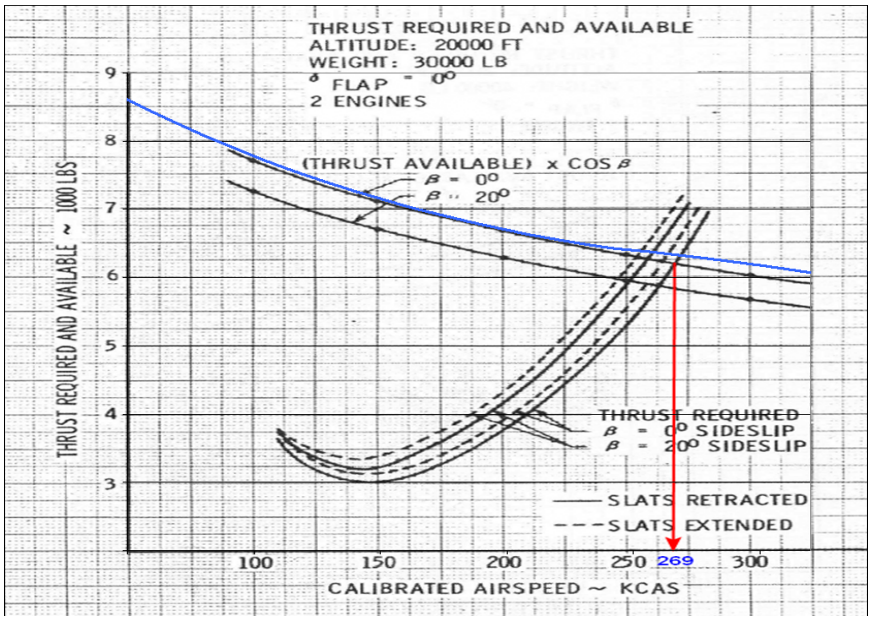
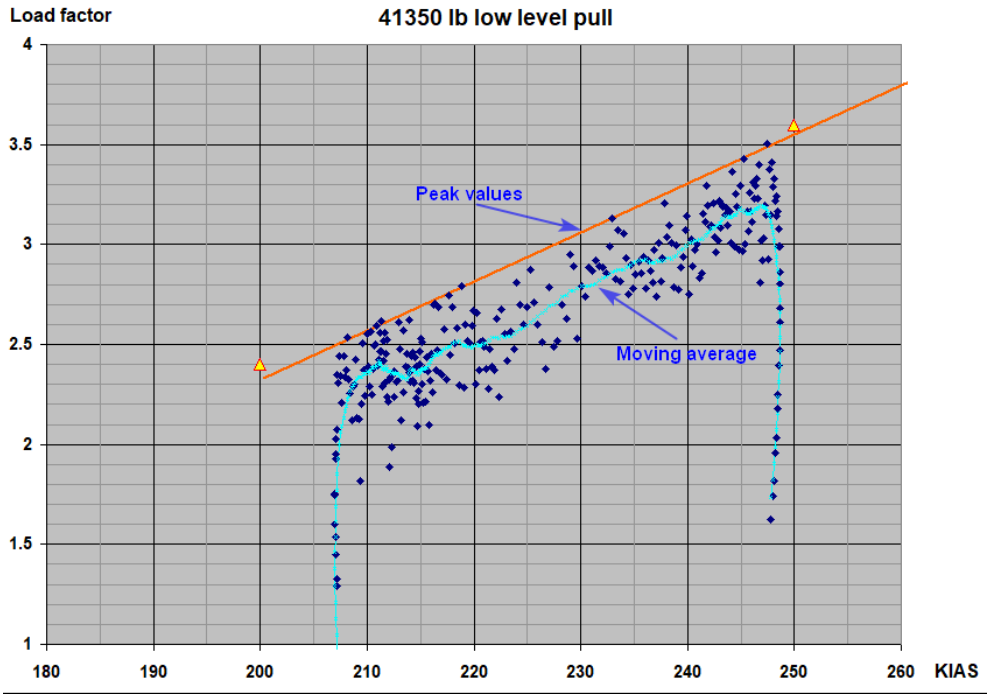
DCS: A-10C II

Flight Improvements

Preparing our new A-10C–II to release we returned to the manoeuvring characteristics of the aircraft and carefully checked them. Making the flight model we used original lift and drag coefficients curves as references, the engine model was verified using the available thrust curves.

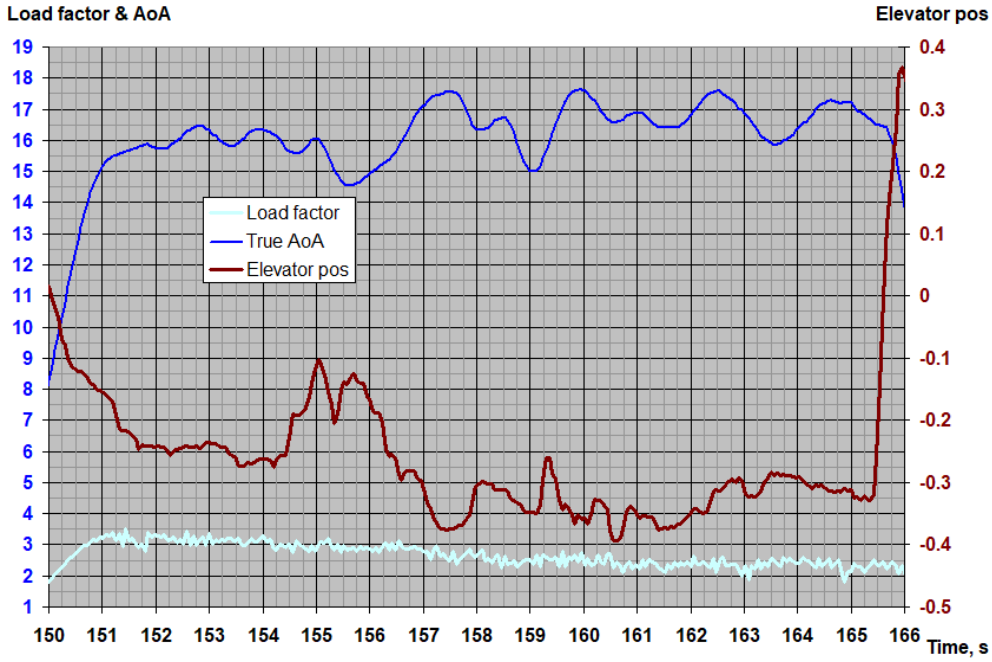


The instantaneous turn rate some users complained to was tested as well and the results were arranged in a form of so called V-g diagram where load factor is plotted versus IAS.
It was noticed during this test that maintaining near-stall AoA at the chopped tone region was a bit tricky due to buffeting and the resulting V-g diagram looked like this one:

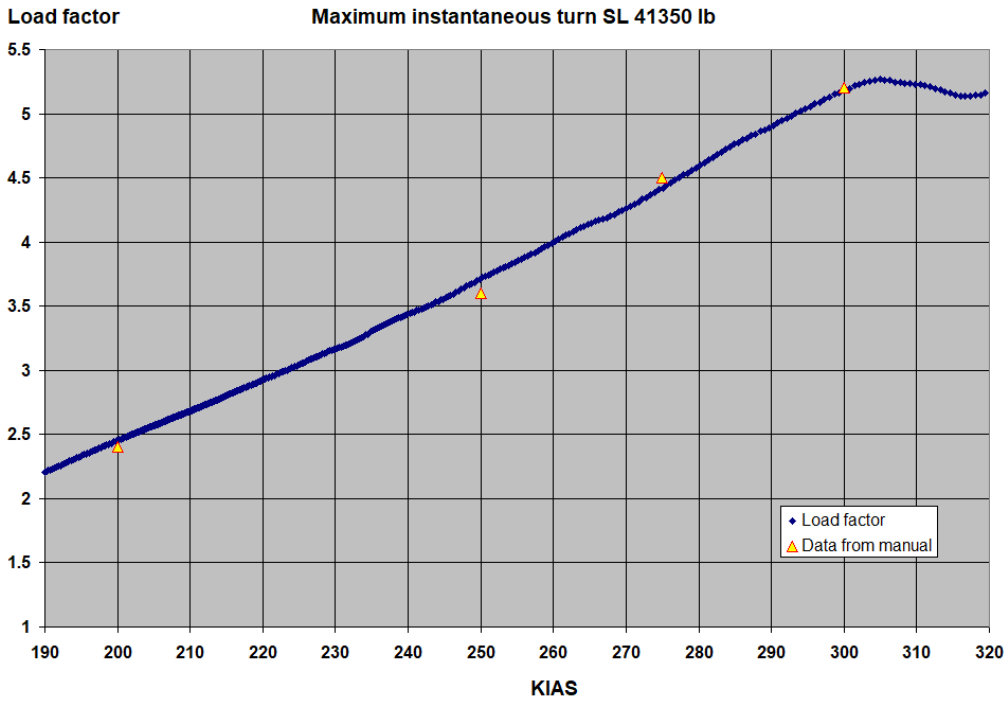


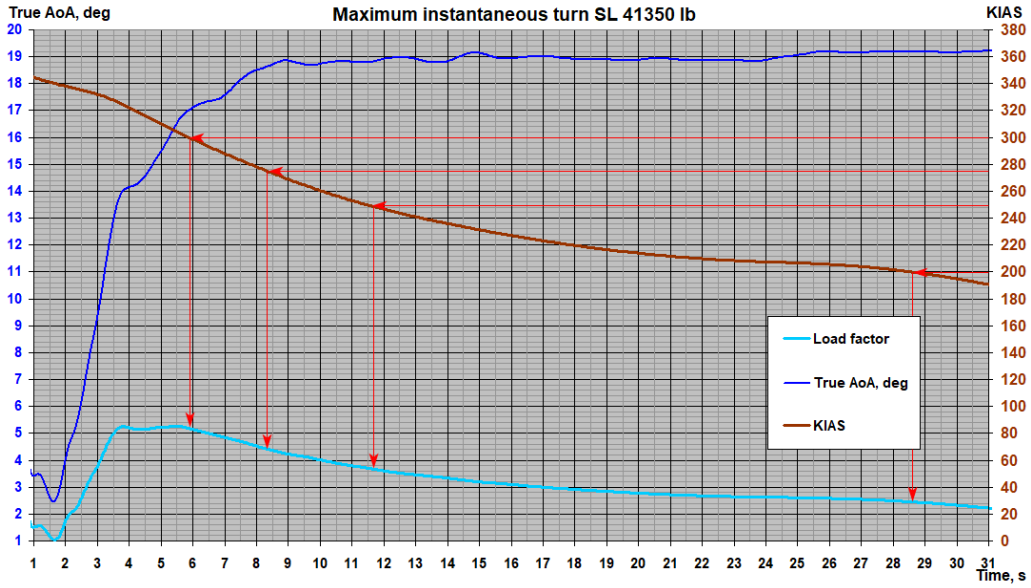
The yellow triangles are the reference points derived from the instantaneous turn performance chart (See Appendix). It's clearly seen that the peaks of load factor matches the reference, but the load factor itself is very uneven, and it's average value is ~10% less giving ~10% loss in turn rate.

The reason was that the buffeting we used for A-10 is not only visual effect of cockpit shaking but it is true aerodynamic disturbance affecting either the airframe or engines, so, the instant wing AoA oscillates giving load factor oscillation. The elevator movement shows significant efforts to maintain the desired angle of attack.



The plot is a time history of the V-g diagram shown above.
The problem was that buffeting began too early as a pre-stall warning, but the aircraft actually has post-stall buffeting at Mach numbers less than 0.6 and buffeting as a sign of stall at higher M numbers.
So, we had to make our buffeting model more flexible and added more ability to fine tuning. The buffeting then was tuned to match the reference chart (See Appendix), and the tests were conducted again for the same conditions.
As it's seen on the plots there is no problem to maintain near-stall AoA and there are no load factor fluctuations at all.





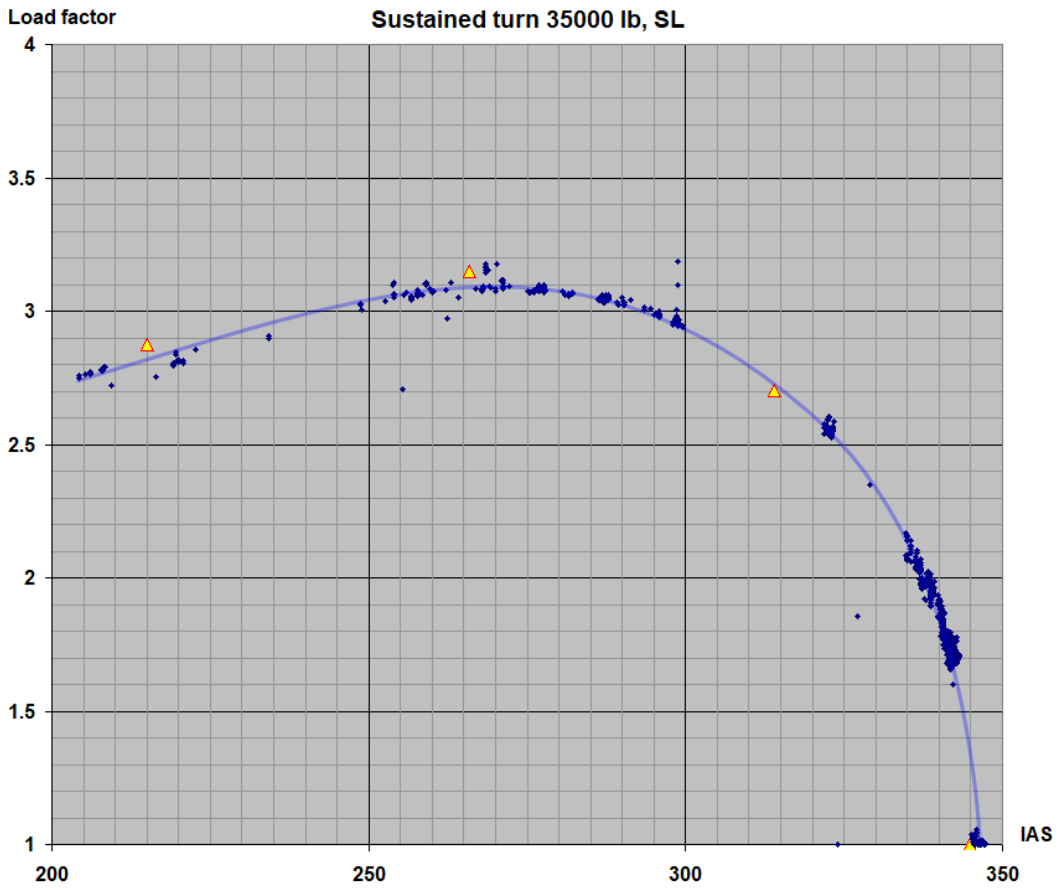
As instantaneous turn rate is only a matter of maximum lift coefficient, sustained turn rate depends on drag polar and available thrust. Very often these polars can be easily derived from the required sustain turn rate but in the case of A-10 the actual drag polars were available, so the task was to compare measured turn rate to the reference values derived from the performance charts.

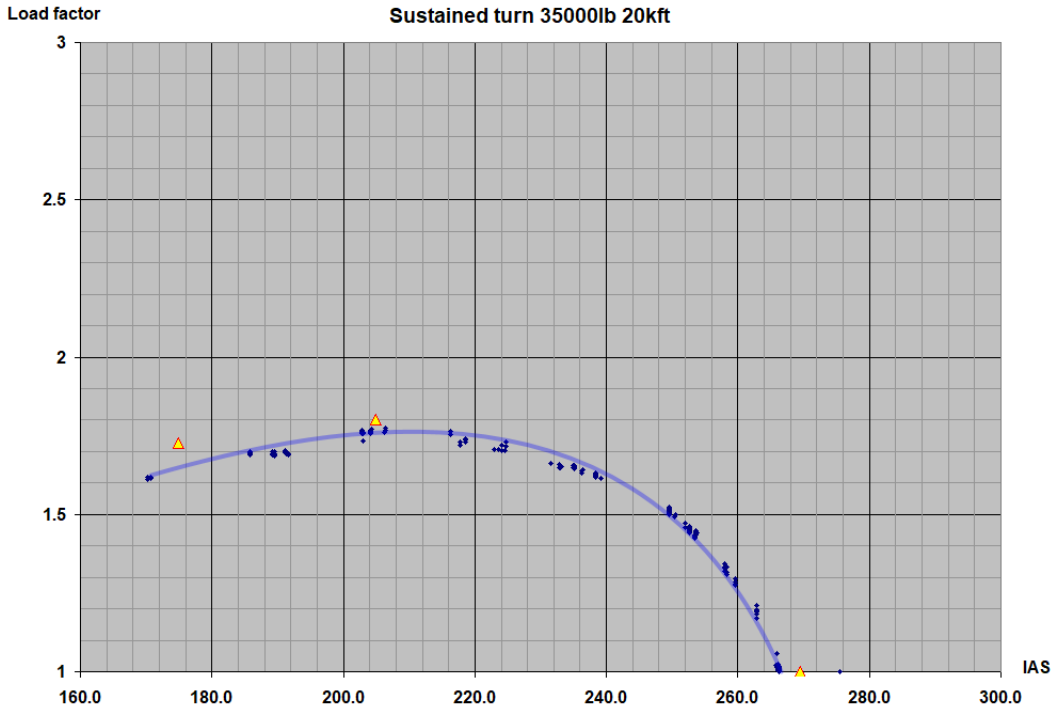
These performance charts (See Appendix) are plotted for different drag indexes (DI). The basic drag index is 0 for the plane with pylons, but the manual gives the following drag index comment:

III. Configurations

Configuration	Gross Wt, Each (Lb)	Drag Index
Leading edge slats extended	-	2.02

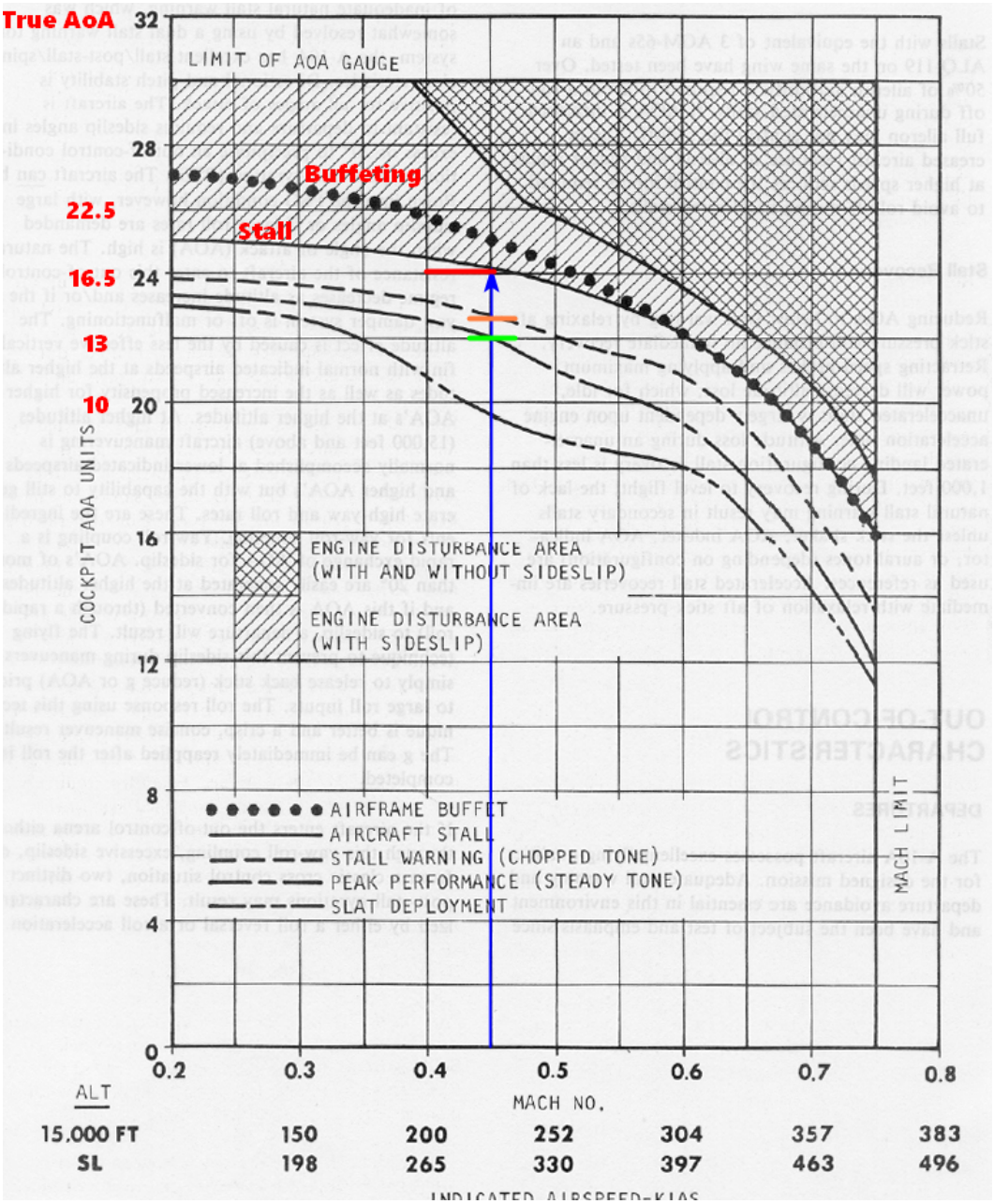
The same changes in drag and, thus, in required thrust we can see at the chart above.
As the sustained turn is performed with slats extended especially within maximum load factor IAS range the DI=2 must be used for obtaining the reference. In the manual only DI=0 and DI=4 charts are available, so the reference points were derived using interpolation between two diagrams.
Sustained turn is a turn with zero specific excess power (SEP), and the best way to get it as accurate as possible without using autopilots is to perform steady turns at different speed and then additionally remove points having absolute SEP value higher than a threshold.
The threshold value is selected to have the resulting line of points either not very fuzzy or not very disperse.



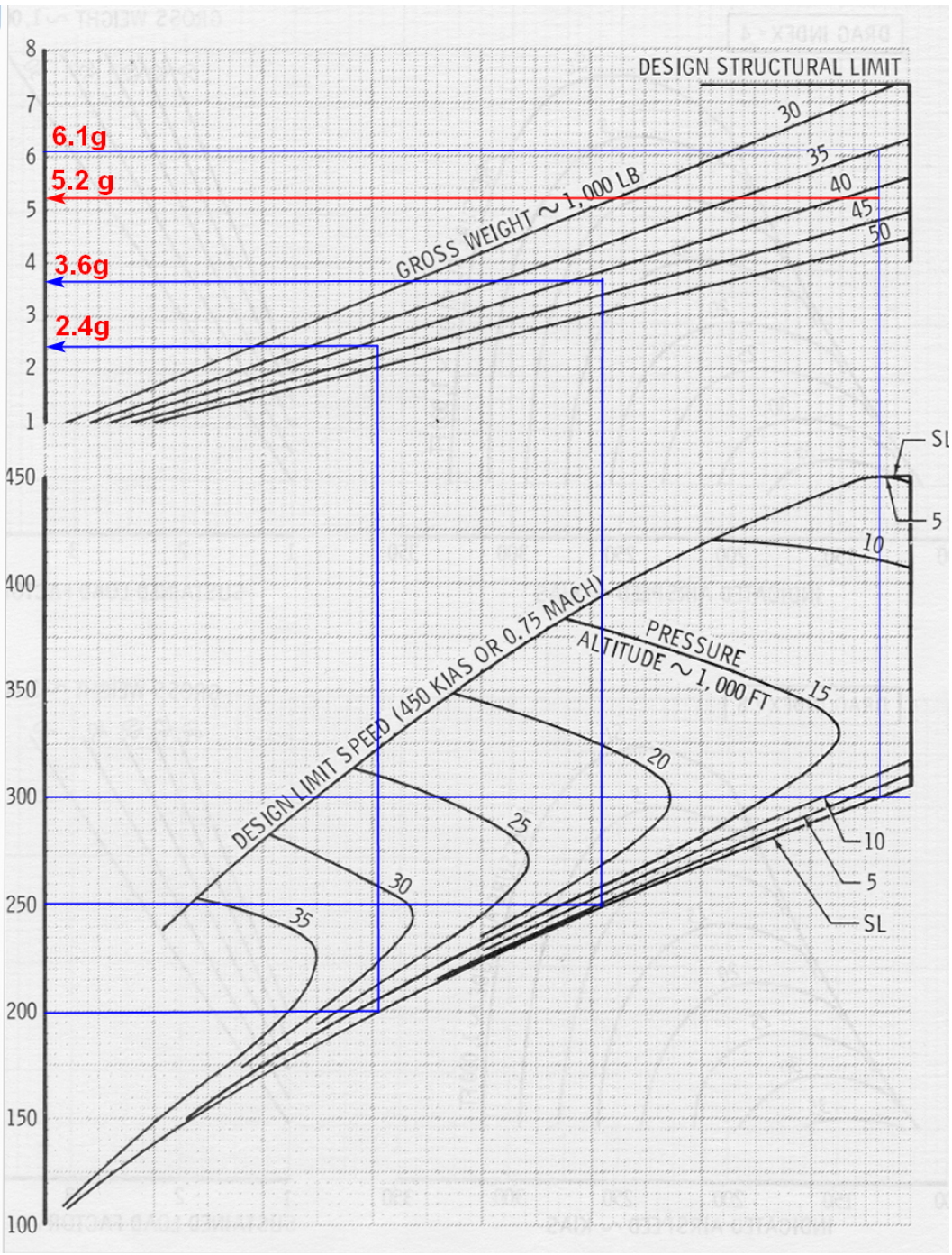


Appendix

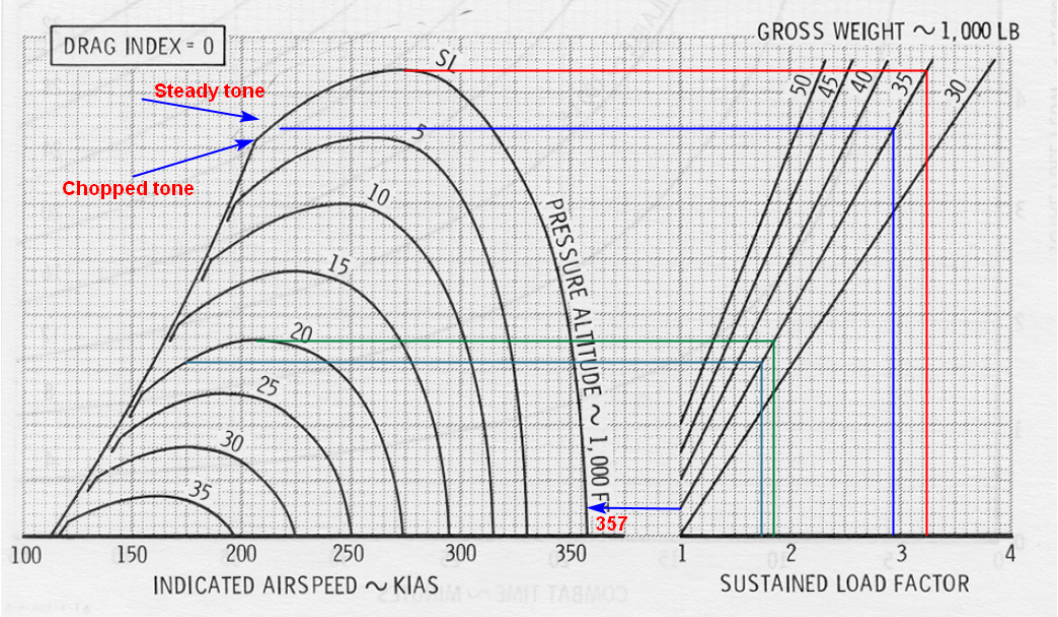
Stall warning and engine/airframe compatibility

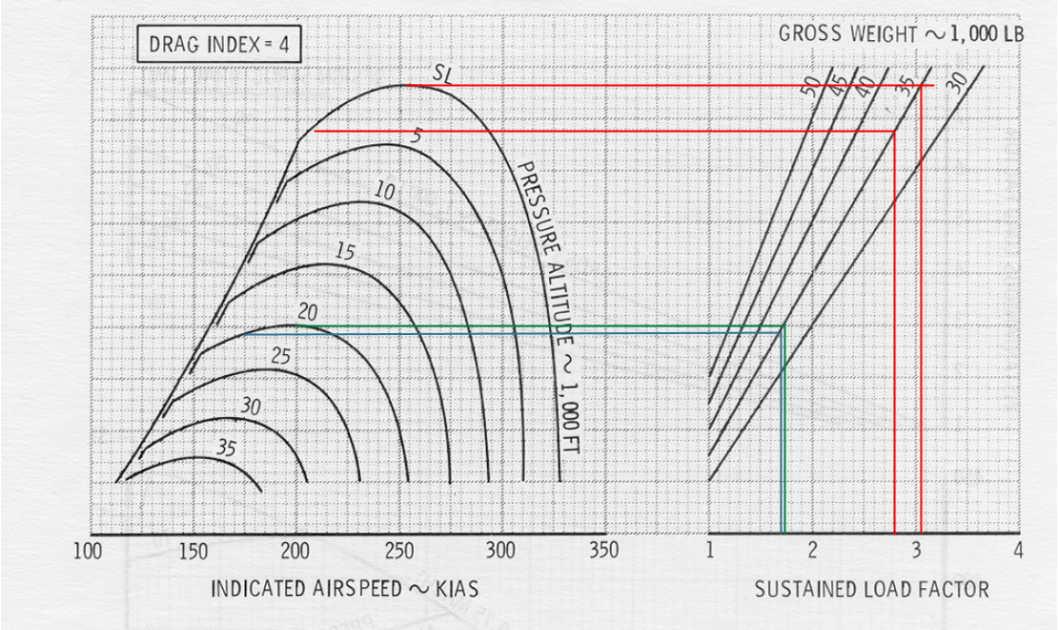


Instantaneous turn rate



Sustained turns for DI=0 and DI=4





Interesting that the maximum speed obtained from the chart for DI=0 (357 knots) differs from the value obtained from the special chart for maximum speed (345 knots)