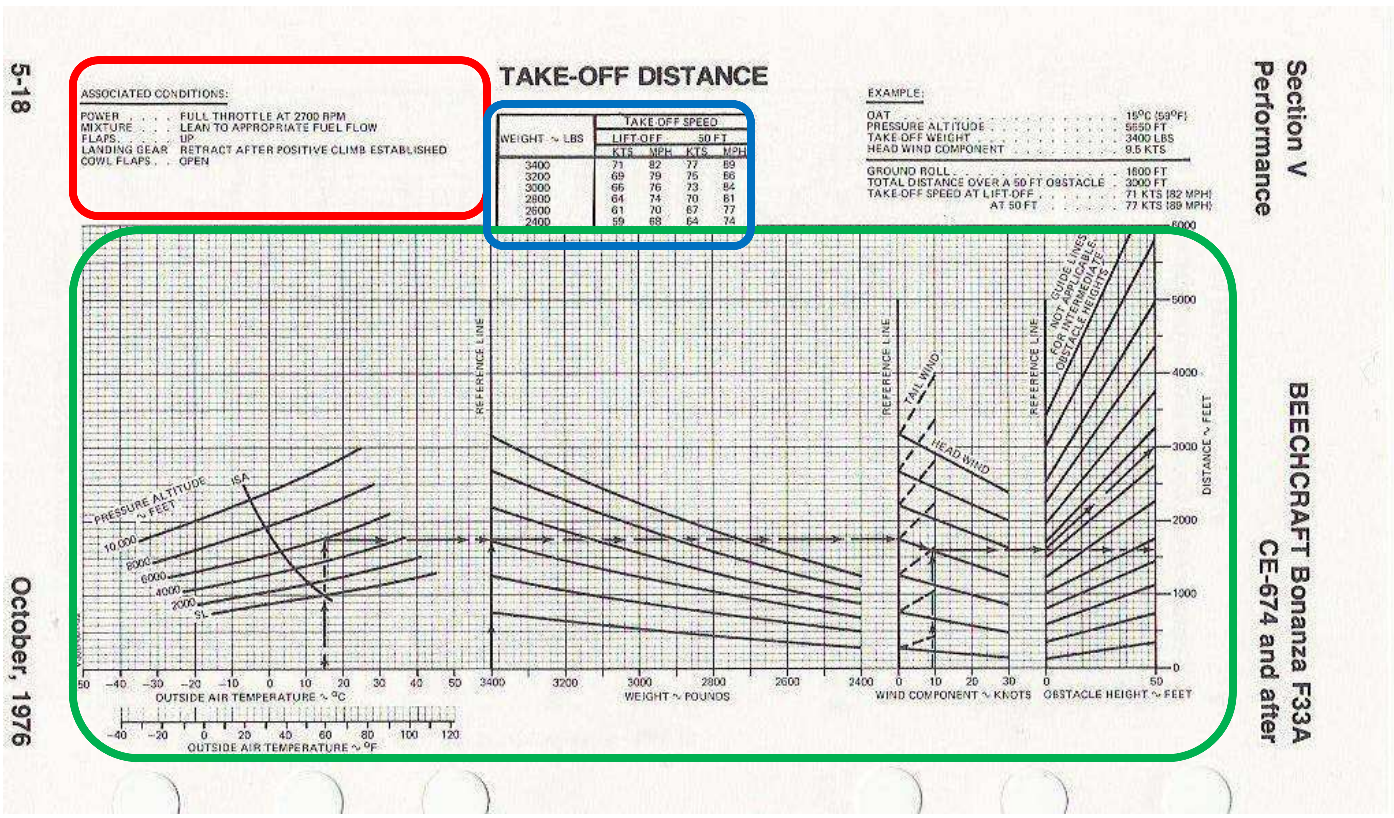
ABS/BPPP Guide to Initial Pilot Checkout:
Using Beech Performance Charts

Beech Pilot's Operating Handbook (POH) performance charts appear complex, but they are actually easy to use. The trick is to look at each chart in segments, using one segment at a time as your performance calculation progresses.

Most Beech performance charts contain three types of data, as indicated on this sample:



Associated Conditions
The first type of data is the *associated conditions*. This is the piloting technique required in order to obtain the computed aircraft performance—do things differently and you don't know what performance will result. In the example of the Takeoff Distance chart the associated conditions call for pull power before brake release, flaps up and landing gear retracted as soon as the airplane achieves a positive rate of climb. The power technique suggests this is essentially a short-field takeoff technique; a rolling takeoff will result in a longer takeoff roll, but the chart does not indicate how much longer. Not mentioned in the associated conditions but assumed by the manufacturer is that the runway surface is paved, level and dry. Any other runway condition will affect takeoff performance, but we have no guidance as to how much.

Look closely at the associated conditions for each performance chart. Pilots must apply a generous safety margin to all performance calculations based on experience in the specific airplane under similar conditions.

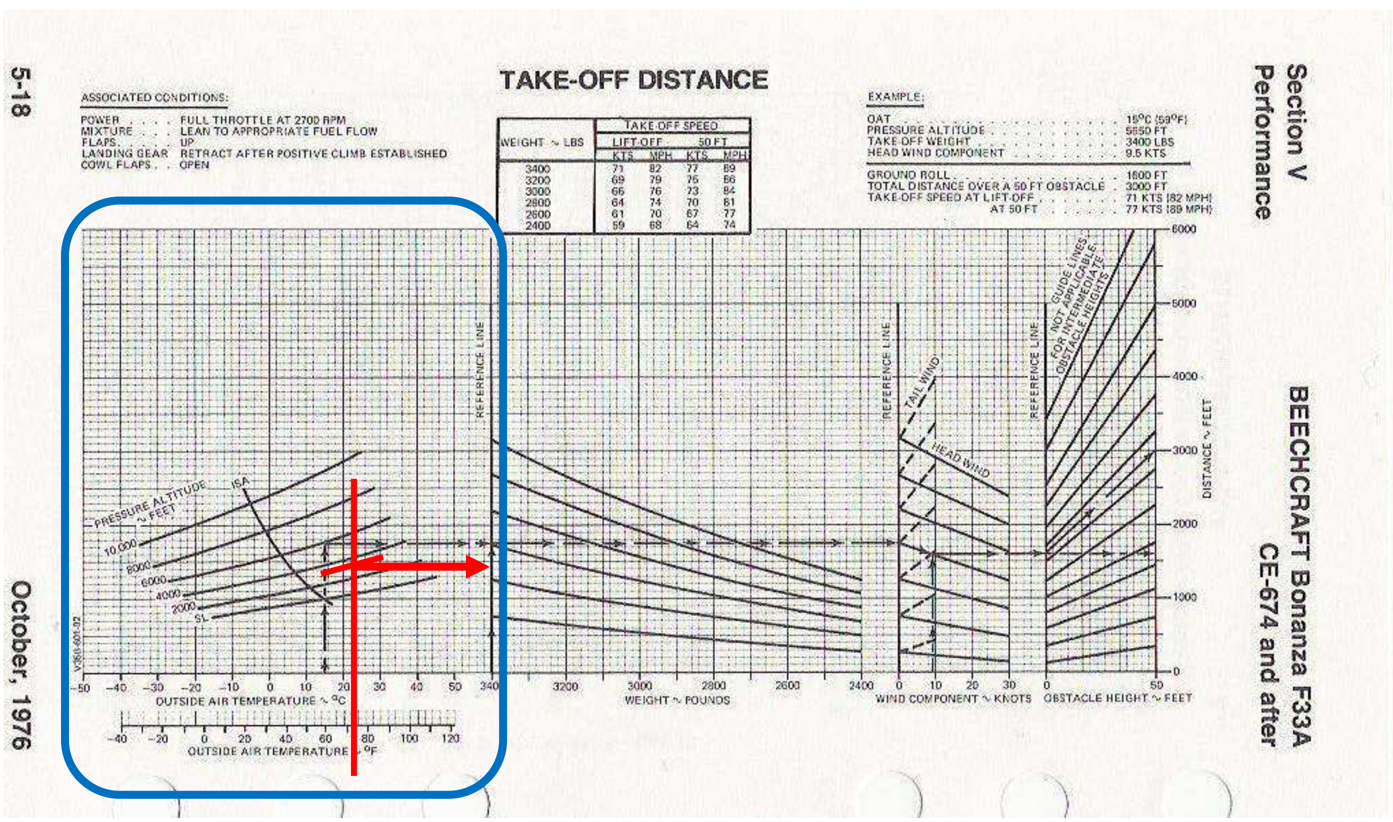
Airspeeds
The second type of data are target airspeeds. Each performance chart will stipulate airspeeds required to obtain computed performance; the speeds may differ based on airplane weight and/or configuration.

Any deviation from either the recommended airspeeds and/or the associated conditions technique requires the pilot use his/her own judgment based on experience. Do not assume the airplane will perform as computed if you use any other technique or speed.

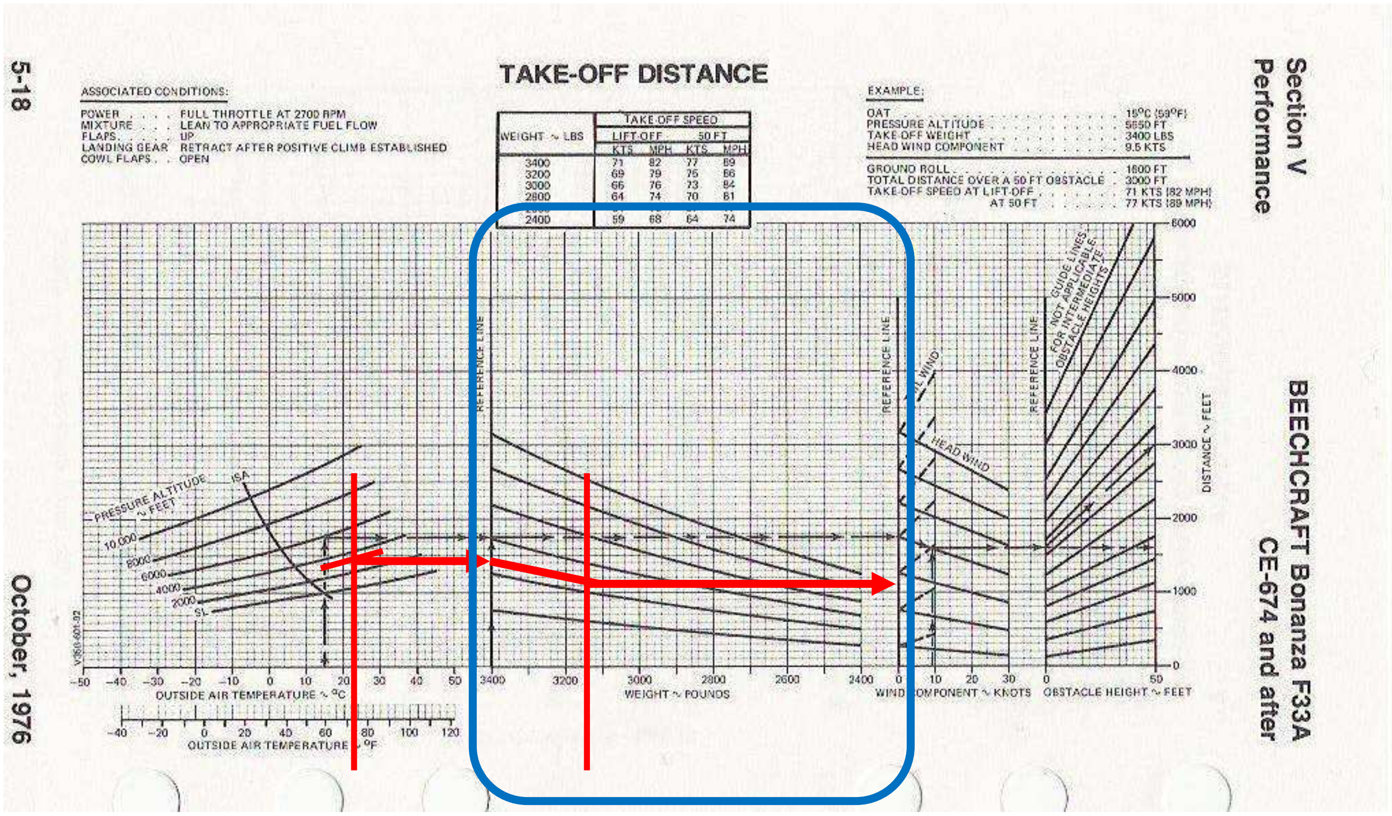
Performance Calculation
The actual performance calculation is also easy if you approach it in segments. Most Beech performance charts are divided into multiple sections, boarded by *reference lines.* Use one section at a time as you compute airplane performance. For example:

1. Density altitude. In the first section compare ambient air temperature to the airplane's pressure altitude. If a data line curves, interpolate between the lines as needed. For example:

   OAT = 22℃ and pressure altitude is 3000 feet. Fin d the intersection of these data lines and move perpendicularly from that point to the next reference line, as below:

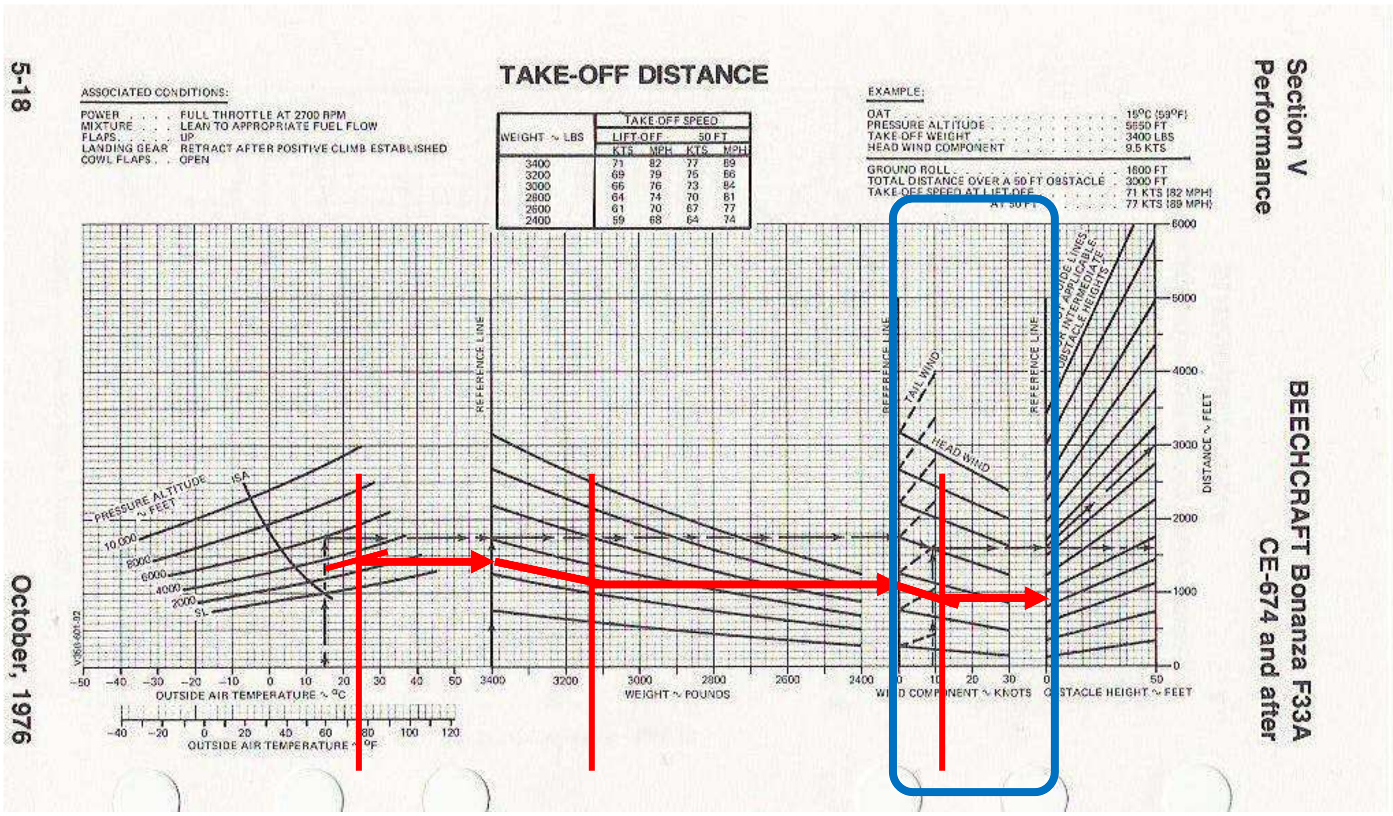


2. Aircraft weight. In the second section you'll adjust the calculation for the airplane's weight. From the point on the reference line you found in the first section, follow the slope of the lines in the second section downward until you intersect the airplane's weight. From that intersection, move horizontally to the next reference line, as shown below with a sample 3150-pound airplane weight:



3. Headwind/Tailwind: The third section of the Takeoff Distance chart permits you to account for the effect of headwind or tailwind on performance. From the second reference line follow the slope of the lines in this section downward to intersect a computed headwind component, or upward to intersect a computed tailwind component on takeoff.

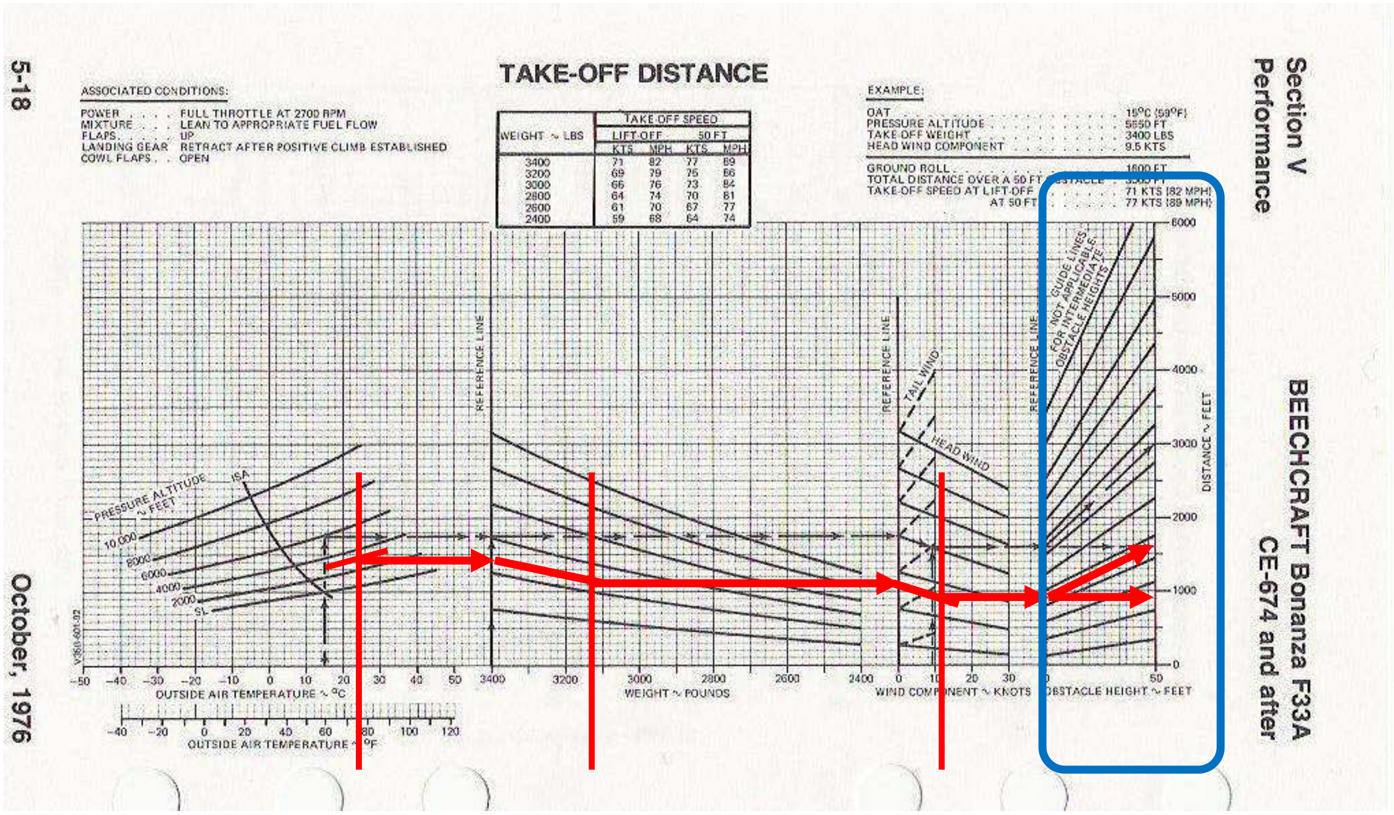
Note the maximum tailwind component for which data are available is 10 knots. From that point of intersection move horizontally to the next reference line. In the example below there is a 12-knot headwind component:



4. <u>Obstacle clearance</u>. The final section of the chart lets you compute final performance. In our example of the Takeoff Distance chart it actually provides two results: ground roll distance from brake release to liftoff, and obstacle clearance distance from brake release to a point where the airplane is 50 foot above the elevation of the beginning of its takeoff roll. Notice the chart is not applicable to intermediate obstacle heights, e.g., it does not accurately predict the distance needed to clear a 30-foot obstacle.

To calculate performance in our example:

- From the last reference point move horizontally to the far right to determine takeoff roll distance.
- From that same reference point follow the slope of the lines upward to the far right to determine the 50-foot obstacle clearance distance.



Most Beechcraft performance charts use this basic layout and require the same technique, although not all charts contain as many variables or require as much interpretation. A little practice with each chart creates the competence necessary to compute expected aircraft performance using the associated conditions and recommended performance speeds.

Performance Calculations Adjustments (certain IO-550 A36s, G36s)

Pilot's Operating Handbooks for the IO-550 A36 and the G36 contain a two-page introduction to the Performance section that in some cases dramatically alters the results of performance calculations made using the charts in that POH section. The adjustments apply to IO-550 engines delivered or subsequently retrofitted with non-altitude compensating fuel pumps (i.e., they employ the engine-driven fuel pump that requires the pilot to manually lean for takeoff above sea level). As the pages (below) show, correction values are small unless the ambient air temperature is above standard, in which case the effect on calculated performance is dramatic. ABS has repeatedly asked Hawker Beechcraft and its predecessor companies to explain the reasoning behind these correction values, when the engine, if properly leaned, should develop the same power with or without the altitude compensating fuel pump, and the performance charts themselves account for higher-than-standard temperatures. To date Beech technical support has been unable to answer the question, and our queries to Engineering and Flight Test have gone repeatedly unanswered.

Raytheon Aircraft — Beech Bonanza A36, Section V

Except as noted, all airspeeds quoted in this section are indicated airspeeds (IAS) and assume zero instrument error.

INTRODUCTION TO PERFORMANCE

REQUIRED CORRECTIONS TO PERFORMANCE GRAPHS AND TABLES

1. For the airplanes specified below, the performance obtained from the following graphs must be adjusted by the specified percentage or fixed amount at all altitudes above sea level. The resulting performance is approximate and will vary with airspeed, temperature, and other ambient conditions.

- E-3100 and after, and-
- Prior airplanes in compliance with S. B. 28-3052, or
- Prior airplanes in compliance with TCM SID 97-3, or
- Prior airplanes incorporating kit 36-9015 with s/n's 135 and after.

TAKE-OFF DISTANCE - FLAPS UP
TAKE-OFF DISTANCE - FLAPS APPROACH
-Increase Distance by 6%

CLIMB
-Decrease Rate-of-Climb by 75 FT/MIN

TIME, FUEL, AND DISTANCE TO CRUISE CLIMB
-Increase Time to Climb by 8%

RANGE PROFILES and ENDURANCE PROFILES
-Decrease Range and Endurance by:

SL to 4000 ft 0.5%
4000 to 8000 ft. 1.0%

March, 2003 — 5-3

Beech Bonanza A36, Section V — **Raytheon** Aircraft

8000 to 12,000 ft 2.0%
12,000 to 16,000 ft. 4.0%

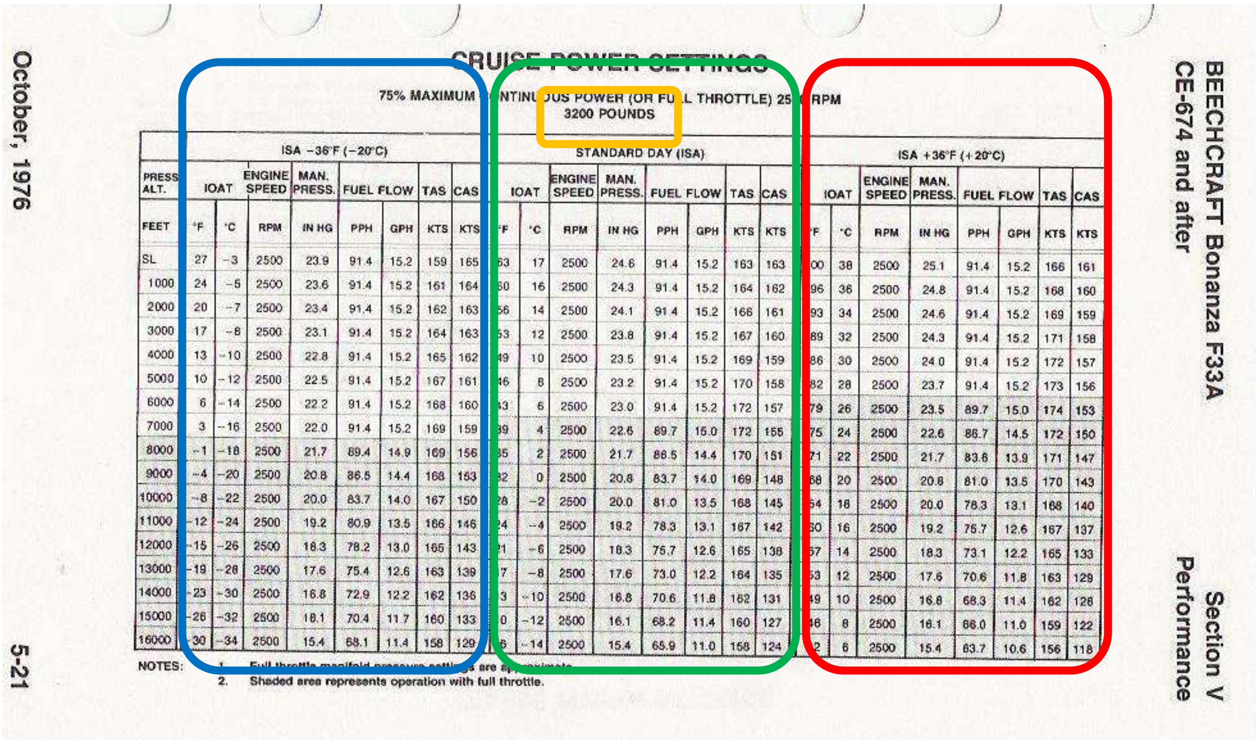
2. After the previous corrections have been made, the following additional corrections must be made for all airplanes when the ambient temperature exceeds that for a standard (ISA) day. Linearly interpolate to obtain corrections for other ambient temperatures between ISA and ISA + 30°C.

GRAPHS/TABLES	ISA + 10°C	ISA + 20°C	ISA + 30°C
TAKE-OFF DISTANCE - FLAPS UP TAKE-OFF DISTANCE - FLAPS APPROACH			
Increase Take-Off Distance by:	8%	15%	23%
CLIMB			
Decrease Rate-of-Climb by:	90 fpm	180 fpm	270 fpm
TIME, FUEL, AND DISTANCE TO CRUISE CLIMB			
Increase Time to Climb by:	15%	30%	45%
CRUISE POWER SETTINGS			
Decrease cruise speeds by:	4 KIAS	7 KIAS	11 KIAS

5-4 — November, 2002

Cruise Performance

Beech's Cruise Performance charts are an exception. Beech provides recommended power settings based either on a computed percentage of power or merely recommended combinations of manifold pressure and propeller rpm, depending on the POH applicable to the specific airplane serial number. In the case of the IO-550-equipped A36 and Baron, beginning in 1984, Beech provides two cruise performance charts at recommended MP/RPM combinations, one with mixture leaned to 20℃ rich of peak EGT, the other at 20℃ lean of peak EGT. With these exceptions all Beech POH cruise performance, endurance and range tables assume the mixture is leaned to 25℉ rich of peak E GT. Any other leaning technique will result in performance differing from that computed using the charts.



BEECHCRAFT Bonanza F33A
CE-674 and after

Section V
Performance

CRUISE POWER SETTINGS

75% MAXIMUM CONTINUOUS POWER (OR FULL THROTTLE) 2500 RPM
3200 POUNDS

PRESS ALT.	ISA −36°F (−20°C)							
	IOAT		ENGINE SPEED	MAN. PRESS.	FUEL FLOW		TAS	CAS
FEET	°F	°C	RPM	IN HG	PPH	GPH	KTS	KTS
SL	27	−3	2500	23.9	91.4	15.2	159	165
1000	24	−5	2500	23.6	91.4	15.2	161	164
2000	20	−7	2500	23.4	91.4	15.2	162	163
3000	17	−8	2500	23.1	91.4	15.2	164	163
4000	13	−10	2500	22.8	91.4	15.2	165	162
5000	10	−12	2500	22.5	91.4	15.2	167	161
6000	6	−14	2500	22.2	91.4	15.2	168	160
7000	3	−16	2500	22.0	91.4	15.2	169	159
8000	−1	−18	2500	21.7	89.4	14.9	169	156
9000	−4	−20	2500	20.8	86.5	14.4	168	153
10000	−8	−22	2500	20.0	83.7	14.0	167	150
11000	−12	−24	2500	19.2	80.9	13.5	166	146
12000	−15	−26	2500	18.3	78.2	13.0	165	143
13000	−19	−28	2500	17.6	75.4	12.6	163	139
14000	−23	−30	2500	16.8	72.9	12.2	162	136
15000	−26	−32	2500	16.1	70.4	11.7	160	133
16000	−30	−34	2500	15.4	68.1	11.4	158	129

PRESS ALT.	STANDARD DAY (ISA)							
	IOAT		ENGINE SPEED	MAN. PRESS.	FUEL FLOW		TAS	CAS
FEET	°F	°C	RPM	IN HG	PPH	GPH	KTS	KTS
SL	63	17	2500	24.6	91.4	15.2	163	163
1000	60	16	2500	24.3	91.4	15.2	164	162
2000	56	14	2500	24.1	91.4	15.2	166	161
3000	53	12	2500	23.8	91.4	15.2	167	160
4000	49	10	2500	23.5	91.4	15.2	169	159
5000	46	8	2500	23.2	91.4	15.2	170	158
6000	43	6	2500	23.0	91.4	15.2	172	157
7000	39	4	2500	22.6	89.7	15.0	172	155
8000	35	2	2500	21.7	86.5	14.4	170	151
9000	32	0	2500	20.8	83.7	14.0	169	148
10000	28	−2	2500	20.0	81.0	13.5	168	145
11000	24	−4	2500	19.2	78.3	13.1	167	142
12000	21	−6	2500	18.3	75.7	12.6	165	138
13000	7	−8	2500	17.6	73.0	12.2	164	135
14000	3	−10	2500	16.8	70.6	11.8	162	131
15000	0	−12	2500	16.1	68.2	11.4	160	127
16000	6	−14	2500	15.4	65.9	11.0	158	124

PRESS ALT.	ISA +36°F (+20°C)							
	IOAT		ENGINE SPEED	MAN. PRESS.	FUEL FLOW		TAS	CAS
FEET	°F	°C	RPM	IN HG	PPH	GPH	KTS	KTS
SL	00	38	2500	25.1	91.4	15.2	166	161
1000	96	36	2500	24.8	91.4	15.2	168	160
2000	93	34	2500	24.6	91.4	15.2	169	159
3000	89	32	2500	24.3	91.4	15.2	171	158
4000	86	30	2500	24.0	91.4	15.2	172	157
5000	82	28	2500	23.7	91.4	15.2	173	156
6000	79	26	2500	23.5	89.7	15.0	174	153
7000	75	24	2500	22.6	86.7	14.5	172	150
8000	71	22	2500	21.7	83.6	13.9	171	147
9000	68	20	2500	20.8	81.0	13.5	170	143
10000	64	18	2500	20.0	78.3	13.1	168	140
11000	60	16	2500	19.2	75.7	12.6	167	137
12000	57	14	2500	18.3	73.1	12.2	165	133
13000	53	12	2500	17.6	70.6	11.8	163	129
14000	49	10	2500	16.8	68.3	11.4	162	126
15000	46	8	2500	16.1	66.0	11.0	159	122
16000	2	6	2500	15.4	63.7	10.6	156	118

NOTES: 1. Full throttle manifold pressure settings are approximate.
2. Shaded area represents operation with full throttle.

October, 1976

5-21

Each recommended power setting chart contains three blocks of data. In the center you'll find performance expectations at standard temperature. To the left (or in some POHs, above) the standard conditions table you'll find colder-than-standard conditions data, for 36°F/20°C below standard temperature. To the right (or below) stand conditions information you'll see hotter-than-standards data, for 36°F/20°C above standard t emperature. The charts assume a given airplane weight, stated in the chart's header; different weights will result in different performance. Areas on the chart shaded in grey are those where full-throttle operation will not deliver the percentage of power or manifold pressure recommended for that specific performance chart. In that region the actual manifold pressure created at full throttle is approximate.

Use forecasts or actual observed temperatures to determine which section of the chart to use. Interpolate between sections if the temperature is between the listed ranges. Then select your altitude and read performance, or select your desired performance and read altitude. Remember that your actual cruise performance varies with airplane weight, rig, engine condition and leaning technique. Use the POH cruise charts, employing a healthy margin for safety, until you have enough experience in the specific airplane to better judge actual cruise performance.

Other charts

Other performance charts in the POH are used in the same way, by matching various airplane and environmental factors and reading or interpolating the results.