. At the same gross weight as the Cruiser II, cruising speed was increased to 118 mph (190 km/hr) and range to 550 miles (885 km). Three of this version (G-ACYK, G-ADEL and G-ADEM) were built, of which the last-named was destroyed in a crash at Blackpool in November 1936. None of the Cruisers remained long

in British Airways service, their performance being too modest for the 'image' required of Britain's second largest airline. Three Cruiser II's and one Cruiser III (G-ACSM, G-ACYL, G-ACZM and G-ADEL) were resold in 1936–37 to Northern and Scottish Airways, which, under its later title Scottish Airways, operated them until the beginning of World War 2. Three were then impressed into the RAF in April 1940, but little or no military use was made of them owing to structural deterioration.

63 **Stinson Model A**

A comparative anachronism in the era of the Boeing, Douglas and Lockheed all-metal twins, the Stinson Model A tri-motor was built only in modest numbers and remains a relatively little-known type of the latter 1930s. It first appeared in 1933, and was built essentially along similar lines, structurally, to an earlier Stinson tri-motor, the Model 6000 of 1931. A novel feature was its one-piece wing structure, built up on a single steel-tube truss spar, with steel ribs. A dural stressed-skin covering was applied inboard of the wing engines, and fabric covering on the outer panels. The low wing was a genuine cantilever type, the two thick struts on each side being provided solely to absorb part of the landing loads. Standard accommodation was for a crew of 2 and 8 passengers, with a toilet and the main baggage/freight hold at the rear of the cabin. Additional storage space was provided in the rear of each outboard nacelle, and an extra hold could be installed if only one pilot was carried. On some aircraft, an NACA cowling was fitted over the nose engine.

The Model A entered service in mid-1934 with Delta Air Corporation, on the Dallas-Atlanta-Charleston air mail route, and with Central Airlines (later a part of Pennsylvania-Central Airlines) on a five-a-day each-way service between Detroit and Washington, DC. In 1935 the Delta Stinsons were relegated to a night service between Atlanta and Fort Worth. Model A's also operated for a short period in the colours of American Airlines. So far as is known the only other customer was Airlines of Australia, which took delivery of three Model A's (VH-UKK and two others) in 1936 for service on its Sydney-Brisbane route. These passed in 1942 into the hands of Australian National Airways, which at the end of World War 2 modified them to twin-engined aircraft by deleting the nose engine and replacing the wing pair with Australian-built 600 hp Pratt & Whitney R-1340-S3H1 Wasp radial engines, fully cowled and driving larger-diameter propellers. An extra freight hold was installed in the nose. In this form, sometimes known as the Model A/2m, the aircraft's gross weight rose to 11,200 lb (5,081 kg), and performance included a take-off run of 690 ft (210 m) and a cruising speed of 166 mph (267 km/hr) at 7,000 ft (2,135 m).

64 **Wibault-Penhoët 28**

Produced by Michel Wibault in 1930, this compact French tri-motor in its original Wibault 280 form had accommodation for 2 crew and 8 passengers. The prototype first flew in November 1930, was powered by 300 hp Hispano-Suiza 9Qa uncowled radial engines, and originally bore the unofficial registration F-ADEK. This was changed to F-AKEK when it was acquired

by the French government, which subjected it to official acceptance trials in early 1931. Prior to these it had been redesignated Wibault 281T after being refitted with 300 hp Gnome-Rhône 7Kb radials, and Wibault 282T when these were replaced by Gnome-Rhône 7Kd Titan Major radials of 350 hp each. With the increased power available, passenger capacity was increased to 10, in individual seats with a central aisle and toilet and baggage facilities at the rear of the cabin. A second 282T prototype (F-AKEL, also purchased by the French government) was completed, and these two prototypes were certificated in March and July 1932 respectively.

During 1931 Wibault joined forces with Chantiers de Saint-Nazaire Penhoët to form a new company, Chantiers Aéronautiques Wibault-Penhoët, and in 1933 this company built six production Wibault 282's. One of these, F-AMHK, together with F-AKEK, was delivered to CIDNA in 1933, which operated them from Paris to Warsaw via Prague. Apparently the dearth of passengers on the east-west run of this service led CIDNA to develop a cargo contract for carrying lobsters in the cabin – the aroma from which was not entirely appreciated by passengers travelling on the return journey! Two other Wibault-Penhoët 282's (F-AMHN and F-AMHO) were used by Air Union on its Golden Clipper (la Voile d'Or) service which replaced the LeO 213 on its Paris-London service. The CIDNA and Air Union 282's, and the second prototype, all passed to Air France (as F-AKEK *Le Frondeur*, F-AKEL *Le Rapide*, F-AMHN *Le Vaillant*, F-AMHK *Le Diligent* and F-AMHO *Le Téméraire*) upon its formation in August 1933, and the remaining three 282's were delivered direct to Air France as F-AMHL *Le Fougueux*, F-AMHM *L'Intrépide* and F-AMHP *La Voile d'Or*.

Various improvements were made after the 282's entry into service, including the adoption of cowling rings for two (and later all three) engines. The next production version, the Wibault-Penhoët 283, had NACA-type cowlings and its main undercarriage units enclosed in deep 'trouser' fairings. The latter feature created airflow problems over the tail surfaces, resulting in the addition of auxiliary fins and an increase in rudder area.

In 1934 (during which time Wibault-Penhoët was taken over by the Breguet company) ten 283's were built, all for Air France. These were F-AMTS *L'Infatigable* (prototype, first flown January 1934), F-AMTT *L'Imbattable*, F-AMYD *Le Glorieux*, F-AMYE *L'Intrigant*, F-AMYF *Le Vengeur*, F-ANBK *L'Ambitieux*, F-ANBL *L'Aventureux*, F-ANBM *Le Conquérant*, F-ANBN *L'Invulnérable* and F-ANBO *Le Merveilleux*. In addition, the much-modified F-AKEK and also F-AMHO were also brought up to 283 standard. The Wibault-Penhoët tri-motors were used on the primary European routes of Air France until their replacement in 1938 by the Bloch 220 (which see).

65 **Savoia-Marchetti S.73 and S.M.75**

By the outbreak of World War 2 Savoia-Marchetti had established a tradition of large tri-motor designs, including the S.M.79 and S.M.84 bombers and S.M.81 and S.M.82 bomber-transports for the Regia

Aeronautica. The commercial tri-motor transport line had begun with the high-wing S.71 (which see), and was followed in the mid-1930s by two low-wing types, each built in quantity. The first was the S.73, which flew on 4 June 1934. The prototype bore no civil registration, and may have been built at the instigation of the Italian Air Ministry; it had the vertical red-white-green fin and rudder stripes then applicable to military aircraft, and the customary fasces symbol beneath the rearmost cabin window. It was powered by three 600 hp Gnome-Rhône Mistral Major 9Kfr engines, and had a tall fin and rudder similar to that of the earlier S.71. The cabin windows were continuous on each side, divided by vertical pillars. Production S.73's differed in having a broader, more squat fin and rudder, separate cabin windows, lengthened nose, and a wide variety of different powerplants. Dimensions included a wing span and area of 78 ft 9 in (24.00 m) and 1,001.0 sq ft (93.00 sq m) and an overall length of 57 ft 3 in (17.45 m). Gross weight of the Stella-engined version was 22,994 lb (10,430 kg), at which the S.73 had a cruising speed of 174 mph (280 km/hr) at 13,125 ft (4,000 m) and a normal range of 634 miles (1,020 km).

So far as can be ascertained, forty-seven S.73's were built in addition to the prototype. The major customer was Ala Littoria, which received twenty-one: ten with 760 hp Wright GR-1820 Cyclone engines, five with 700 hp Piaggio Stella X.RC's, two with 800 hp Alfa Romeo 126 RC 10's, and four others. Sabena had twelve, seven of them licence-built by SABCA and all with 600 hp Mistral Major 9Kfr engines; other recipients were Avio Linee Italiane (six, with Alfa Romeos); CSA (six, with 615 hp Walter-built Bristol Pegasus IIM2's); and the Regia Aeronautica (one, presumably for evaluation).

The S.73 went into service in mid-1935, and operated over a wide area of Europe, including routes to Scandinavia, across the Mediterranean to North and Central Africa, and in the Belgian Congo. Accommodation was for a flight crew of 4, a steward, and 18 passengers. The main cabin lay aft of the wing main spars, and seated 14 persons in individual armchairs on each side of a centre aisle. There was a toilet to the rear of the cabin and space for baggage and small freight beneath the cabin floor. The remaining 4 passengers were seated in a separate forward cabin, elevated above the wing centre-section (which housed the fuel tanks) and on the same level as the flight deck. Beneath the flight deck was a second, smaller freight compartment. The S.73 was still in widespread service at the outbreak of war in Europe, and after Italy's entry into the war in June 1940 thirteen of the Ala Littoria fleet were acquired by the Commando Servizi Aerei Speciale of the Regia Aeronautica.

The S.M.75 was a considerably larger aircraft, and was the first Savoia-Marchetti tri-motor to have a retractable main landing gear. There was apparently no separate prototype, the first flight on 6 November 1937 probably being made by the first production S.M.75 (I-TACO). This and at least twenty-nine more S.M.75's were delivered to Ala Littoria, with whom they entered service in 1938. Standard powerplant was three 750

hp Alfa Romeo 126 RC 34 radial engines, although one example (in 1942) is known to have been fitted with 860 hp Alfa Romeo 128's and the five S.M.75's delivered to the Hungarian airline Malert were powered by Gnome-Rhône K14 engines. One S.M.75 was delivered to the Regia Aeronautica, and at least nine others were built whose ownership is uncertain; some of these may also have gone to Ala Littoria.

The S.M.75 carried a flight crew of 3 and a steward, and had standard 3-abreast seating for 24 passengers in two 12-seat cabins separated by a refreshments bar. Passenger capacity could be increased to 30. Aft of the rear cabin were a toilet and a baggage/freight compartment, with additional baggage space under the floor of the rear cabin. A smaller compartment was located beneath the front of the forward cabin, ahead of the wing leading-edge. On 9 January 1939 an S.M.75, piloted by N. Prota and G. Bertocco, set up international speed records of 207 mph (333 km/hr) and 205 mph (330 km/hr) over 621 mile (1,000 km) and 1,243 mile (2,000 km) closed circuits while carrying a 22,046 lb (10,000 kg) payload. About a dozen of the Ala Littoria aircraft were impressed for military service when Italy entered World War 2, and a modified version known as the S.M.75*bis* was built specifically as a military transport. A twin-float derivative, the S.M.87, appeared in 1943.

66 **Dewoitine 338**

This elegant French tri-motor, which formed an important component of Air France's long-range fleet during the late 1930s, was a development of the record-breaking Dewoitine 332 (F-AMMY *Emeraude*), which flew for the first time on 11 July 1933 and subsequently made many much-publicised flights in Europe and to North and West Africa, the USSR and French Indo-China. The D 332, acquired by Air France in November 1933, was a smaller aircraft than the D 338, and accommodated a 3-man flight crew, 8 passengers and 882 lb (400 kg) of baggage or freight. It was powered by three 575 hp Hispano-Suiza 9V engines, and had a non-retractable landing gear with 'trouser' fairings over the main units. In January 1934, when almost home after a triumphant flight to Saigon, it crashed in appalling weather, with no survivors.

The sole D 332 was followed by three examples of the larger Dewoitine 333 (F-AKHA *Antares*, later F-ANQA, F-ANQB *Cassiopée* and F-ANQC *Altair*), delivered to Air France in 1935. The D 333 had accommodation for 2 more passengers than the D 332, and on 17 May 1935 inaugurated a Toulouse-Dakar service as part of the Air France route to South America. The type was later used in South America, on the sector between Buenos Aires and Natal, Brazil.

Air France placed an initial order for twenty-one examples of the D 338, which first flew in 1935, and eventually acquired twenty-nine D 338's of its own, as well as being responsible for operating one of the two others that were built for the French government. Seating capacity varied according to the routes flown, ranging from 22 passengers on short-haul routes in Europe and to North Africa, to 15

or 18 on middle-distance routes and 12 (including 6 in sleeper accommodation) on long-range sectors. The cabin was well soundproofed, which perhaps was just as well if one accepts a wartime attempt to aid identification of the Dewoitine 338 which declared: 'In the air this aeroplane emits a great noise, like a flight of Harvards'. First operations began in mid-1936, at first between Paris and Cannes; later it was flown on the Paris-Dakar route. An experimental Paris-Hanoi flight in January 1938 paved the way for a regular Damascus-Hanoi service, and on 10 August that year the route was extended to Hong Kong. During the early months of World War 2 the Dewoitine 338 was used on the Paris-Heston service; after the fall of France a number were operated by LAM (Lignes Aériennes Militaires) between Beirut and Brazzaville, and seven were seized by the German forces and allocated to Deutsche Lufthansa.

67 **Focke-Wulf Fw 200 Condor**

Several of the German warplanes of World War 2 originated before the outbreak of hostilities in designs intended to meet joint military and civil requirements. One which originated purely as a commercial transport design was the Focke-Wulf Condor, developed to meet a Lufthansa requirement for a 26-passenger long-range airliner. Design work, led by Prof Dipl Ing Kurt Tank, began in the spring of 1936 and was rewarded with a development contract in July of that year. In the following autumn Focke-Wulf began the construction of three prototypes, and made plans for a pre-series production batch of nine more. The Fw 200 V1 first prototype, which flew on 27 July 1937, was powered by four 875 hp Pratt & Whitney Hornet S1EG radial engines. Shortly after this flight it received the identity D-AERE *Saarland*. The V2 second prototype (D-AETA *Westfalen*) was essentially similar, but was powered by 720 hp BMW 132G-1 engines. The similarly-powered V3, one of two Condors acquired by the Luftwaffe as VIP transports for the use of Adolf Hitler and his staff and advisers, became D-2600 and was named *Immelmann III*; later in its career its markings were varied as WL+2600 and later still as 26+00. The BMW 132 was retained for seven of the nine Fw 200A-0 pre-production batch, five of which were allocated to Deutsche Lufthansa and were also given Versuchs numbers. These were the V4 (D-ADHR *Saarland*), V5 (D-AMHC *Nordmark*), V6 (D-ACVH *Grenzmark*), V7 (D-ARHW *Friesland*) and V9 (D-AXFO *Pommern*). Of these, the V6 and V7 were powered by 750 hp BMW 132L engines, the remainder being powered by the BMW 132G-1. Two BMW-powered Fw 200A-0's were delivered, in July and November 1938, to the Danish airline DDL as OY-DAM *Dania* and OY-DEM *Jutlandia* respectively. The remaining two pre-series aircraft, which were Hornet-powered, were delivered to Sindicato Condor SA of Brazil in August 1939 as PP-CBI *Abaitara* and PP-CBJ *Arumani*. Standard accommodation in the Condor included a 9-passenger smoking compartment in the forward fuselage and a rear main cabin for 16 or 17 passengers.

The Condor first demonstrated its long-range capabilities outside Germany when the V4 made a flight

from Berlin to Cairo via Salonika on 27 June 1938, and quite soon after this DLH and DDL put the Condor into operational airline service. Further publicity came on 10 August 1938, when the Fw 200 V1 left Berlin for a non-stop flight to New York, for which it was redesignated Fw 200 S1, re-registered D-ACON and renamed *Brandenburg*. It arrived at Floyd Bennett airfield 24 hours 55 minutes later, and completed the return flight in 19 hours 47 minutes. On 28 November 1938 it began an equally spectacular flight, this time reaching Tokyo in 42 hours 18 minutes flying time from Berlin, with refuelling stops at Basra, Karachi and Hanoi. Unfortunately the aircraft was lost shortly afterwards, when it ditched on its approach to land at Manila, but its visit to Japan had not been without success, for it brought an order for five Fw 200B's from Dai Nippon KKK, and a request from the Imperial Japanese Navy for a sixth equipped as a potential reconnaissance-bomber. In the event, the fulfilment of this order – and of another from Aero O/Y of Finland for two Fw 200B's – was prevented by the outbreak of war in Europe, but four B-series Condors were completed and allocated to Deutsche Lufthansa. These comprised one B-1 (D-ASBR *Holstein*), with 850 hp BMW 132Dc engines; and three B-2's (D-ABOD *Kurmark*, D-ASHH *Hessen* and D-AMHL *Pommern*), with 850 hp BMW 132H-1 engines. The new *Pommern* was a replacement for D-AXFO, which was lost shortly after the outbreak of World War 2. One other Condor – D-ASVX *Thüringen*, the first Fw 200C-0 – was allocated to Lufthansa, but before delivery it and the rest of the DLH fleet were acquired by the Luftwaffe in the spring of 1940 and employed as troop transports during the German invasion of Norway.

The two Danish Condors continued to operate a Copenhagen-Amsterdam-UK service for some months after the outbreak of war, until OY-DAM was impounded in Britain early in April 1940. It subsequently flew for a time in BOAC markings as G-AGAY *Wolf*.

68 **Junkers Ju 90**

The first design studies which led to the commercial transport version of the Ju 90 were made in the spring of 1936, using as a basis Junkers' existing design for the Ju 89 long-range bomber. At the end of that year, when it became apparent that the latter project would prove abortive, Dipl Ing Ernst Zindel and his design team obtained permission to utilise the wings, powerplant, landing gear and tail assembly of the Ju 89 V3 in the construction of a prototype for the proposed transport. This prototype, the Ju 90 V1 (D-AALU *Der Grosse Dessauer*), made its first flight on 28 August 1937, powered by four 1,050 hp Daimler-Benz DB 600A engines, but broke up in flight on 6 February 1938 while undergoing flutter tests. The life of the V2 (D-AIVI *Preussen*) was almost as short: it crashed at Bathurst in December 1938 while undergoing tropical trials for Deutsche Lufthansa. The Ju 90 V2 was the first of a second batch of three prototypes powered by 800 hp BMW 132H radial engines. A crew of 4 was carried, and the passenger accommodation was offered in two basic alternative layouts. In one the fuselage was divided into 5 equal

cabins, each having facing pairs of seats on each side of a centre aisle, i.e. 40 seats in all. The two forward cabins were designated as smoking compartments. The alternative layout provided for two larger cabins, a 16-seat smoker forward and a main rear cabin seating 22 or 24 passengers. Forward and aft of the passenger cabins were cloakrooms, toilets, a galley and mail or baggage compartments, and there was additional baggage space in the wing centre-section beneath the cabin floor.

In view of the early demise of the first two prototypes, much of the publicity and route-proving flying devolved upon the Ju 90 V3 (D-AURE *Bayern*), which was completed early in 1938 and was used for the first Lufthansa services with the type between Berlin and Vienna later that year. The V4 (D-ADLH *Sachsen*) was the prototype for the Ju 90B-1 production version, of which eight were ordered by DLH. These were the V5 (D-ABDG *Württemberg*), V6 (D-AEDS *Preussen*, replacement for the V2), V7 (D-ADFJ *Baden*), V10 (D-ASND *Mecklenburg*), V11 (D-AFHG *Oldenburg*), V12 (D-ATDC *Hessen*), V13 (D-AJHB *Thüringen*) and V14 (D-AVMF *Brandenburg*). Two other B-type aircraft, with Twin Wasp SC3G engines, were ordered by South African Airways and designated Ju 90Z-2; they were allocated registrations ZS-ANG and ZS-ANH, but were not delivered and instead received Versuchs numbers V8 and V9 respectively.

Not all of the aircraft listed were actually operated by Lufthansa, and the Ju 90's pre-war airline service was of a rather limited nature, although a daily Berlin-Belgrade service was operated in 1940. Earlier, a project had been launched in 1937 to develop a more powerful version, the Ju 90S. After the conquest of Poland the Ju 90S development team transferred its activities to the Letov works at Prague-Letnany, where development work led, not to a new commercial transport version, but to the Ju 290 military transport for which D-AFHG eventually became the prototype.

69 **Boeing Stratoliner**

The Stratoliner, the first four-engined pressurised airliner to be built in the United States, originated in December 1935 as a transport counterpart to the Boeing Model 299 Flying Fortress bomber. The original project, initiated in parallel with the Model 299, was known as the Model 300, but was soon developed into a later project with the Boeing Model number 307. This was designed to use, virtually unchanged, the complete wings, power installation and tail assembly of the B-17C Flying Fortress, the only notable change being the introduction of leading-edge 'letter-box' slots on the outer wings. An entirely new fuselage, some 3 ft 6 in (1.07 m) greater in diameter than that of the bomber, could accommodate a flight crew of 5 and 33 passengers. If required, the cabin could be converted to a 16-berth sleeper transport, with space for 9 other passengers in reclining sleeper chairs.

No separate prototype was built, Boeing preferring to await firm airline orders before beginning manufacture. These came in 1937, when Pan American Airways ordered four Stratoliners and TWA six (later reduced to five). A production line

of ten aircraft was then laid down, and the first flight, on 31 December 1938, was made by NX19901, the first of the Pan American aircraft. This, unfortunately, was destroyed during a test flight in March 1939, but the programme was continued by subsequent aircraft off the line. The second and subsequent Stratoliners had a fully-pressurised passenger cabin, as envisaged in the original design. Only one major design change, an increase in the vertical tail area, was found to be necessary. The second PanAm aircraft, NX19902, flew experimentally in early 1939 with a long, straight dorsal fin fairing, but the configuration eventually adopted was a complete redesign incorporating a smaller-area rudder and an enlarged fin with curving dorsal fairing, resembling closely the surfaces introduced later on the B-17E Flying Fortress.

The three Pan American Stratoliners (NC19902, NC19903 and NC19910) were delivered in 1940. They were named *Clipper Rainbow, Clipper Flying Cloud* and *Clipper Comet*, and were designated Model S-307, although often referred to as PAA-307. They were powered by four Wright GR-1820-G102A Cyclone engines, each developing 1,100 hp for take-off, and were used on services from Brownsville and Los Angeles to Mexico City. The TWA aircraft, designated SA-307B, were generally similar, except for GR-1820-G105A Cyclones and triangular flap hinge fairings under the inboard wing trailing-edges. Identities were NC19905 *Comanche*, NC19906 *Cherokee*, NC19907 *Zuni*, NC19908 *Apache* and NC19909 *Navajo*. Prior to America's entry into World War 2 the utilisation of all eight Stratoliners was high, and by the time of Pearl Harbor the TWA quintet alone had flown 4,522,500 miles (7,278,210 km) without an accident. From 1942 the PAA trio, flown by airline crews and retaining their civilian markings, were employed on military transport schedules between the USA and South America, being returned to airline ownership in late 1944. The five TWA aircraft, although also flown by airline crews, were given the military designation C-75 during their service with Air Transport Command.

One other Stratoliner was built. This was an SB-307B, delivered in July 1939 to millionaire Howard Hughes and equipped for an attempt – prevented by the outbreak of war – on his own record of July 1938 in a Lockheed Model 14 for a round-the-world flight.

70 **de Havilland D.H.91 Albatross**

More than 35 years after its first appearance the de Havilland Albatross would still qualify for any list of the world's most handsome aeroplane designs. It was conceived originally as a passenger transport, capable of cruising at 200 mph (322 km/hr), but was ordered in the first instance as a long-range mailplane, capable of carrying a 1,000 lb (454 kg) payload non-stop across the North Atlantic. This order, for two aircraft to Specification 36/35, was placed by the Air Ministry in January 1936, and the design team was led by A. E. Hagg, who had been responsible not only for the D.H.84, D.H.86 and D.H.89 biplane airliners (which see) but for the D.H.88 Comet racing aeroplane which had won the famous 'MacRobertson' race from England to Australia in 1934. For the Comet, Hagg had developed a

form of all-wood stressed-skin construction which resulted in an extremely strong thin-section cantilever wing, and the same philosophy was employed in the construction of the new D.H.91. Other noteworthy features of the design were the Gipsy Twelve engines – evolved by Major Frank Halford by uniting two six-cylinder Gipsy Six in-line engines to form a twelve-cylinder Vee – and electrical actuation of the split flaps and main landing gear extension and retraction.

The first of the two trans-Atlantic Albatrosses flew for the first time on 20 May 1937. Originally the twin fins and rudders were strut-braced and inset on the upper surface of the tailplane. After preliminary flight testing, however, the standard form of unbraced endplate vertical surfaces was adopted. Fuel was contained in four fuselage tanks, over the wing centre-section, having a total capacity of 1,320 Imp gallons (6,000 litres), giving the mailplane version a maximum range of 3,230 miles (5,198 km) – considerably better than the 2,500 miles (4,023 km) demanded by the Air Ministry Specification. The mail payload was stowed in a compartment in the rear fuselage, aft of the wings, with access via a door in the starboard side. The aircraft was operated by a 4-man crew, consisting of captain, first officer, wireless operator and navigator. The two Albatross mailplanes, although allotted the military serial numbers K8618, and K8619, instead appeared on the British Civil Register as G-AEVV and 'VW.

Quick to appreciate the economic and visual appeal of the Albatross, Imperial Airways ordered a fleet of five with a 22-passenger interior, and these were delivered from October 1938 as G-AFDI *Frobisher* (flagship), G-AFDJ *Falcon*, G-AFDK *Fortuna*, G-AFDL *Fingal* and G-AFDM *Fiona*. In 1939 the two original aircraft were added to the fleet for experimental mail services and were named *Faraday* and *Franklin* respectively. The Albatross passenger version interior was divided into three cabins for 8, 8 and 6 persons, in 4-abreast seating with a central aisle. There was a 4-man flight crew, as in the mailplane, and a cabin steward. Forward of the front passenger cabin, on the port side, was a 58 cu ft (1.64 cu m) baggage compartment, with a galley opposite on the starboard side. Aft of the rear cabin was a toilet and the main mail/freight hold, with a capacity of 158 cu ft (4.47 cu m). The passenger version had about one-third of the fuel capacity of the mailplane, this being disposed in underfloor tanks at the front and rear of the fuselage of 270 gallons (1,227 litres) and 170 gallons (773 litres) respectively. Over a 1,000 mile (1,610 km) range, the passenger version could carry a payload of 4,188 lb (1,900 kg); a maximum payload of 5,388 lb (2,444 kg) could be carried over ranges of up to 600 miles (965 km). Take-off and landing could be accomplished in less than 1,000 ft (305 m). Externally, it could be distinguished by its additional cabin windows (6 each side) and slotted underwing flaps.

After experimental Christmas mail flights (by *Frobisher* and *Falcon*) to Cairo in December 1938, the passenger fleet settled down in January 1939 to operate Imperial Airways' service from Croydon to Paris, Brussels and Zurich. After the outbreak of World War 2 *Faraday* and *Franklin*, after conversion to passenger/mail configuration and a brief period of service with BOAC, were impressed into the RAF. G-AFDI to 'DM, retaining their civilian identities, passed into BOAC ownership in 1940 and were employed on the airline's services to Lisbon (inaugurated on 6 June 1940 by *Fingal*) and Shannon.

INDEX

The reference numbers refer to the illustrations and corresponding text.

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