TABLE 2 APPLICATIONS FOR THE R-1340 WASP

Model	hp/rpm take-off or military	Normal hp	Weight (lb)	Diameter (in.)	Length (in.)	Aircraft installations
Wasp A	410/1900	410/1900	745	51.44	42.63	Boeing F2B, F3B, 40A
Wasp B	450/2100	420/2000	670	50.63	43.38	Atlantic C-5; Boeing 4B1 & 4B4; Curtiss XO-12; Douglas O-32A & BT-2; Fokker F-10A; Ford C-4; Thomas Morse XO-19; Vought XF2U-1
Wasp C1	420/2000	420/2000	750	51.44	42.60	Amphibions N-2-C; Bellanca CH-400 & Model D; Boeing 100 & 204; Buhl CA-6W; Curtiss 6000A & A6A; Fairchild 71, 71A; Ford 5AT-B, C & CS; Hamilton H-45; Lockheed Air Express 3; Altair 8D & 8G; Vega 5 & 5A; Metal G2W; N. American Super Universal (Fokker A52); Ryan B-7; Stinson SM-6B; Zenith Z-6-A
Wasp SC1	450/2100	450/2100	745			Bellanca F-2, CH-400; Boeing Alpha 4-A, 4E; Curtiss 6000A; Detroit DL1; Douglas Dolphin 8-114; Fairchild C-96; FC-2-W2; Laird CL-RW-450; Lockheed 5C, 10C, & C101; Sikorsky S-36BS, S-39B & 38C
Wasp D	450/2100	450/2100	705	51.44	42.57	Boeing P-12C, XP-12G; Ford C-4A; Northrop ZC-19; Thomas Morse ZO-22
Wasp T1D1	525/2100	525/2100	763	51.44	42.63	Fokker F-22

Wasp S1D1	550/2200	550/2200	763	51.44	42.63	Bellanca F; Boeing F4B4; Lockheed UC-85; Orion 9D & 9D2
Wasp SE	500/2200	500/2200	750	51.44	42.59	Boeing P-12D, 12K, XP-12L, XP-12H; Detroit C-23 & C-25; Lockheed Vega Y1C-17
Wasp S1H1	600/2250	550/2200	865	51.80	43.01	Grumman Mallard G-73
Wasp S1H1-G	600/2250	550/2200	930	51.81	47.80	Boeing 247D & C-73; Australia's Whirraway; de Havilland Otter; Fokker S-13
Wasp S3H1	600/2250	550/2200	865	51.80	43.01	Bellanca 31-50; Grumman G-73; Lockheed 10E; N. American NA-16-1, NA-15-3; Canada Car & Foundry Norseman; Fiat G49-A; Machhi MB323; Piaggio P-150
Wasp S3H1-G	600/2250	550/2200	953	51.80	47.81	Douglas EJ-2 & 25-2; Junkers JU-52
Wasp S6H1	600/2250	500/2200	864	51.44	44.08	North American N-16-2
Wasp S1H2	600/2250	550/2200	868	51.80	45.90	Sikorsky S-55; Westland-Sikorsky S-55
R-1340-1	410/1900	410/1900	670	50.67	43.37	Curtiss XA-4; Douglas RD-1; Fairchild C-8 & XF-1; Ford C-4A, B (engine sold as Wasp A)
R-1340-3	450/2100	450/2100	670	50.67	43.39	Curtiss P-3A; Douglas O-32,A; Thomas Morse XO-19 (engine sold as Wasp B)
R-1340-4	450/2100	450/2100	705	51.44	42.57	Boeing F4B-4A; Douglas RD-3; Vought OSU-1, O3U-1 (engine sold as Wasp D)
R-1340-5	450/2200	450/2000	672	50.63	43.38	Thomas Morse XO-19; Douglas O-32 (engine sold as Wasp B)
R-1340-6	500/2200	500/2200	705	51.44	42.57	N. American NJ-1, SNJ-1; Vought O3U-6 (engine sold as Wasp D)

(Continued)

TABLE 2 APPLICATIONS FOR THE R-1340 WASP (CONT)

Model	hp/rpm take-off or military	Normal hp	Weight (lb)	Diameter (in.)	Length (in.)	Aircraft installations
R-1340-7	450/2100	450/2100	700	51.43	42.59	Boeing P-12; Douglas BT-2, 2A, 2B, 2B1, 2BG, 2BR, 2C1, 2C,G, O-32A; Lockheed C-12; Thomas Morse O-19A, B, C (engine sold as Wasp C)
R-1340-8	500/2200	500/2200	730	51.50	43.00	Boeing F4B-3, -4, -4A (engine sold as Wasp SD)
R-1340-9	450/2000	450/2000	700	51.43	42.59	Boeing XP-12A, B; Douglas YO-22; Fairchild F-1A; Thomas Morse O-19 (engine sold as Wasp SC)
R-1340-10	500/2200	500/2200	730	51.50	43.00	Boeing F4B-4; Douglas RD-2 (engine sold as Wasp SD)
R-1340-11	450/2100	450/2100	743	51.50	42.62	Boeing P-12C, G; Ford C4A, B Thomas Morse O-19D (engine sold as Wasp D)
R-1340-12	550/2100	550/2100				Boeing F4B-4; Curtiss XSOC-1; Vought O3U-3 & O3U-6
R-1340-13	375/1850	375/1850		51.44		Thomas Morse O-19D, E; Boeing P-12C, G (engine sold as Wasp TDG)
R-1340-14	550/2100	550/2100				N. American NJ-1; Vought O3U-6 (engine sold as Wasp D1)
R-1340-15	575/2200	450/2200		51.50	47.62	Boeing P-12C, G; Thomas Morse O-19D, E (engine sold as Wasp SC)
R-1340-16	550/2200	550/2200	763	51.43	42.63	N. American SNJ-1; Boeing F4B-4 (engine sold as Wasp S1D1)
R-1340-17	500/2200	500/2200		51.50	43.25	Boeing P-12D, E, K & XP-12L (engine sold as Wasp SD)

R-1340-18	550/2100	550/2100				Curtiss SOC-1,2,3; Boeing P-12F; N. American NJ-1, SNJ-1; N.A.F. SON-1
R-1340-19	500/2000	500/2200	715	51.50	43.25	Boeing P-12F (engine sold as Wasp SE)
R-1340-21	500/2000	600/2200	715	51.44		Boeing Y1P-26 (engine sold as Wasp S2E)
R-1340-22	550/2100	550/2100	798	51.50	42.63	Curtiss SOC-1A, B, SOC-2A, B, SOC-3A, B; N.A.F. SON-1A
R-1340-23	540/2100	575/2200	715	51.44		Boeing P-12J (engine sold as Wasp SD)
R-1340-25	600/2200	600/2200	715	51.44		Sold as Wasp C2 with fuel injection
R-1340-27	500/2000	570/2200	715	51.50	43.25	Boeing P-26 & P-26C, P-29A
R-1340-29	550/2100	450/2200	715	51.50	43.25	Douglas C-29
R-1340-31	550/2200	500/1920	742			Boeing XP-29
R-1340-32	575/2200	575/2200	882			Boeing YP-29, A, B
R-1340-33	600/2120	550/2200	792	51.50	46.75	Boeing P-26B (similar to -27 except redesigned for Marvel fuel injector)
R-1340-36	600/2250	550/2200	877	51.50	44.20	Boeing YOSS-1; Curtiss XO2C-1; SOC-4; N.A.F. XOSN-1; N. American SNJ-2, -3;
R-1340-38	500/2000	570/2200				Bellanca JE-1 (engine sold as Wasp SE)
R-1340-39		550/2000				Boeing P-29
R-1340-40						Sikorsky HO4S1 (S-55)
R-1340-41	600/2250	550/2200	842			Bellanca L-11; Detroit ZC-23; N. American Y1BT-10; Northrop A-17AS (engine sold as S3H1)
R-1340-42						N. American T-6G (engine-converted R-1340 AN-1 by Navy for Hydromatic prop)
R-1340-43	550/2200	550/2200	864	51.50	42.25	Lockheed XC-35
R-1340-45	600/2250	550/2200	930	51.44	47.94	Convair YBC-3; N. American BC-2;
R-1345-46						Goodyear ZP4K (engine converted AN-2)

(Continued)

Table 2 Applications for the R-1340 Wasp (cont)

Model	hp/rpm take-off or military	Normal hp	Weight (lb)	Diameter (in.)	Length (in.)	Aircraft installations
R-1340-47	600/2250	550/2200	864	51.44	42.94	N. American AT-6, BC-1, BC-1A, BC-11
R-1340-48						Kaman HOK-2 (engine converted to AN-1)
R-1340-49	600/2250	550/2200	864	51.44	42.94	Comm. Australia Wirraway; Lockheed UC-36B; N. American BC-1A, -1B, AT-6A.
R-1340-51	600/2250	550/2200	863	51.44	42.94	Curtiss O-52
R-1340-53	600/2250	550/2200	930	51.70	47.70	Boeing C-73 (engine sold as S1H1-G)
R-1340-55	600/2250	550/2200	865			Bell YH-12B, XH-12 & Model 48
R-1340-57	600/2250	550/2200	878	52.00	45.50	Sikorsky H-19A, B, C, HRS-1, -2, YH-19.
R-1340-96	450/2100					Douglas RD-3 & -4 (engine sold as Wasp D)
R-1340 AN-1	600/2250	550/2200	865 mag 878 alum	51.81	43.00	Boeing AT-15BO, XAT-15; Bellanca AT-15BL; Cessna C-106A; Chase XPG-4; Fairchild XAT-13, AT-13; McDonnell AT-15MC; Noorduyn YC-64. C-64A, C-64, UC-64B, AS, AT-16; Harvard II; N. American SNJ-2, -3, -4, -5, -6, AT-6B, C, D, F Piasecki HRP-1, -2
R-1340 AN-2	550/2200	550/2200	938	51.81	47.80	Goodyear Navy ZNPK, ZNPM

Table 3 Specifications for the R-1690 Hornet A

Horsepower	525–875
rpm	1900–2300
No. of cylinders	9
Weight (lb)	795–1075
Bore (in.)	6.125
Stroke (in.)	6.375
Design start	1926
First run	1926
First flight	May 1927
Production quantity	2,944

power than the Wasp so that the airlines could carry more payload than would have been feasible with the Wasp. The Hornet engine played an important role in mapping out routes across the Atlantic and Pacific Oceans for the Sikorsky S-42 (Fig. 8). In these early engines, the rocker mechanism was lubricated by grease. In the later model Hornet shown in Fig. 9, oil under pressure was piped into the rocker boxes. Once again, applications for a Pratt & Whitney engine were impressive (see Table 4).

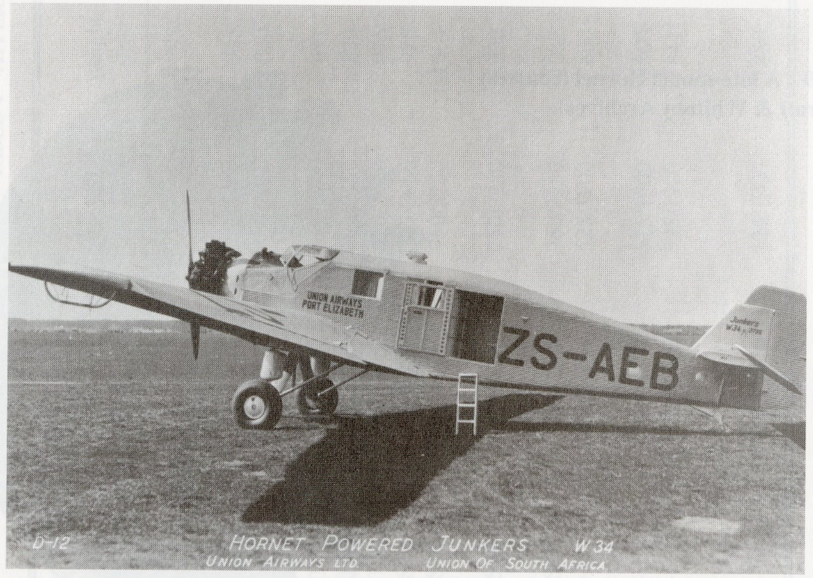

Fig. 7 The Junkers W34 was used extensively by Union Airways Ltd. in South Africa (courtesy of Pratt & Whitney Archives).

TABLE 7 FLYING BOAT ENGINES IN PAN AM'S FLEET

Aircraft	Number	Engine model	Horsepower	Number per a/c	Total engines
S-38	38	P&W R-1340	450	2	76
S-40	3	P&W R-1690	660	4	12
S-41	3	P&W R-1860	575	4	12
S-42	10	P&W R-1690	875	4	40
S-43	12	P&W R-1690	850–875	2	24
Consolidated	14	P&W R-1860	575	2	28
Martin M-130	3	P&W R-1830	950	4	12
Boeing 314	12	Wright R-2600	1500–1600	4	48
VS-44[a]	3	P&W R-1830	1200	4	12
Installed engines				Total	264[b]

[a] These aircraft were bought for American Export Airlines, which eventually were absorbed by Pan Am after WWII.
[b] There probably was about another 20 percent of engines as spares.

Immediately after WWII, the long-range capability of aircraft such as the DC-4 and land-based subsequent aircraft sounded the final knell for the flying boats.

WASP AND HORNET ENGINES ARE REFINED

R-985 WASP JR.

This engine started out at 300 hp because there was a significant market for a dependable engine smaller than the Wasp. The design philosophy was the same as its bigger brothers, Wasp and Hornet. Many young military

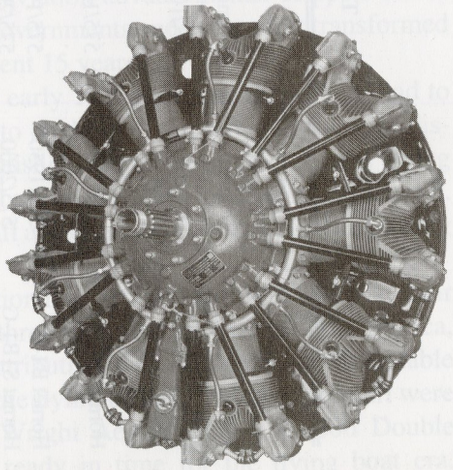

Fig. 11 This is a later model of the R-985, evident from the fine cuts in the cooling fins and the oil lubricated rocker mechanisms. The oil connection to the rocker boxes is not in place for six of the nine cylinders (courtesy of Pratt & Whitney Archives).

TABLE 8 SPECIFICATIONS FOR THE R-985 WASP JR.

Horsepower	300–450
rpm	2000–2300
Number of cylinders	9
Weight (lb)	565–684
Bore (in.)	5.1875
Stroke (in.)	5.1875
Design start	August 1929
First run	November 1929
First flight	
Production quantity	39,037

officers learned to fly on training aircraft powered by the R-985 or the R-1340 and that gave them a good feeling about Pratt & Whitney products (Fig. 11 and Tables 8 and 9).

R-2270—THE FIRST TWIN ROW

Even while designing the Big Hornet (R-1860), Pratt & Whitney designed its first twin-row engine using the Wasp-size cylinders. This R-2270 engine had two rows of seven for a total of 14 cylinders (see Fig. 12 and Table 10). Its primary use was to explore ways of putting two rows together mechanically rather than seeking how to get the maximum power out of twin rows. The figure gives away its time period by the valve covers that indicate grease-packed lubrication. This experimental one-of-a-kind engine is number X-24, the first and only twin-row engine of this particular design.

Once the maximum horsepower per cylinder and the maximum number of cylinders per row were established, the next step was to add another similar row. This approach provided an increase in power without an increase in the size. There were questions about the cooling effectiveness of the second row in a twin-row radial engine configuration. Enough information and experience was gained in the design, building, and testing of this engine to permit the launching of the high-production R-1830 twin-row engine and the Twin Wasp Jr., R-1535.

R-1830 TWIN WASP

This is the company's most successful engine, if one measures success by the number of engines produced. It was a major commercial transport and military bomber engine. The first two production twin-row engines, R-1830 (Fig. 13, Tables 11 and 12) and R-1535, departed from the one-piece master rod philosophy of the Wasp, Hornet, and Wasp Jr. Mead, Hobbs, and Willgoos