the AEROSTAR LOG

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KEEPING'S GORGEOUS 601P

Bob Keeping

I discovered that you can learn something from every person you meet. That's why the AOA Conventions and the Member's forum are so important to me...

By Norm Howell

SWEET SPOT

Efficient Flight Planning for the Aerostar

How to get the Most Bang for your Buck!

As we all know, the Aerostar airplane is one of the fastest civil piston twins ever manufactured. In addition, skilled design and engine integration also makes it a very efficient airplane as well. This combined characteristic of speed with efficiency is the hallmark of only a very few civil private airplanes in the world. Mooney and Aerostar airplanes have always enjoyed this reputation (most deservedly so), and new manufacturer Pipistrel is poised to make its mark as the "speed with economy" champion of the more modern designs.

With the current fuel prices, there is a great interest (at least for me) to obtain the most efficient operation possible while still enjoying the great utility of speed that is intrinsic to this outstanding design. To put it colloquially, we want "The Most Bang for the Buck". However, what does that mean, really, and how do we put it in practice? There has been, and always will be, endless debate on this subject....many Aerostar owners seem to want the most "Bang" regardless of cost. The most often used quote is "I didn't buy this airplane to fly slow". Other owners may want to fly using the "Least Bucks" philosophy, and miss out on a lot of the very satisfying "Bang". My own opinion is that there is a pretty ideal ratio in aviation between speed (the bang) and fuel economy (the buck). And, that ratio has some very sound engineering behind it, as you will see. In addition, I have found that smart flight planning with tools that are available to anyone on the Internet for free can really maximize the total performance of the Aerostar. Here we go.....

In 1980, Professor B.H. Carson of the US Naval Academy wrote a paper for the American Institute of Aeronautics and Astronautics (AIAA) Aircraft Systems Meeting conference held in Anaheim, CA. It was called "Fuel Efficiency of Small Aircraft". In the paper, he proposed that the most efficient operation of the airplane was at a speed where the combination of speed and fuel economy was maximized. This calibrated air speed where V * MPG was at its maximum is faster than max range speed, and quite a bit faster than max endurance speed. For the Aerostar, max range speed (gross weight, sea level, standard) is 117 knots (KIAS). This also corresponds to the published maximum all-engine rate of climb speed VY as shown in the Aerostar Airplane Flight Manual (AFM). Carson's paper goes through quite a mathematical derivation to come up with a way to relate max range speed to his "optimum cruise" speed....I'll spare you the details, but will tell you the speed is about 1.32 * VY. So, for the Aerostar: Carson's Speed is 154 knots (KIAS).

And you say "Cool, Norm. But I have never heard of Carson's Speed!" That's true. And there is a very good reason for that. Carson proposed his speed as a cruise speed...but, he neglected some very important efficiency aspects of current aviation piston engines and he also neglected the wind (the wind never blows and the atmosphere is always "Standard" in an AIAA Technical Symposium!). Flying at Carson's Speed in still air result in an engine power of about 50-55% for many airplanes, and these engines are realistically most efficient at around 65%. Lower power settings tend to exacerbate losses due to the propeller and engine rotating friction, and four-cylinder engines are worse than sixes with respect to the latter factor. And the air is never still. So, Carson's Speed as a worthy aviation parameter has never, ever gained traction in the GA community.

But, I use this speed, every flight, in my Aerostar, to great benefit. How? Just keep reading!

The Comparative Aircraft Flight Efficiency (CAFE Foundation) in Santa Rosa, CA (www.cafefoundation.org) started looking at the issue of flight efficiency at about the same time as Carson published his paper. They held a series of general aviation races in the 1980s that measured speed, fuel efficiency and payload carried, and offered prizes for the best performance in a number of classes. Through a great deal of refinement, they found that the low engine power of the original formula V * MPG was not ideal, and the ideal cruise parameter is VMG1.3* MPG (where VMG is velocity made good, for more info on that see here http://en.wikipedia.org/wiki/Velocity_made_good , and that number is raised to the 1.3 power. Sorry for the exponents, but that kind of math is unavoidable). <> In aviation as well as sailing, it is Velocity Made Good (the resulting speed from point A to point B) that gives the "bang" I was talking about earlier. And of course, "buck" is still MPG. So, the most bang for the buck is when you fly the CAFE Parameter (named after the CAFE Foundation), where VMG1.3* MPG is maximized. <> And you say "Cool, Norm. So how the heck do I plan for that, exactly? And 'splain it so I don't have to have an advanced degree in quantum mechanics to understand it. And, don't cost me any money to do this thing, either". OK, you're on. <> You have already taken the first step, as an Aerostar owner. And your choice was validated from an engineering standpoint, by Professor Carson! In his 1980 paper, Carson proposed the ideal cruise airplane, a light twin capable of flight at 25,000 feet, 250 KTAS, two 300hp engines, a weight of 4900 pounds, low flat plate drag area, and a wingspan of (only) 32 feet. We all know this is very close to the original plan for the Aerostar 601 as conceived by Ted Smith in 1963. Of course, the current 601 deviates from this concept a bit, but not much. The speed with efficiency we want is designed into our favorite airplane, right from the start. <> However, you can have the most efficient airplane on the planet, but without smart flight planning, that efficiency can be lost. Why? Because the air is not still, and it is not Standard. By flying a very very smart profile, and by choosing the best altitude for the winds, we can get the most bang for the buck in actual practice, not just as a mental exercise in an engineering paper. <> So, here is the smart profile...Carson had a very good idea for efficient speed, but his proposal turns out to be completely appropriate for a different phase of flight than he originally postulated. Carson's Speed is an ideal cruise climb speed. You use about 50-55% of your power to move forward, and use the rest for climb. All of it. Do not reduce power at all for climb unless it is for noise or to comply with a limitation in the AFM/type certificate. So, in my case, I climb at 154 KIAS with full power (29.5"/2575) and full rich, and pull back the props to 2500 RPM after passing pattern altitude to reduce cabin noise a little (my airplane is not subject to the 2475 RPM community noise limit of the later 601s after s/n 715). That's it. The engines don't run too hot on EGT or TIT because I am at full rich, and they don't run too hot on CHT because I am at a much higher indicated airspeed (154 knots) than the speed used to validate the engine cooling margins for climb during certification flight tests. I don't adjust the speed for less than gross weight, or for winds, or for increasing altitude. I don't even adjust the power for short term level offs imposed by ATC for traffic. There really is not that much positive impact to the "bang for the buck" by making those adjustments, and it unnecessarily complicates the task. What really matters next is where you level off. <> And here is where every weather man who has ever given you a bad forecast makes it right. Your cruise altitude depends on consideration of safety (first) and efficiency. Your choice of cruise altitudes is constrained by terrain clearance, icing levels and ATC radio reception from a safety standpoint. The altitudes that are remaining to be chosen can be sorted for efficiency based upon forecast winds and the resulting predicted velocity made good. And the prediction is good, because those crafty weathermen have been working for years to get better at forecasting.... and their atmospheric models now are excellent. Winds aloft predictions in particular that are less than 4 hours in the future are dead nuts on, so the time frame is well within the usual preflight activity span. And you say "Cool, Norm. You talked about that earlier. Gimme the tools." You only need one. It is FltPlan.com. This site has the most robust airplane performance prediction algorithm for flight planning that I know of. And it's free. Now, Jeppesen FliteStar may have better airplane performance predictions, but it is expensive....$600 for the IFR version, and only the more expensive Corporate Version has advanced airplane models for performance optimization.

If you go to Fltplan.com, you can create an advanced model of your airplane's performance, for free. I have done so for my 601P. The model I programmed uses the Carson's Speed cruise climb profile for climb, and a 65% power lean-of-peak prediction for the cruise performance. The table is shown below:

★ AEST FUEL BURN PROFILE : *AEST 601P/Carson/65%LOP*

Method 1. Copy Performance Data from another profile and use for N425CA

The data listed down below in Method 2 for N425CA will be replaced with the performance profile from the DONOR's Username & DONOR's Tail Number.
Put the Username and Tail Number of the 'Donor' that you are getting the data from in the boxes below.

DONOR's Username	DONOR's Tail Number	Include Donor's ICAO Data	
testwest ex:PILOT123	N425CA ex:N1234A	☑	Copy Profile

OR

Method 2. Manually Change Performance Data for N425CA

Use this section to customize your aircraft to the way you fly.

AIRCRAFT REG: N425CA MAX. ALTITUDE: 25,000 Make and Model: PA-601P AEROSTAR

HELP **Advanced** Fuel Burn Calculation (optional)
Leave the **Fuel Unit** box blank if you do not want to use this method.
We recommend new users skip over the ADVANCED METHOD until they have used the program for a while.

Enter **Fuel Units**: Gallons Enter Taxi out Fuel Burn: 3

Climb Fuel Flow @2,000 MSL: 50 @25,000: 50 **Descent** Fuel Flow @2,000 MSL: 20 @25,000: 20

You must also enter Cruise Fuel Burn info in the blue boxes below for each altitude in order to use the ADVANCED method

HELP **Hourly** Fuel Burn Calculation (optional) Use these boxes if using fuel burn by the hour.

○ ON ◉ OFF Fuel Burn by hourly method.

1st hour	2nd hour	3rd hour	4th hour	5th hour	6th hour	7th hour and on
35	25	25	25	24.5	24.5	24.5

Cruise Altitudes - Set Default (optional)
Use this feature to over-ride the computer generated default cruise altitudes (for other than short flights).
Leave the boxes blank (empty) if you want the program to select the Cruise Altitude.

Default **West** Bound Cruise **Altitude**: Default **East** Bound Cruise **Altitude**:

HELP Altitude	HELP Climb Speed (IAS)	HELP Rate of Climb (FPM)	HELP Cruise Speed (TAS)	HELP Cruise Fuel Burn	HELP Descent Speed (IAS)
0,000	130	1200	175	25	120
1,000	154	1100	175	25	140
2,000	154	1100	180	25	180
3,000	154	1050	180	25	185
4,000	154	1050	180	25	185
5,000	154	900	185	25	195
6,000	154	900	190	25	207
7,000	154	900	192	25	207
8,000	154	900	192	25	207
9,000	154	900	193	25	207
10,000	154	850	193	25.5	207
11,000	154	850	193	25.5	204
12,000	154	850	194	25.5	201
13,000	154	840	195	25.5	199
14,000	154	780	196	25.5	195
15,000	154	715	197	25.5	195
16,000	154	655	198	25.5	194
17,000	154	590	200	25.5	194
18,000	154	530	202	25.5	194
19,000	154	470	202	25.5	194
20,000	154	410	204	25.5	185
21,000	154	345	205	26.0	175
22,000	154	335	206	26.0	170
23,000	154	325	207	26.0	170
24,000	154	260	207	26.0	170
25,000	154	200	207	26.0	170

press here when done

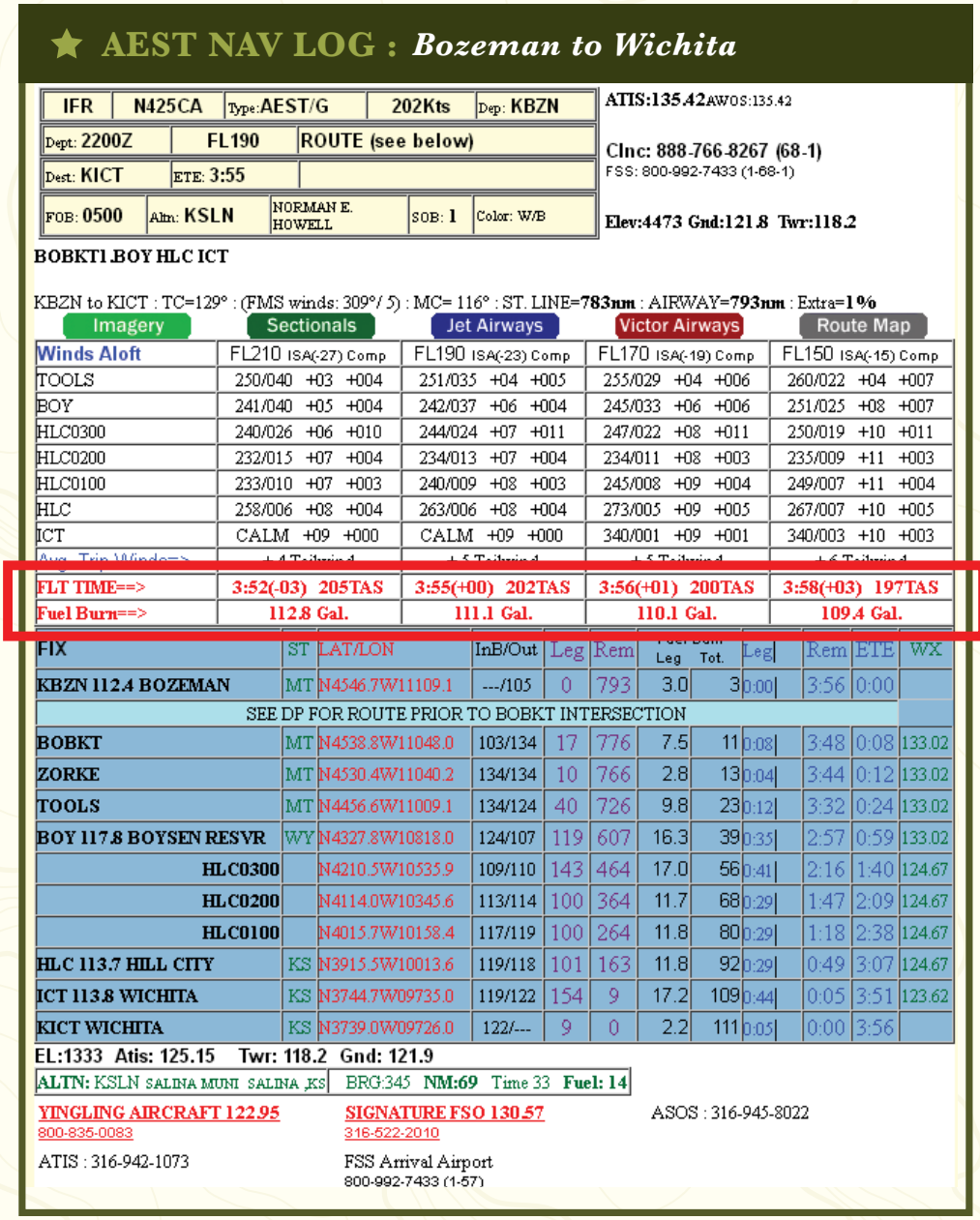
65% power, lean of peak, in still air, at the highest altitude attainable where 65% power is still available, results in the most efficient instantaneous CAFE cruise parameter. But enroute headwinds and/or tailwinds have an overriding effect on velocity made good. Strong headwinds in particular can result in a very low optimum cruise altitude. So, you want an airplane that is comfortable (e.g. pressurized) and fast way up high, and yet be inherently efficient when the winds force you down low.

"The turbonormalized pressurized Aerostar 601p with the high altitude turbos and intercoolers is the only, ***and I mean only****, airplane in the world with this ideal combination of characteristics."*

And that's why I own one. So, I want to plan a flight in my 601P, let's say from Bozeman, Montana to Wichita, Kansas. I need to be at least 15,000 feet to make the altitude requirements on the departure procedure, so that forms a lower constraint on choice of altitude. Going east, so it's odd altitudes from 15,000 to FL250. That's seven possible altitudes. I plug a reasonable route into the fltplan.com planner using my Aerostar 601P performance profile (with the Carson's Speed climb and 65% LOP cruise as shown above) and out pops this route and nav log:

★ AEST FLIGHT PLAN : *Bozeman to Wichita*

The important numbers on this NavLog are the Flt Time and Fuel Burn, printed in red right in the middle of the page. As shown, I took a guess at the best altitude of FL190 for this trip. Fltplan computed a time for the trip of 3 hours 55 minutes and a fuel burn of 111.1 gallons, using the expected winds at the time of the flight. Remember, if you put this plan in about 4 hours or less before departure, the winds are going to be very precisely forecast. Notice that there are also predictions run for several other altitudes as shown in the Nav Log.



★ AEST NAV LOG : *Bozeman to Wichita*

IFR	N425CA	Type: AEST/G	202Kts	Dep: KBZN
Dept: 2200Z	FL190	ROUTE (see below)		
Dest: KICT	ETE: 3:55			
FOB: 0500	Altn: KSLN	NORMAN E. HOWELL	SOB: 1	Color: W/B

ATIS:135.42 AWOS:135.42

Clnc: 888-766-8267 (68-1)
FSS: 800-992-7433 (1-68-1)

Elev:4473 Gnd:121.8 Twr:118.2

BOBKT1.BOY HLC ICT

KBZN to KICT : TC=129° : (FMS winds: 309°/ 5) : MC= 116° : ST. LINE=**783nm** : AIRWAY=**793nm** : Extra=**1%**

Imagery | Sectionals | Jet Airways | Victor Airways | Route Map

Winds Aloft	FL210 ISA(-27) Comp	FL190 ISA(-23) Comp	FL170 ISA(-19) Comp	FL150 ISA(-15) Comp
TOOLS	250/040 +03 +004	251/035 +04 +005	255/029 +04 +006	260/022 +04 +007
BOY	241/040 +05 +004	242/037 +06 +004	245/033 +06 +006	251/025 +08 +007
HLC0300	240/026 +06 +010	244/024 +07 +011	247/022 +08 +011	250/019 +10 +011
HLC0200	232/015 +07 +004	234/013 +07 +004	234/011 +08 +003	235/009 +11 +003
HLC0100	233/010 +07 +003	240/009 +08 +003	245/008 +09 +004	249/007 +11 +004
HLC	258/006 +08 +004	263/006 +08 +004	273/005 +09 +005	267/007 +10 +005
ICT	CALM +09 +000	CALM +09 +000	340/001 +09 +001	340/003 +10 +003
Avg. Trip Winds==>	+4 Tailwind	+5 Tailwind	+5 Tailwind	+6 Tailwind
FLT TIME==>	**3:52(-03) 205TAS**	**3:55(+00) 202TAS**	**3:56(+01) 200TAS**	**3:58(+03) 197TAS**
Fuel Burn==>	**112.8 Gal.**	**111.1 Gal.**	**110.1 Gal.**	**109.4 Gal.**

FIX	ST	LAT/LON	InB/Out	Leg	Rem	Leg	Tot.	Leg	Rem	ETE	WX
KBZN 112.4 BOZEMAN	MT	N4546.7W11109.1	---/105	0	793	3.0	3	0:00	3:56	0:00	
SEE DP FOR ROUTE PRIOR TO BOBKT INTERSECTION											
BOBKT	MT	N4538.8W11048.0	103/134	17	776	7.5	11	0:08	3:48	0:08	133.02
ZORKE	MT	N4530.4W11040.2	134/134	10	766	2.8	13	0:04	3:44	0:12	133.02
TOOLS	MT	N4456.6W11009.1	134/124	40	726	9.8	23	0:12	3:32	0:24	133.02
BOY 117.8 BOYSEN RESVR	WY	N4327.8W10818.0	124/107	119	607	16.3	39	0:35	2:57	0:59	133.02
HLC0300		N4210.5W10535.9	109/110	143	464	17.0	56	0:41	2:16	1:40	124.67
HLC0200		N4114.0W10345.6	113/114	100	364	11.7	68	0:29	1:47	2:09	124.67
HLC0100		N4015.7W10158.4	117/119	100	264	11.8	80	0:29	1:18	2:38	124.67
HLC 113.7 HILL CITY	KS	N3915.5W10013.6	119/118	101	163	11.8	92	0:29	0:49	3:07	124.67
ICT 113.8 WICHITA	KS	N3744.7W09735.0	119/122	154	9	17.2	109	0:44	0:05	3:51	123.62
KICT WICHITA	KS	N3739.0W09726.0	122/---	9	0	2.2	111	0:05	0:00	3:56	

EL:1333 Atis: 125.15 Twr: 118.2 Gnd: 121.9

ALTN: KSLN SALINA MUNI SALINA ,KS | BRG:345 NM:69 Time 33 Fuel: 14

YINGLING AIRCRAFT 122.95
800-835-0083

SIGNATURE FSO 130.57
316-522-2010

ASOS : 316-945-8022

ATIS : 316-942-1073

FSS Arrival Airport
800-992-7433 (1-57)

Hmm, which is better? Do I go higher and faster, but burn more fuel, or do I go lower and save the gas? And are there any other choices? Well the answer to the last question is easy. Take a look at the lower left corner of the NavLog page. There is a little button down there that says "Winds Aloft Matrix". Push it, and this little gem of a page pops up:

★ WIND ALOFT MATRIX : *AEST 601P*

KBZN to KICT	N425CA	Thursday 05-10-12 Dept: 1600L - Arr: 2055L

BOBKT1.BOY HLC ICT

Winds Aloft	FL250 ISA(-35) Comp	FL230 ISA(-31) Comp	FL210 ISA(-27) Comp	FL190 ISA(-23) Comp	FL170 ISA(-19) Comp
TOOLS	246/047 +02 +000	248/044 +03 +002	250/040 +03 +004	251/035 +04 +005	255/029 +04 +006
BOY	238/044 +05 +001	240/042 +05 +003	241/040 +05 +004	242/037 +06 +004	245/033 +06 +006
HLC0300	233/030 +05 +008	236/027 +05 +009	240/026 +06 +010	244/024 +07 +011	247/022 +08 +011
HLC0200	229/019 +06 +004	231/017 +06 +004	232/015 +07 +004	234/013 +07 +004	234/011 +08 +003
HLC0100	223/011 +06 +001	226/011 +07 +002	233/010 +07 +003	240/009 +08 +003	245/008 +09 +004
HLC	232/007 +07 +002	253/006 +08 +004	258/006 +08 +004	262/006 +08 +004	273/005 +09 +005
ICT	239/002 +08 +001	CALM +08 +000	CALM +09 +000	CALM +09 +000	340/001 +09 +001
Avg. Winds=>	+3 Tailwind	+4 Tailwind	+4 Tailwind	+5 Tailwind	+5 Tailwind
FLT TIME==>	**3:52(-03) 207TAS**	**3:50(-05) 207TAS**	**3:52(-03) 205TAS**	**3:55(+00) 202TAS**	**3:56(+01) 200TAS**
Fuel Burn==>	**116.0 Gal.**	**113.7 Gal.**	**112.9 Gal.**	**111.2 Gal.**	**110 Gal.**

Winds Aloft	FL150 ISA(-15) Comp	FL130 ISA(-11) Comp	FL110 ISA(-07) Comp	FL090 ISA(-03) Comp	FL070 ISA(+01) Comp
TOOLS	260/022 +04 +007	265/014 +03 +006	292/010 +04 +008	340/010 +03 +010	293/009 N/A +007
BOY	251/025 +08 +007	257/017 +09 +007	292/014 +08 +012	357/015 +04 +012	324/014 +03 +009
HLC0300	250/019 +10 +011	252/016 +12 +010	262/013 +12 +010	311/011 +10 +010	355/019 +06 +011
HLC0200	235/009 +11 +003	235/008 +13 +003	232/006 +15 +002	281/006 +16 +005	119/011 +18 -011
HLC0100	249/007 +11 +004	254/006 +12 +003	257/007 +15 +004	272/011 +15 +009	279/017 +11 +015
HLC	267/007 +10 +005	262/007 +11 +005	239/010 +13 +004	201/015 +12 -005	192/017 +11 -008
ICT	340/003 +10 +003	340/005 +11 +004	259/009 +11 +006	209/014 +09 -002	191/018 +07 -009
Avg. Winds=>	+6 Tailwind	+6 Tailwind	+7 Tailwind	+5 Tailwind	+1 Tailwind
FLT TIME==>	**3:59(+04) 197TAS**	**4:01(+06) 195TAS**	**4:02(+07) 193TAS**	**4:04(+09) 193TAS**	**4:09(+14) 192TAS**
Fuel Burn==>	**110 Gal.**	**110 Gal.**	**110 Gal.**	**107 Gal.**	**108 Gal.**

OK, this is cool. I can now look at the flight time and fuel burn (again, in red) for every possible altitude (and some not-so-possible ones). Anything below 15,000 feet on this plan is a non-starter due to the altitude required on the BOBKT1.BOY departure procedure. For my selected cruise power setting (65% LOP in still air, which provides the best instantaneous CAFE parameter, remember?), which of these altitudes gives the best bang for the buck? It's not immediately obvious...but it could be, and you can help, there is an audience participation part coming up!

I made up a little spreadsheet to take the trip distance (A to B, great circle straight line, remember we are interested in velocity made good), trip time, and fuel burn, and calculate velocity made good and nmpg....and the CAFE parameter. Have a look:

Route BZN-ICT										
St Line Distance (NM)	783	783	783	783	783	783	783	783	783	783
Altitude (ft)	FL250	FL230	FL210	FL190	17000	15000	13000	11000	9000	7000
Fuel (gallons)	116.0	113.7	112.9	111.2	110.0	110.0	110.0	110.0	107.0	108.0
Time (hours:minutes)	3:52	3:50	3:52	3:55	3:56	3:59	4:01	4:02	4:04	4:09
Time (minutes)	232	230	232	235	236	239	241	242	244	249
Velocity Made Good [VMG] (knots)	202.50	204.26	202.50	199.91	199.07	196.57	194.94	194.13	192.54	188.67
Nautical Miles Per Gallon (NMPG)	6.75	6.89	6.94	7.04	7.12	7.12	7.12	7.12	7.32	7.25
CAFE Parameter VMG^1.3 x MPG	6724.44	6938.12	6909.08	6898.52	6935.38	6822.42	Too Low for Departure Procedure	Too Low for Departure Procedure	Too Low for Departure Procedure	Too Low for Departure Procedure

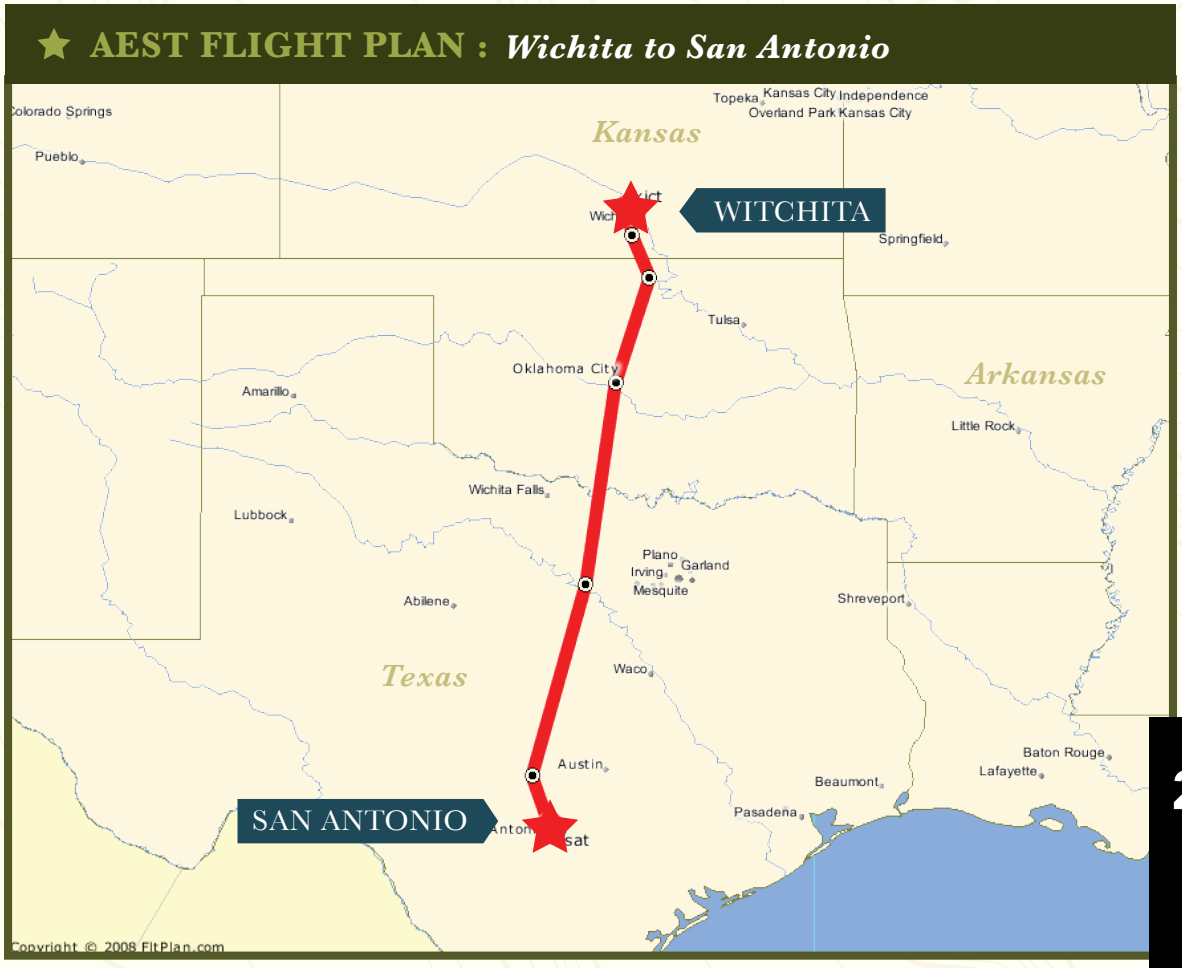
> *"...notice the huge dropoff in the CAFE score... higher is definitely not better here, even in the presence of a (small) tailwind."*

OK, this is really neat. I originally chose FL190 based upon safety (terrain clearance) and perceived efficiency (a little tailwind). However, the spreadsheet above says the altitude which gives the highest predicted CAFE parameter, or the most bang for the buck, is either FL230 or 17,000. For this case, notice the huge dropoff in the CAFE score at FL250....higher is definitely not better here, even in the presence of a (small) tailwind.

SWEET SPOT

OK, LET'S DO IT FASTER NOW.

Next leg is Wichita to San Antonio....and there are headwinds. Yuck. Let's go JAMEY PER IRW MQP STV.STV1, and guess an altitude, it's evens this time. FL200, and we get this:



★ AEST NAV LOG : *ICT to SAT, headwinds!*

IFR	N425CA	Type:AEST/G	204Kts	Dep: KICT
Dept: 2300Z	FL200	ROUTE (see below)		
Dest: KSAT	ETE: 2:43			
FOB: 0500	Altn: KAUS	NORMAN E. HOWELL	SOB: 1	Color: W/B

ATIS:125.15 VOT:114.0

Clnc:125.7

FSS: 800-992-7433 (1-57)

Elev:1333 Gnd:121.9 Twr:118.2

JAMEY PER IRW MQP STV.STV1

KICT to KSAT : TC=187° : (FMS winds: 187°/ 20) : MC= 180° : ST. LINE=**490nm** : AIRWAY=**498nm** : Extra=**2%**

Imagery | Sectionals | Jet Airways | Victor Airways | Route Map | Current Radar | Radar Loop

Winds Aloft	FL220 ISA(-29) Comp	FL200 ISA(-25) Comp	FL180 ISA(-21) Comp	FL160 ISA(-17) Comp
PER	017/005 +08 +004	010/006 +09 +005	003/006 +09 +006	354/006 +10 +006
IRW	165/013 +09 -011	140/013 +09 -008	110/012 +08 -001	116/010 +09 -002
MQP	186/020 +10 -020	175/019 +09 -019	165/018 +08 -016	168/018 +08 -017
STV	223/041 +10 -037	223/040 +10 -035	223/038 +10 -034	218/034 +10 -031
Avg. Trip Winds=>	- 22 Headwind	- 20 Headwind	- 18 Headwind	- 17 Headwind
FLT TIME==>	**2:42(-01) 206TAS**	**2:43(+00) 204TAS**	**2:43(+00) 202TAS**	**2:45(+02) 198TAS**
Fuel Burn==>	**84.8 Gal.**	**82.7 Gal.**	**81.1 Gal.**	**80.7 Gal.**

Hit the wind matrix button, and we get this:

★ WIND ALOFT MATRIX : *ICT to SAT*

KICT to KSAT JAMEY PER IRW MQP STV.STV1

Winds Aloft	FL260 ISA(-37) Comp	FL240 ISA(-33) Comp	FL220 ISA(-29) Comp	FL200 ISA(-25) Comp	FL180 ISA(-21) Comp
PER	252/008 +07 +000	308/005 +09 +004	017/005 +08 +004	010/006 +09 +005	003/006 +09 +006
IRW	189/013 +08 -013	190/014 +10 -014	165/013 +09 -011	140/013 +09 -008	110/012 +08 -001
MQP	196/026 +09 -026	197/022 +10 -022	186/020 +10 -020	175/019 +09 -019	165/018 +08 -016
STV	224/046 +10 -041	224/043 +11 -038	223/041 +10 -037	223/040 +10 -035	223/038 +10 -034
Avg. Winds=>	- 26 Headwind	- 23 Headwind	- 22 Headwind	- 20 Headwind	- 18 Headwind
FLT TIME==>	**ABOVE MAX ALT.**	**2:42(-01) 207TAS**	**2:42(-01) 206TAS**	**2:43(+00) 204TAS**	**2:43(+00) 202TAS**
Fuel Burn==>	---	**86.2 Gal.**	**84.8 Gal.**	**82.7 Gal.**	**81 Gal.**

Winds Aloft	FL160 ISA(-17) Comp	FL140 ISA(-13) Comp	FL120 ISA(-09) Comp	FL100 ISA(-05) Comp	FL080 ISA(-01) Comp
PER	354/006 +10 +006	356/006 +10 +005	022/005 +11 +004	177/011 +11 -011	164/014 +07 -014
IRW	116/010 +09 -002	121/009 +10 -003	126/007 +11 -003	162/014 +11 -012	176/017 +07 -016
MQP	168/018 +08 -017	170/019 +09 -018	173/019 +09 -018	181/019 +10 -019	175/019 +06 -019
STV	218/034 +10 -031	212/029 +10 -028	206/024 +10 -024	198/021 +11 -021	186/021 +09 -021
Avg. Winds=>	- 17 Headwind	- 16 Headwind	- 15 Headwind	- 17 Headwind	- 18 Headwind
FLT TIME==>	**2:45(+02) 198TAS**	**2:46(+03) 196TAS**	**2:47(+04) 194TAS**	**2:51(+08) 193TAS**	**2:54(+11) 192TAS**
Fuel Burn==>	**81 Gal.**	**80 Gal.**	**79 Gal.**	**80 Gal.**	**78 Gal.**

NOT TO BELABOR THE POINT, BUT…

The tradeoffs still aren't obvious, are they? But FL200 is clearly not the best choice, if I go FL180 it's a couple gallons less gas. Let's put those numbers into the spreadsheet:

Route ICT-SAT									
St Line Distance (NM)	490	490	490	490	490	490	490	490	490
Altitude (ft)	FL240	FL220	FL200	FL180	16000	14000	12000	10000	8000
Fuel (gallons)	86.2	84.8	82.7	81.0	81.0	80.0	79.0	80.0	78.0
Time (hours:minutes)	2:42	2:42	2:43	2:43	2:45	2:46	2:47	2:51	2:54
Time (minutes)	162	162	163	163	165	166	167	171	174
Velocity Made Good [VMG] (knots)	181.48	181.48	180.37	180.37	178.18	177.11	176.05	171.93	168.97
Nautical Miles Per Gallon (NMPG)	5.68	5.78	5.93	6.05	6.05	6.13	6.20	6.13	6.28
CAFE Parameter VMG^1.3 x MPG	4911.01	4992.09	5078.06	5184.64	5103.09	5126.45	5150.97	4932.45	4945.83

"You say "Cool Norm. But 180 knots door to door is not very Aerostar-ish". Yeah, I know. Headwinds suck. But this is what it is like in actual practice."

And now the choice is obvious. I'll file for FL180 and get on my way, fast (kinda) and efficient. You say "Cool Norm. But 180 knots door to door is not very Aerostar-ish". Yeah, I know. Headwinds suck. But this is what it is like in actual practice. And I can hear the voice of the skeptic now, my old arch-opponent, longtime Aerostar owner (and Duke owner before that), the one and only Krashbern T. Throttlebottom. Last time I saw (heard) ol' Krashbern, he was at an airshow, belly hangin' over his huge belt buckle, bragging to some poor young thing that wandered too close to his gravity field….."Lemme Tell Ya 'bout the DUKE!!" And every one of you AOA readers knows Krashbern or one of his relatives!

Krashbern likes to "kick it old skool". He's gonna run FL180 at 78% ROP Best Power, because "Fuel's cheaper than engines, son". Krashbern knows that today is cold, it's ISA -21 deg C (brr!). His power setting is 19.1 gph/engine and he gets 226 KTAS, jus' like the intercooled 601P power setting and cruise table says. But with the headwinds in Krashbern's face he can only get 208 knots ground-speed on cruise. Using the book VY climb, cruise at FL180 at 78% best power, and about 210 knots on the descent (headwinds, remember?), Krashbern's "old skool" flight from ICT to SAT is 2 hours 34 minutes and he's just tellin' the line guy to "throw 101 gallons of fuel in her" when I taxi up. My flight was 2+43 and burned 81 gallons...and the result:

"Krashbern's Old Skool" CAFE parameter is 4476. Fast+Efficient CAFE Parameter is 5185. And this is at the best possible altitude.

And with today's fuel prices, when Krashbern T. Throttlebottom gets to San Antonio, his poor operation of a very efficient airplane as shown above gets him there 9 minutes earlier, but will cost an extra 120 bucks, on this one leg alone.

And that is NOT getting the most bang for the buck!

NOW HERE IS WHERE THE AUDIENCE PARTICIPATION COMES IN.

I am going to ask the folks at FltPlan.com to add an additional row to the winds aloft matrix output, which calculates the CAFE parameter and highlights the altitude with the best score. As you can see above, it's a bit of a pain to transfer the time and fuel outputs for each altitude into a spreadsheet, deal with the units transfers from hours and minutes to minutes, then to nautical miles per minute, etc etc. This output could easily be done automatically by the web site, but the request from simply one power user won't be enough to get them to make the upgrade. I'll need at least a couple of AOA FltPlan.com users (who actually see merit in these ideas) to lend their voices to the request for an upgrade to the Fltplan.com NavLog output. So please contact me through the AOA Forum, or contact AOA to get my email address. Your help is solicited and welcome!

So, there you have it. The smart flight profile and the tools to make the most efficient flight plans possible are right here. When the FltPan.com output is updated as we will advocate, you won't need an advanced engineering degree to understand these concepts, and even a high-schooler could implement them. And it won't cost you a dime to gain this added total performance.

And you say "Cool, Norm! Can we talk about this more on the forum?"

You betcha. I post as "testwest" on the AOA forum, and you can PM me for my email. In the mean-time, happy planning and flying in your ideal airplane!