HIGH FIDELITY
Flight Models

ANGLE OF ATTACK

Cat III AOA Limiter

Corner Vcas

DYNAMIC PRESSURE BREAKPOINTS

by Mav-Jp & Raptor one

INTRODUCTION 4

1. AERODYNAMIC SECTION 8

1.1 Introduction 8

1.2 The Pitch limiters 10

1.2 The Lift and Drag (Cl / Cd) 12

1.3 The Rudder (CY) 19

1.4 The Drag Index (DI) 20

2 ENGINES SECTION 22

2.1 The Pratt & Whitney engines 22

2.2 The General Electric Engines 28

3 A BIT OF HISTORY 31

3.1 F16 A - Block 15 31

3.2 F16 - MLU 32

3.3 F16 C/D – Block 30 / 32 34

3.4 F16 C/D - Block 40 / 42 36

3.5 F16 C/D - Block 50/52 38

4 PERFORMANCE SECTION 40

4.1 F16 A – Block 15 40

4.2 F16 C– Block 30 58

4.3 F16 C– Block 32 76

4.4 F16 C– Block 50 94

4.5 F16 C– Block 52 112

5 SOURCES AND CREDITS 130

5.1 Sources 130

5.2 Credits 130

The charts included in this document relate only to the flight models developed for use in the Falcon 4.0 PC flight simulation.

No classified or confidential information was used to develop these flight models.

INTRODUCTION

By Andre “Raptor One” Joseph

Flight models in Falcon 4 have come a long way since the original version was released in December 1998. Surprisingly, the flight models did not get a major overhaul until work began on the SuperPAK series of patches by the Falcon 4 Unified Team (F4UT). The first set of fully revamped flight models was featured in SuperPAK Version 2 which was released in January 2002. Tom “Saint” Launder headed up this effort within F4UT to revamp the flight models. When it came to the F-16 flight model, Saint and I did our best to model the F-16C Block 52 given the amount of time, data, knowledge, and capabilities we possessed. I worked on giving the model a fairly accurate thrust model for idle, military (MIL) power, and maximum afterburning power (Max AB) and Saint worked on the aerodynamic coefficient tables, roll rate tables, flight control limiters, and other basic flight model data file variables such as fuel, weight, engine spool times, flap settings, and the like.

Attempting to model reality is rarely something one gets 100% right on the first attempt. SuperPAK Version 2 was not the final version of the F-16 flight model(s) by a long shot. I made changes to the idle thrust and flight control limiter sections of the F-16 Block 52 flight model for SuperPAK Version 3. For Version 4 I attempted to model all the different F-16 blocks flown by the USAF from the block 15 on up to the block 52. All blocks contained updated aerodynamic data from various “technical” sources (NASA technical reports, aerospace journal technical reports, etc.). Low speed, high angle of attack roll rate was also updated based on input from an Israeli F-16D weapons system officer who had quite a bit of stick time as well. I also did my best to model the various different engines found in blocks 15 through 52. The original thrust model I provided for the block 52 in the previous two SuperPAK versions was almost completely redone as well.

While working on the flight models for SuperPAK Version 4, I came to the conclusion that I simply couldn’t get the accuracy I was looking for in the F-16 flight models by piecing together thrust and aerodynamic data from various sources and tweaking this data by comparing the performance in the simulation to known performance figures. I had a good amount of performance data on the early F-16 variants that used the original Pratt and Whitney F100-PW-200 afterburning turbofan engine at that point in time, having spent well over two years collecting data on the F-16. As a student in the field of aerospace engineering, I knew that given certain output performance data for an aircraft such as acceleration or specific excess power (P_S), once could calculate values for thrust given the drag or values for drag given the thrust. Not only that, but given charts for how many G the F-16 can pull at different angles of attack (AoA) at various airspeeds, or what AoA was required to hold 1 G level flight at various altitudes and airspeeds, I could easily calculate the lift vs. AoA for various Mach numbers. Luckily, I had recently found afterburning thrust data for the YF-16 (F-16 prototype) which used the F100-PW-100 engine. The difference between the -200 and -100 was primarily idle thrust logic added for the -200 to prevent compressor stalls, so the afterburning thrust was still basically the same throughout the flight envelope. This was the start of something special.

At first I thought I would simply be able to improve upon the work I had already done for SuperPAK Version 4 with my newfound approach and thrust data. My quest for realism turned into an obsession though. I realized how much closer I could come to a 100% accurate F-16 flight model by using available flight performance data in conjunction with basic aircraft performance equations. I spent a good part of the summer, day in and day out, making calculations and subsequent plots of the F-16's lift coefficient as a function of AoA (C_L vs. AoA) and lift coefficient vs. drag coefficient (C_L vs. C_D). I made these plots for as many Mach numbers as I could. I had to stop these efforts when September rolled around and school work became my top priority. But there was no looking back from that point on. The work I had done for SuperPAK Version 4 was old news in my opinion. Those flight models were, of course, included in SuperPAK 4, but simply because new flight models based on this new, explicitly calculated data were nowhere close to being ready at the time of its release.

When school work took over my life from flight models in September 2003, a fellow Falcon 4 virtual pilot, callsign "Mav-jp", was nice enough to take over the work I started. I had come to know Mav-jp months earlier when I provided him some information related to the flight model data different versions of Falcon 4 used (I think that's how we met at least). It was not until September that I discovered he was actually an aerospace engineer though! I immediately filled him in on my work, sent him a huge excel workbook full of graphs, calculation tables, and so on and told him where I intended to go from there. With very little explanation needed on my part, he continued down the path I set out on months earlier. I think you will all be very impressed to see how far he has brought that initial excel workbook I generated.

....

By “Mav-jp”

The first time I contacted “Raptor One” was for the purpose of incorporating the flight models of SP3 into “SP1-MJ”. At that time my knowledge of Falcon 4 flight modeling was limited. When I discovered that a group named “BMS” was able to modify the Falcon 4 exe, I decided to see if I could add my own stone for flight modeling. My initial intention was to improve the Mirage 2000 flight model for SP1-MJ2, however, after Raptor informed me that he had started working on a new F16 flight model from scratch, I became very interested in his work. Because of his time consraints, I proposed to help him complete the job. This was my biggest mistake of 2003, as it was the start of a project that would take up most of my free time for the next year.

Once I began testing the flight models within Falcon 4, I noticed there was a problem with the CAT1 limiter. The model calculated by Raptor wasn’t reacting as expected within the simulator, because while the CAT1 limiter was present in the DAT file, it was not activated in the code. I decided to contact the BMS group, and fortunately a fix was able to be quickly implemented by the BMS coders so that the CAT1 limiter could be activated for BMS 2.0. The second huge modification to the Falcon 4 executable (for flight modeling at least) was the creation of a completely new fuel flow table in the flight model data files. With these two exe modifications, I was able to complete Raptor’s work. It took me 5 months to complete the calculations for the lift and drag coefficients for the F-16A Block 15 alone.

Another month was dedicated to the creation of a new Cy-β (derivative of the side force coefficient with respect to sideslip angle) table. This new table was calculated from NASA sources and a public domain simulation program that makes use of the same NASA sources.

The next step was to create the thrust data for the F100-PW-220, F100-PW-229, F110-GE-110 and F110-GE-129. Using various data sources and approximations/extrapolations from the data available, I was able to create relatively accurate thrust tables. The fuel flow tables were then extrapolated from this thrust and our knowledge of the general behavior of the thrust-specific fuel consumption (TSFC) depending on Mach number and altitude.

The final step was to extensively modify the drag index of all the weapons in the Falcon4 world.

I was really happy and proud to work with Raptor, the guru of Falcon 4 flight model community. We (hopefully) have nearly the same vision and goals when it comes to flight modeling, and we hope you enjoy our vision.

……………………………………………………………………………………

"Virtual Pilot" Commentary

You may be wondering right now whether all this hard work will simply go right over your head. Perhaps you are just a casual flyer and don't pay much attention to detail in terms of the flight model. You may also be wondering whether you need to be a real F-16 pilot or an aerospace engineer to appreciate the (sometimes) subtle differences in the various F-16 blocks we now model to much higher levels of precision. Perhaps our friend Peter "Sappy" Legg, an excellent Falcon 4 dogfighter, can elaborate.

I've been involved with Falcon4 for around 18 months now, and in that time have accumulated over 1000 hours in the Virtual F-16, mostly in the Dogfight arena, honing BFM skills and learning to squeeze every last ounce of performance out of the SP3, SP4 beta and SP4 FMs. Each new incarnation represented a significant change in the way the FMs handled, and along with them, a new learning curve. I'll admit it's been a little frustrating moving from FM to FM wondering when it was all going to stop and if we would ever have the 'ultimate' F-16 FM to stick with.

Well, I'm very happy to say that over the past several months I've become aware of the fantastic amount and quality of data going into these FMs, the knowledge and talent of people like Mav-JP and Raptor One who are implementing it, and the hours and hours of FM performance testing and data recording done by numerous beta testers to ensure that the FMs and the data matched up in every respect.

So, what does this mean to the Falcon4 pilot?

Well, firstly, I know that most of the community appreciates the sense of immersion that Falcon4 offers. As far as jet sims go, Falcon4 is unique…it has soul…and for many of us, its not a sim at all, it's a way of life. But whether you fly online or offline, human vs. human or against the AI, you're a Falcon Fanatic or only hit the skies once a month, you fight the forces of evil or enjoy scenic joy flights around the snow capped mountain regions of North Korea, or the deserts of Iraq…these FMs should substantially add to that sense of immersion. Even if you don't pay enough attention to the flight models to notice large differences (some will be unavoidable and there will be a learning curve), each time you climb into the Viper pit, understand that you're about to fly something that simulates various F-16 block performances far more accurately than anything that has come before.

For the purists who are attuned to various flight model performances, for the dogfighters looking for an edge, and for those who simply want to learn some basic BFM and to know how to get the best out of their jet, the charts accompanying these FMs will be an invaluable tool for you. I recommend studying them, because, obvious or not, there are very real performance differences between the various blocks, and what you're used to in earlier FMs, and will make a difference in the way you fly.

For those interested in DACT or flying something other than the same old FM, the good news is that this package includes FMs for the Block 15, 25, 30, 32, 40, 42, 50 and 52. The months of testing and dogfighting with Raptor One in the various blocks, learning the differences and relative advantages and disadvantages of each, requiring different tactics and flying styles, added a whole new dimension to the Falcon experience.

In short, these new FMs are simply awesome.

Ladies and Gentlemen… you are in for a real treat.

1. AERODYNAMIC SECTION

1.1 Introduction

80 percent of the airframe structure of the F-16 is of conventional aluminum alloy, and about 60 percent of the structural parts are made from sheet metal. An attempt was made to minimize the amount of exotic material used in the construction of the F-16 in the interest of saving cost. About 8 percent is steel, composites are 3 percent and titanium is 1.5 percent.

The F-16 is built in 3 major subsections, nose, center and aft. In order to save money, the fuselage structure is fairly conventional in overall configuration, being based on conventional frames and longerons. The forward manufacturing breakpoint is just aft of the cockpit, while the second is forward of the vertical fin.

The wing platform of the F-16 is effectively that of a cropped delta with a 40-degree leading edge sweep. The wing has 4 percent thickness/chord ratio, and the aerofoil section is 64A204. The wing structure incorporates five spars and 11 ribs. Upper and lower wing skins are one-piece machined components. From left to right, the wing gradually blends with the fuselage, making it impossible to tell where the wing begins and the fuselage ends. This wing/body blending made it possible to increase the internal volume, enabling more fuel could be carried. In fact, 31 percent of the loaded weight of an F-16 is fuel, accounting for the long range of the Fighting Falcon. Gradually increasing the thickness of the wing in the region of the root resulted in a stiffer wing than would have been possible with a conventional design. In forward-to-aft planform, the wing leading edge blends smoothly with the fuselage by means of leading edge strakes. At high angles of attack, these strakes create vortices which maintain the energy of the boundary air layer flowing over the inner section of the wing. This delays wing root stalling and maintains directional stability at low speeds and high angles of attack. Vortex energy also provides a measure of forebody lift, reducing the need for drag-inducing tail trim. By keeping the inner-wing boundary layer energized, the strakes allowed the wing area to be kept smaller, saving about 500 pounds in weight.

The wing trailing edges have a set of inboard "flaperons", which are combine the duties of flaps and ailerons. The flaperons operate as conventional ailerons for controlling the aircraft during conventional flight. During takeoffs and landings, they can be drooped by as much as 20 degrees, operating as flaps. The outboard trailing edge wing surfaces are fixed.

Wind tunnel tests demonstrated the need for leading edge flaps to improve lift and directional stability at high angles of attack. Leading edge maneuvering flaps and trailing edge flaperon can be moved at up to 35 degrees per second to shape the wing aerofoil to match aerodynamic conditions. The moving flaps reduce the drag, maintain lift at high angles of attack, improve directional stability and minimize buffeting. The use of lift-increasing maneuvering flaps allowed a smaller wing of reduced span to be used.

The wing is only 1.5 inches deep at the point where the leading edge flap actuator is installed, so the design of this component was a significant challenge. In the spring of 1982, actuator failures caused the USAF to ground all F-16s that had exceed 200 hours flight time for an inspection of the wing leading edge flap. A routine inspection had turned up excessive wear in the actuation mechanism which controls the position of the leading-edge maneuvering flap. More than 40 aircraft required repair.

During the early development of the F-16, both single- and twin-vertical tail formats had been studied. Wind tunnel tests showed that vortices produced by the forebody strake or LEX generally improved directional stability but that certain strake shapes actually reduced stability at high angles of attack when twin tails were fitted. Consequently, it was felt that the use of the twin-tail format involved significantly greater development risks, and a single vertical tail was adopted. The disadvantage is that the single vertical tail now has to be sufficiently tall.

The single vertical stabilizer has a multi-spar and multi-rib structure made from aluminum, but the skins are made of graphite epoxy. The two ventral fins underneath the fuselage are made of glass fiber. There is a runway arrester hook underneath the rear fuselage.

Aft of the wing, the fuselage blends smoothly in cross-section into a side-body fairing that extends all the way to the rear of the aircraft. The all-flying horizontal tailplane is attached to the rear of this side body fairing. The air brakes are mounted inboard of each horizontal stabilizer at the end of the side body fairing, one set on each side of the rear fuselage. The air brakes are of the split type, the upper and lower sections opening through a maximum angle of 60 degrees.

The wings are far too thin to accommodate the main undercarriage units, so they are attached to the main fuselage and retract forward into wells in the lower fuselage. The nose gear is located just aft of the intake, so that debris thrown up by the nose wheel will not be ingested into the intake. The steerable nose landing gear retracts aft and rotates through 90 degrees to lie flat underneath the intake duct.

The air intake is located underneath the fuselage, at a point just below the cockpit. The ventral location of the air intake subjects it to minimal airflow disturbance over a wide range of flight conditions and aircraft maneuvers, since the forward fuselage tends to shield the intake from the full effects of aircraft maneuvers, minimizing the effects of sudden changes in the angle of attack on airflow into the engine. At an angle of attack of 25 degrees, for example, the air flows into the intake at an angle of only ten degrees with respect to the aircraft's longitudinal axis. The lower edge of the intake lip is only 38 inches above the ground, but, surprisingly, FOD problems caused by the ingestion of runway debris into the engine have been relatively minor.

The intake is of fixed geometry type, which saves on complexity, weight, and cost. A fixed-geometry boundary-layer splitter plate separates the upper lip of the intake from the lower fuselage. There is a separation strut mounted inside the intake for additional tunnel rigidity.

In the interest of savings in cost, a number of parts are interchangeable between port and starboard. These include the horizontal tail surfaces, wing flaperons, 80 percent of the main landing gear components, and many of the actuator units.

Under the Multinational Staged Improvement Plan (MSIP) approved in February 1981, a series of improvements were developed for the F-16. Among these were modifications of the structure and wiring of the wings to carry the AMRAAM, the provision of hardpoints on the intake sides to carry the LANTIRN electro-optical system.

A new horizontal tail plane of increased area was introduced under Engineering Change Proposal 426. It provides greater control forces needed to cope with heavier munitions loads. The revised tail was easier and less expensive to produce.

The vertical fin can be modified to allow the fitting of a braking parachute if the customer so desires. Norwegian F-16s were all fitted with this feature, since Norway has many short airfields which are often covered with ice and snow, making the use of wheel brakes impractical.

An in-flight refueling socket is mounted on the top of the fuselage just ahead of the fin leading edge. It is normally covered by an inward-hinged door when not in use. The receptacle can accommodate the rigid boom used by USAF aerial tankers, or it can have a probe fixed into it for use with drogues.

SOURCE : http://home.att.net/~jbaugher4/f16.html

1.2 The Pitch limiters

The F-16A/B employed an all-electronic fly-by-wire (FBW) flight control system instead of the traditional hydro mechanical systems with linkages and cables. The system is a four-channel analogy system, the F-16A/B having been designed too early to accommodate the quadruplexed digital system that was provided on the Space Shuttle and on the F/A-18 Hornet. The FBW system makes it possible for the F-16 to fly safely with its center of gravity behind the center of pressure, thus providing the aircraft with an inherent instability that makes it highly responsive to the controls and to use relatively modest amounts of tail deflection during high-g manoeuvres. The use of relaxed stability enabled a smaller tail to be used, since less force was needed to alter aircraft attitude. The General Dynamics team was the first to take the bold step of eliminating mechanical backups to the FBW system, trusting the aircraft completely to electronics.

Experience with a triplex digital system on the AFTI/F-16 gave GD the confidence to abandon the proven analog FBW system of the earlier Fighting Falcon and adopt the quadruplex digital FBW system for the Block 25 and beyond F-16C/D.

SOURCE : http://home.att.net/~jbaugher4/f16.html

Falcon 4 code has been written to simulate this FBW system via the limiter tables.

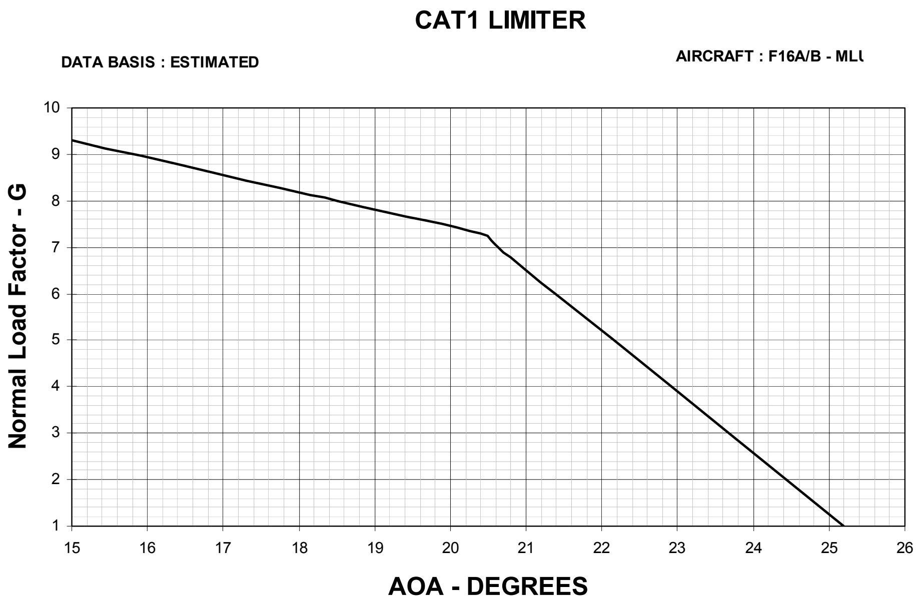
1.1.1 The CAT1 limiter

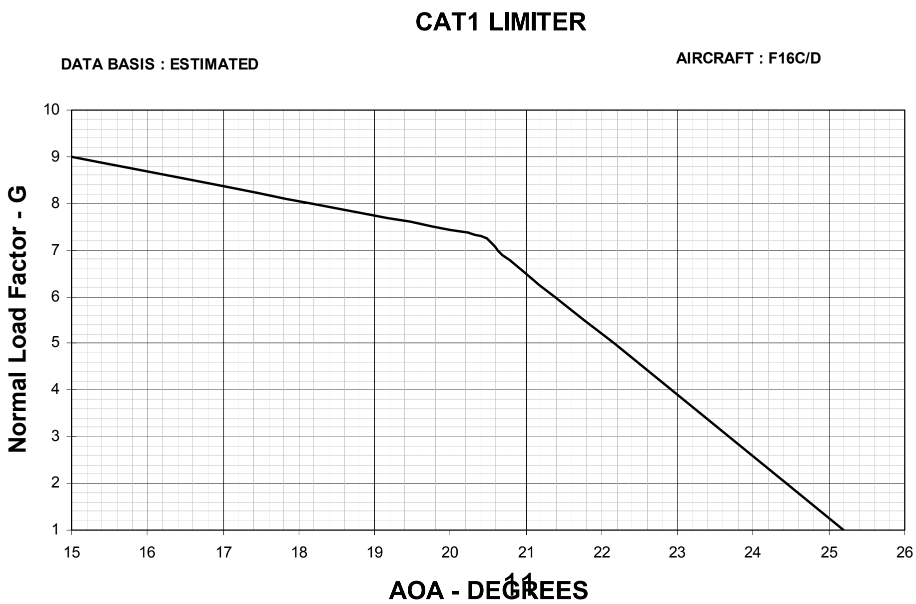
The CAT 1 limiter is one of the most important limiters on the F16, as it controls the G vs. AOA. For a given AOA, the CAT1 limiter limits the number of Gs you can pull. For example, with an AOA of 25 degrees you can not pull more than 1G.

The F16A/B has an analog FBW and the F16 C/ D has Digital FBW.

The CAT1 limiter is activated at 15 degrees of AOA and above.

The G limiter for the F16 A/B is 9.3 G, and for the F16 C/D the G limit is 9G.





1.1.2 The supersonic limiter

The real F-16 has another G / AOA limiter when it flies at high altitude and at supersonic speed (subsonic is just controlled with the CAT 1 limiter). Within that flight envelope, the F16 is not always allowed to reach 9G for every AOA.

This limiter doesn't exist in Falcon4. In fact when the AOA exceeds 15 degrees the „classic" CAT1 limiter is activated in the sim. This situation occurs for instance at 45 000 ft and mach 1.6 where you can exceed the 15 AOA limit.

To be able to simulate this limiter and to bypass the CAT1 limiter included automatically in the code, we were obliged to control this situation directly with the CL factor. This is why you can see in the next Chart that above MACH 1.3 the CL is becoming constant at a certain AOA. With this trick, we are able to simulate accurately this „supersonic" limiter.

Once again, the F16 A/B and F16 C/D do not have the same „supersonic" limiter. Basically the F16 A/B is allowed to pull more Gs than the F16 C/D in the same flight situation.

1.2 The Lift and Drag (Cl / Cd)

The Cl / Cd tables are, with the engine tables, the heart of the flight model. These new Cl / Cd tables have been calculated from scratch using many sources.

Cl /Cd are non-dimensional coefficients. In Falcon 4, they depend on 2 parameters: the AOA and the MACH. IRL Cl /Cd are also dependant on altitude but this influence is small. Falcon4 Cl /Cd tables are sufficient to give very accurate results.

The relationship between lift and the drag is as follows:

$$Lift = \frac{1}{2} * \rho * S * (Ma)^2 * Cl$$

$$Drag = \frac{1}{2} * \rho * S * (Ma)^2 * Cd$$

Where :

- S is the reference surface Area (ft^2)
- M is the mach number
- ρ is the density (slug/ft^3)
- a is the speed of sound (ft/s)

“a” and “ρ” are dependant from the altitude, the standard atmosphere used in falcon 4 is the following one :

h (ft)	a (ft/s)	ρ (slug/ft^3)
0	1116,45	0,0023769
5000	1097,09	0,0020481
10000	1077,39	0,0017553
15000	1057,32	0,0014957
20000	1036,86	0,0012665
25000	1015,98	0,0010652
30000	994,67	0,0008894
35000	972,90	0,0007366
40000	968,08	0,0005851
45000	968,08	0,0004601
50000	968,08	0,0003618
55000	968,08	0,0002846
60000	968,08	0,0002238

The G load (n) and turn rate (ω) are directly calculated from Cl:

$$n = \frac{Lift}{Gw} = \frac{\frac{1}{2} * \rho * S * (Ma)^2 * Cl}{Gw}$$

$$\omega = \frac{G}{(Ma)} * \sqrt{(n^2 - 1)}$$

Where :

- Gw is the weight (lbs)
- G is the gravity (32.2 ft/s^2)

The relation between drag and thrust is given by the PS factor

$$Ps = Thrust(lbs) - Drag = Thrust - \frac{1}{2} * \rho * S * (Ma)^2 * Cd$$

The EM charts can be directly drawn from thrust, CL, CD and the limiters via these equations.

1.2.1 The LEF modeling

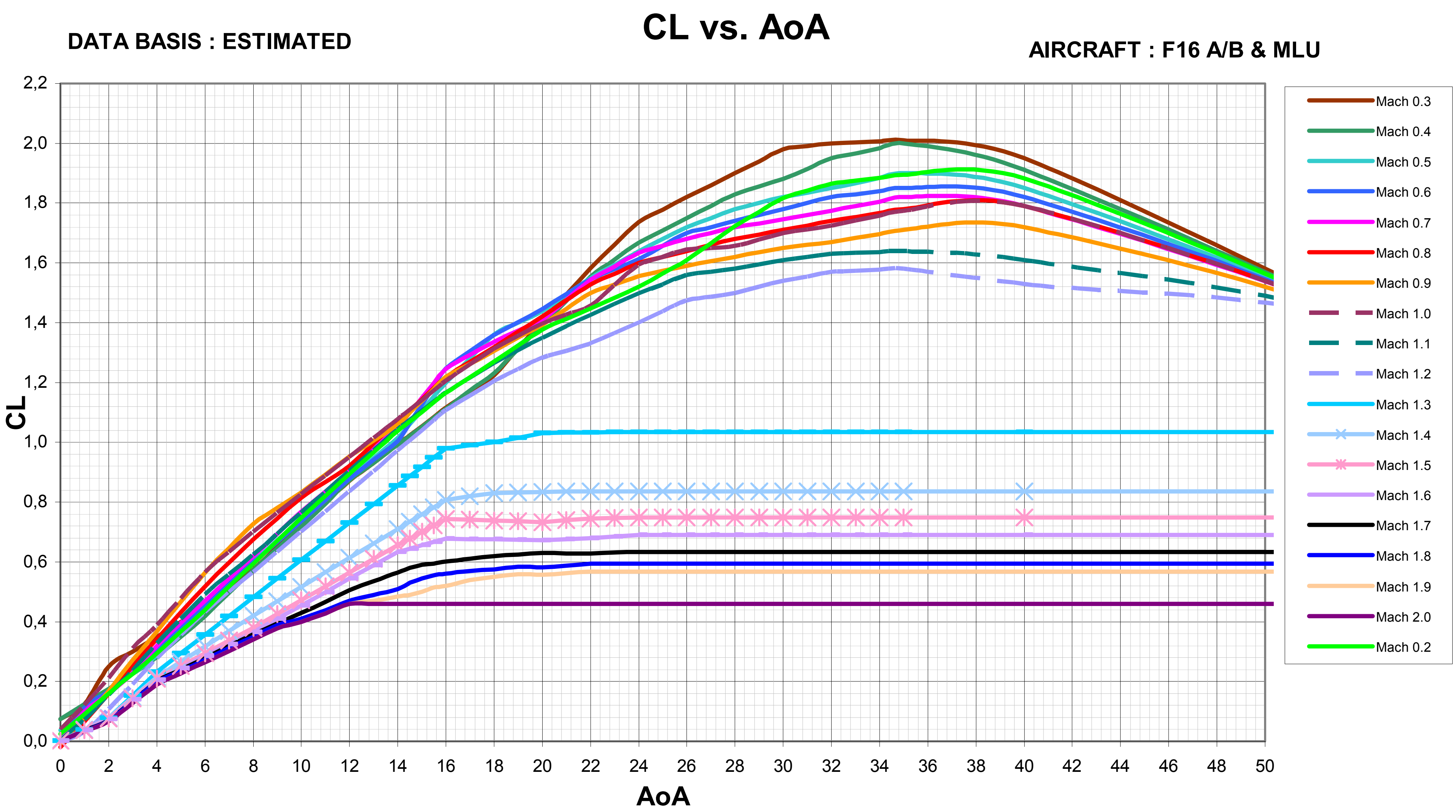
The Leading Edge Flap is activated in Falcon4, but is basically a “tweak” in the Flight model and a visual effect than a realistic simulation of the real effect. In any case the real effect of the LEF would be very difficult to implement in the code.

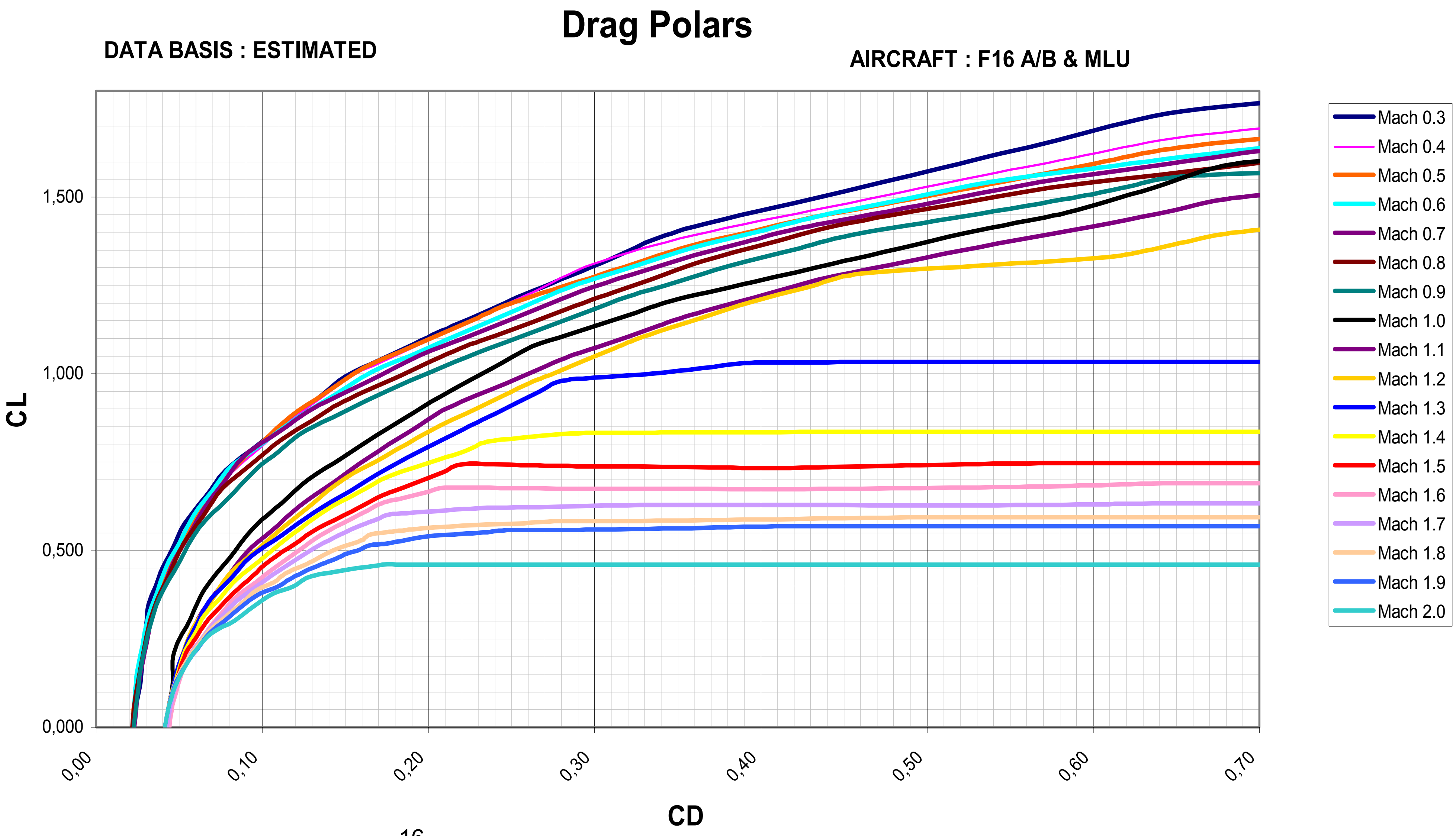
All the data available on the F16 includes the LEF effect, which means that when we try to calculate the Lift of the F16, the lift we find is the “Global lift” including the LEF effects. Therefore the only case where it would be useful to correctly simulate is when the pilot uses it manually or when it is damaged.

In these new flight models, the goal was to find the real global LIFT, and to be sure that this global lift is the one you will find in the sim. To do that, as we didn’t want to freeze the LEF visual effect, we were forced to subtract from the CL the effect of the LEF as it is coded in the game.

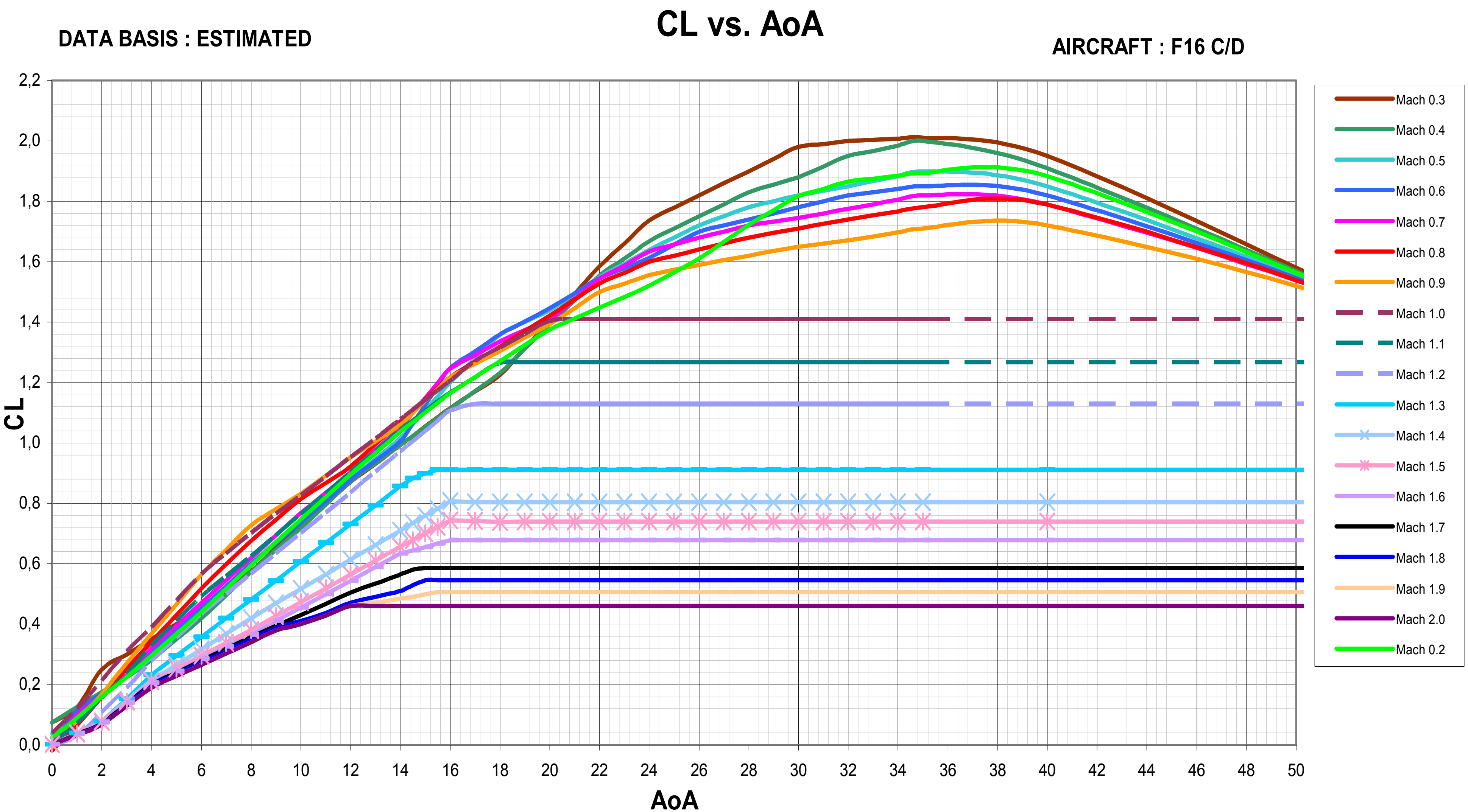
The result is that we have in the game the LIFT that we really want to simulate. The CL charts you will find hereafter are the charts corresponding to the global lift we want. If you check the .dat files carefully you will see that CL tables are not exactly the same as these charts, and this is a result of the LEF compensation. LEF compensation is active from 0 to 25 degrees of AOA.

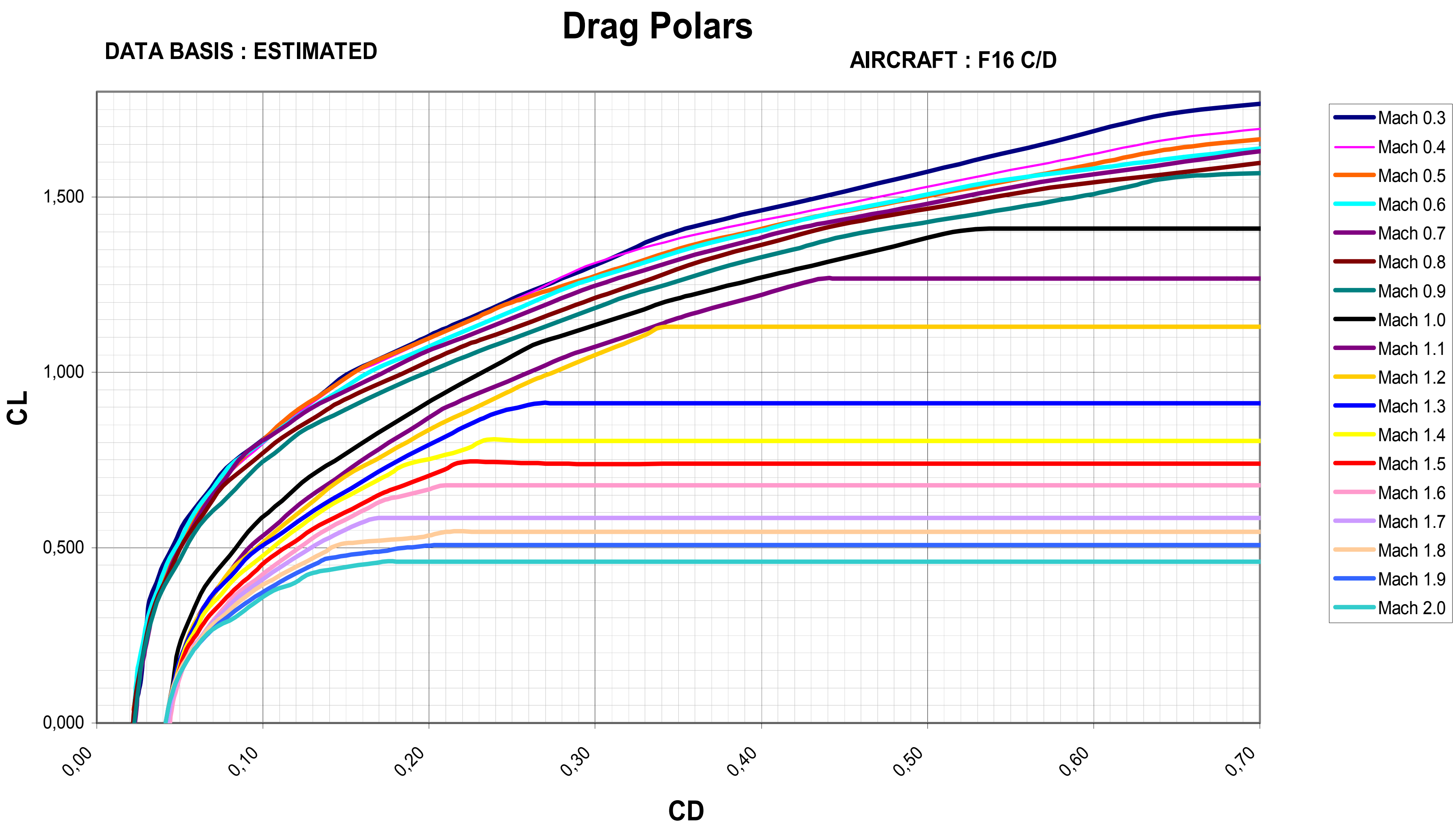
1.2.2 CL / CD for F16 A/B & MLU




Drag Polars
DATA BASIS : ESTIMATED
AIRCRAFT : F16 A/B & MLU
CL
CD
0,000
0,500
1,000
1,500
0,00
0,10
0,20
0,30
0,40
0,50
0,60
0,70
Mach 0.3
Mach 0.4
Mach 0.5
Mach 0.6
Mach 0.7
Mach 0.8
Mach 0.9
Mach 1.0
Mach 1.1
Mach 1.2
Mach 1.3
Mach 1.4
Mach 1.5
Mach 1.6
Mach 1.7
Mach 1.8
Mach 1.9
Mach 2.0

1.2.3 CL / CD for F16 C/D




Drag Polars
DATA BASIS : ESTIMATED
AIRCRAFT : F16 C/D
CL
CD
0,000
0,500
1,000
1,500
0,00
0,10
0,20
0,30
0,40
0,50
0,60
0,70
Mach 0.3
Mach 0.4
Mach 0.5
Mach 0.6
Mach 0.7
Mach 0.8
Mach 0.9
Mach 1.0
Mach 1.1
Mach 1.2
Mach 1.3
Mach 1.4
Mach 1.5
Mach 1.6
Mach 1.7
Mach 1.8
Mach 1.9
Mach 2.0

1.3 The Rudder (CY)

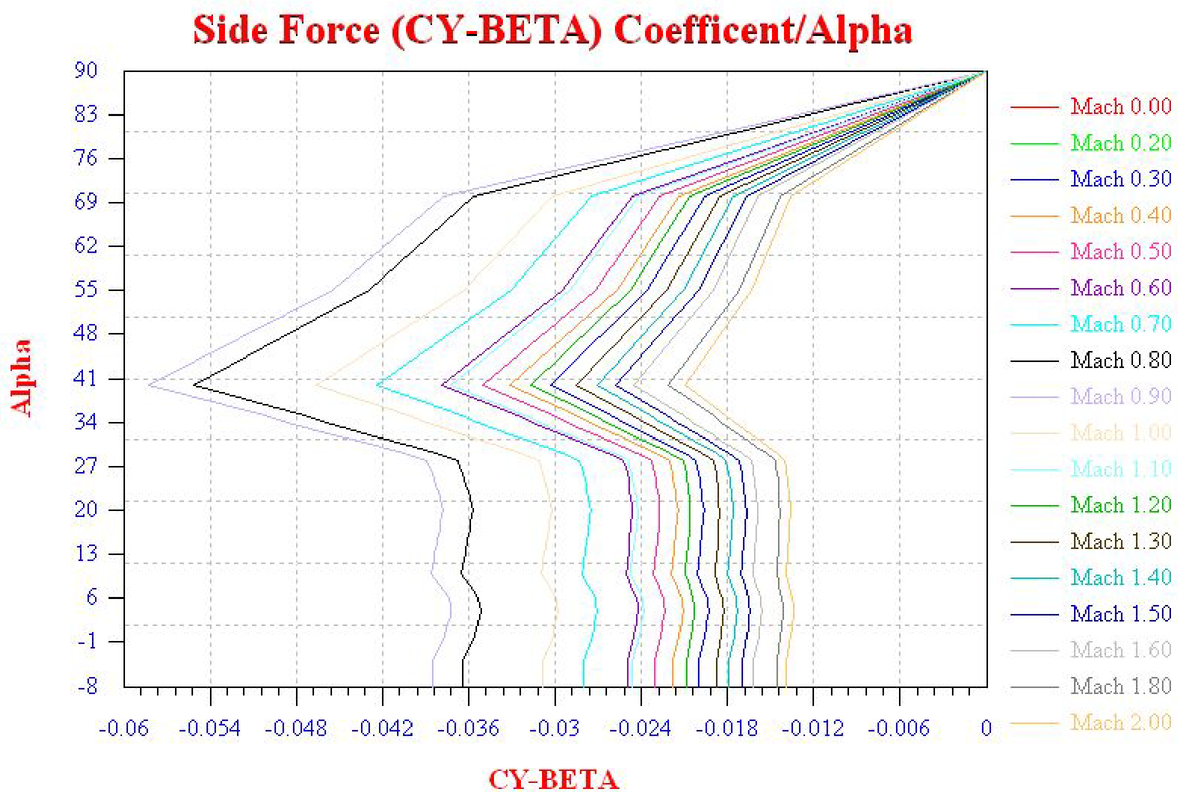
The effect of the rudder is mainly controlled with three parameters.

- The Yaw limiters control the effect of the rudder with the AOA
  - In CAT 3, the rudder is 100% efficient up to 3 degrees of AOA and its effect is null at 15 degrees of AOA.
  - In CAT 1, the rudder is 100% efficient up to 14 degrees of AOA and its effect is null at 26 degrees of AOA.
- The side force derivative CY beta table that controls directly the effect of the rudder for different AOA.

Derivative Cy coefficient of .dat files (depending on the AOA) are the Slope of the CY vs. Beta curve where Beta is the sideslip angle. The CY table has been written from scratch from a NASA simulation program

http://www.aem.umn.edu/people/faculty/balas/darpa_sec/SEC.Software.html.

The results are shown hereafter:



1.4 The Drag Index (DI)

When the plane carries stores, it increases the drag. Falcon4, as in real life, models the drag with the drag index coefficients. Each store has its own Drag index, depending on its shape, its position under the wing and the presence of other stores next to it.

The total drag of the plane is then calculated in the code:

$$Total\_Drag = Drag(DI = 0) + \sum DI * Stores\_drag$$

Where:

- Drag (DI=0) comes from the aerodynamic section (CD)
- DI of each store comes from the WCD file
- Stores_drag is a coefficient which is in the limiter section of the dat file

Unfortunately, in previous flight models the drag for DI =0 was not really accurate and did not match USAF documentation, because the Stores_drag coefficient could not be calculated.

With the new flight models, we were determined to have an accurate DI=0, and from this were able to determine the Stores_drag coefficient linked with REAL Drag index.

We modified the entire drag index for all the stores in the Falcon4 world. For the ones we didn't know we just multiplied the FF3 or SP4 ones with the right factor to give the same result in flight:

$$New\_DI = Old\_DI * \frac{New\_Stores\_Drag}{Old\_Stores\_Drag}$$

As some F16 stores are also carried by other planes, we were obliged to change the Stores limiters of all the other planes accordingly to have the same global drag as in previous versions.

This forced us to update all the non-F16 flight models and the whole WCD file (for both SP4.1 and FF3)

For non F16 planes, the drag in flight will be exactly the same as in other versions, but in the munitions page the drag index is now realistic.

For F16 plane, the drag with stores is now accurate and of course the drag index in the munitions page is also realistic.

WARNING WARNING WARNING

⚠ **Consequently, these new flight models MUST NOT be used without the associated WCD file and the modified flight models for all the other planes.**

⚠ **For future F4 versions, if these flight models are chosen, the WCD database and the other flight models must be modified accordingly**

2 ENGINES SECTION

For SP4 users, every blocks are simulated and can be chosen directly in the game.

For FF3 users, you can choose you engine in F4 patch if you want to switch between PW and GE engines

2.1 The Pratt & Whitney engines

The development of the Pratt & Whitney F100 turbofan began in August of 1968 when the USAF awarded contracts to both P & W and General Electric for the development of engines to be used in the projected F-X fighter, which was later to emerge as the F-15 Eagle.

In 1970, Pratt and Whitney was declared the winner of the competition and was awarded the contract for the engine for the F-15. The engine was to be designated F100. Two versions of the engine were planned, the F100 for the USAF and the F401 for the Navy. The latter engine was intended for later models of the F-14 Tomcat, but was cancelled when the size of the planned Tomcat fleet was cut back in an economy move.

The F100 is an axial-flow turbofan with a bypass ratio of 0.7:1. There are two shafts, one shaft carrying a three-stage fan driven by a two-stage turbine, the other shaft carrying the 10-stage main compressor and its two-stage turbine. For the F100-PW-200 version, normal dry thrust is 12,420 pounds, rising to a maximum thrust of 14,670 pounds at full military power. Maximum afterburning thrust is 23,830 pounds.

The F100 engine was first tried in service with the F-15 Eagle. The Air Force had hoped that the F100 engine would be a mature and reliable power plant by the time that the F-16 was ready to enter service. However, there were a protracted series of teething troubles with the F100 power plants of the F-15, compounded by labor problems at two of the major subcontractors. Initially, the Air Force had grossly underestimated the

number of engine power cycles per sortie, since they had not realized how much the F-15 Eagle's manoeuvring capabilities would result in abrupt changes in throttle setting. This caused unexpectedly high wear and tear on the engine, resulting in frequent failures of key engine components such as first-stage turbine blades. Most of these problems could be corrected by more careful maintenance and closer attention to quality control during manufacturing of engine components. Nevertheless, by the end of 1979, the Air Force was being forced to accept engineless F-15 airframes until the problems could be cleared up.

However, the most serious problem with the F100 in the F-15 was with stagnation stalling. Since the compressor blades of a jet engine are airfoil sections, they can stall if the angle at which the airflow strikes them exceeds a critical value, cutting off airflow into the combustion chamber which results in a sudden loss of thrust. Such an event is called a stagnation stall. Stagnation stalls most often occurred during high angle-of-attack manoeuvres, and they usually resulted in abrupt interruptions of the flow of air through the compressor. This caused the engine core to lose speed, and the turbine to overheat. If this condition was not quickly corrected, damage to the turbine could take place or a fire could occur.

Some stagnation stalls were caused by "hard" afterburner starts, which were mini-explosions that took place inside the afterburner when it was lit up. These could be caused either by the afterburner failing to light up when commanded to do so by the pilot or by the afterburner actually going out. In either case, large amounts of un burnt fuel got sprayed into the aft end of the jet pipe, which were explosively ignited by the hot gases coming from the engine core. The pressure wave from the explosion then propagated forward through the duct to the fan, causing the fan to stall and sometimes even causing the forward compressor stage to stall as well. These types of stagnation stalls usually occurred at high altitudes and at high Mach numbers.

Normal recovery technique from stagnation stalls was for the pilot to shut the engine down and allow it to spool down. A restart attempt could be made as soon as the turbine temperature dropped to an acceptable level.

When it first flew, the YF-16 seemed to be almost free of the stagnation stall problems which had bedevilled the F-15. However, while flying with an early model of the F100 engine, one of the YF-16s did experience a stagnation stall, although it occurred outside the normal performance envelope of the aircraft. Three other incidents later occurred, all of them at high angles of attack during low speed flights at high altitude. The first such incident in a production F-16 occurred with a Belgian aircraft flying near the limits of its performance envelope. Fortunately, the pilot was able to get his engine restarted and land safely. The F-16 was fitted with a jet-fuel starter, and from a height of 35,000 feet the pilot would have enough time to attempt at least three unassisted starts using ram air.

When the F100 engine control system was originally designed, Pratt & Whitney engineers had allowed for the possibility that the ingestion of missile exhaust might stall the engine. A "rocket-fire" facility was designed into the controls to prevent this from happening. When missiles were fired, an electronic signal was sent to the unified fuel control system which supplied fuel to the engine core and to the afterburner. This signal commanded the angle of the variable stator blades in the engine to be altered to avoid a stall, while the fuel flow to the engine was momentarily reduced and the afterburner

Exhaust was increased in area to reduce the magnitude of any pressure pulse in the afterburner. Tests had shown that this "rocket-fire" facility was not needed for its primary purpose of preventing missile exhaust stalls, but it turned out to be handy in preventing stagnation stalls. Engine shaft speed, turbine temperature, and the angle of the compressor stator blades are continuously monitored by a digital electronic engine control unit which fine-tunes the engine throughout flight to ensure optimal performance. By monitoring and comparing spool speeds and fan exhaust temperature, the unit is able to sense that a stagnation stall is about to occur and send a dummy "rocket-fire" signal to the fuel control system to initiate the anti-stall measures described above. At the same time, the fuel control system reduces the afterburner setting to help reduce the pressure within the jet pipe.

The afterburner-induced stalls were addressed by a different mechanism. In an attempt to prevent pulses from coming forward through the fan duct, a "proximate splitter" was developed. This is a forward extension of the internal casing which splits the incoming air from the compressor fan and passes some of this air into the core and diverts the rest down the fan duct and into the afterburner. By closing the gap between the front end of this casing and the rear of the fan to just under half an inch, the designers reduced the size of the path by which high-pressure pulses from the burner had been reaching the core. Engines fitted with the proximate splitter were tested in the F-15, but this feature was not introduced on the F-15 production line, since the loss of a single engine was less hazardous in a twin-engine aircraft like the Eagle. However, this feature was adopted for the single-engine F-16.

These engine fixes produced a dramatic improvement in reliability. Engines fitted to the F-16 fleet (and incorporating the proximate splitter) had only 0.15 stagnation stalls per 1000 hours of flying time, much better than the F-15 fleet.

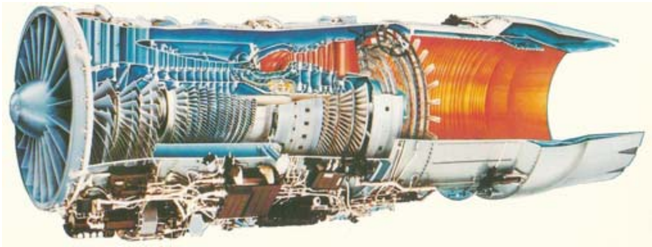
In an attempt to make the F100 more competitive with the General Electric F110, Pratt & Whitney introduced the more powerful F100-PW-229 version in the early 1990s. This engine is rated at 29,100 pounds of thrust with full afterburner. It has higher fan airflow and pressure ratio, a higher-airflow compressor with an extra stage, a new float-wall combustor, higher turbine temperatures, and a redesigned afterburner. It has about 22 percent more thrust than previous F100 models. The first F-16s powered by the -229 engines began to be delivered in 1992. However, the degree of mechanical changes introduced in the -229 makes it impractical to rebuild -200 or -220E engines to -229 standards.

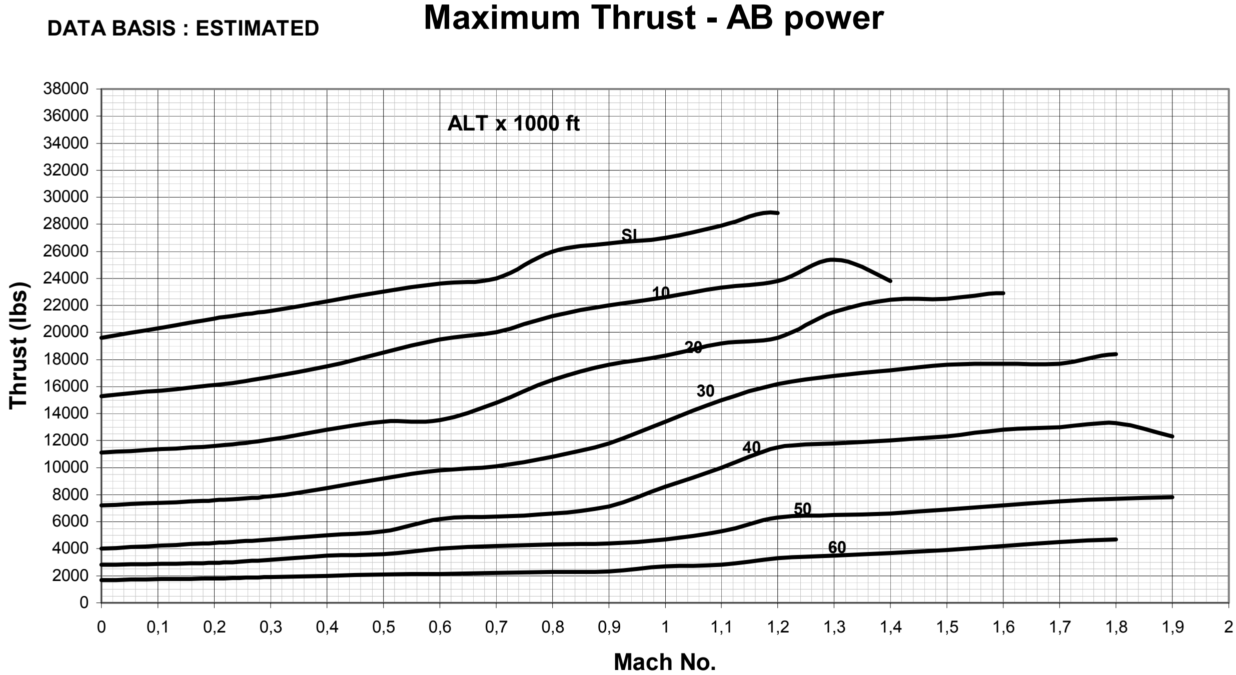
The more powerful F100-PW-229 finally gave P&W the chance of re-entering the export market. In 1991, South Korea chose the F100-PW-229 for its License-built F-16s, maintaining engine commonality with F-16Cs and Ds that were purchased earlier from the USA.

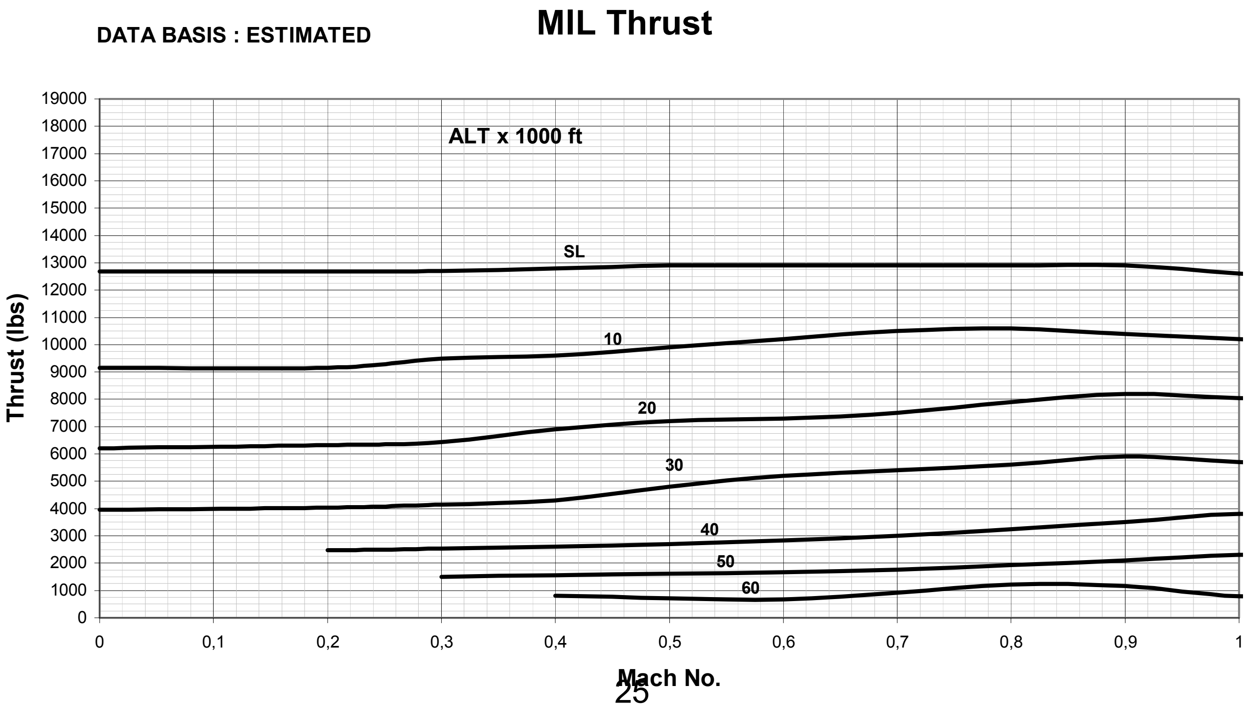
The F100-PW-200+ is intended for foreign air forces which operate significant numbers of F-16s that are powered by -200 and -220E engines, but which are denied access to the more powerful -229. It combines the core of the -220 with the fan, nozzle, and digital control system of the -229.

SOURCE : http://home.att.net/~jbaugher4/f16.html

2.1.1 F100 – PW – 200







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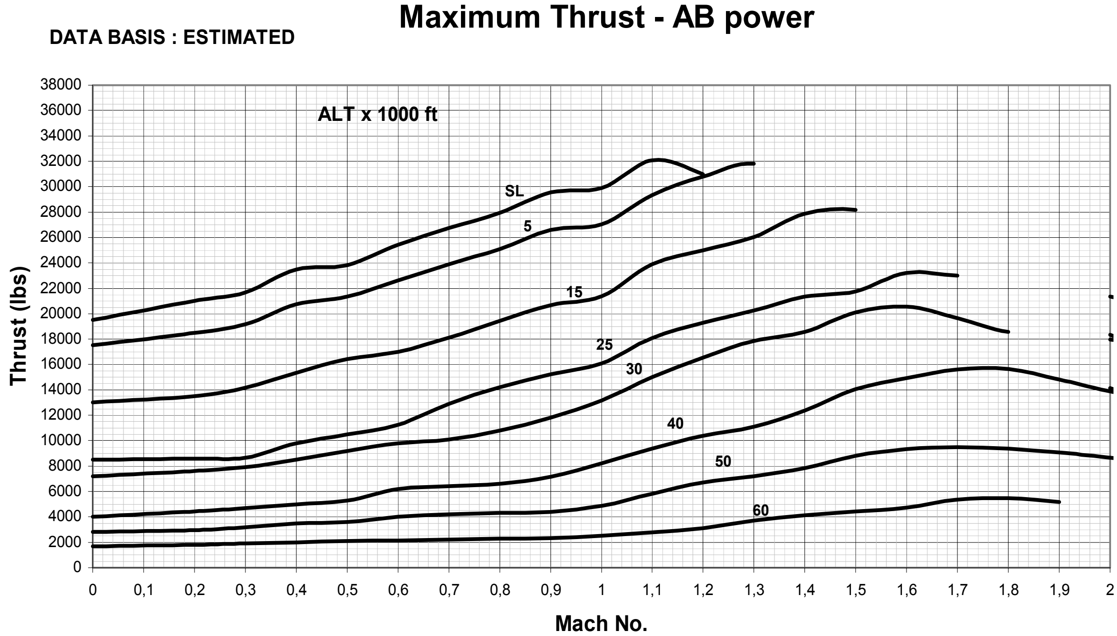
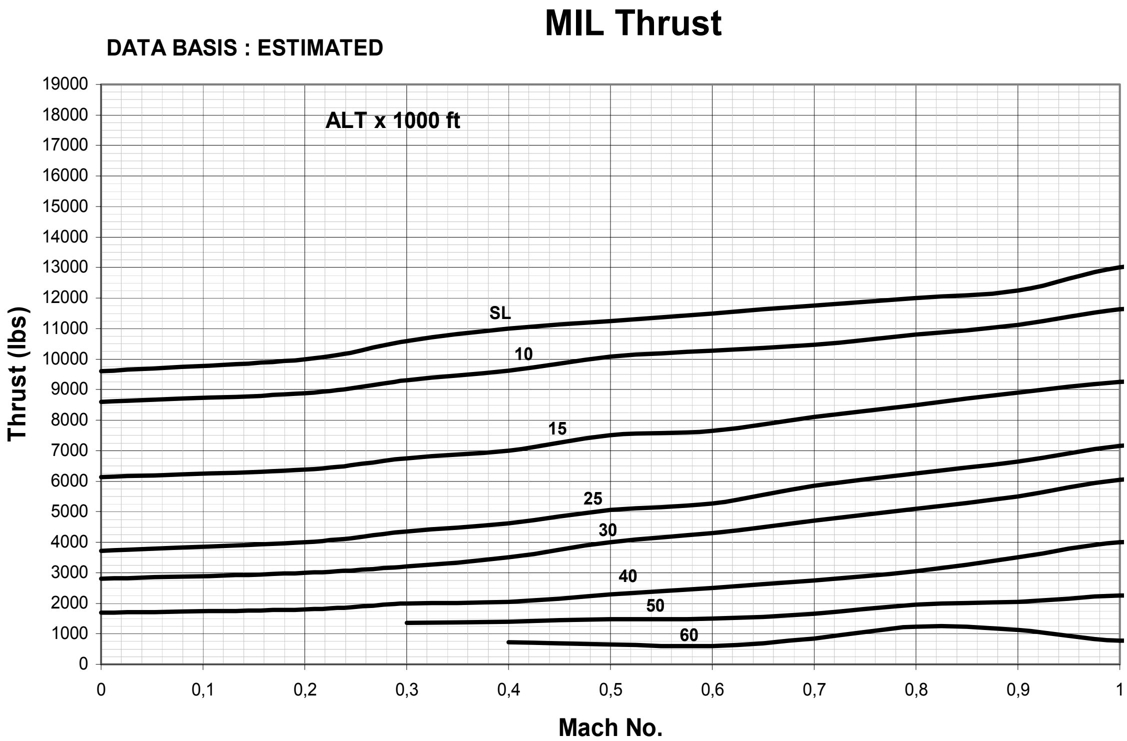
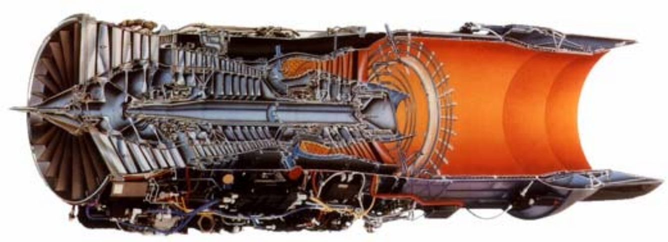
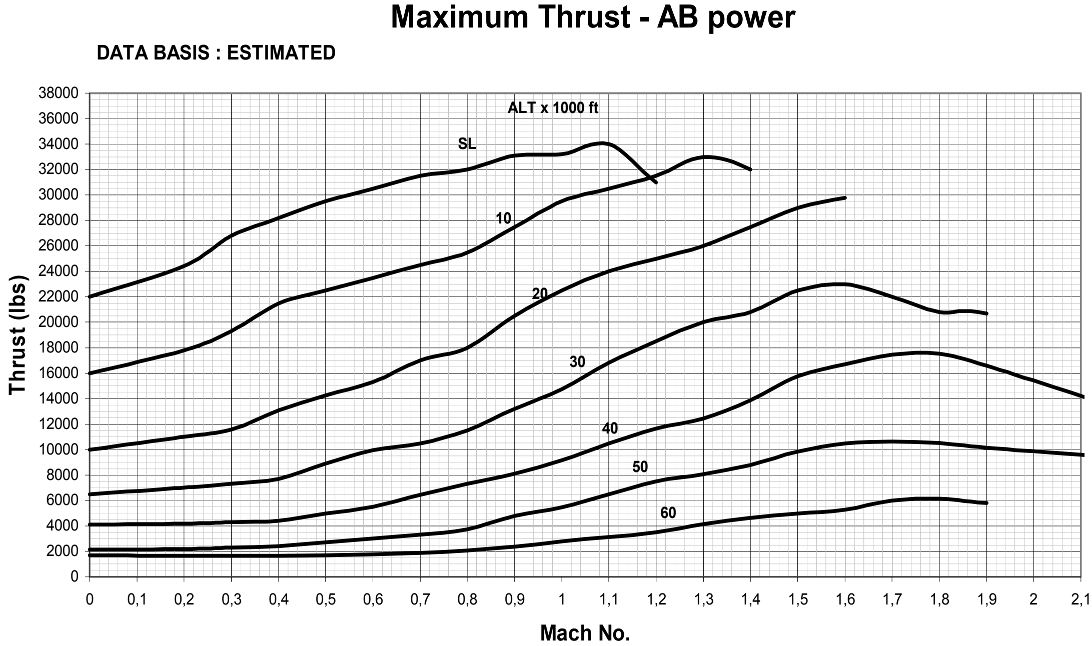
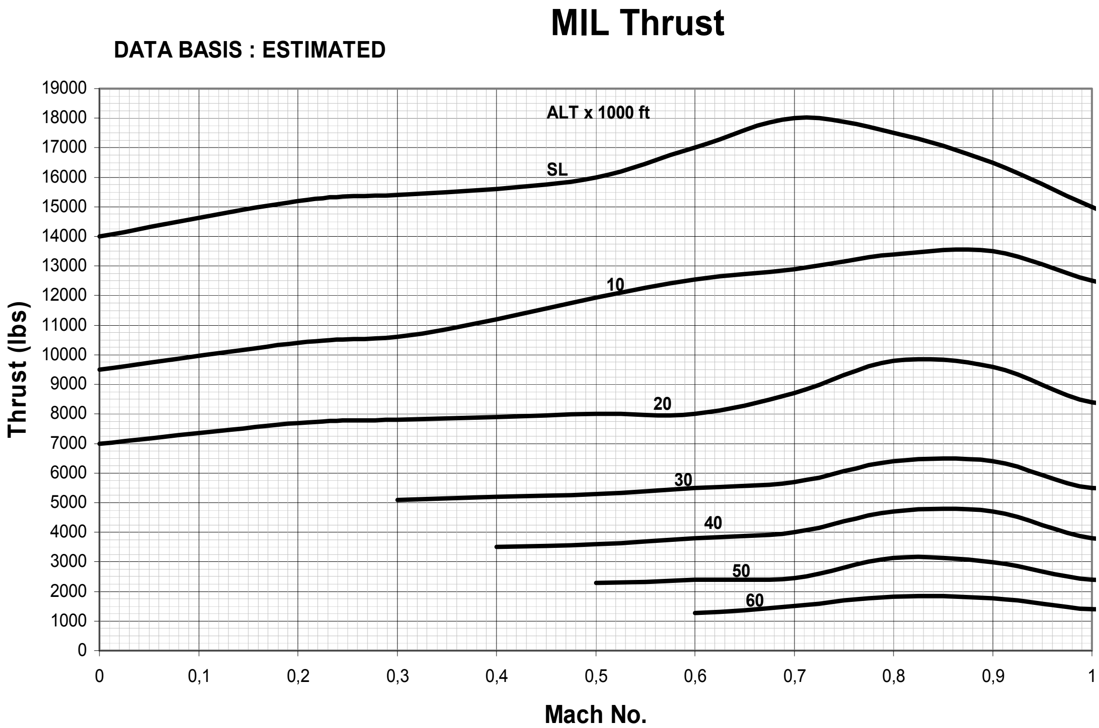




2.1.3 F100 – PW – 229







2.2 The General Electric Engines

Unhappy with the accident rate due to stagnation stalls in both the F-15 and F-16, in 1979, the USAF placed a contract with General Electric to develop an alternative engine for both fighters. General Electric combined the core of the Rockwell B-1's F101 engine with a scaled-up version of the F404 low-pressure system and augmentor. This engine was ultimately to emerge as the F110.

GE was given a contract for full-scale development of its new engine, which was to be designated F110.

The General Electric F110 is similar in size to the Pratt & Whitney F100. The F110 has a three-stage fan leading to a nine-stage compressor, the first three stages of which are variable. The bypass ratio is 0.87 to 1. The annular combustion chamber is designed for smokeless operation, and has 20 dual-cone fuel injectors and swirling-cup vaporizers. The single-stage HP turbine is designed to cope with inlet temperatures as high as 2500 degrees F (1370 C). Blades are individually replaceable without rotor disassembly. An uncooled two-stage LP turbine leads to a fully-modulated afterburner. When afterburning is demanded, fuel is injected into both the fan and core flows, which mix prior to combustion.

All F110s ordered by the USAF were for the F-16 fleet, with the F-15 retaining the F100. The choice of engines for the Fighting Falcon began with the Fiscal Year 1985 Block 30 F-16C/Ds. About 75 percent of the F-16s purchased from that time on by the USAF were powered by the GE engine, with the remainder being powered by the P & W engine. However, it is not intended that individual units operate with F-16s powered by two different engine types, since that would create a spare parts and logistics nightmare. The choice of engines for the F-16 is made at the Wing level.

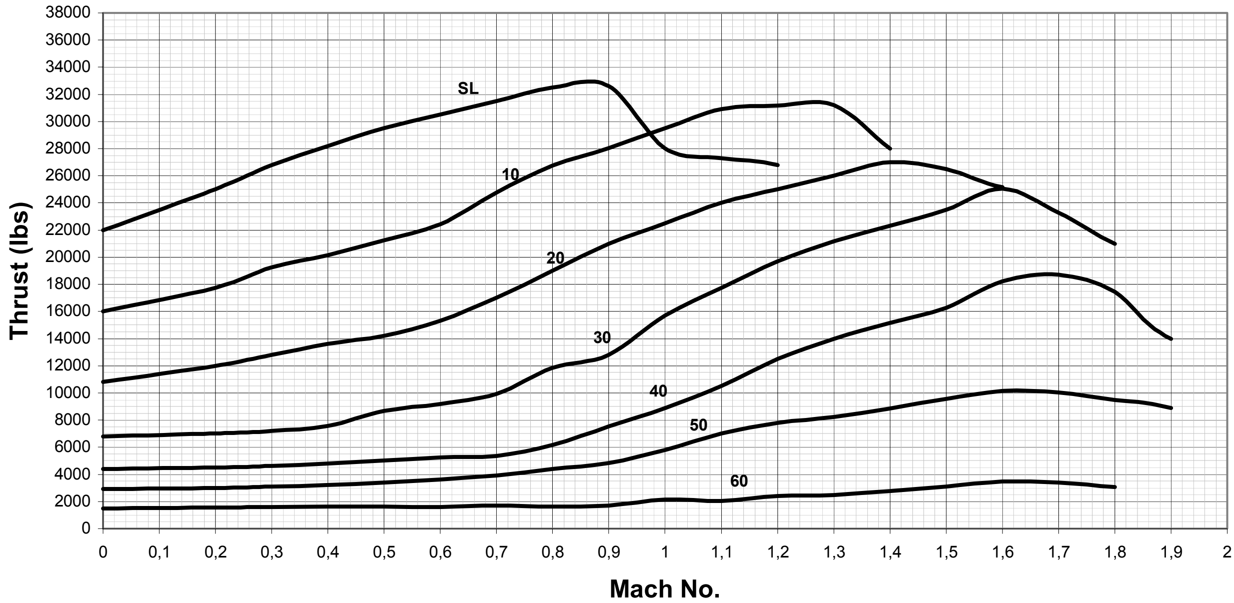
On the export market, the higher thrust of the F110 made it the engine of choice through the mid to late 1980s.

SOURCE : http://home.att.net/~jbaugher4/f16.html

2.2.1 F110 – GE – 100

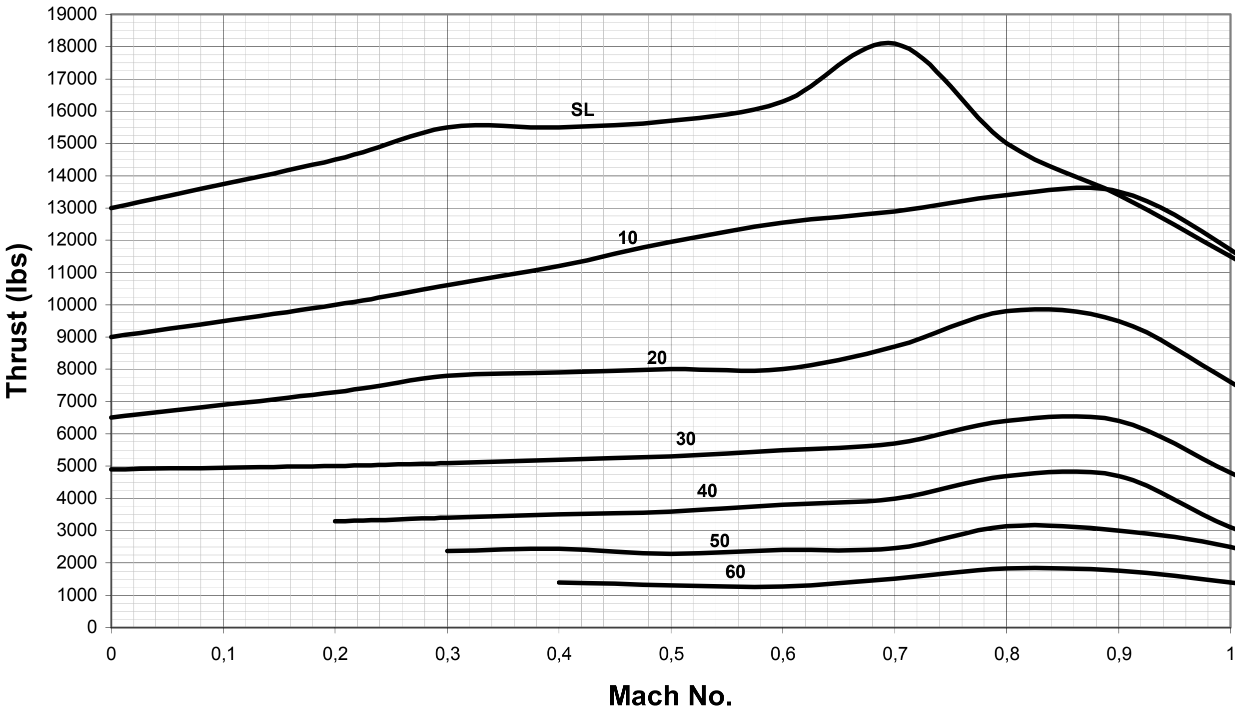
Maximum Thrust - AB power

DATA BASIS : ESTIMATED

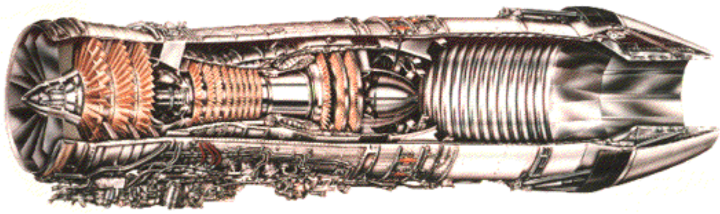


MIL Thrust

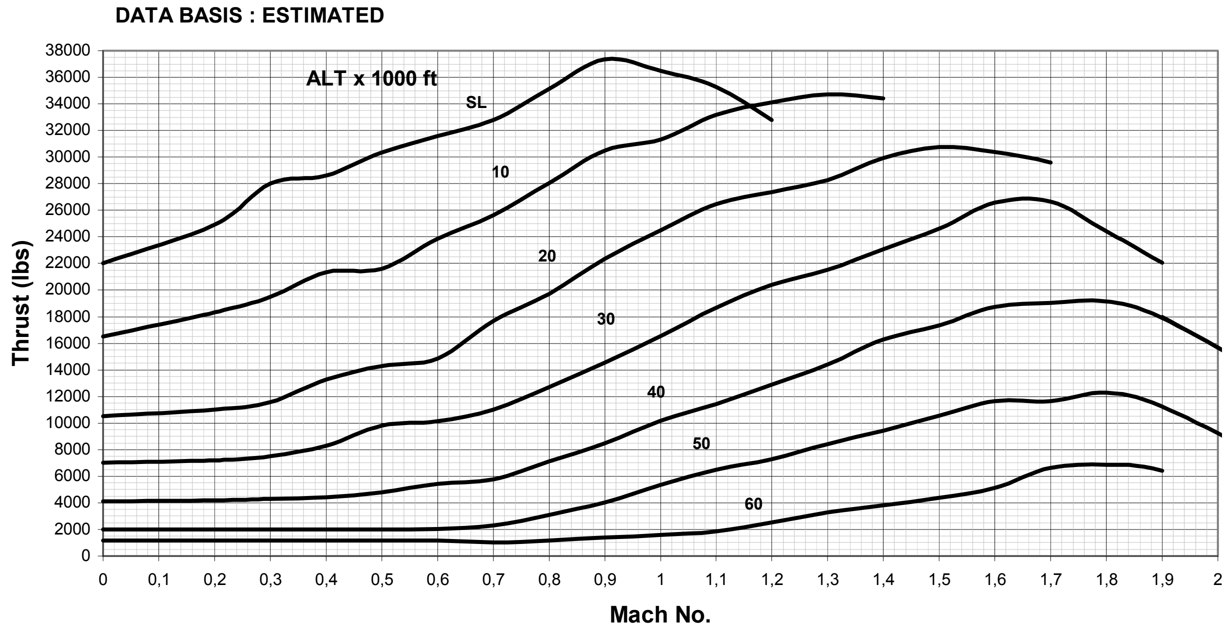
DATA BASIS : ESTIMATED



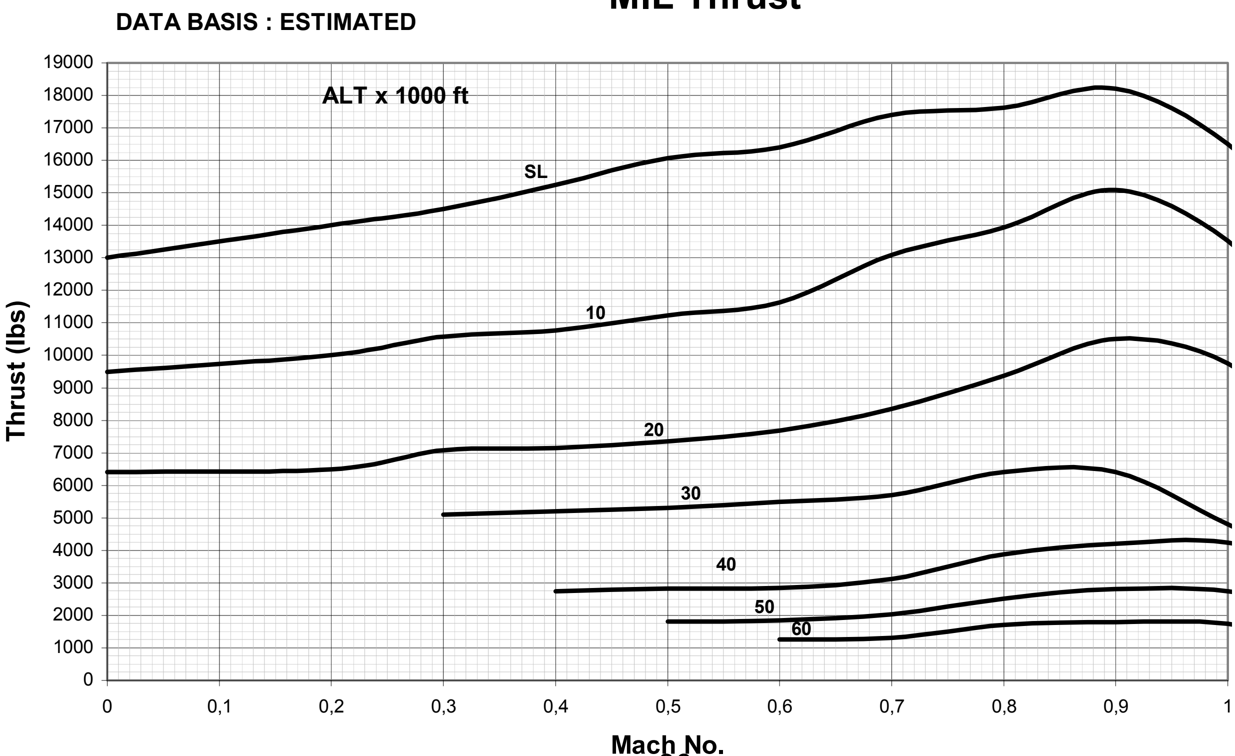
2.2.2 F110 – GE – 129



Maximum Thrust - AB power



MIL Thrust



3 A BIT OF HISTORY

3.1 F16 A - Block 15

The first important changes to the F-16A/B were introduced on Block 15 (also known as MSIP Stage I).

Among these changes were the introduction of the extended horizontal stabilizator (the so-called "big tail"), which provided better stability and more authority for out-of-control situations. It changes lift-off rotation speeds and allows stable flight at higher angles of attack.

Block 15 aircraft also have two dogtooth radar warning antennae parallel to each other underneath the radome. The blade antenna underneath the air intake was deleted.

The AN/APG-66 radar on the Block 15 F-16A/B was provided with an early version of a track-while-scan mode for greater air defense capability. They also have "Have Quick I" secure UHF voice radios.

The Block 15 F-16A/Bs were the last to be delivered with monochrome CRTs on the control panel, although their terminals were later upgraded for color.

Additional structural strengthening was added to allow an extra 1000 pounds of ordnance to be carried on the under wing points.

SOURCE : http://home.att.net/~jbaugher4/f16.html

F16 A - BLOCK 15:

- Engine: F100- PW-200
- Empty weight : 16800 lbs
- Fuel : 7162 lbs

3.2 F16 - MLU

In the mid 1980s, faced with an improving Soviet threat, numerous European F-16A/B Block 15 aircraft were scheduled to go through a Mid-Life Update (MLU) program. The MLU program was designed to bring the Block 15 aircraft up to the standards of the Block 50/52 F-16C/D, in particular to give them the capability of carrying and launching BVR weapons such as the AIM-120 AMRAAM, together with the ability to carry out precision weapons delivery missions at night and in adverse weather.

The international MLU agreement was signed on May 3, 1991, with the USA, Belgium, Denmark, the Netherlands, and Norway all being participants. The USA had originally planned to upgrade some of its F-16A/Bs as part of the MLU program, but because of the end of the Cold War and the general reduction in the US fighter force, it withdrew from the program in 1992, but agreed to continue to support the MLU and to carry out test flying for development. The European MLU pact had to be revised downward to reflect the new fiscal constraints arising from the end of the Cold War.

General Dynamics (now Lockheed Fort Worth) was awarded a contract to build the MLU kits. One F-16 from each of the USAF, Danish, Dutch, and Norwegian air forces was delivered to Lockheed Forth Worth in September 1992 to act as a prototype for conversion under the MLU program.

The MLU aircraft are all re-equipped with the Northrop Grumman AN/APG-66(V)2 radar. This more advanced unit has an improved transmitter and low-power RF section, and a new signal data processor. The system has a 25-percent longer range, and can carry out multiple missile engagements. It is compatible with BVR missiles such as SkyFlash, AIM-7 and MICA as well as the AMRAAM.

The three computers of the original F-16 (the fire-control computer, the stores management computer, and the HUD controller) are replaced by a single Texas Instruments (now Raytheon) modular mission computer.

The gauge cockpit instruments are replaced by electronic instruments using full-color LCD displays. The original HUD is replaced by a wide-angle GEC-Marconi unit similar to that fitted to the Block 50/52 F-16C/D. The cockpit and display generator are compatible with night-vision goggles. The cockpit and display generator also have provisions for helmet-mounted displays, but HMD technology is not incorporated into the system itself.

The MLU carries the Hazeltine AXP-113(V) IFF system, with a quadruple set of interrogator antenna mounted ahead of the windshield. This system is not carried in USAF F-16Cs.

A fully-integrated Global Positioning System (GPS) is installed, and a digital terrain system (DTS) is fitted. The DTS is built into the OSC/Fairchild Defense Data Transfer Unit (DTU). The DTU allows the pilot to load mission data into the system via a plug-in cartridge. The DTU cartridge has a processor which incorporates a terrain profile matching algorithm. DTS determines the exact position of the fighter by matching the changing radar altimeter readings to the terrain profiles stored in the database. DTS provides terrain-following information to the HUD, and DTS data provides the aircraft's pilot with a warning if the aircraft is in any danger of striking an obstacle. GPS and INS provide two independent checks on the health of the DTS. The DTS also provides passive ranging to ground targets.

The MLU also provides chin pylons for FLIR and targeting pods. The basic MLU does not provide an active onboard electronic warfare system, but the Terma EW system can support active jamming and missile approach warning systems.

SOURCE : http://home.att.net/~jbaugher4/f16.html

F16 – MLU:

- Engine: F100- PW-220
- Empty weight : 16800 lbs
- Fuel : 7162 lbs

Lockheed Martin F-16 AM (MLU) © Robert Kysela

3.3 F16 C/D – Block 30 / 32

The Block 25 F-16C/D aircraft were all powered by the Pratt & Whitney F100-PW-200 turbofan. A pair of these engines also powered the F-15 Eagle. However, the F100 turbofan had been prone to stagnation stalls from the beginning, and the company had added a new fuel pump and a redesigned augmentor in an attempt to reduce the frequency of these engine stalls and to make it easier to restart the engine when they did occur.

The first F-16 version to accommodate both engines was the Block 30/32 (sometimes known as MSIP III), with Block 30 having the F110 and Block 32 having the F-100. The two Blocks have a common engine bay that can accommodate either engine, but for various technical reasons described below, it is not practical to fit a Block 30 F-16 with a F100 engine or to fit a Block 32 F-16 with a F110 engine.

The Block 30 F-16 was powered by the General Electric F110-GE-100 engine. This engine is somewhat larger than the F100 and about 771 pound heavier. However, the F110 provides more thrust than the F100. For this reason, it requires a larger amount of air. This in turn required that the area of the air intake be increased to admit the extra air. However, this change was not made at first, and early F-16C/D Block 30s (Block 30A and 30B) are "small inlet" aircraft, the large inlet being made standard for F110-powered Fighting Falcons from serial number 86-0262 onward. The "large-mouth" intake allows air mass flow to increase from 254 to 270 pounds per second. The "large- mouth" intakes can be distinguished from "small-mouth" intakes by the presence of a ECS ram air inlet duct below the fuselage which is canted slightly forward. In addition, the engine exhaust nozzle for F110-powered aircraft is slightly shorter and more round than that of the F100-powered F-16s. Because of the higher thrust, the Block 30 F-16 is a better performer than the Block 32.

The Block 32 F-16 was powered by the F100-PW-220 engine. The F100-PW-220 was slightly less powerful than the F100-PW-200, but had a new, longer-life compressor, a more stable augmentor, and a digital engine control system which made the engine more reliable and less prone to stagnation stalling. Blocks 25 and 32 are almost identical in external appearance except for the latter's ducts for the ASPJ. Unfortunately, air intake shapes could not be standardized on the production line because the lower-thrust F100 engine could not accommodate the additional air, and the F100 powered F-16s in Block 32 retained the original smaller intake shape. A kit has been developed to bring earlier -200 engines up to a standard nearly equivalent to -220, these converted engines being designated F100-PW-220E.

Block 30 fighters introduced expanded computer memory for the Programmable Display Generator and the Data Entry Electronics Unit. They were also provided with the *Seek Talk* secure voice communication system.

Block 30 also introduced the capability of carrying and launching the AGM-45 Shrike ant radiation missile, the AIM-120 AMRAAM air-to-air missile, and the Hughes AGM-65D Maverick air-to surface missiles.

Block 30 aircraft also introduced the AN/ALE-40 radar warning receiver and the ALE-47 chaff/flare dispenser. Block 30F and beyond added provisions for four rather than two chaff/flare dispensers added on the left side of the aircraft (the aft fuel cell had to be decreased slightly in size to accommodate this change). Block 30s also introduced structural upgrades to strengthen the airframe, and they were fitted with adhesively-sealed center and aft tanks. The Block 30 also introduced a radar warning receiver located in a knob-like fairing on the leading edge flap on both sides of the wing, replacing a RWR previously located on the nose. This new location gives better hemispherical coverage in the forward direction. This RWR has been retrofitted to many earlier F-16s.

The first Block 30 F-16C (85-1398) took off on its first flight on June 12, 1986 with company pilot John Fergione at the controls. The first Block 30 F-16D (85-1509) flew on July 30, 1986, with Joe Bill Dryden and Dave Thigpen in the cockpit.

The first flight of a Block 32 F-16C (86-0210) was made on June 12, 1986, with John Fergione at the controls. The first Block 32 F-16D took off on its maiden flight on the same day with Dave Thigpen and Joe Bill Dryden in the cockpit.

Block 30/32 Fighting Falcons were manufactured beginning in January of 1986, with the first deliveries taking place in July of 1987.

SOURCE : http://home.att.net/~jbaugher4/f16.html

F16C - BLOCK 30

- Engine: F110- GE-100
- Empty weight : 18700 lbs
- Fuel : 7162 lbs

F16C - BLOCK 32

- Engine: F100- PW-220
- Empty weight : 17914 lbs
- Fuel : 7162 lbs

3.4 F16 C/D - Block 40 / 42

The next major Fighting Falcon production block was Block 40/42, sometimes also known as the "Night Falcon" because of its enhanced night/all-weather capabilities.

Block 40/42 (also part of MSIP III) introduced the Martin-Marietta LANTIRN (Low-Altitude Navigation and Targeting Infra-Red for Night) navigation and targeting system, which makes it possible to carry out both night and bad-weather ground attack operations. This system consists of two pods-- a AAQ-13 navigation pod carried on the left-hand chin pylon and an AAQ-14 targeting pod on the right-hand chin pylon. The AAQ-13 has a wide-angle FLIR sensor and a Texas Instruments terrain-following radar. The AAQ-14 pod carries a stabilized and steerable IR imager and a laser rangefinder.

The LANTIRN must interface with the flight controls, since the pod flies the airplane while in terrain-following mode. The LANTIRN system required a lot more automation to make it possible for the pilot to fly hands-off while in a weapons-delivery mission, and the analog flight control system of the F-16 was replaced by an AlliedSignal quadruplex flight control system. The digital flight control system allows data to go straight from the LANTIRN pod right to the flight control system, and allows automatic terrain-following capability.

The Block 40/42 is provided with a fully-integrated GPS (Global Positioning System) navigation receiver, being the first combat aircraft to be so equipped. HARM II, and carries the reliability-enhanced APG-68V radar.

The Block 40/42 is also provided with a diffractive optics and holographic, wide-angle heads-up display built by GEC-Marconi. It offers a wider field of view than the previous reflective HUD, and imagery can be superimposed over the outside view. The HUD can be fed with FLIR imagery from the LANTIRN system.

The configured engine bay has options for either the General Electric F110-GE-100 (Block 40) or the Pratt & Whitney F100-PW-220 (Block 42), although the two engines are not routinely interchangeable. The Block 40 F-16 has a larger air intake than that of the Block 42 because of the greater airflow requirements of the F110 engine.

The airframe was provided with greater structural strength, which raised the 9-g capability from 26,900 pounds to 28,500 pounds. The undercarriage legs were made longer in order to provide more adequate clearance for the two under fuselage LANTIRN pods, and the wheels and tires were made larger. The Block 40/42 aircraft also have bulged landing gear doors to accommodate the larger wheels, and the landing lights were moved from the main landing gear well to the nose gear doors.

The first Block 40 F-16C (87-0350) flew on December 23, 1988, with company test pilot Steve Barter at the controls. The first Block 40 F-16D (87-0391, flew for the first time on February 8, 1969, with Ken Giles and Joe Sweeney in the cockpit. The first Block 42 F-16C (87-0356) was flown on April 25, 1989 by Bland Smith. The first Block 42 F-16D (87-0394) took off on its first flight on May 26, 1989, flown by Joe Sweeney and Tim Easton. Deliveries of the Block 40/42 Fighting Falcon began in December of 1988. The first Block 40 was deployed to Luke AFB, Arizona in May of 1989. The first user of the Block 42 was the 58th TFW (now known as the 56th FW) at Luke AFB, Arizona.

The Block 40/42 was in production between 1988 and 1995, with a total of 744 being built. Examples were sold to Israel, Egypt, Bahrain, and Turkey. Production of the Block 40/42 has been re-started to meet additional demand from Egypt and Bahrain. Egypt will get 21 aircraft in 1999/2000, probably taken from the Turkish production line, and Bahrain will acquire 12 additional Block 40s from the same source to equip a second squadron.

SOURCE : http://home.att.net/~jbaugher4/f16.html

F16 C - BLOCK 40

- Engine: F110- GE-100
- Empty weight : 20186 lbs
- Fuel : 7162 lbs

F16 C - BLOCK 42

- Engine: F100- PW-220
- Empty weight : 19500 lbs
- Fuel : 7162 lbs

3.5 F16 C/D - Block 50/52

The current production version of the Fighting Falcon is Block 50/52. It was produced in parallel with the Block 40/42, beginning in 1991.

The Block 42 F-16C/D weighed over 3000 pounds more than the earlier F-16A/B, but had approximately the same engine thrust. In addition, the Block 40/42 was expected to carry much heavier and bulkier loads, which called for much more engine power, especially at low altitudes. More engine power was clearly required.

In support of this requirement, the USAF launched a project known as Increased Performance Engine (IPE) to develop more powerful versions of both the F100 and F110. The results were the Pratt & Whitney F100-PW-229 and the General Electric the F110-GE-129, both of which offered significantly more takeoff thrust and better performance at high speeds at low level.

The F100-PW-229 combines the core of the -220 with a new low-pressure section and an improved augmenter, giving about 22 percent more thrust. This improved performance brings the F100 nearly up to the performance level of the F110. The F100-PW-229 is lighter and more powerful than earlier F100s, and had been flying at Edwards AFB since mid-1990 in test ship 81-0816. The F110-GE-129 introduced internal changes to make it possible for the engine to run hotter. The -129 engine offers about a ten-percent increase in high-altitude thrust and about a 30 percent increase in high-speed, low-level thrust.

Block 50/52 F-16s are powered by the General Electric F110-GE-129 and the Pratt & Whitney F100-PW-229 respectively.

The first Block 50 F-16 (90-0801) flew for the first time on October 22, 1991, with company test pilot Keith Giles at the controls. The first Block 50 F-16D (90-0834) took off on its first flight on April 1, 1992, with Steve Barter and Bland Smith on board. The first Block 50 F-16 was delivered to the USAF in November of 1993, with the 388th Fighter Wing at Hill AFB, Utah being the first recipient. The first Block 52 F-16C (90-0809) was made on October 22, 1992, with Steve Barter, and the first Block 52 F-16D (90-0893) flew for the first time on November 24, 1992, with Joe Sweeney and Steve Barter at the controls. The 23rd FS based at Spangdahlem in Germany was the first USAFE unit to receive the Block 50, which arrived in 1993.

The Block 50/52 carries the Northrop Grumman APG-68(V5) radar, which has a high-speed integrated circuit signal processor which makes the unit twice as fast as the radar of the Block 40/42. In additional, the radar is considerably more reliable than the earlier unit. The signal processor improves the radar's reliability and performance in electronic countermeasures.

The Block 50/52 is capable of carrying the Raytheon AGM-88B HARM antiradiation missile. In order to make this missile compatible with the F-16, a HARM Avionics Launcher Interface Computer is fitted. This computer is used to pre-program the HARM missile with the bearing and range of the target before launch, so that the HARM will be able to reach the vicinity of the target The Block 50/52 also introduced the Texas Instruments AN/ASQ-213 HARM Targeting System pod which enables the F-16 to locate and identify enemy emitters, which makes it possible for the aircraft to operate as an independent *Wild Weasel* SEAD aircraft. Although the Block 30 F-16C could carry the HARM as well, these aircraft lacked the electronics and the load carrying ability to fully exploit the weapon. With the advent of the ASQ-213 HARM targeting system, the Block 50 can act as a truly effective SEAD aircraft, filling the gap left by the retirement of the F-4G. The USAF has unofficially adopted the designation F-16CJ for the HARM-capable Block 50/52 F-16C.

The Block 50/52 was also capable of carrying the new Northrop AGM-137 Tri-Service Stand-Off Attack Missile (TSSAM) stand-off attack missile, but this was cancelled in December of 1994.

The Block 50/52 carries the Lockheed Martin (formerly Loral) AN/ALR-56M radar warning receiver which replaces the ALR-69 on earlier F-16 versions. The presence of this unit can be identified by the presence of can-like antennae on the wing leading edge. The AN/ALR-56M has been retrofitted into all USAF F-16C/Ds. The block 50/52 also carries the improved AN/ALE-47 Group A chaff/flare dispenser system. However, the Block 50/52 F-16s are not LANTIRN-capable, and they have the old-style Block 30 heads-up display. .

On December 9, 1992, it was announced that Lockheed had bought out the Fort Worth Division of General Dynamics for 1.525 billion dollars in cash. The plant would henceforth be known as the Lockheed Fort Worth Company. This marked the end of production of complete aircraft by General Dynamics, the remaining elements of the company now being involved only in the manufacture of submarines, the M1A1 tank, airliner components, missiles, space systems, and electronics. The manufacture of the F-16 would, however, still continue at Fort Worth, with the aircraft now being known as the Lockheed F-16.

SOURCE : http://home.att.net/~jbaugher4/f16.html

BLOCK 50

- Engine: F110- GE-129
- Empty weight : 19975 lbs
- Fuel : 7162 lbs

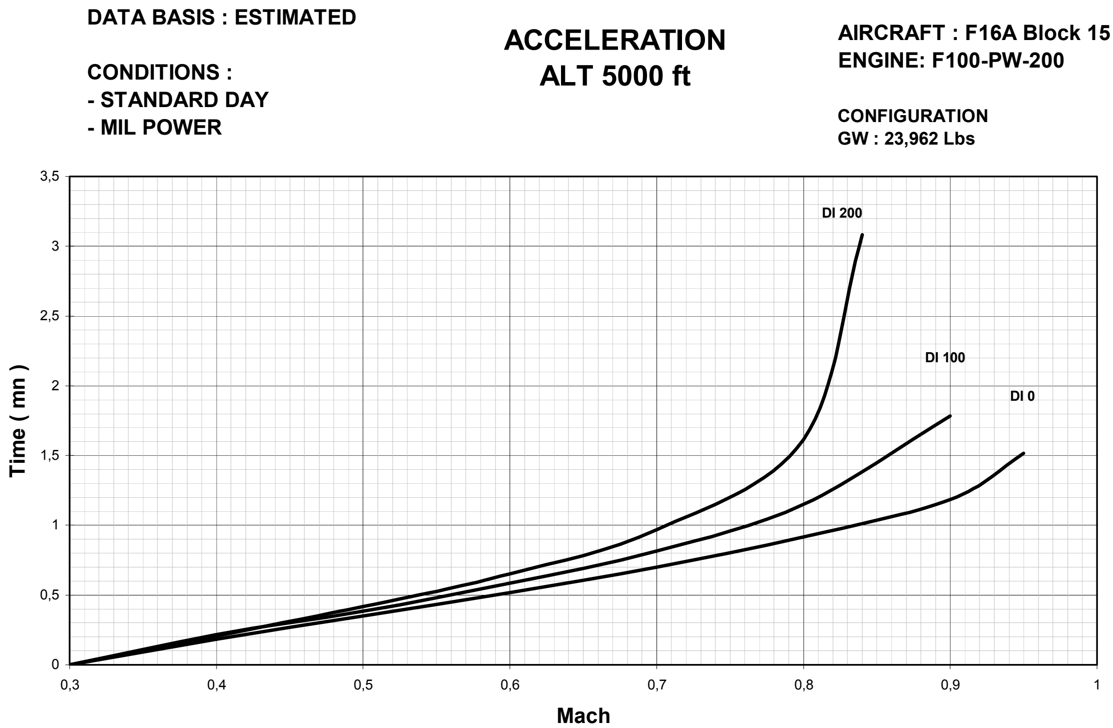
BLOCK 52

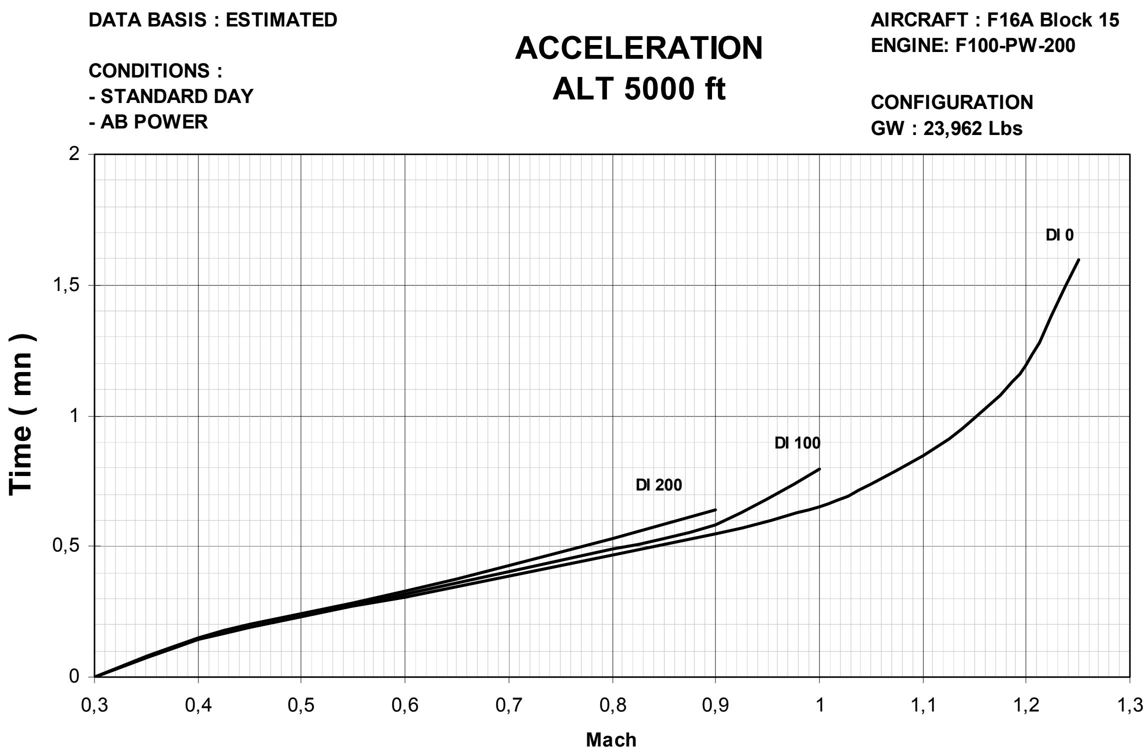
- Engine: F100- PW-229
- Empty weight : 19635 lbs
- Fuel : 7162 lbs

4 PERFORMANCE SECTION

4.1 F16 A – Block 15

4.1.1 Acceleration charts





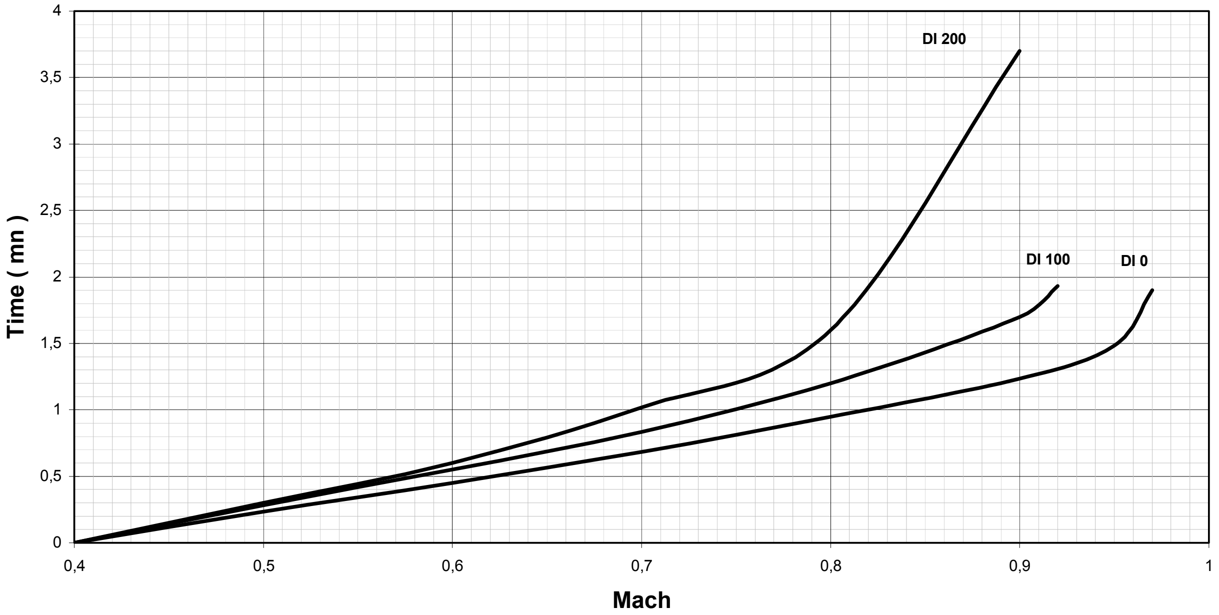
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 15000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 23,962 Lbs



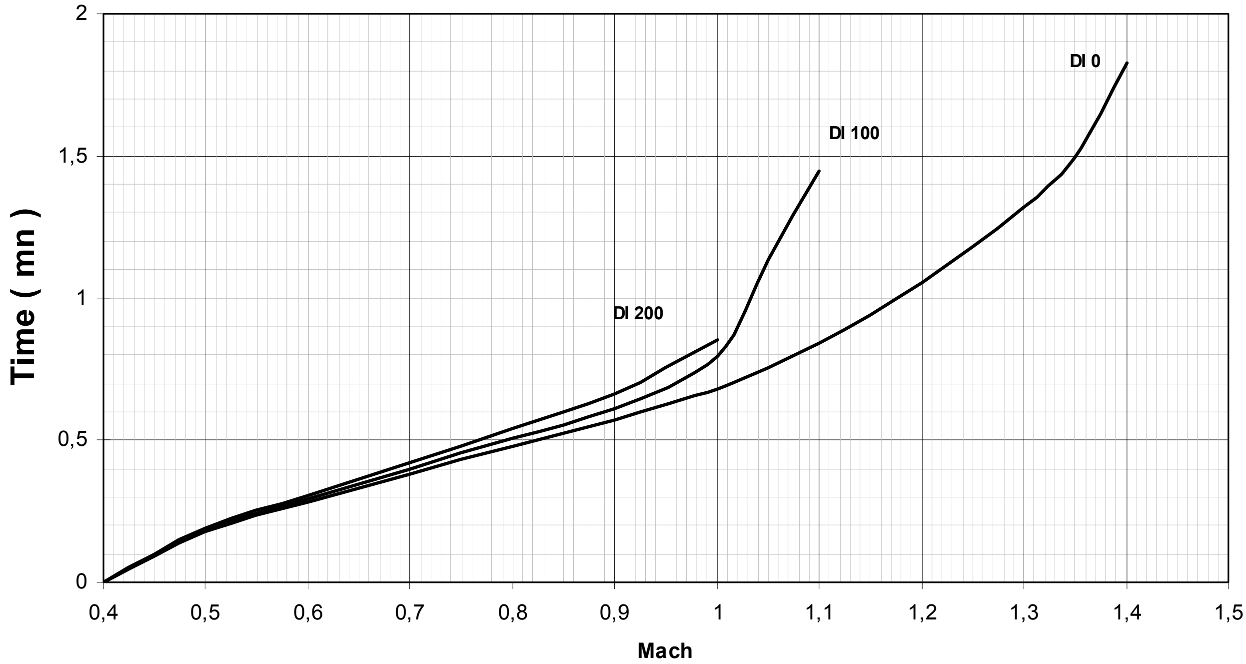
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 15000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 23,962 Lbs



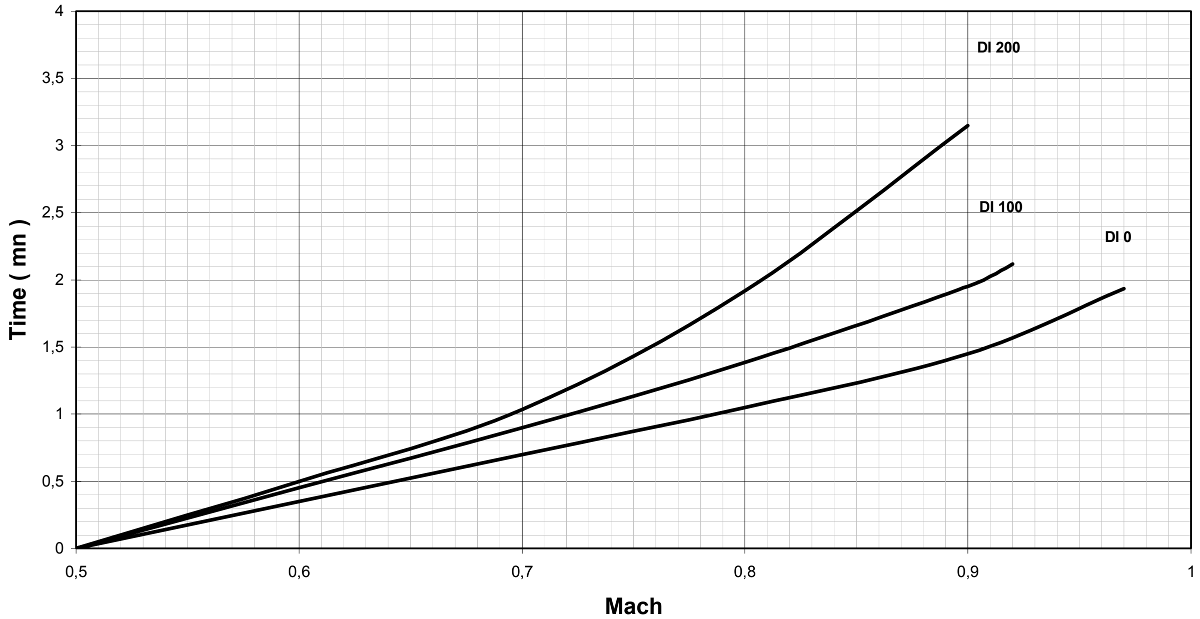
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 23,962 Lbs



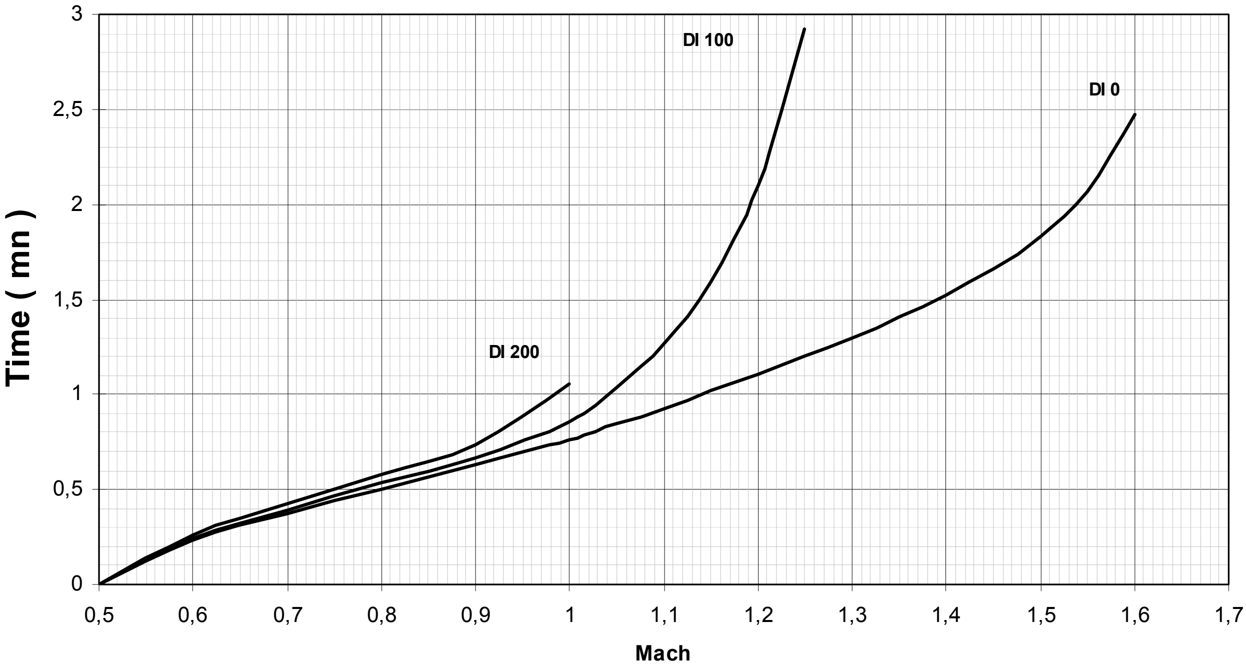
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 23,962 Lbs

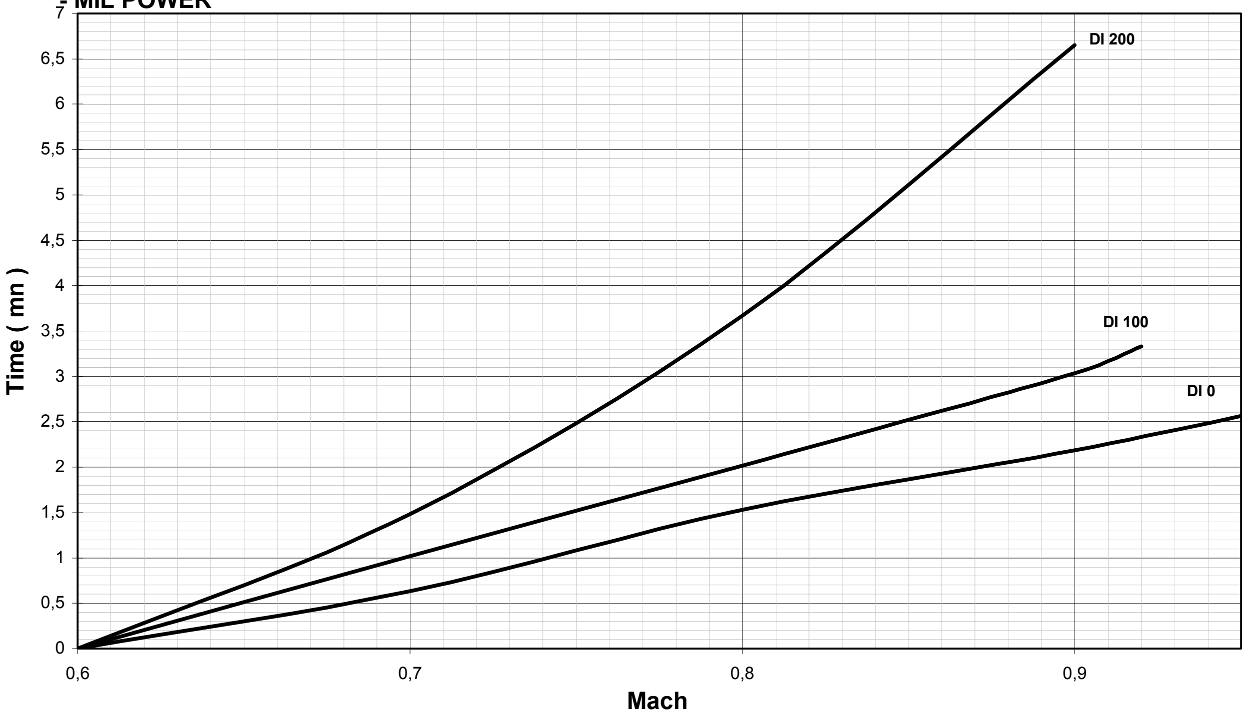


DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200
CONFIGURATION
GW : 23,962 Lbs



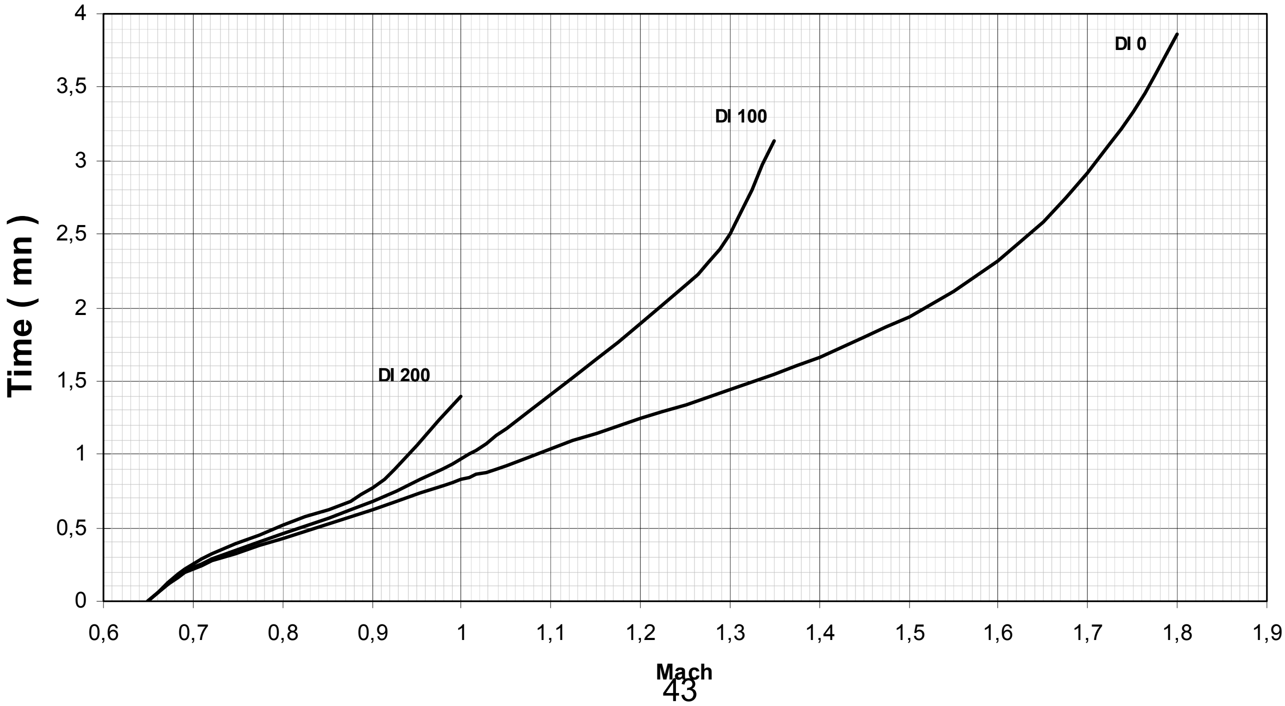
DATA BASIS : ESTIMATED

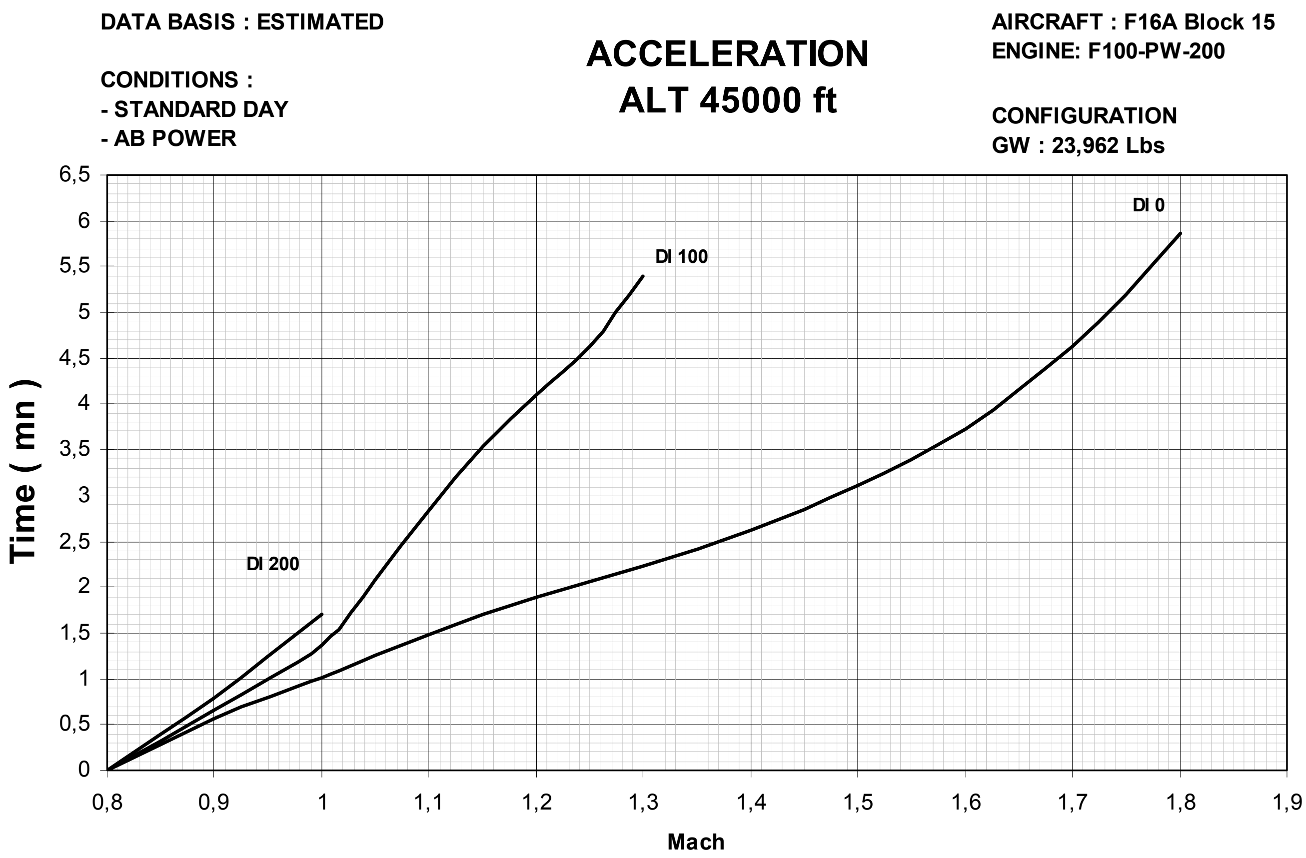
CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 23,962 Lbs




DATA BASIS : ESTIMATED
CONDITIONS :
- STANDARD DAY
- AB POWER
ACCELERATION
ALT 45000 ft
AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200
CONFIGURATION
GW : 23,962 Lbs
Time (mn)
Mach
DI 200
DI 100
DI 0
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5
5
5,5
6
6,5
0,8
0,9
1
1,1
1,2
1,3
1,4
1,5
1,6
1,7
1,8
1,9

4.1.2 Deceleration charts

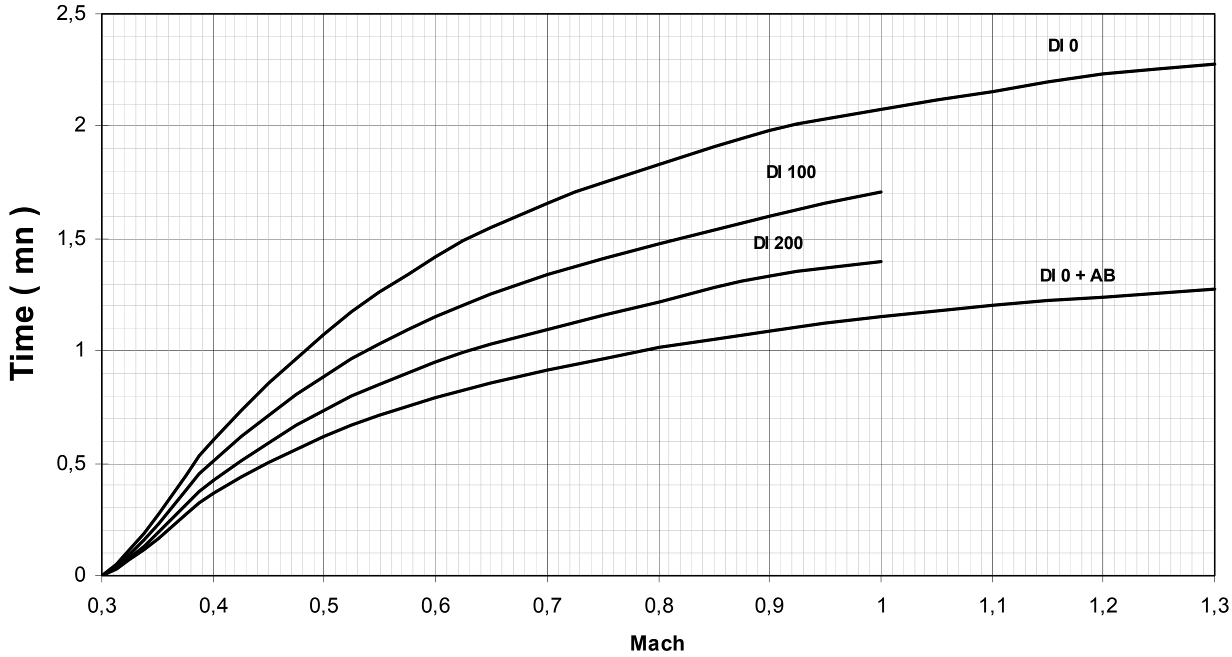
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 5000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 22,862 Lbs



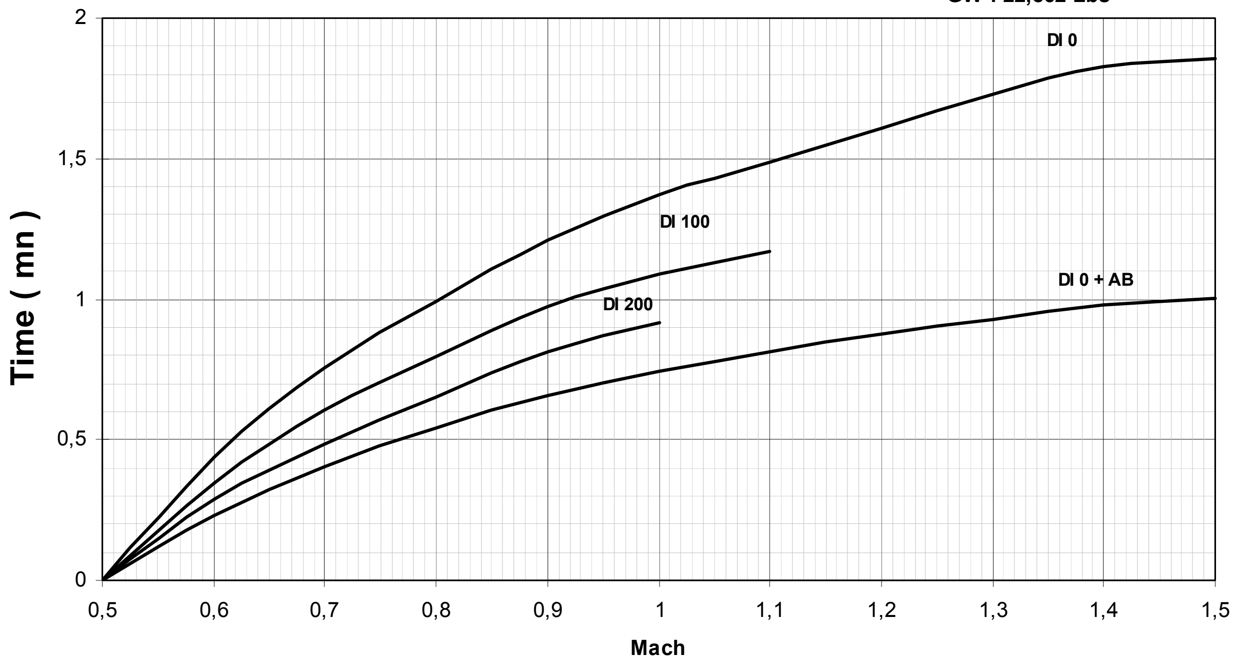
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 15 000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 22,862 Lbs



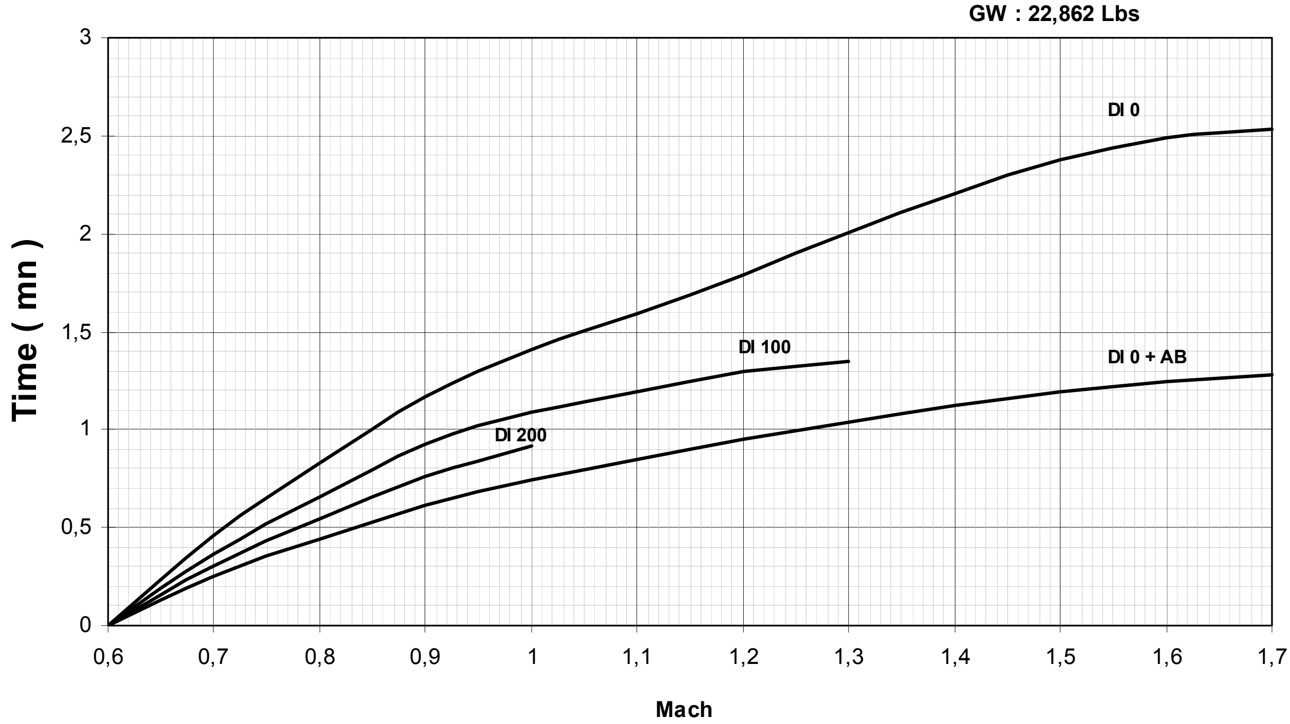
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 25 000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 22,862 Lbs



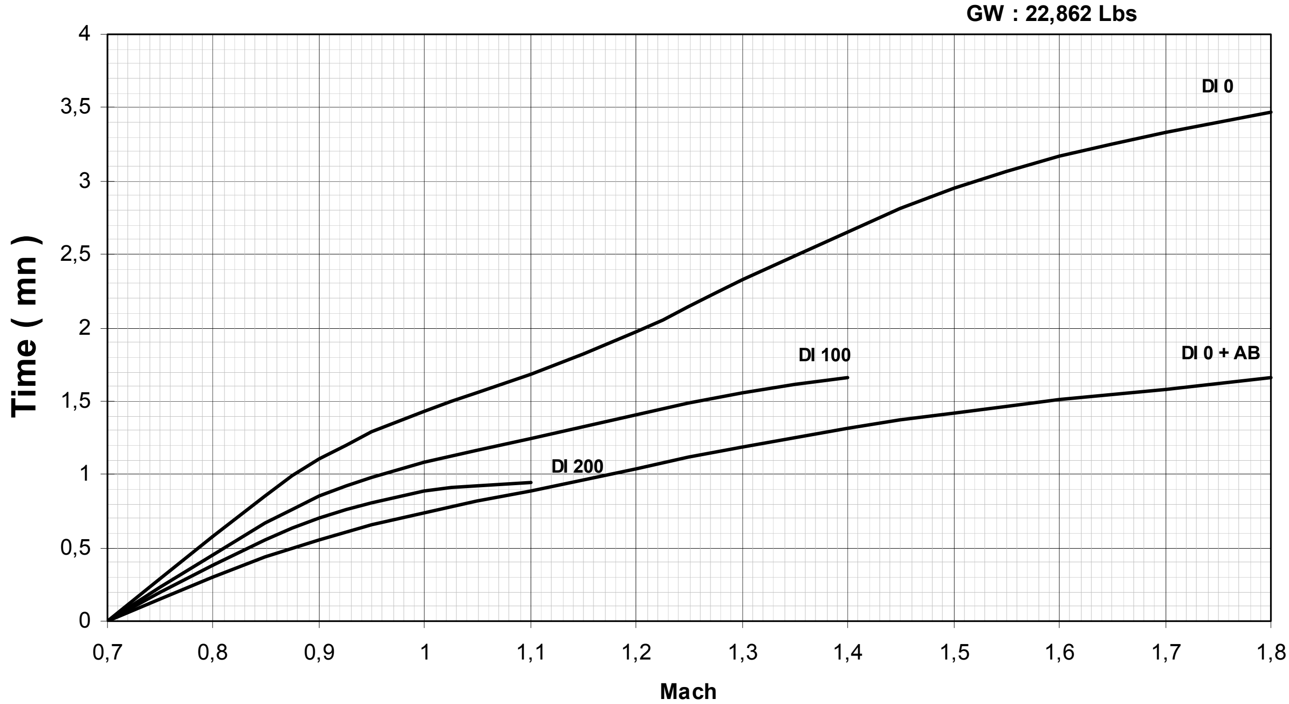
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 35 000 ft

AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 22,862 Lbs



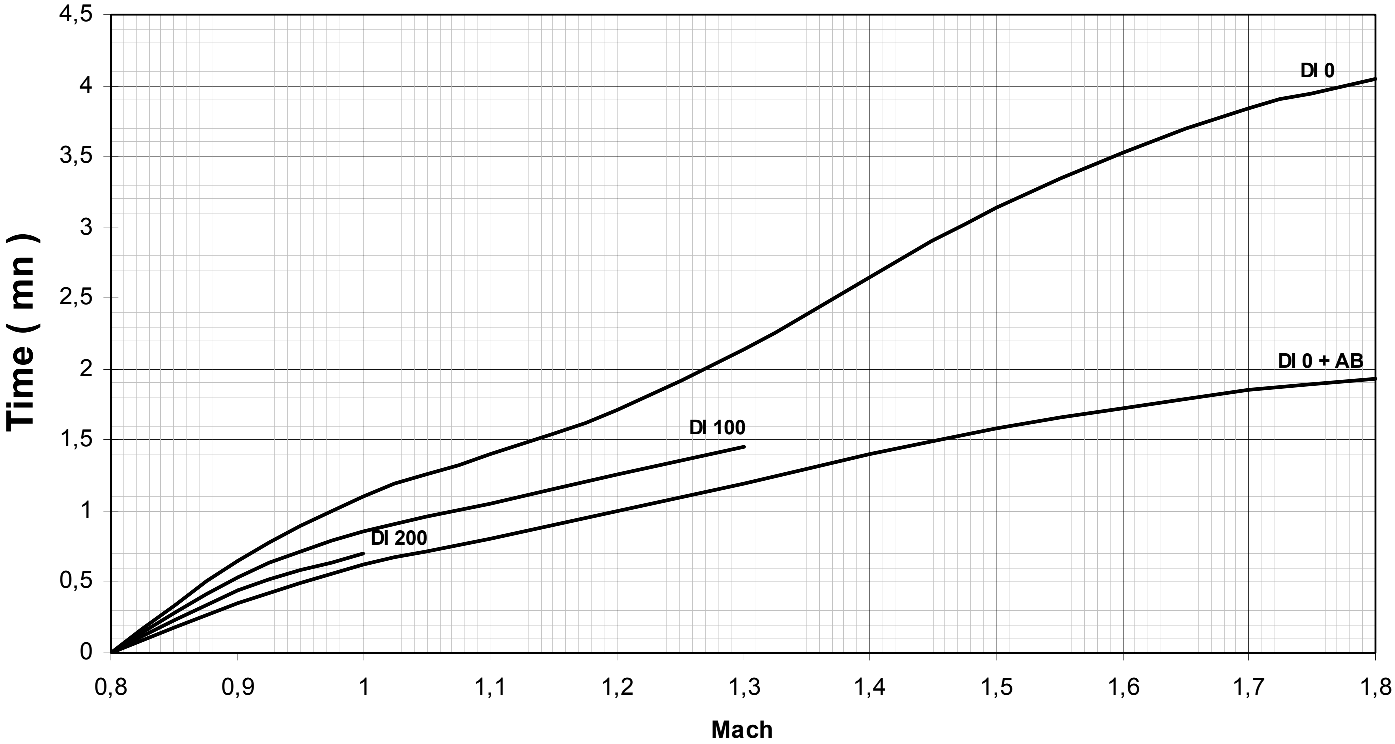
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 45 000 ft

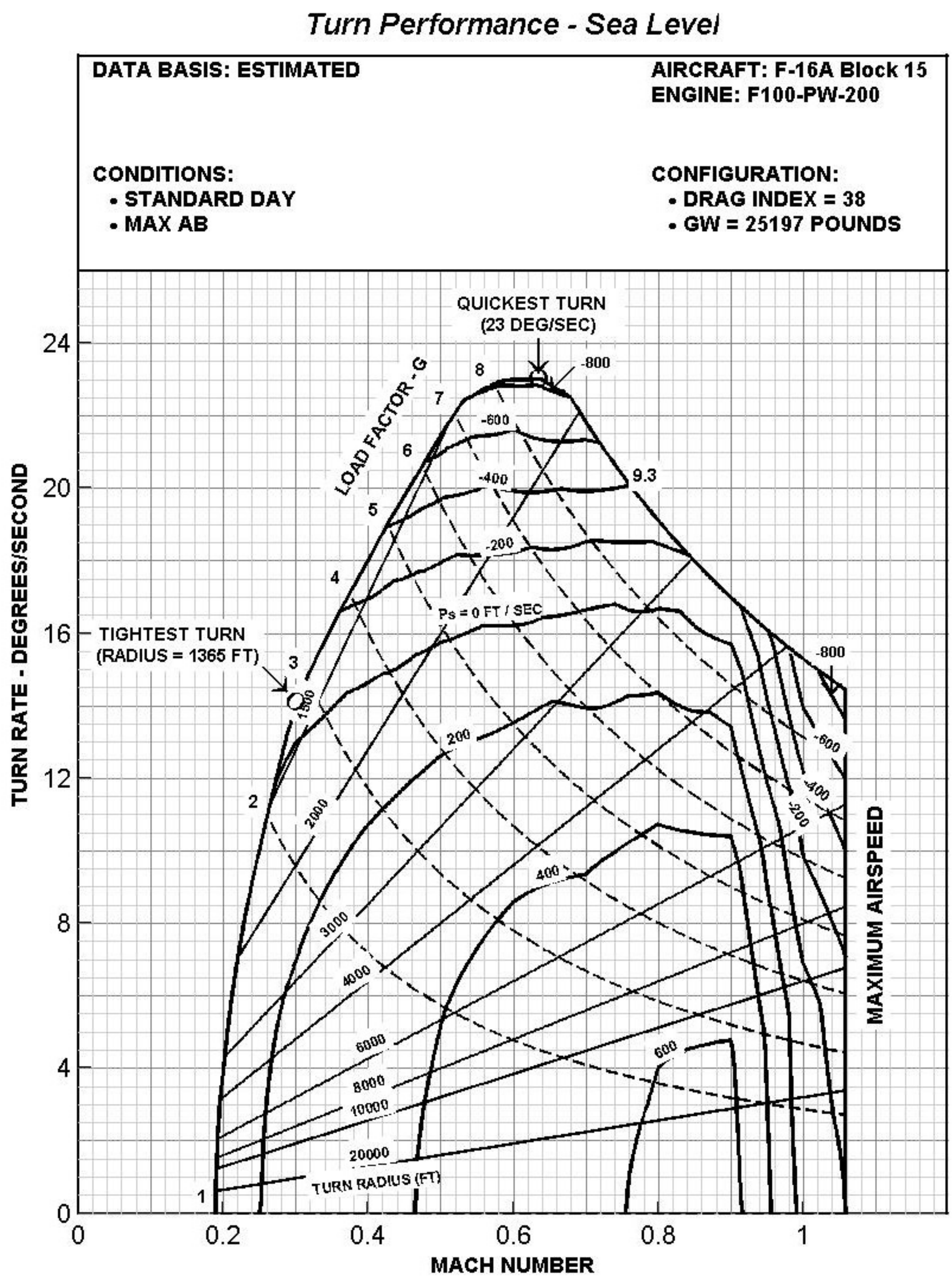
AIRCRAFT : F16A Block 15
ENGINE: F100-PW-200

CONFIGURATION
GW : 22,862 Lbs

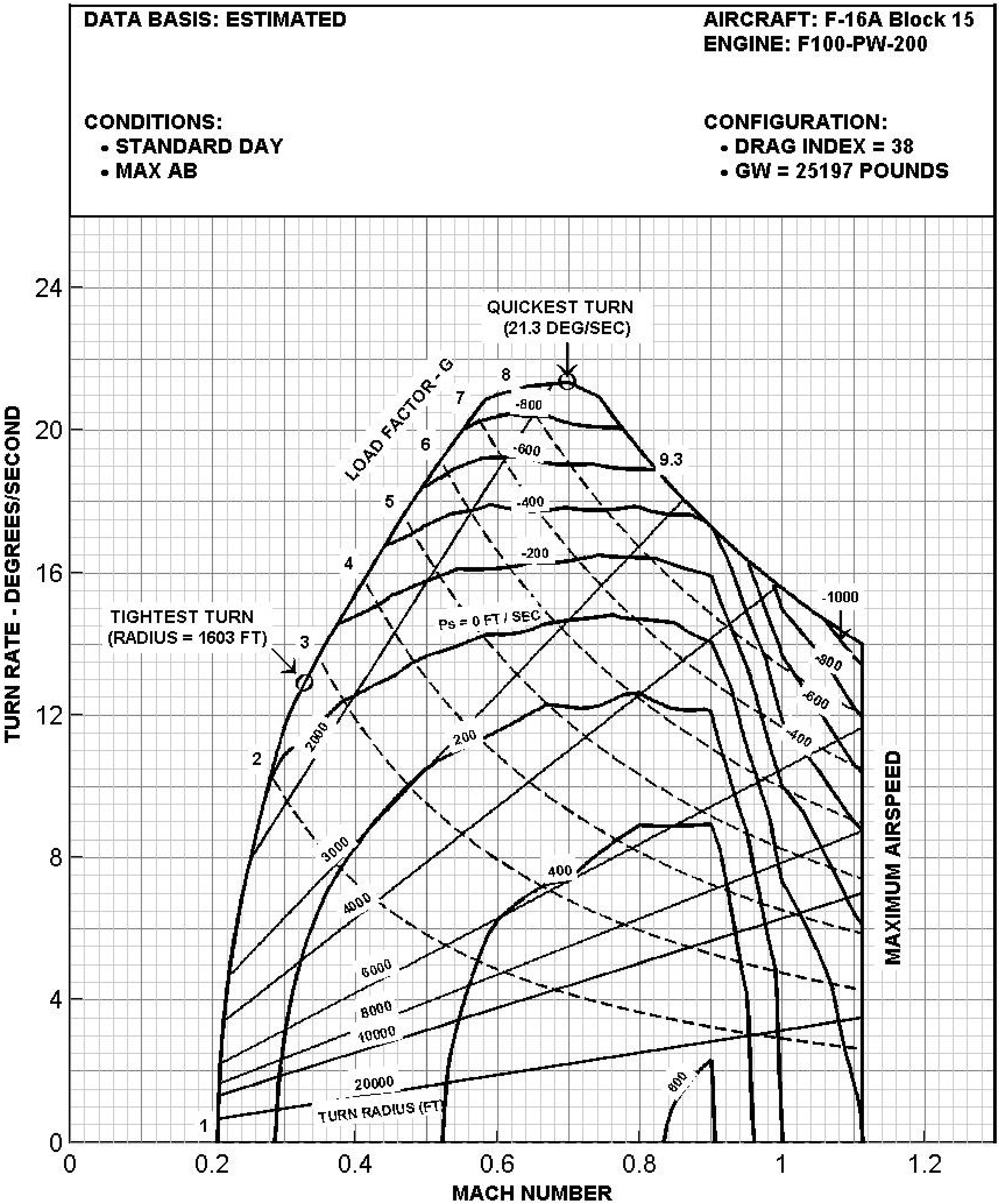


4.1.3 EM charts

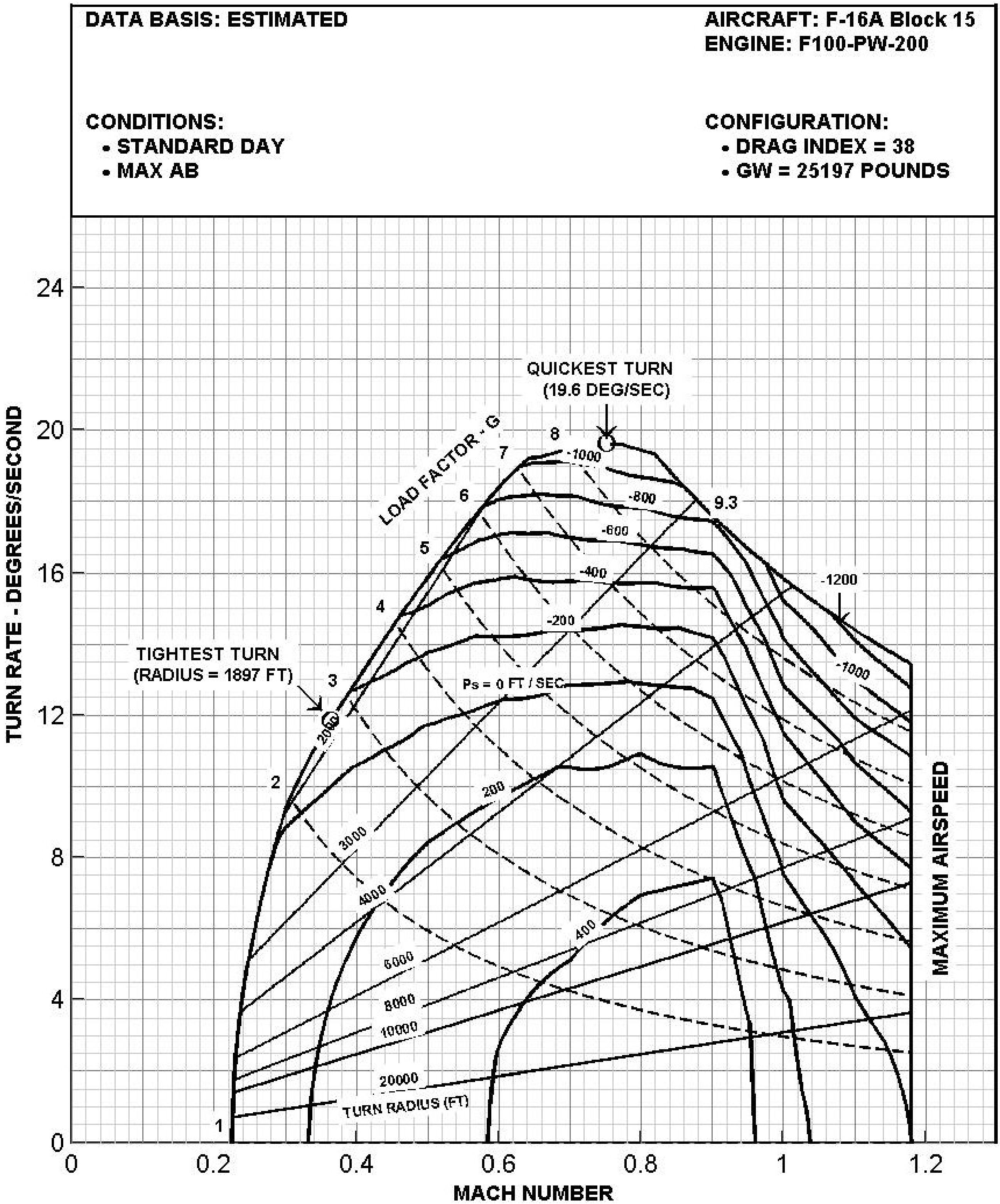
EM charts have been drawn in combat configuration: FUEL 100 % + 4 AIM9M +



Turn Performance - 5000 Feet



Turn Performance - 10000 Feet



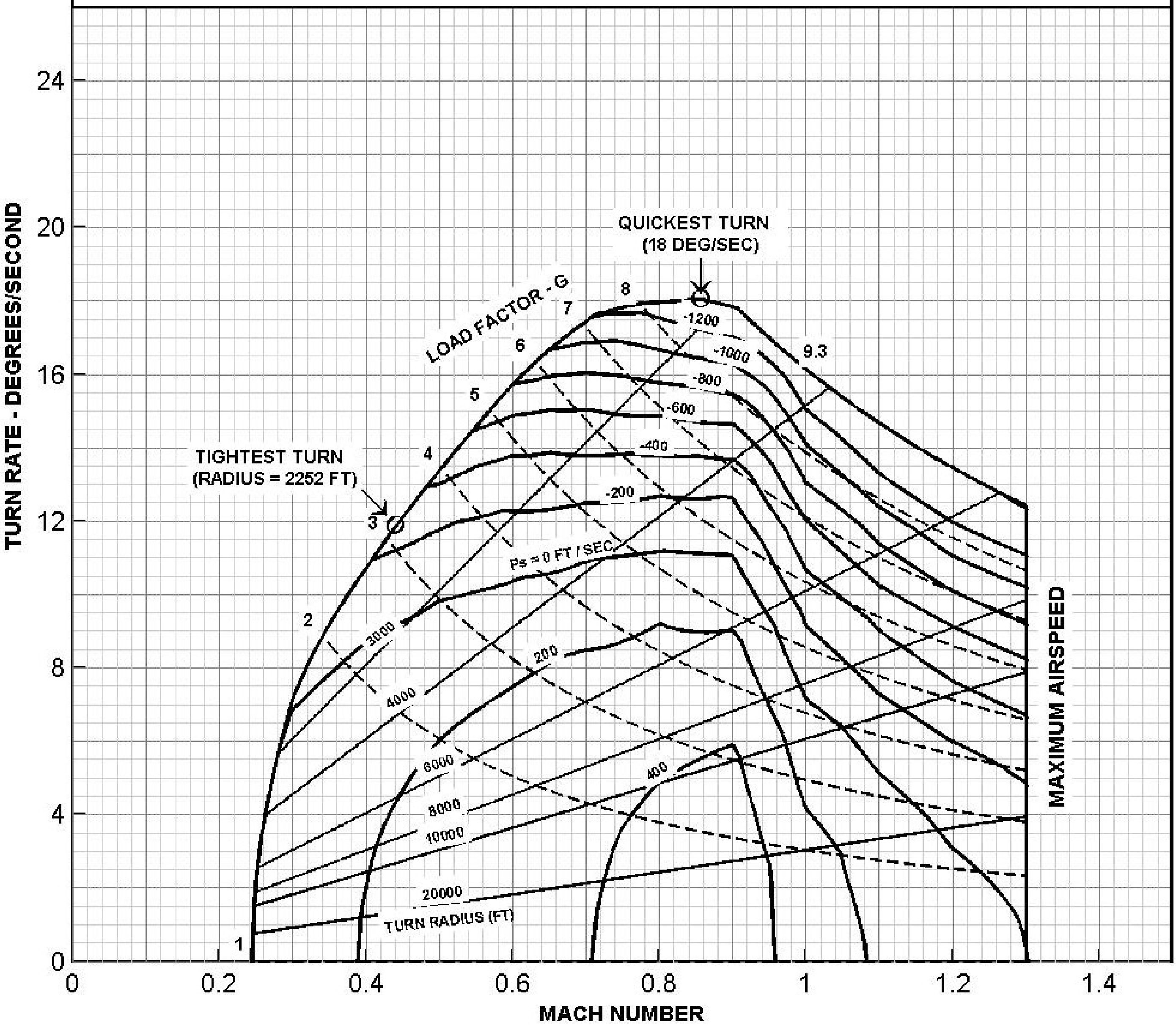
Turn Performance - 15000 Feet

DATA BASIS: ESTIMATED

AIRCRAFT: F-16A Block 15
ENGINE: F100-PW-200

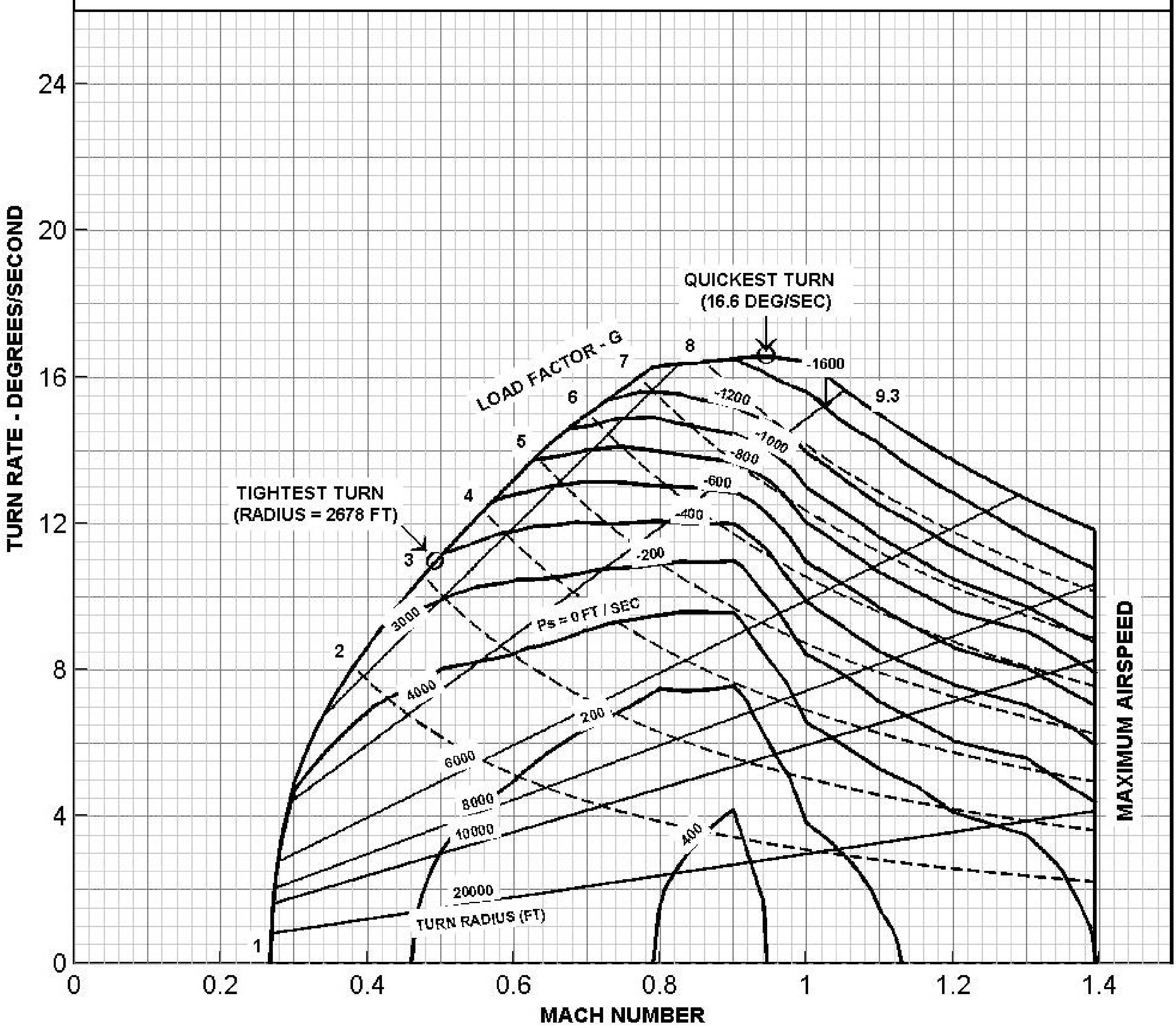
CONDITIONS:
- **STANDARD DAY**
- **MAX AB**

CONFIGURATION:
- **DRAG INDEX = 38**
- **GW = 25197 POUNDS**



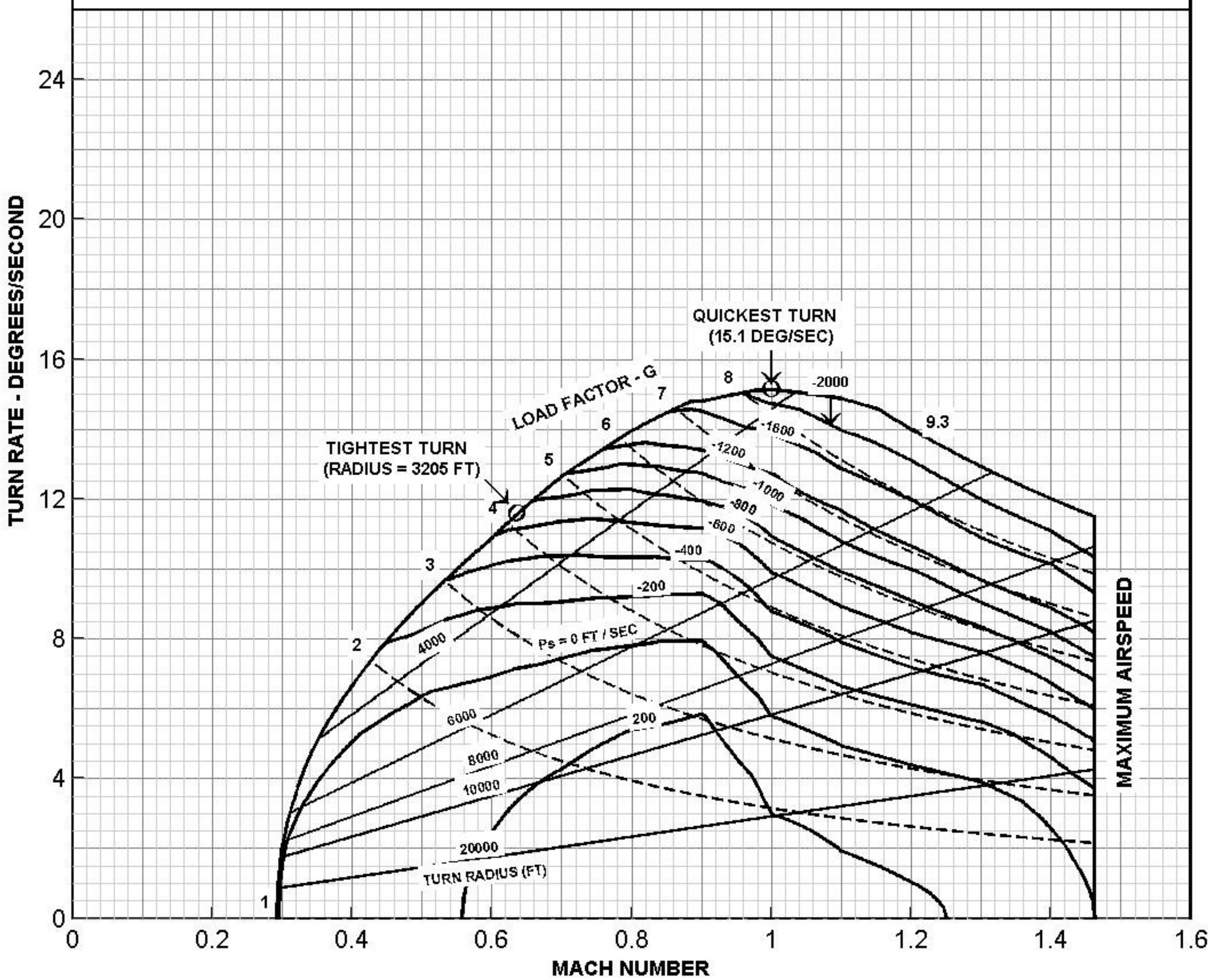
Turn Performance - 20000 Feet

DATA BASIS: ESTIMATED	**AIRCRAFT: F-16A Block 15** **ENGINE: F100-PW-200**
CONDITIONS: • STANDARD DAY • MAX AB	**CONFIGURATION:** • DRAG INDEX = 38 • GW = 25197 POUNDS



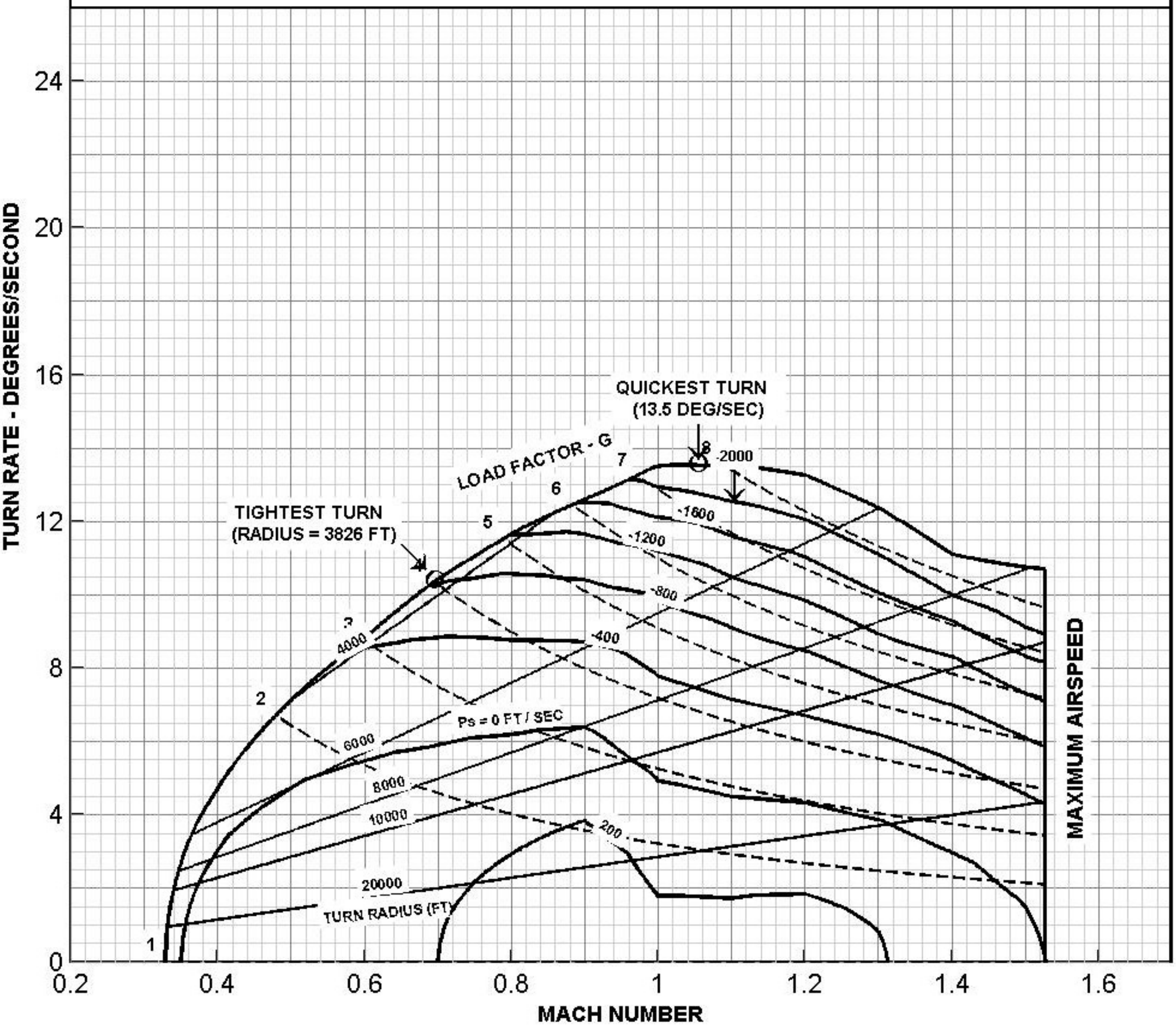
Turn Performance - 25000 Feet

DATA BASIS: ESTIMATED	**AIRCRAFT: F-16A Block 15** **ENGINE: F100-PW-200**
CONDITIONS: • **STANDARD DAY** • **MAX AB**	**CONFIGURATION:** • **DRAG INDEX = 38** • **GW = 25197 POUNDS**



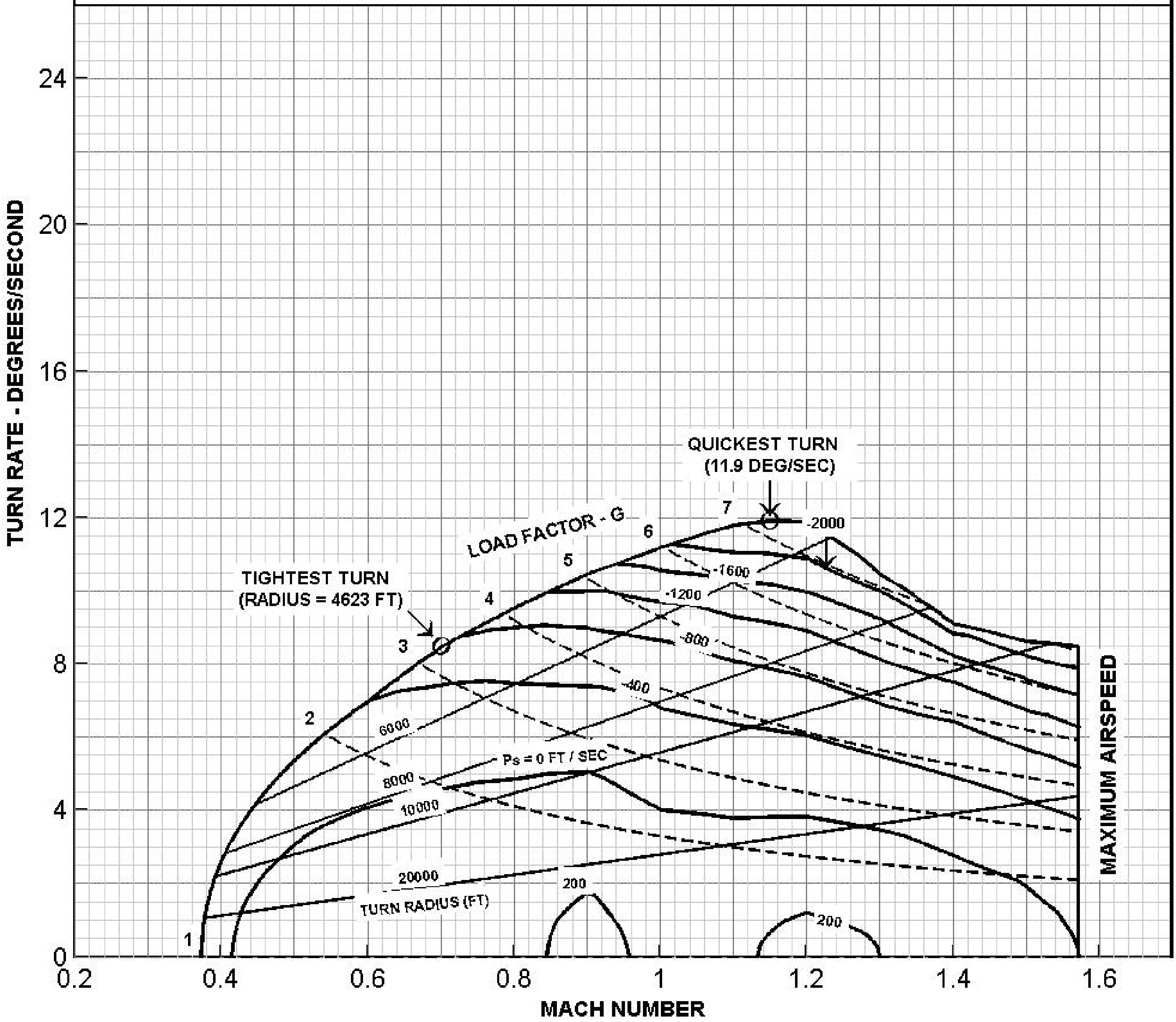
Turn Performance - 30000 Feet

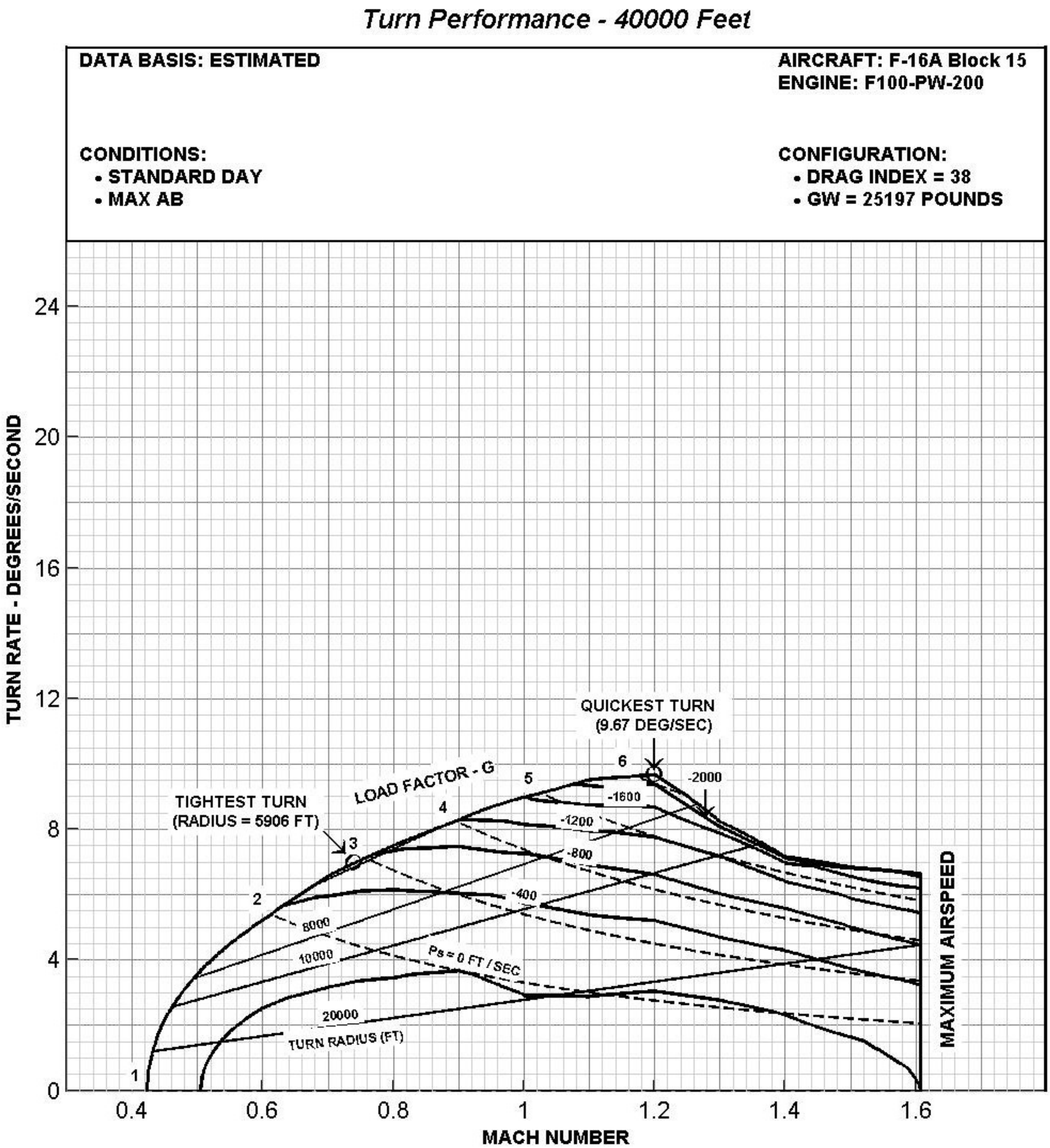
DATA BASIS: ESTIMATED	AIRCRAFT: F-16A Block 15 ENGINE: F100-PW-200
CONDITIONS: • STANDARD DAY • MAX AB	CONFIGURATION: • DRAG INDEX = 38 • GW = 25197 POUNDS



Turn Performance - 35000 Feet

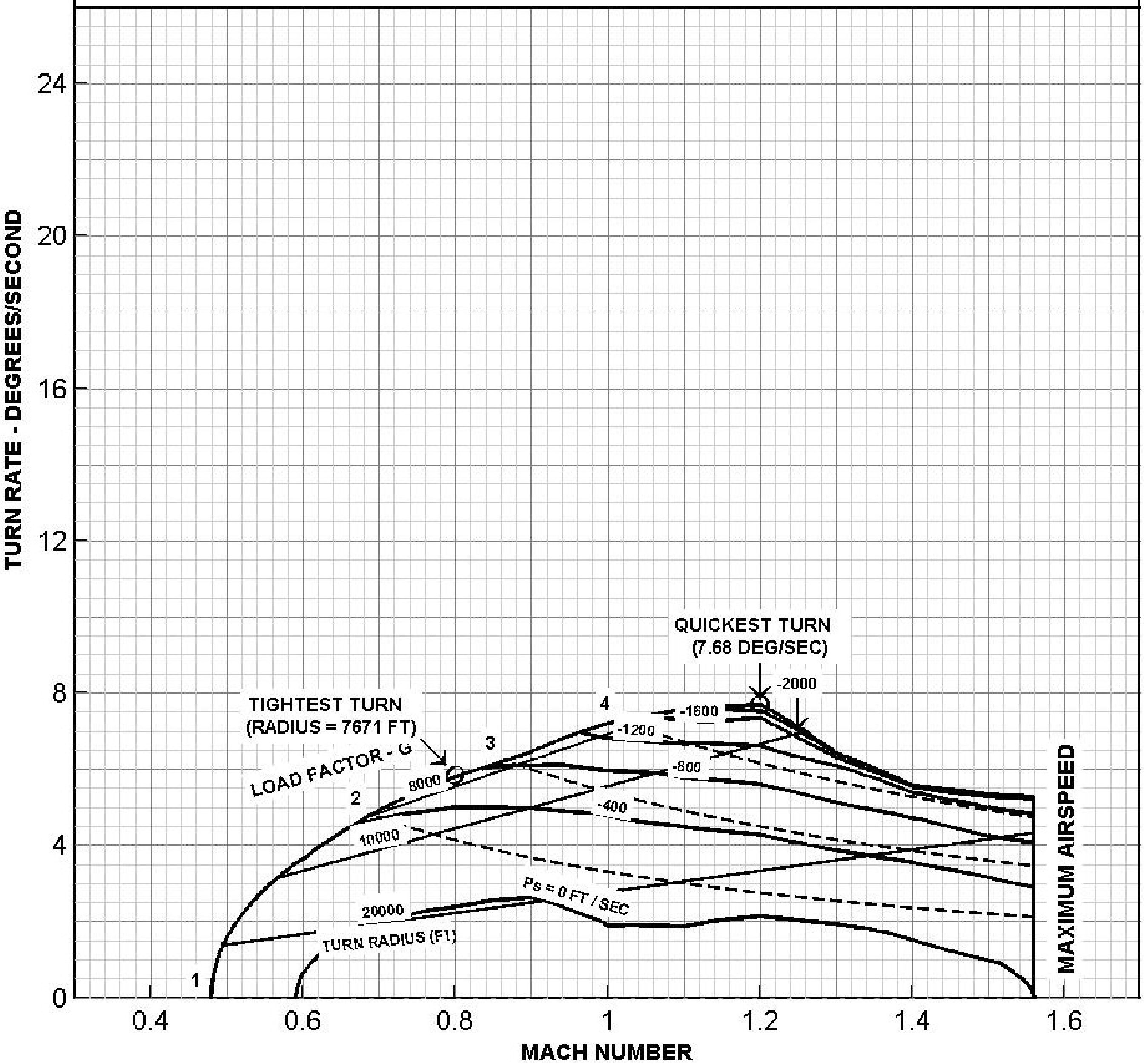
DATA BASIS: ESTIMATED	**AIRCRAFT: F-16A Block 15** **ENGINE: F100-PW-200**
CONDITIONS: • **STANDARD DAY** • **MAX AB**	**CONFIGURATION:** • **DRAG INDEX = 38** • **GW = 25197 POUNDS**




Turn Performance - 40000 Feet
DATA BASIS: ESTIMATED
AIRCRAFT: F-16A Block 15
ENGINE: F100-PW-200
CONDITIONS:
• STANDARD DAY
• MAX AB
CONFIGURATION:
• DRAG INDEX = 38
• GW = 25197 POUNDS
TURN RATE - DEGREES/SECOND
MACH NUMBER
QUICKEST TURN
(9.67 DEG/SEC)
TIGHTEST TURN
(RADIUS = 5906 FT)
LOAD FACTOR - G
Ps = 0 FT / SEC
TURN RADIUS (FT)
MAXIMUM AIRSPEED
-2000
-1600
-1200
-800
-400
8000
10000
20000

Turn Performance - 45000 Feet

DATA BASIS: ESTIMATED	AIRCRAFT: F-16A Block 15 ENGINE: F100-PW-200
CONDITIONS: • STANDARD DAY • MAX AB	CONFIGURATION: • DRAG INDEX = 38 • GW = 25197 POUNDS



4.2 F16 C– Block 30

4.2.1 Acceleration charts

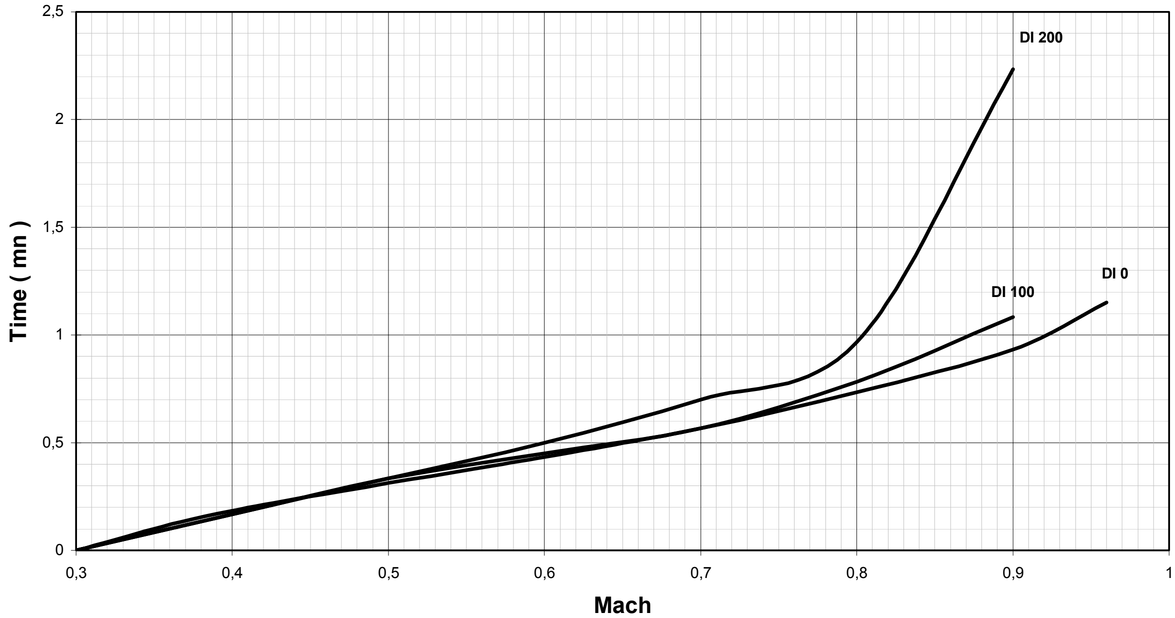
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



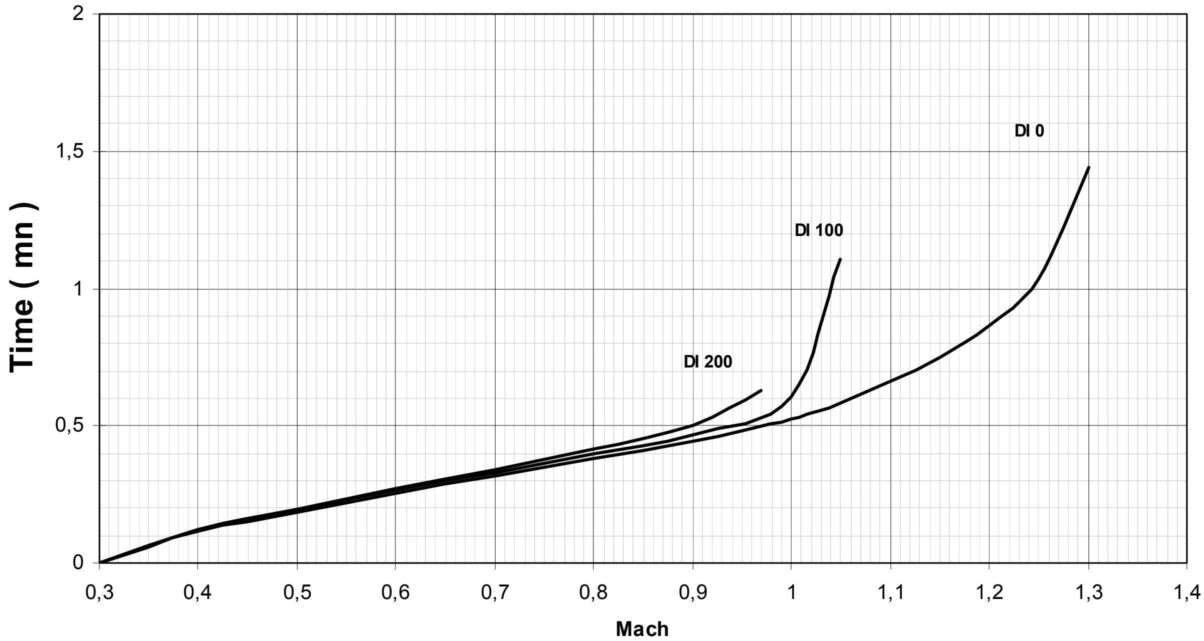
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



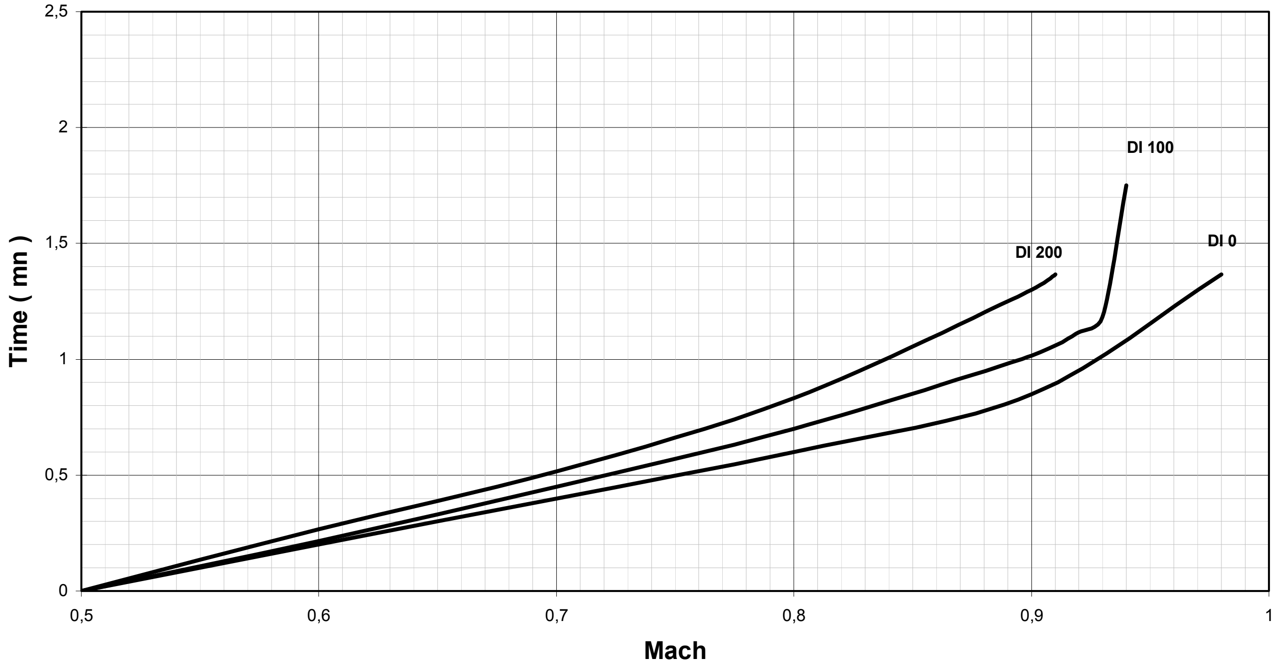
DATA BASIS : ESTIMATED

ACCELERATION
ALT 15000 ft

CONDITIONS :
- STANDARD DAY
- MIL POWER

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



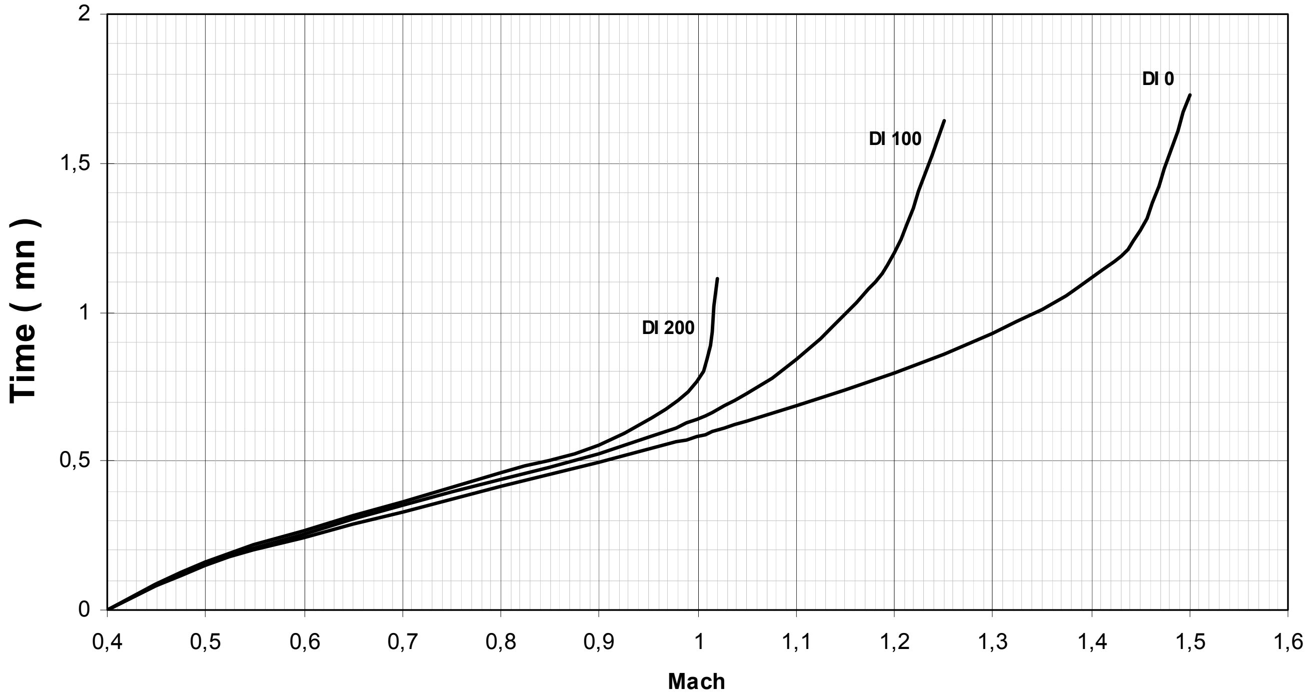
DATA BASIS : ESTIMATED

ACCELERATION
ALT 15000 ft

CONDITIONS :
- STANDARD DAY
- AB POWER

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



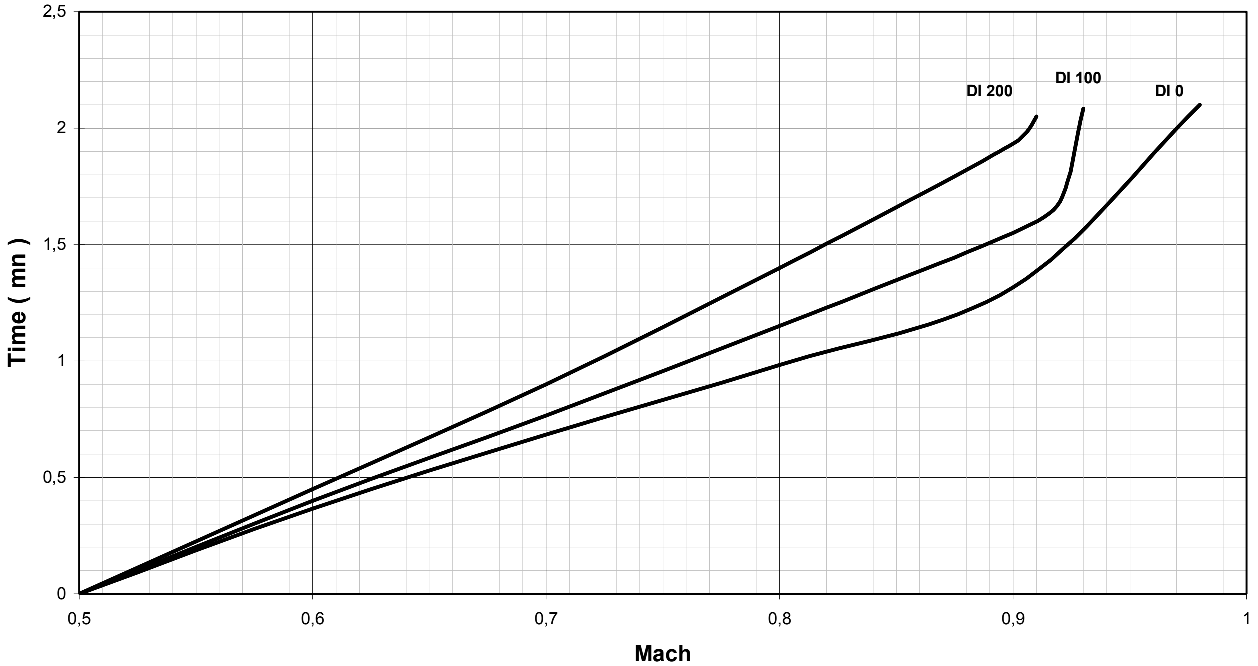
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



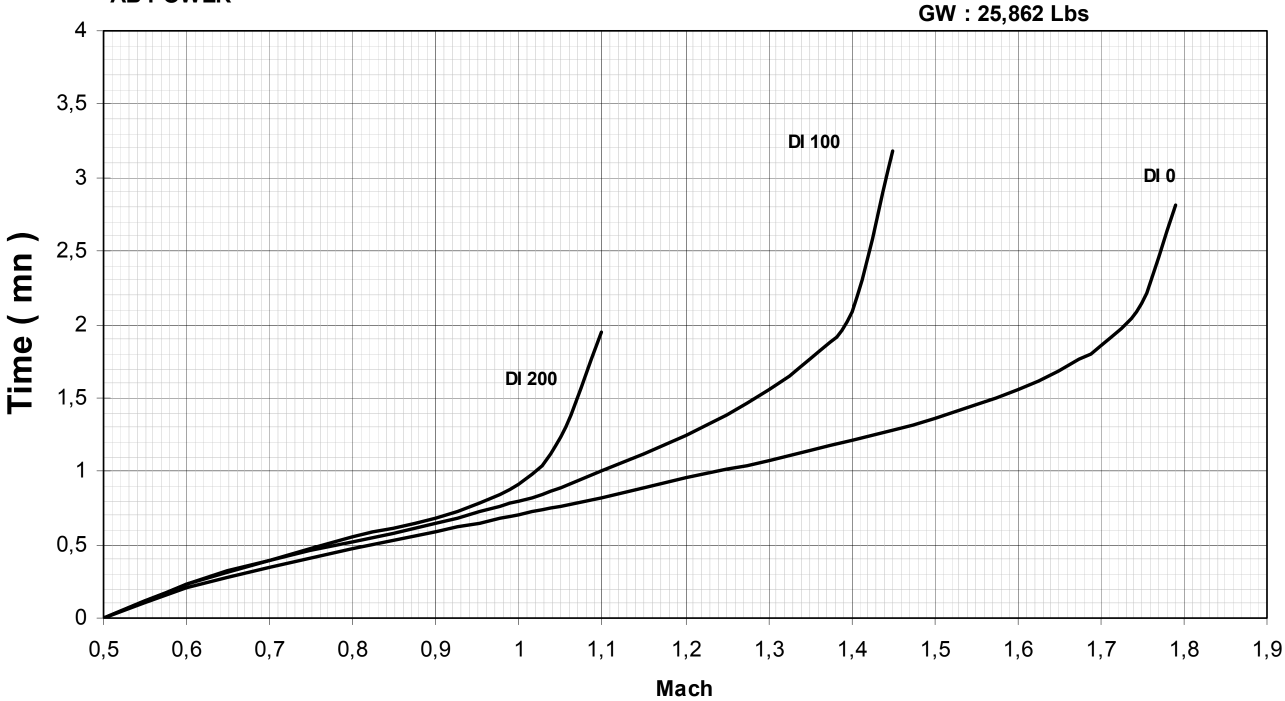
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



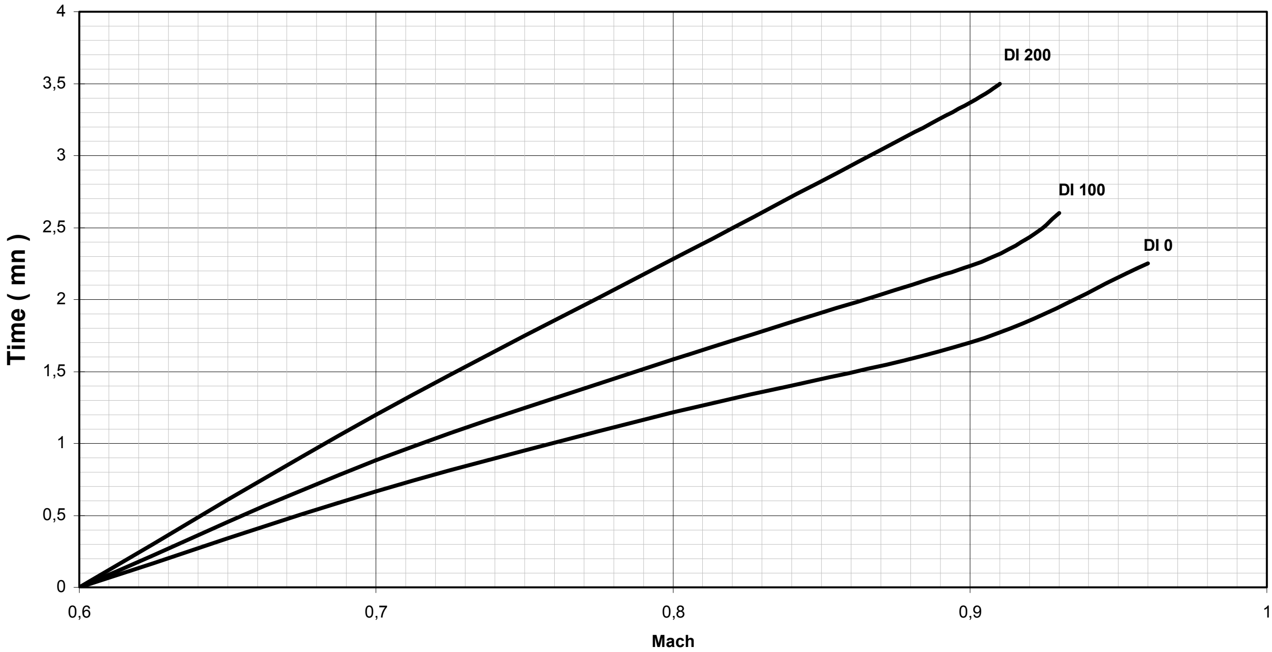
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



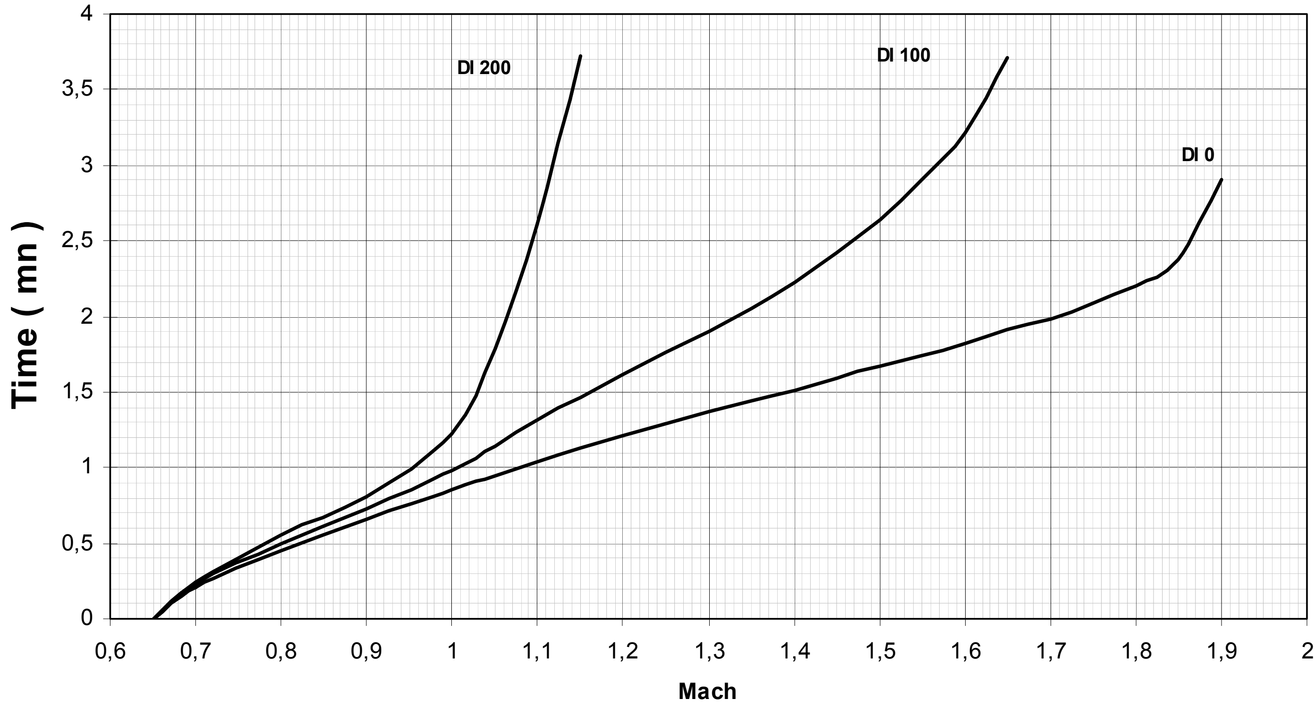
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



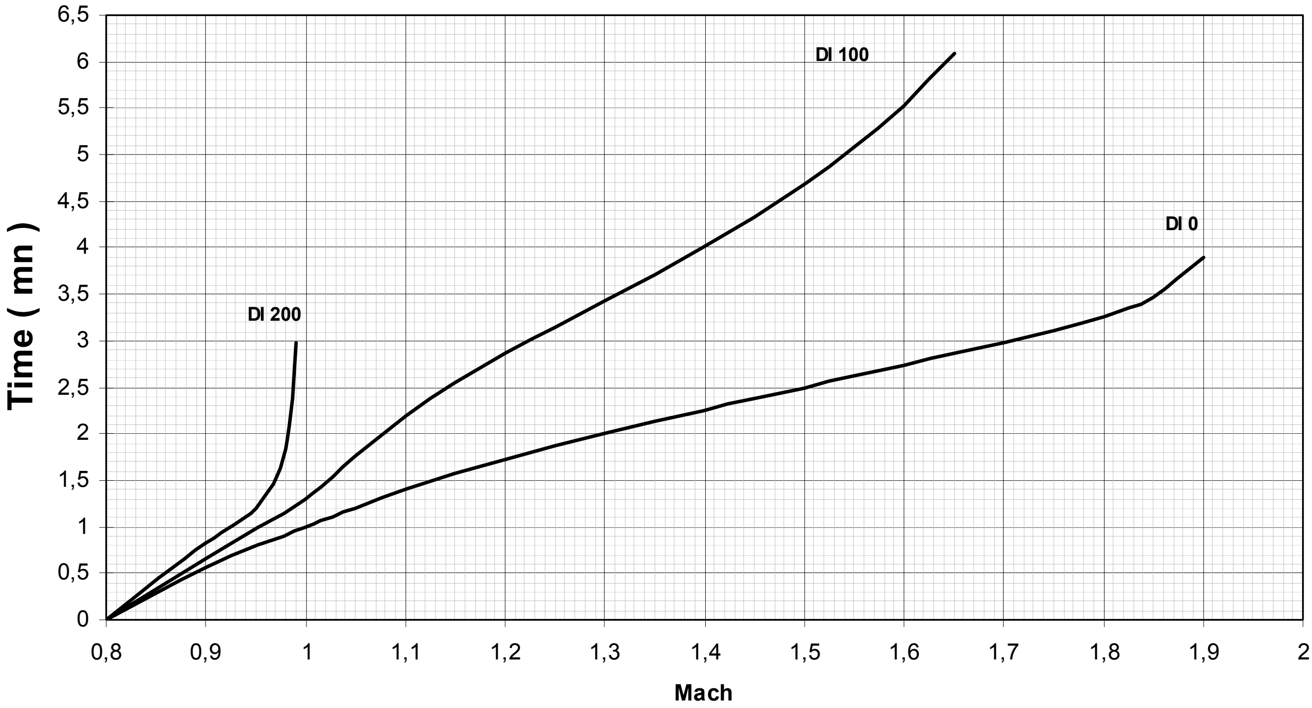
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 45000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 25,862 Lbs



4.2.2 Deceleration charts

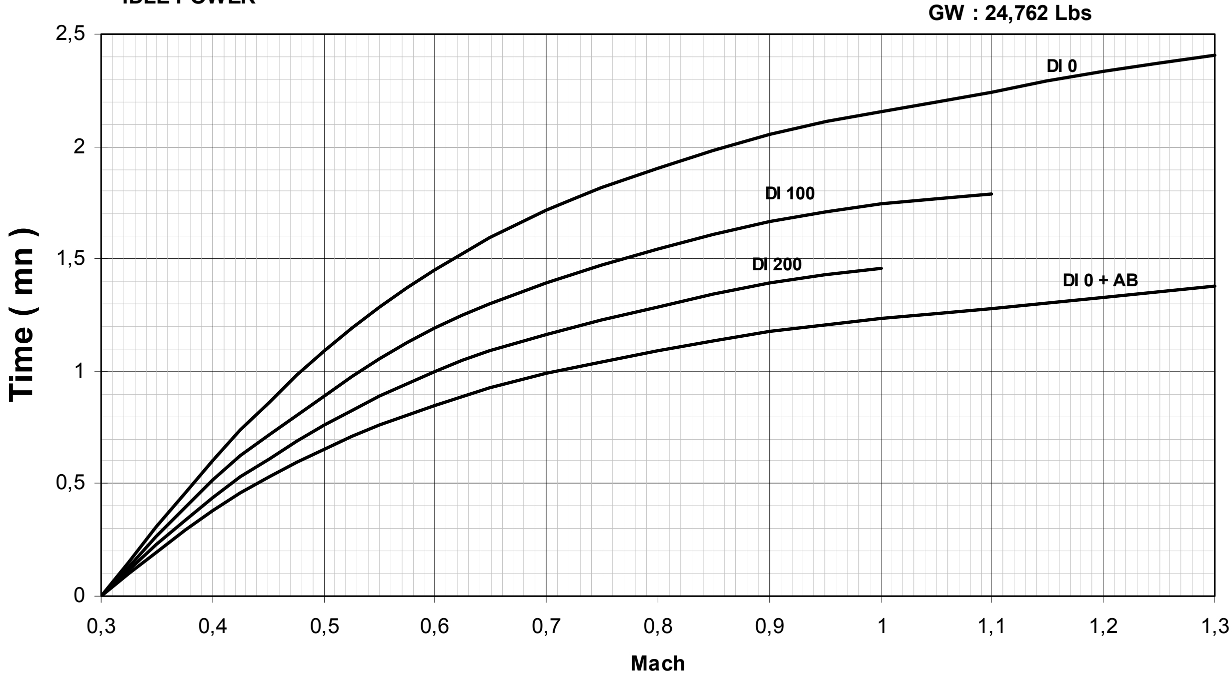
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 24,762 Lbs



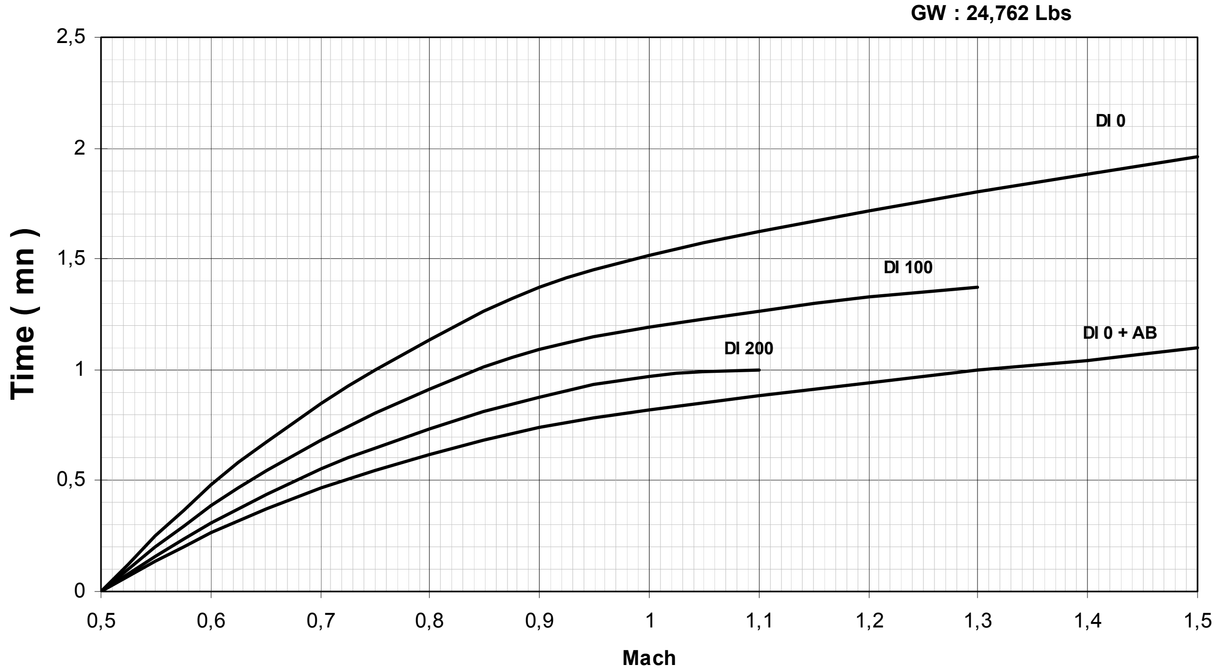
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 15000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 24,762 Lbs



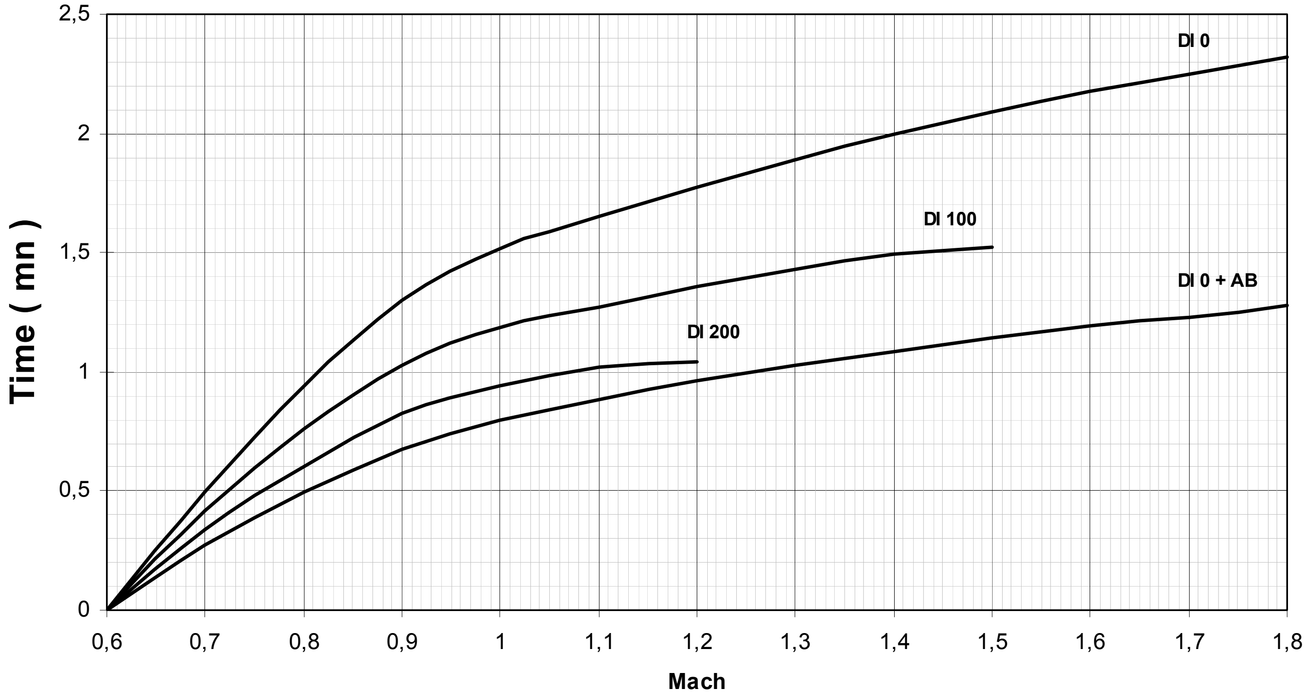
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 24,762 Lbs



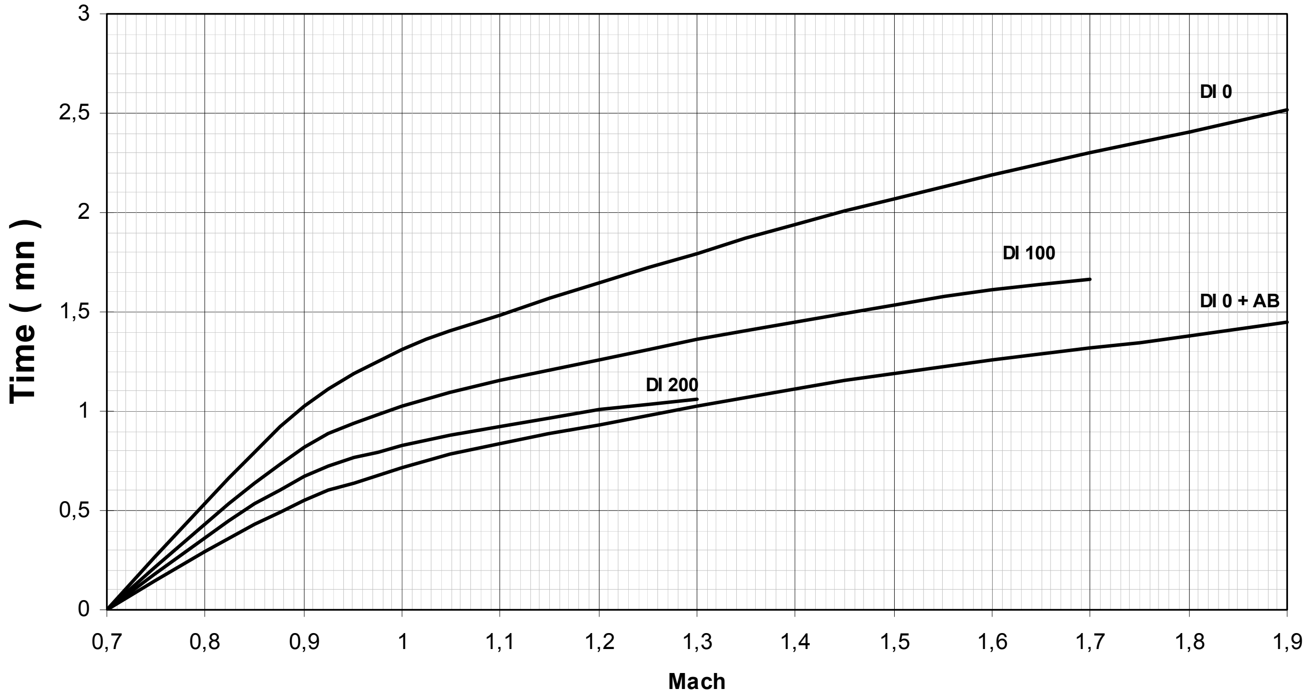
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 24,762 Lbs



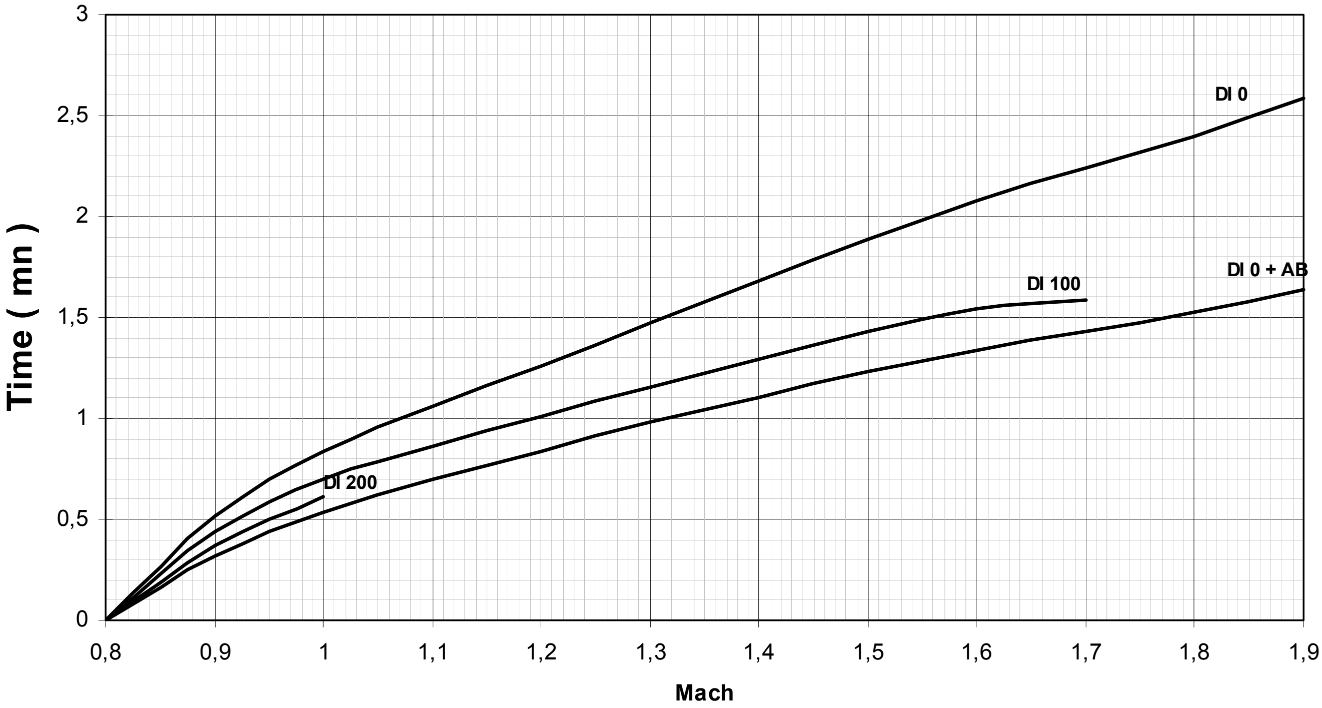
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 45000 ft

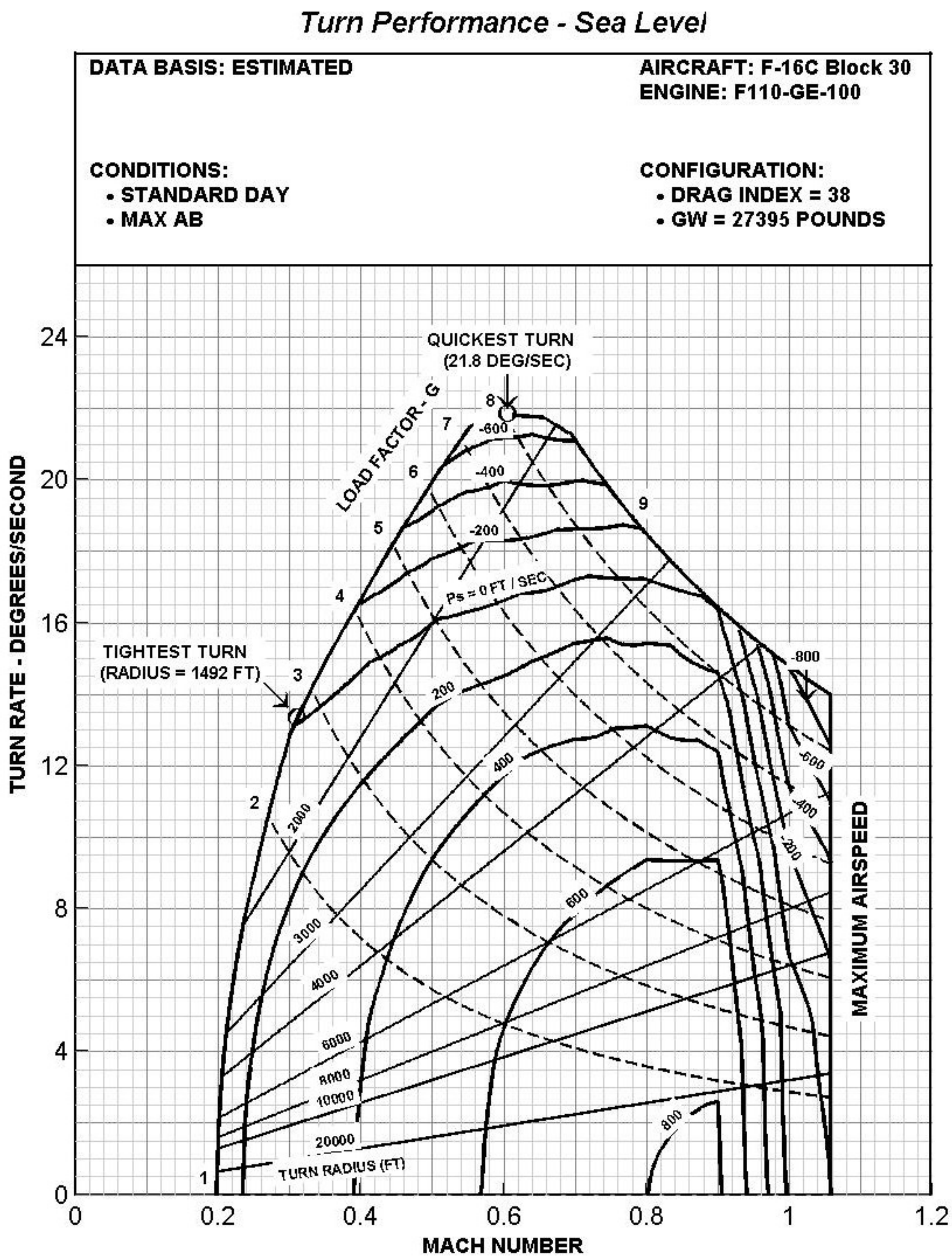
AIRCRAFT : F16C Block 30
ENGINE: F110-GE-100

CONFIGURATION
GW : 24,762 Lbs

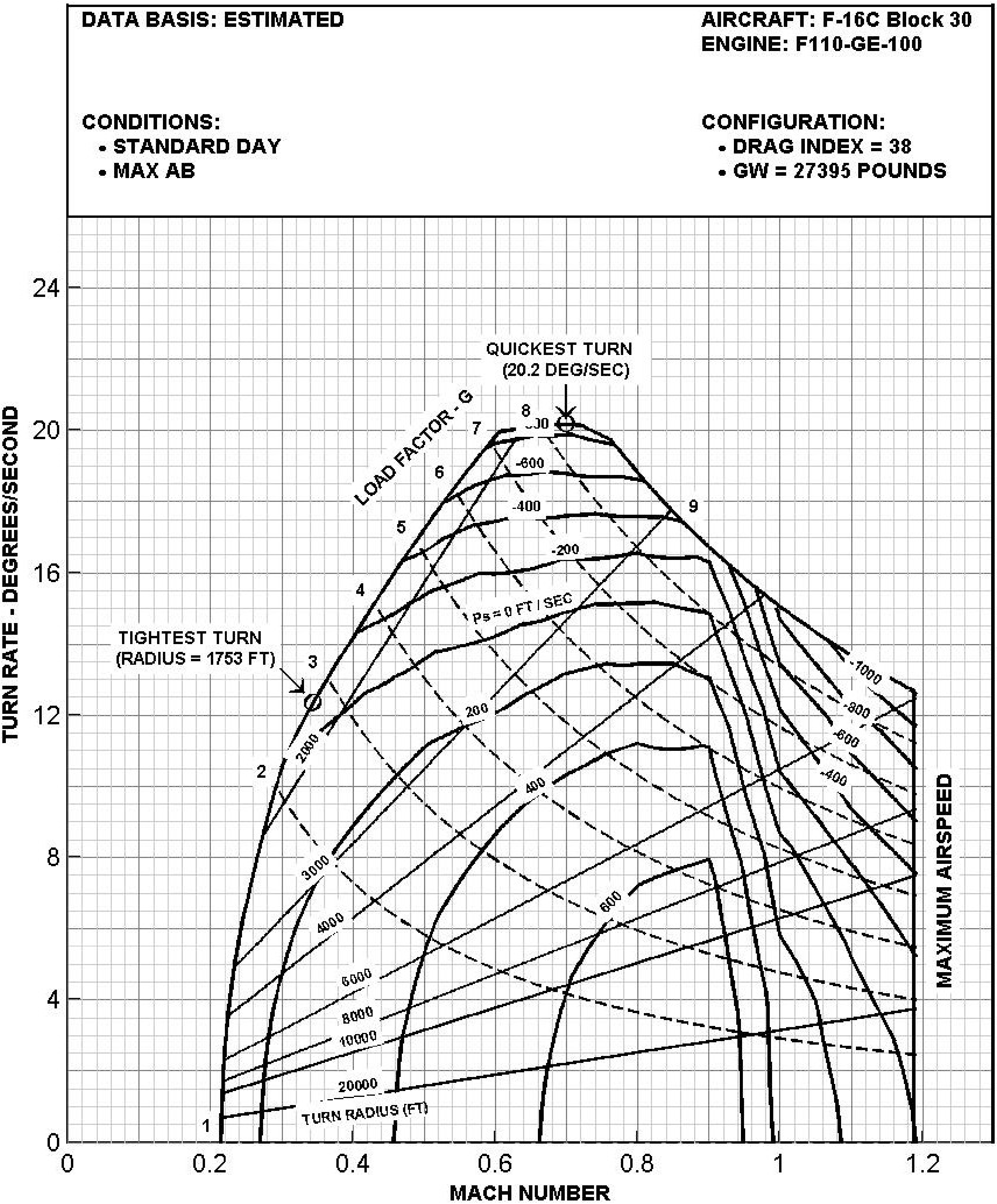


4.2.3 EM charts

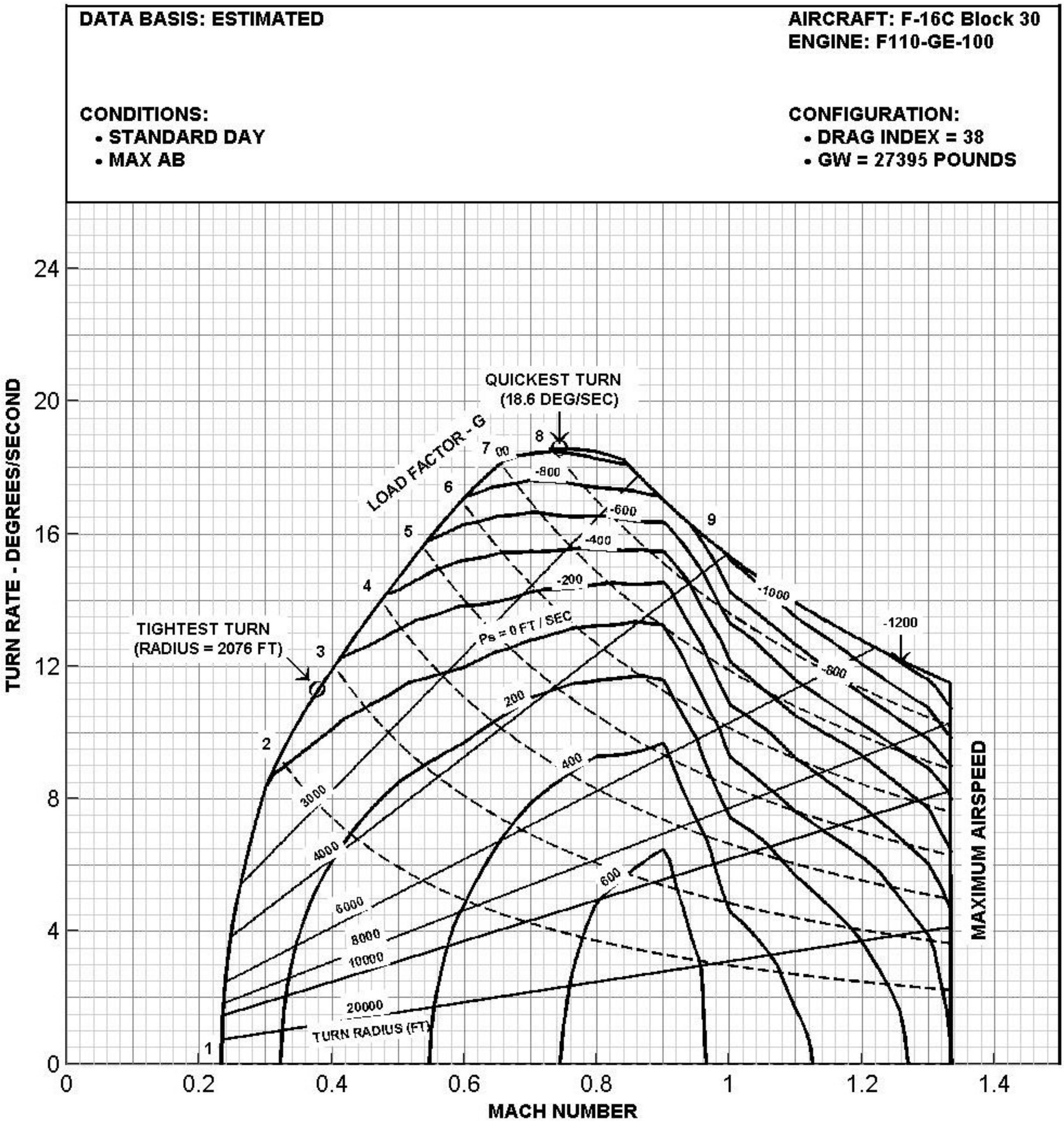
EM charts have been drawn in combat configuration: FUEL 100 % + 2 AIM9M + 2 AIM120 + ALQ131



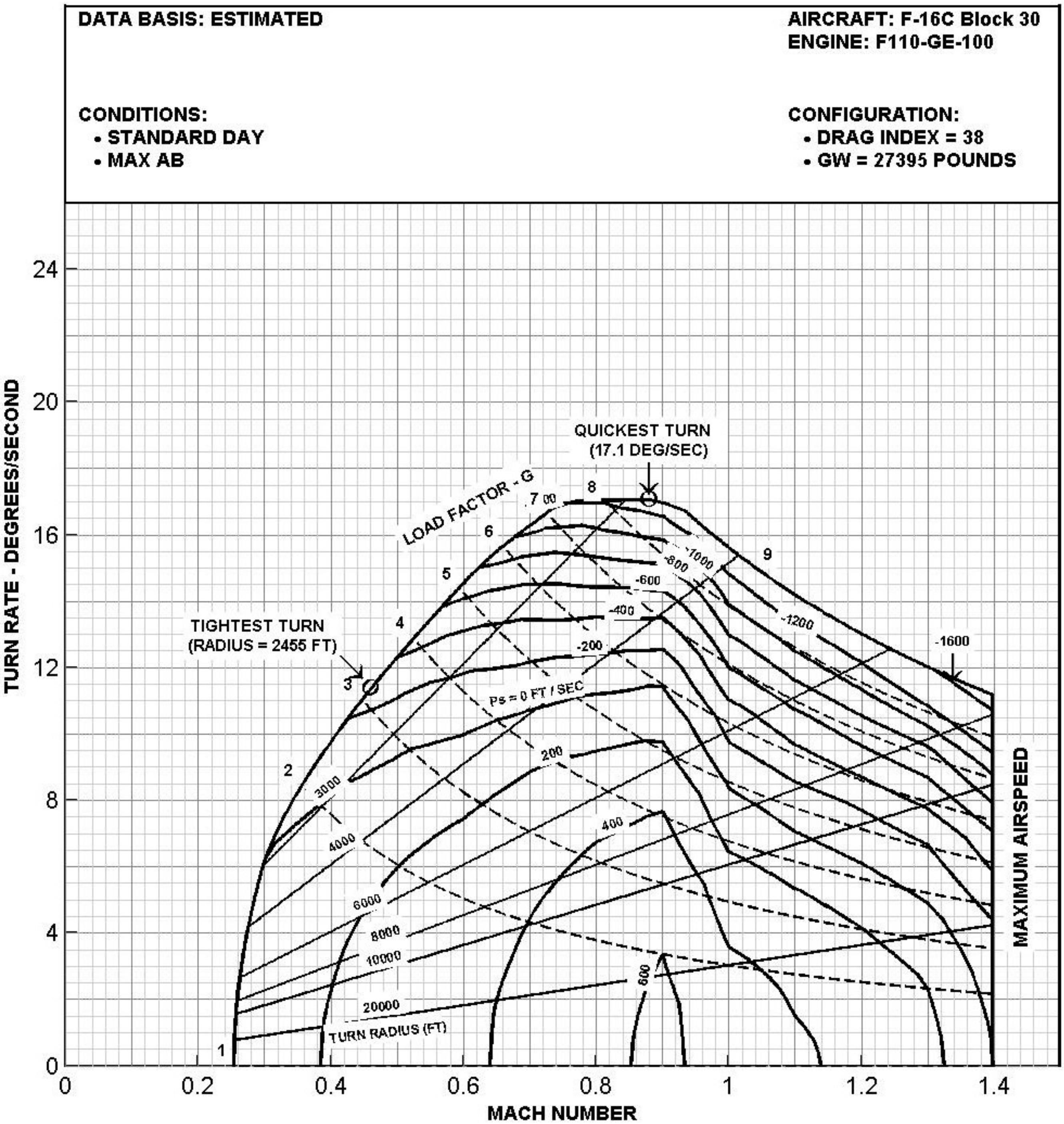
Turn Performance - 5000 Feet



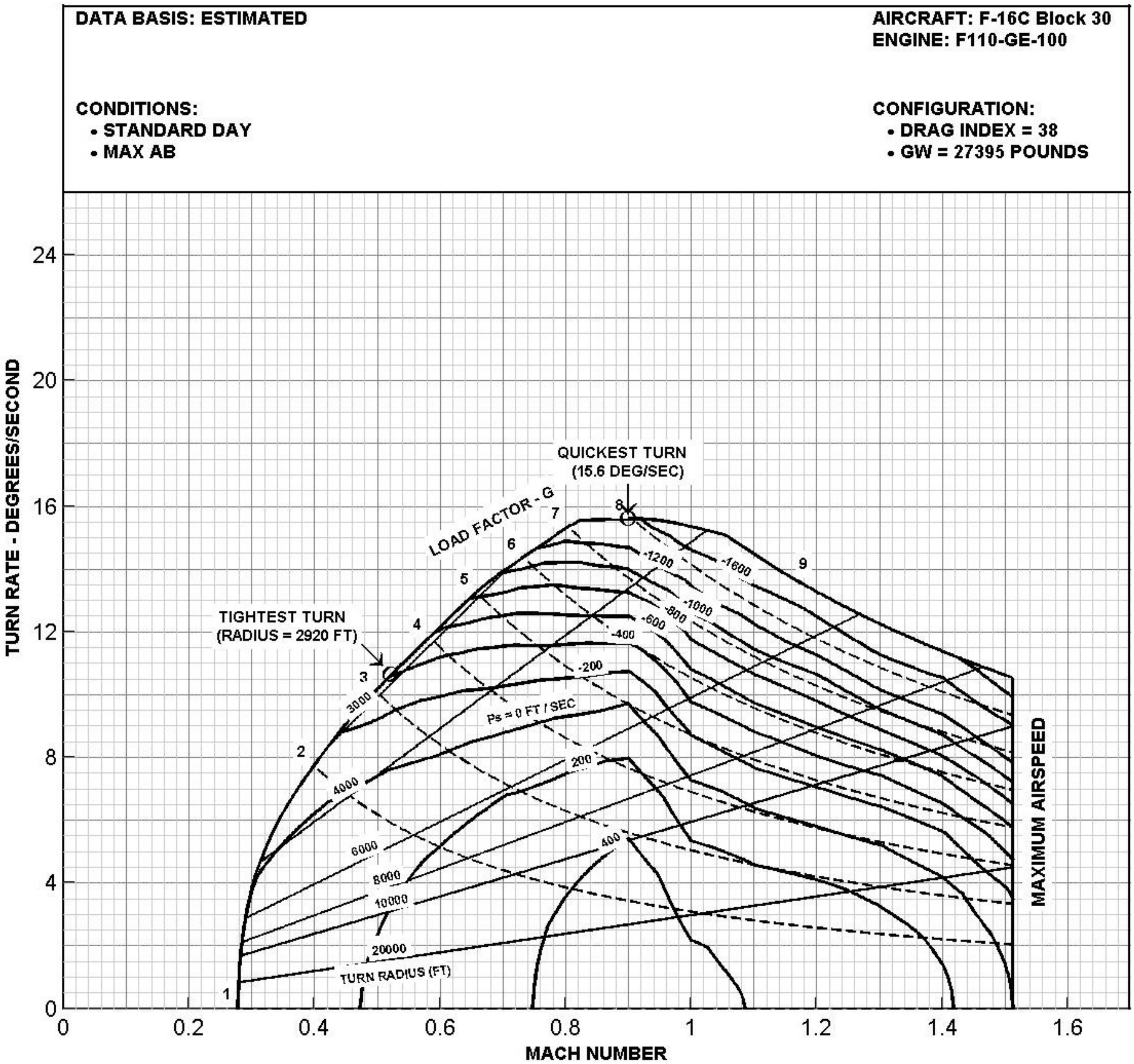
Turn Performance - 10000 Feet



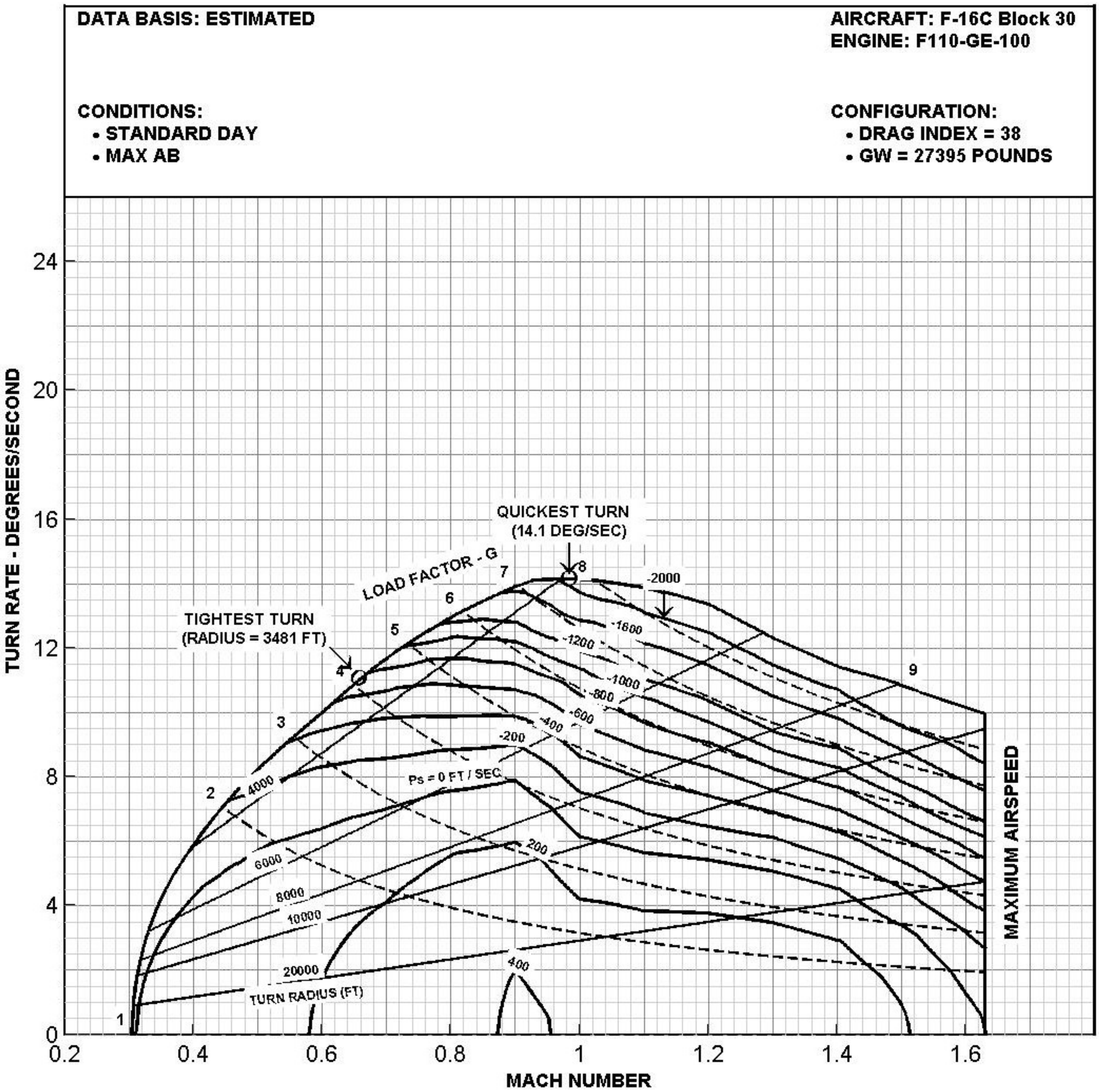
Turn Performance - 15000 Feet



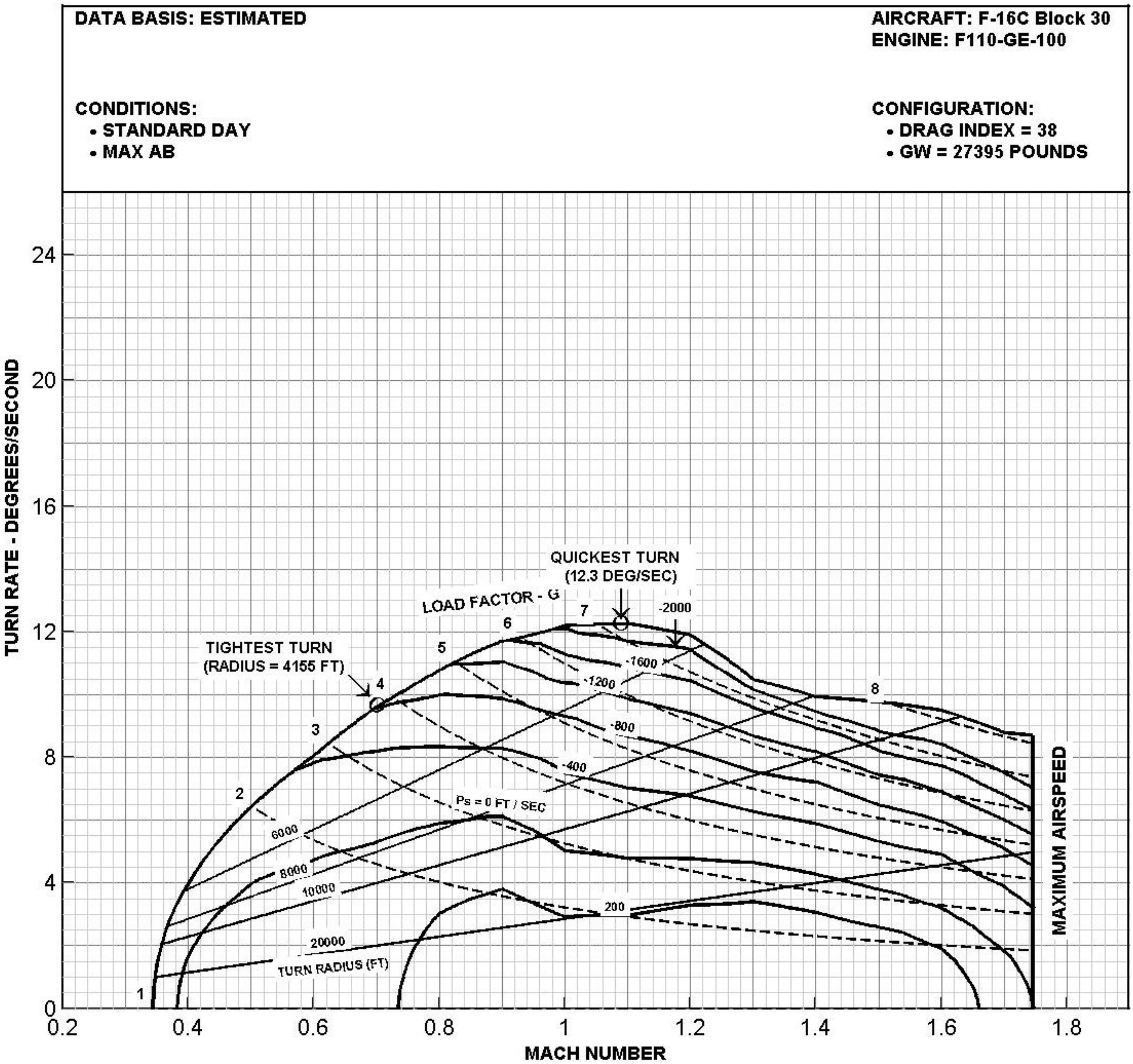
Turn Performance - 20000 Feet



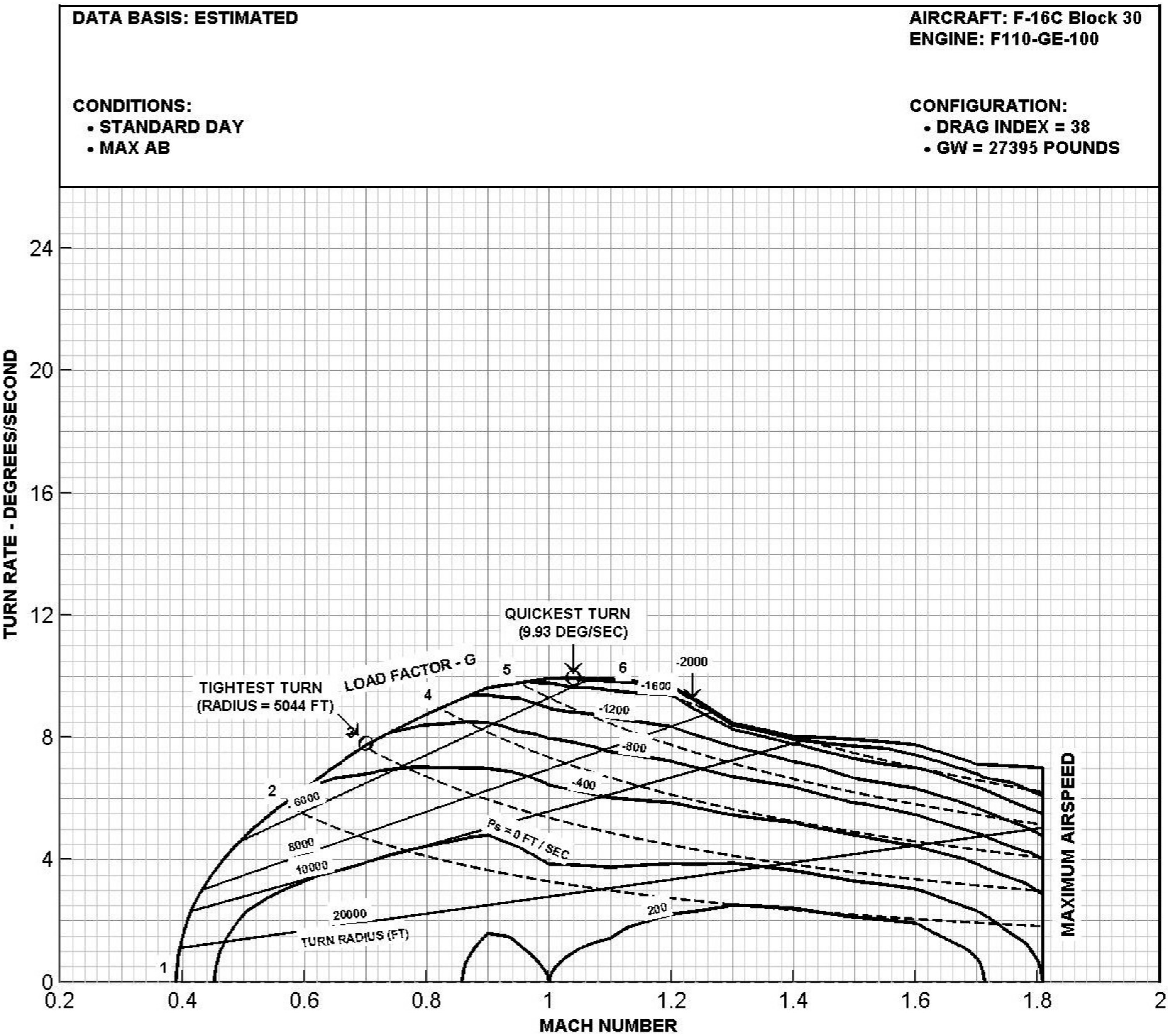
Turn Performance - 25000 Feet



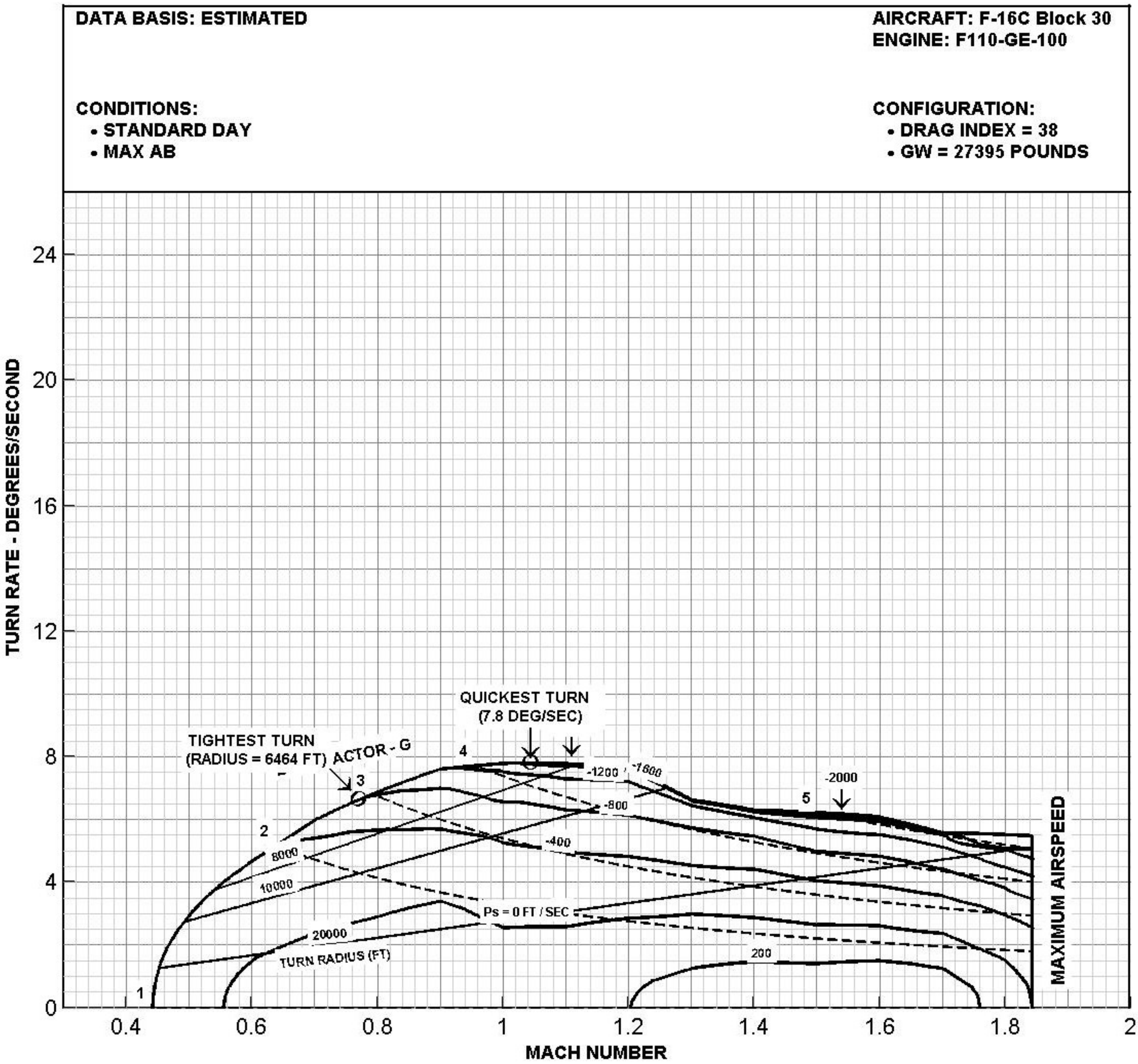
Turn Performance - 30000 Feet



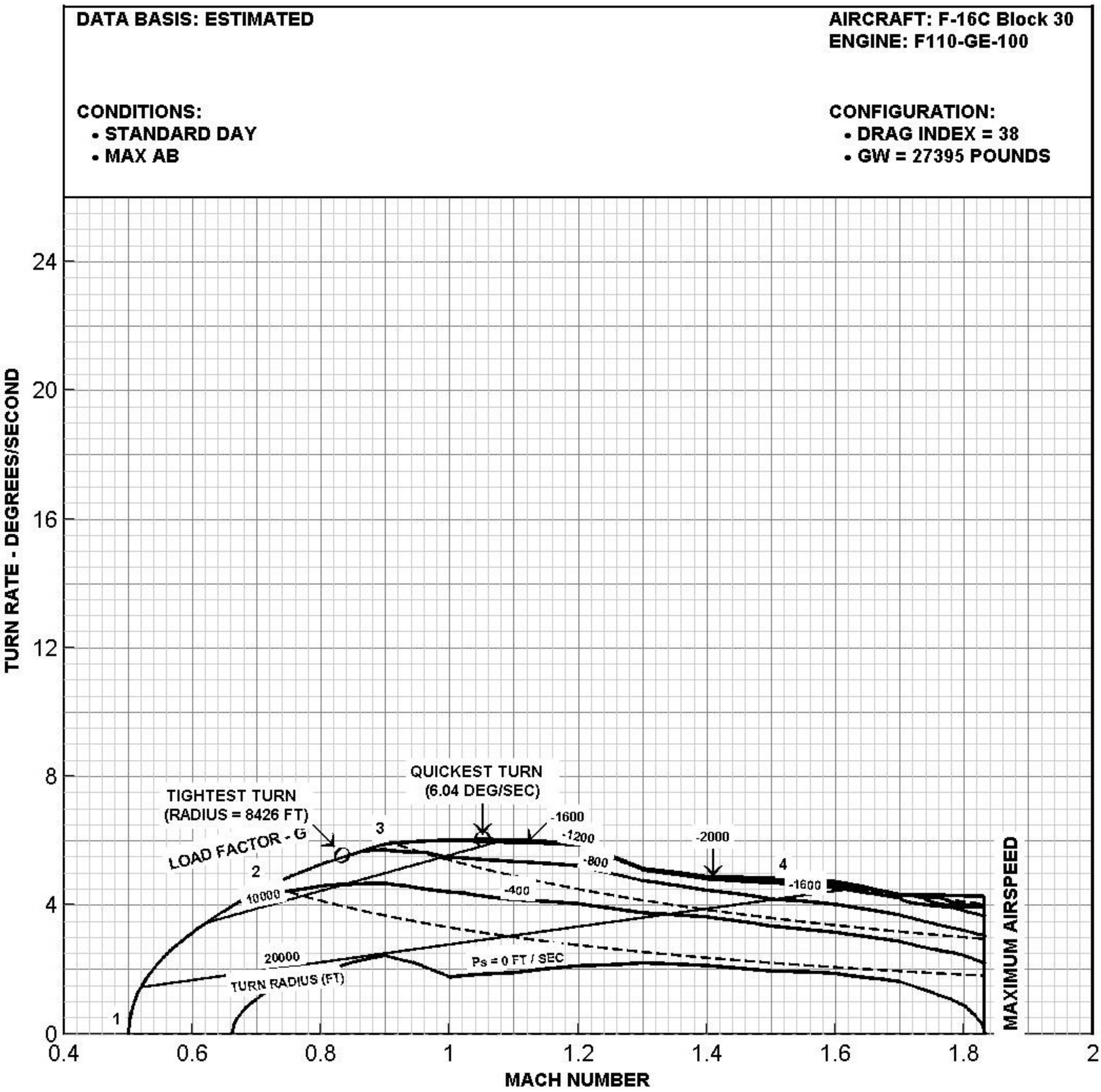
Turn Performance - 35000 Feet



Turn Performance - 40000 Feet



Turn Performance - 45000 Feet



4.3 F16 C– Block 32

4.3.1 Acceleration charts

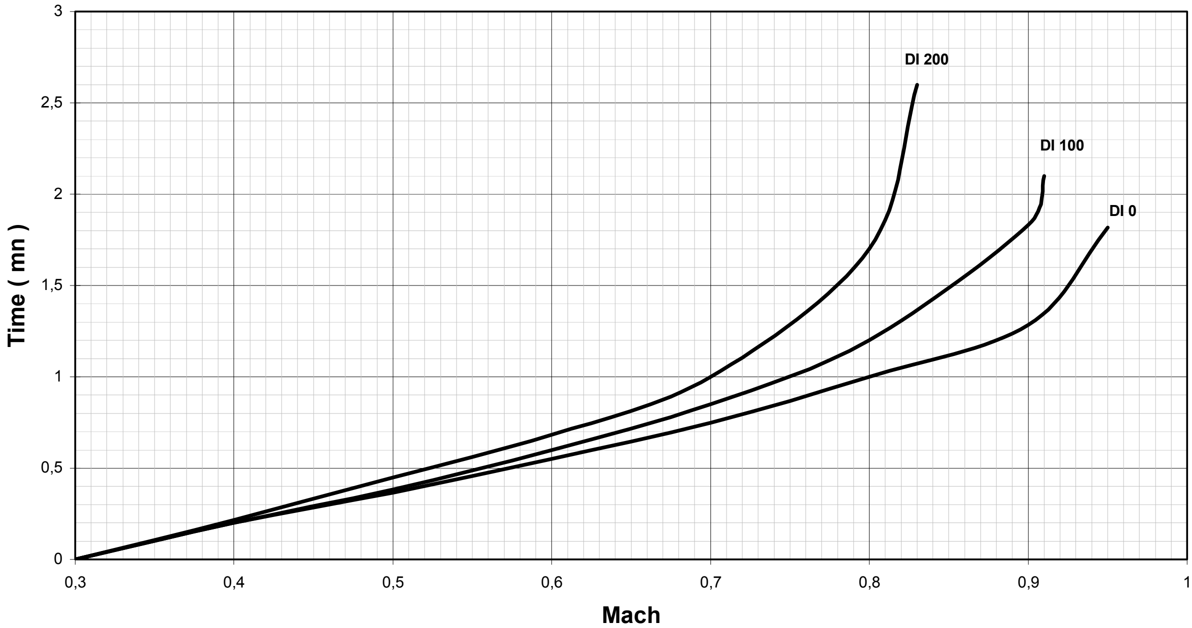
DATA BASIS : ESTIMATED

ACCELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONDITIONS :
- STANDARD DAY
- MIL POWER

CONFIGURATION
GW : 25,076 Lbs



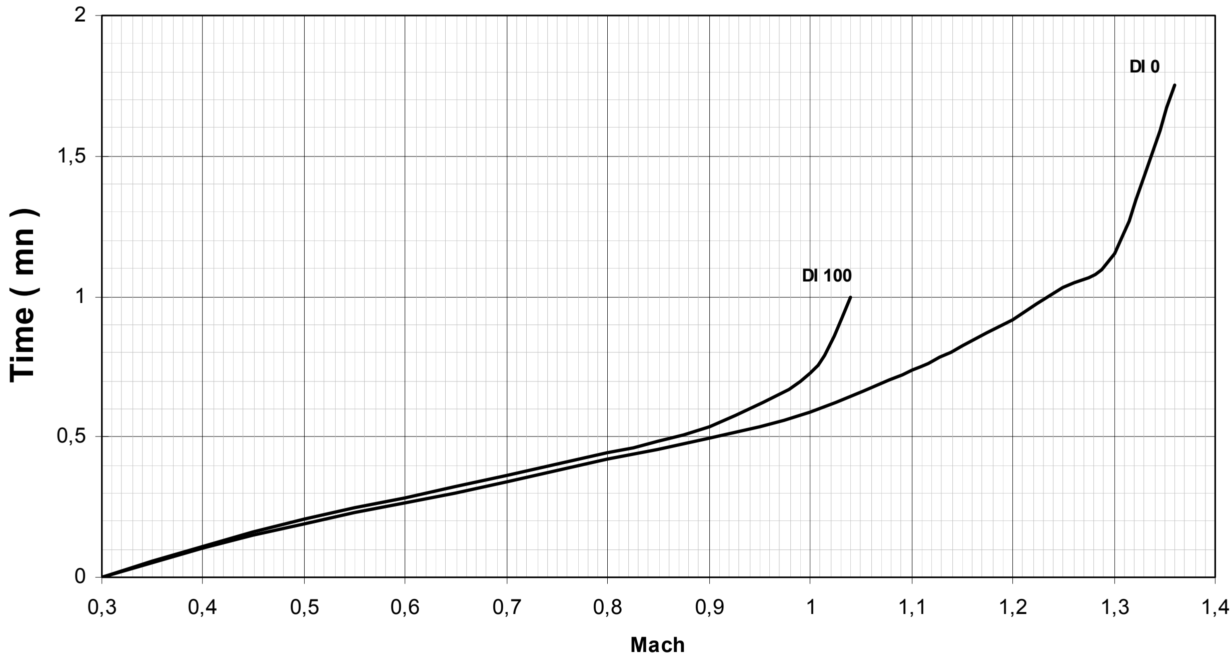
DATA BASIS : ESTIMATED

ACCELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONDITIONS :
- STANDARD DAY
- AB POWER

CONFIGURATION
GW : 25,076 Lbs



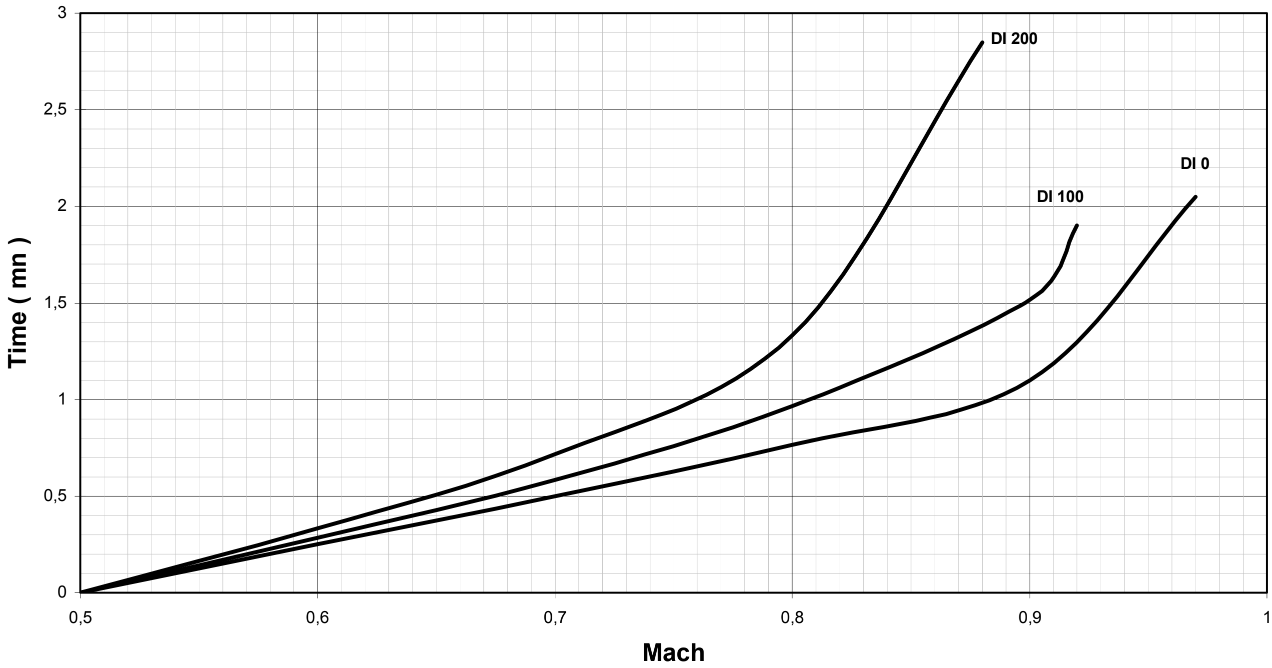
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 15000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 25,076 Lbs



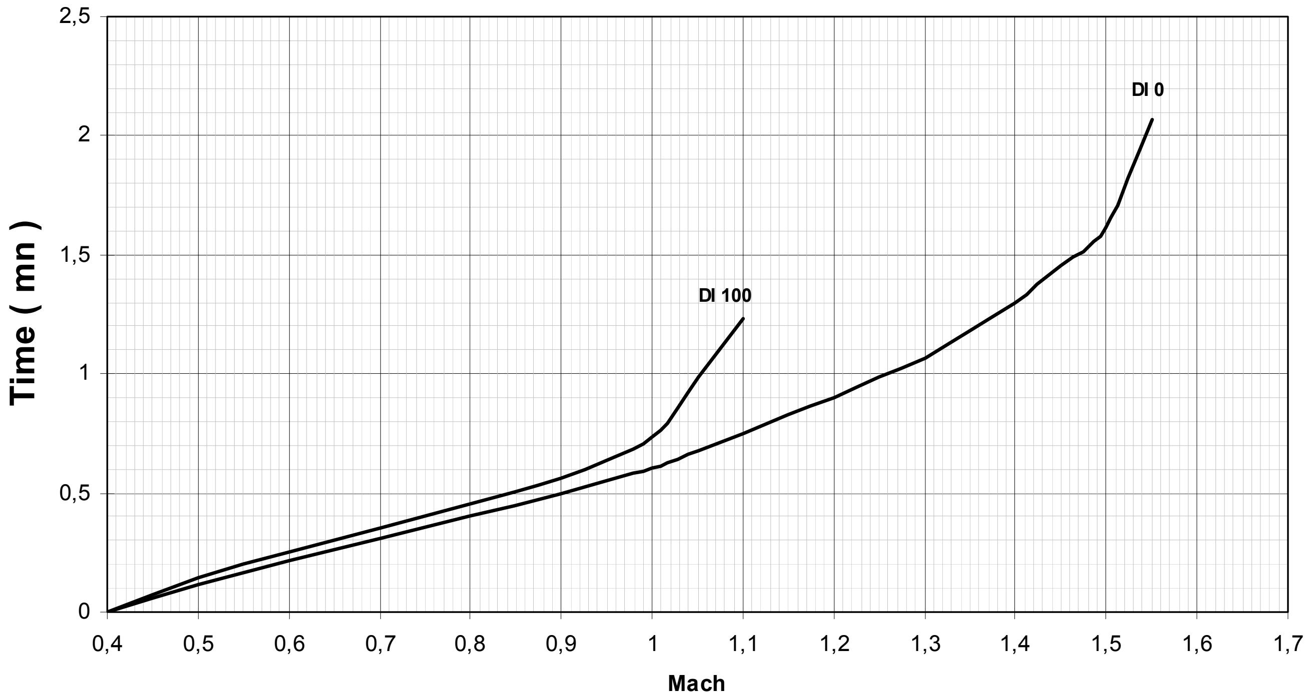
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 15000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 25,076 Lbs



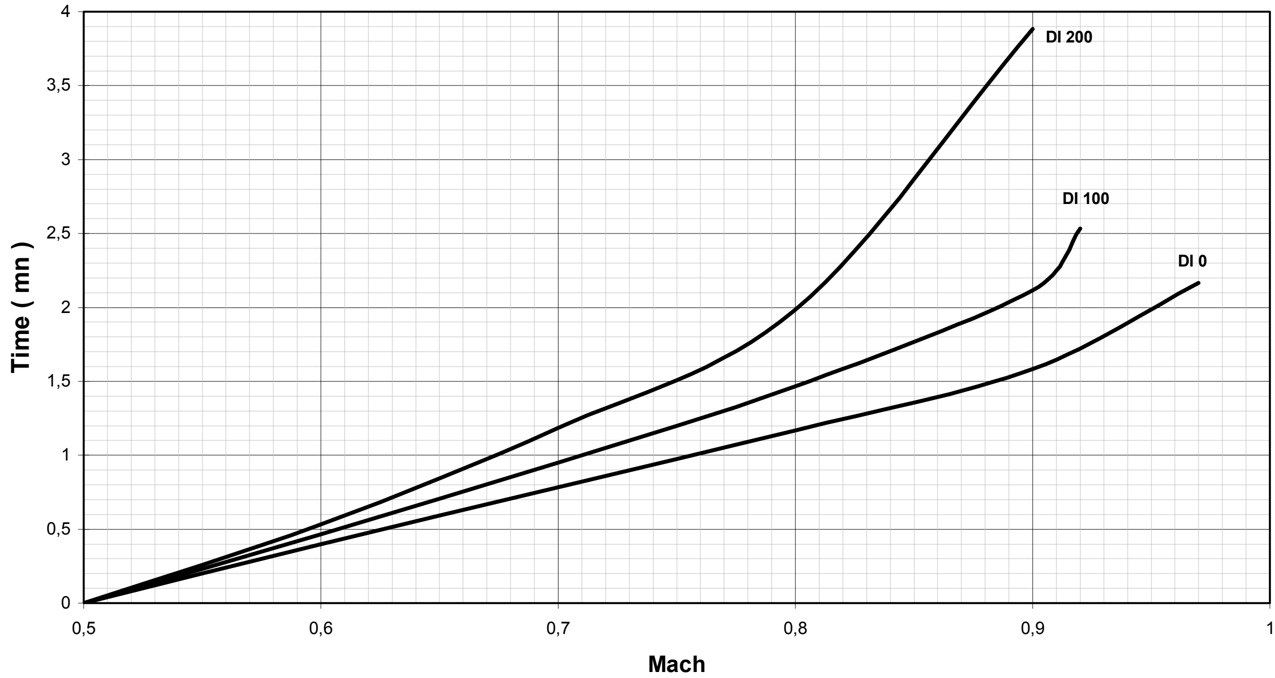
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 25,076 Lbs



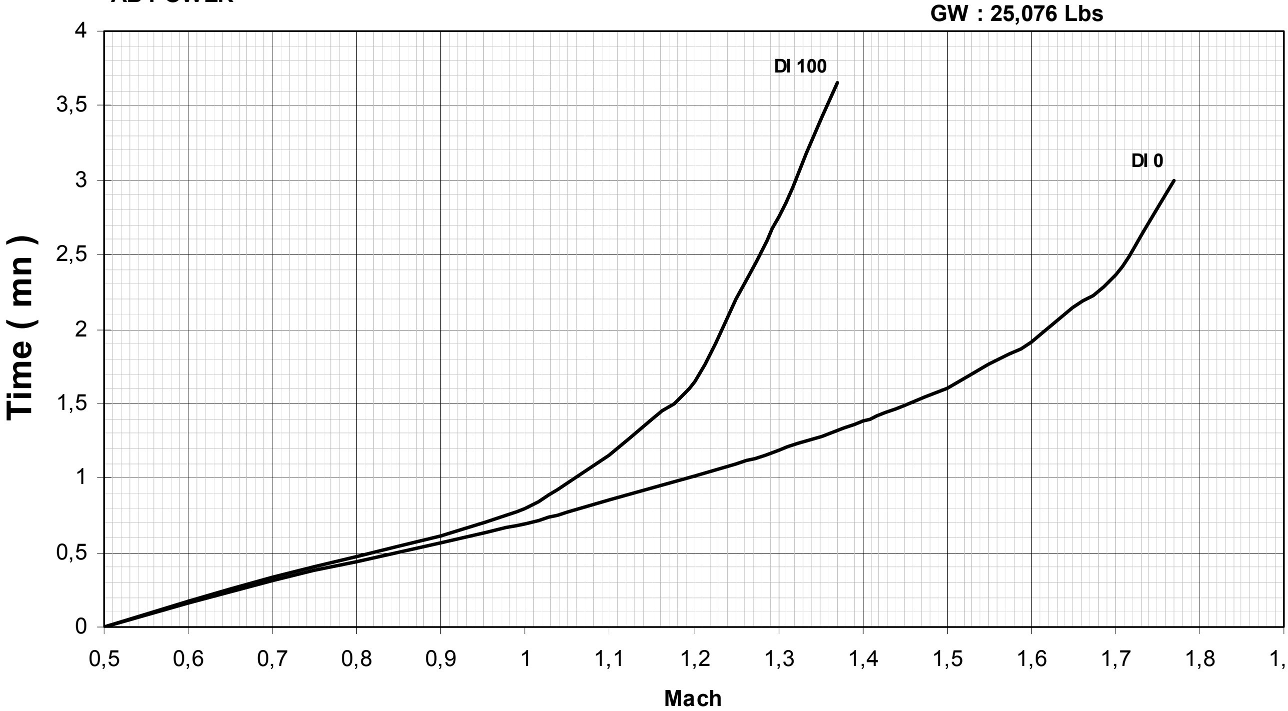
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 25,076 Lbs



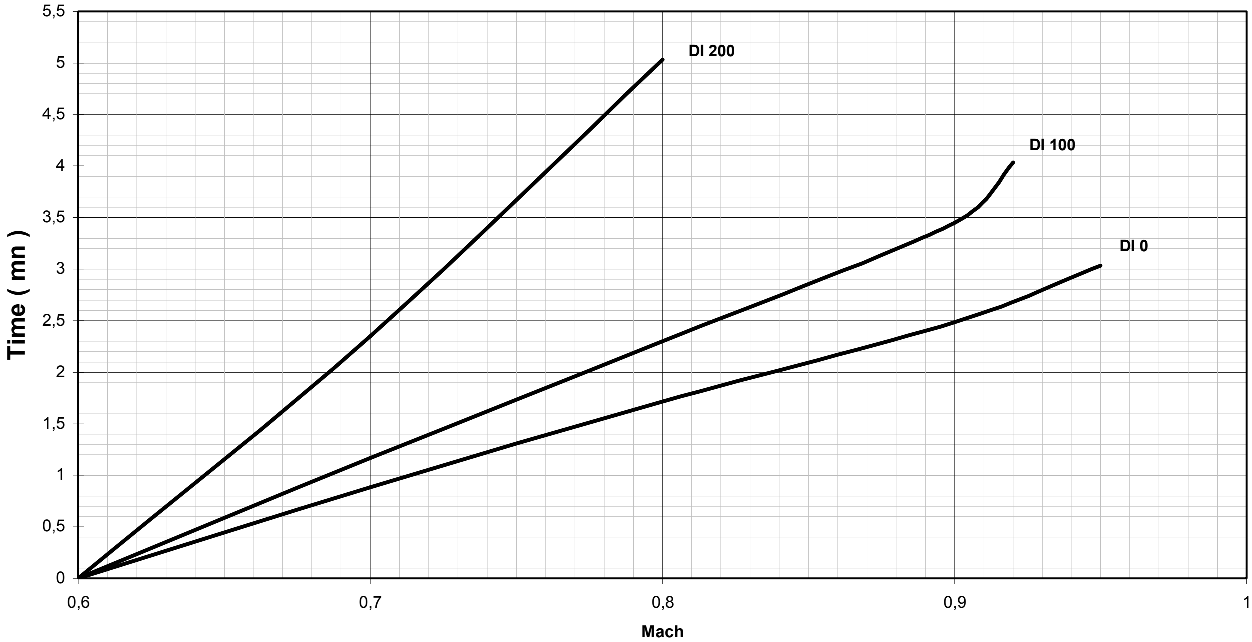
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 25,076 Lbs



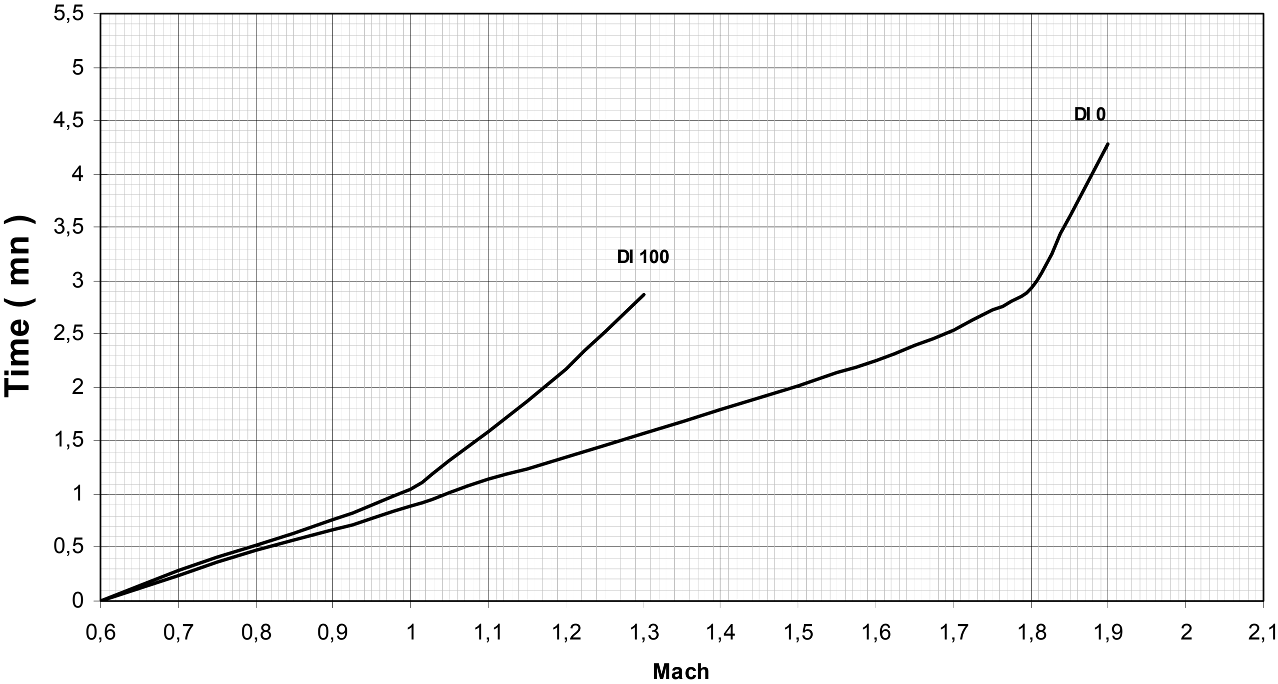
DATA BASIS : ESTIMATED

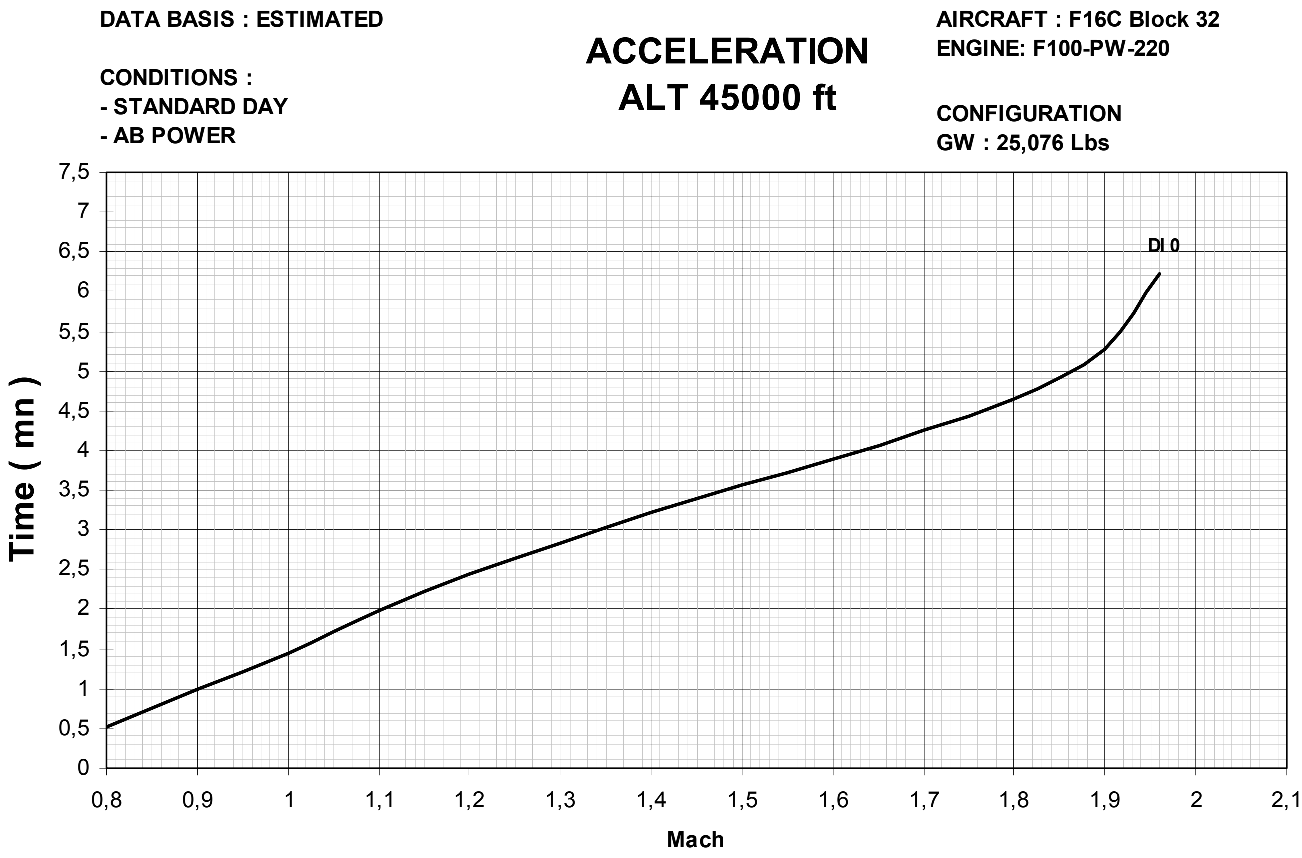
CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 25,076 Lbs




DATA BASIS : ESTIMATED
CONDITIONS :
- STANDARD DAY
- AB POWER
ACCELERATION
ALT 45000 ft
AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220
CONFIGURATION
GW : 25,076 Lbs
DI 0
Time (mn)
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5
5
5,5
6
6,5
7
7,5
0,8
0,9
1
1,1
1,2
1,3
1,4
1,5
1,6
1,7
1,8
1,9
2
2,1
Mach

4.3.2 Deceleration charts

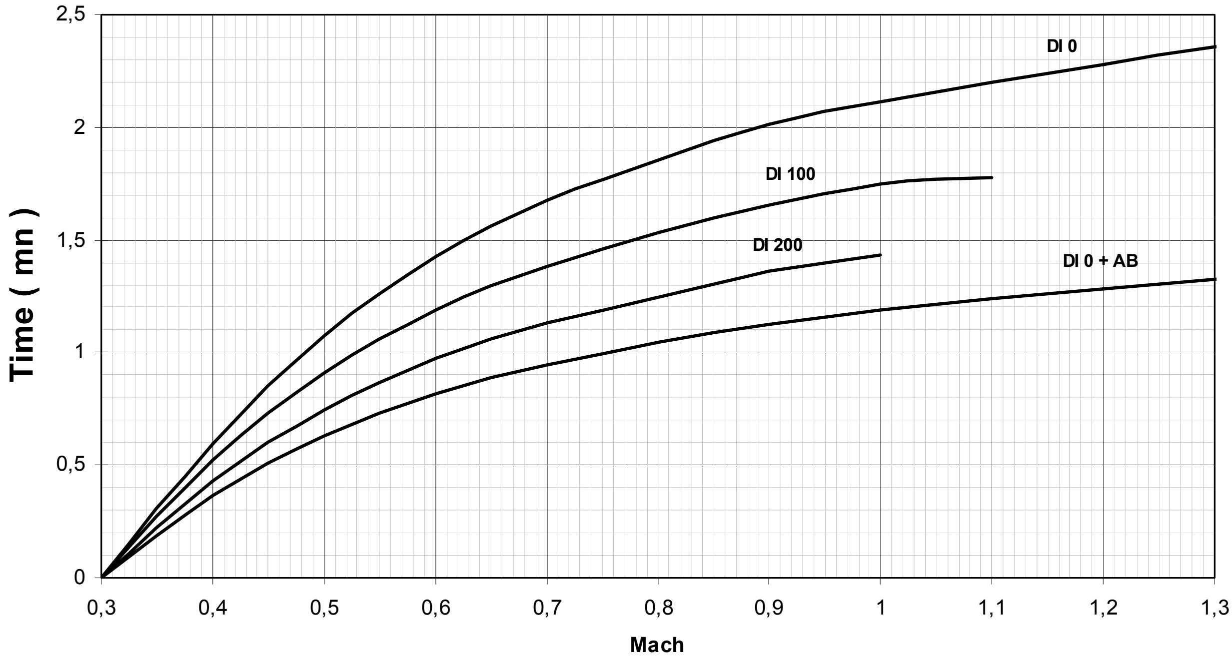
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 23,976 Lbs



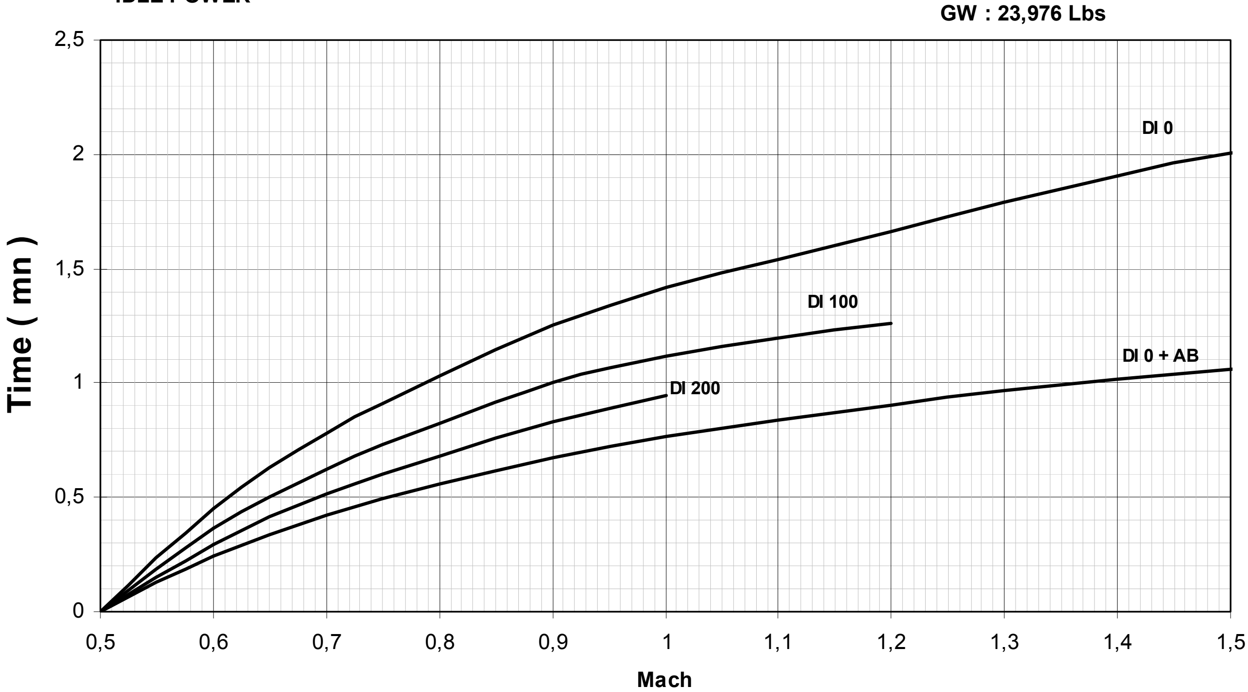
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 15000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 23,976 Lbs



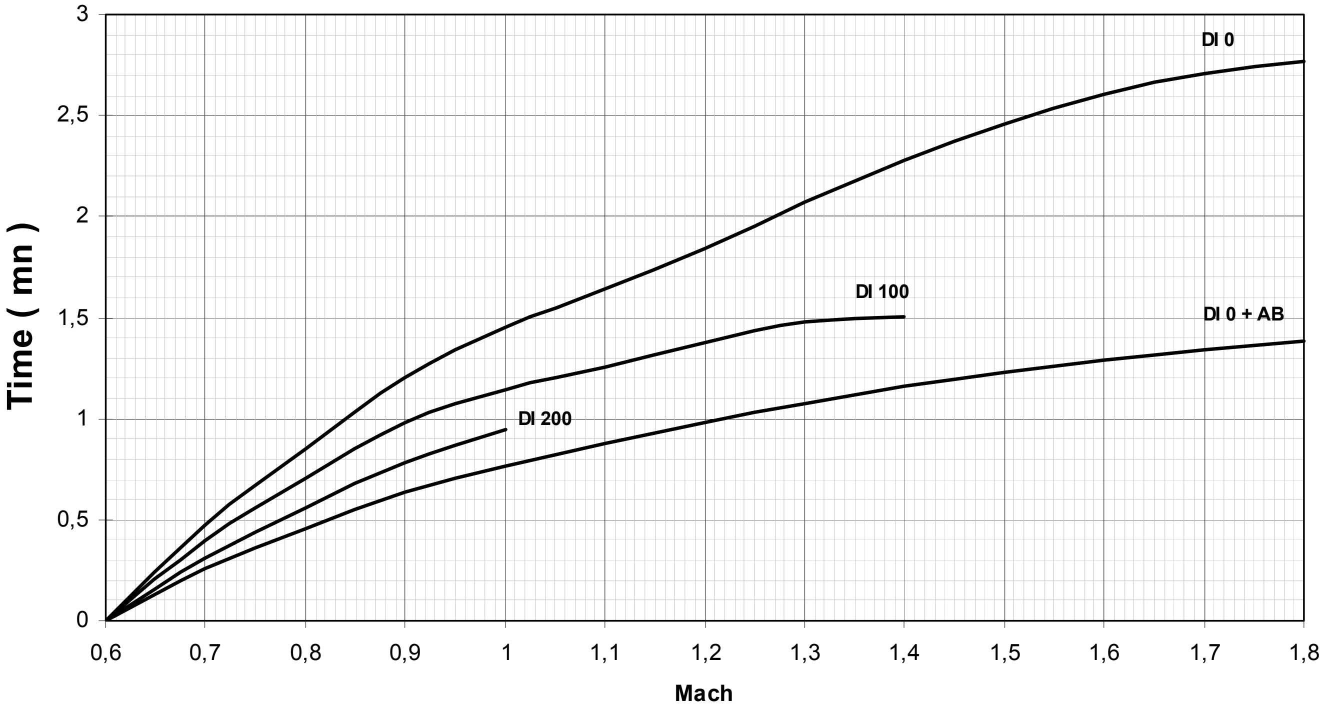
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 23,976 Lbs



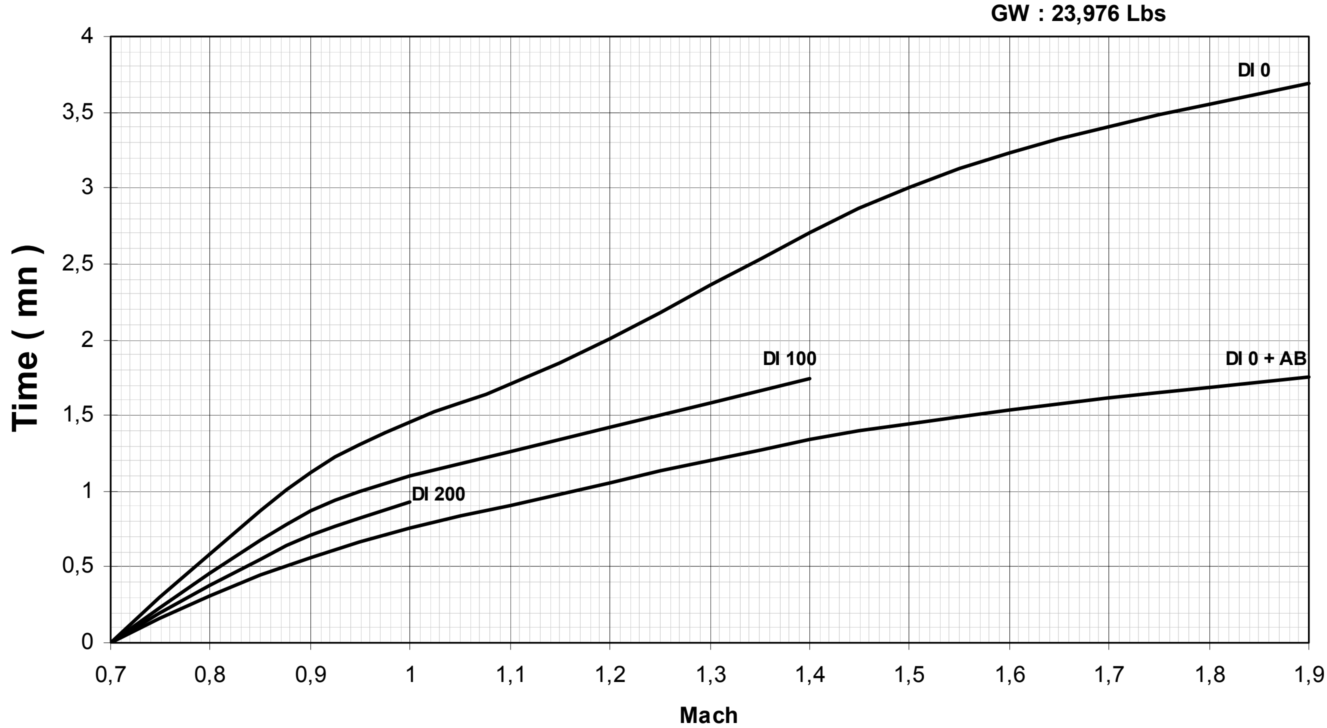
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

CONFIGURATION
GW : 23,976 Lbs



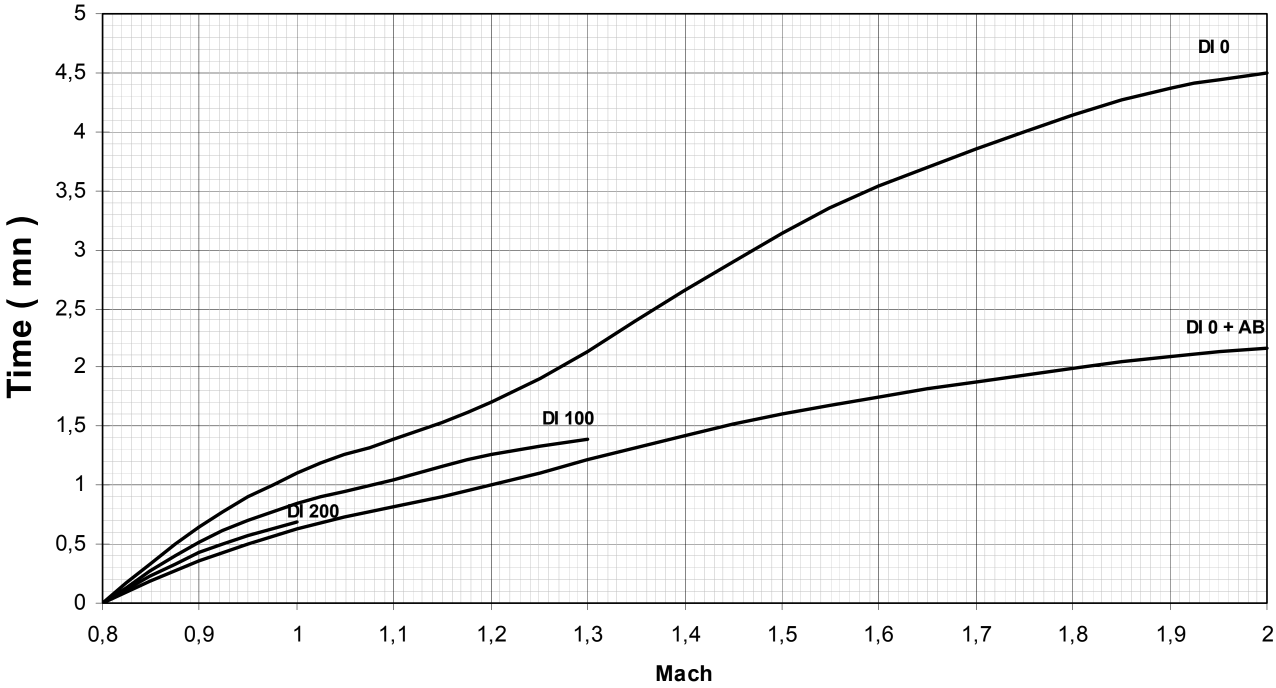
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 45000 ft

AIRCRAFT : F16C Block 32
ENGINE: F100-PW-220

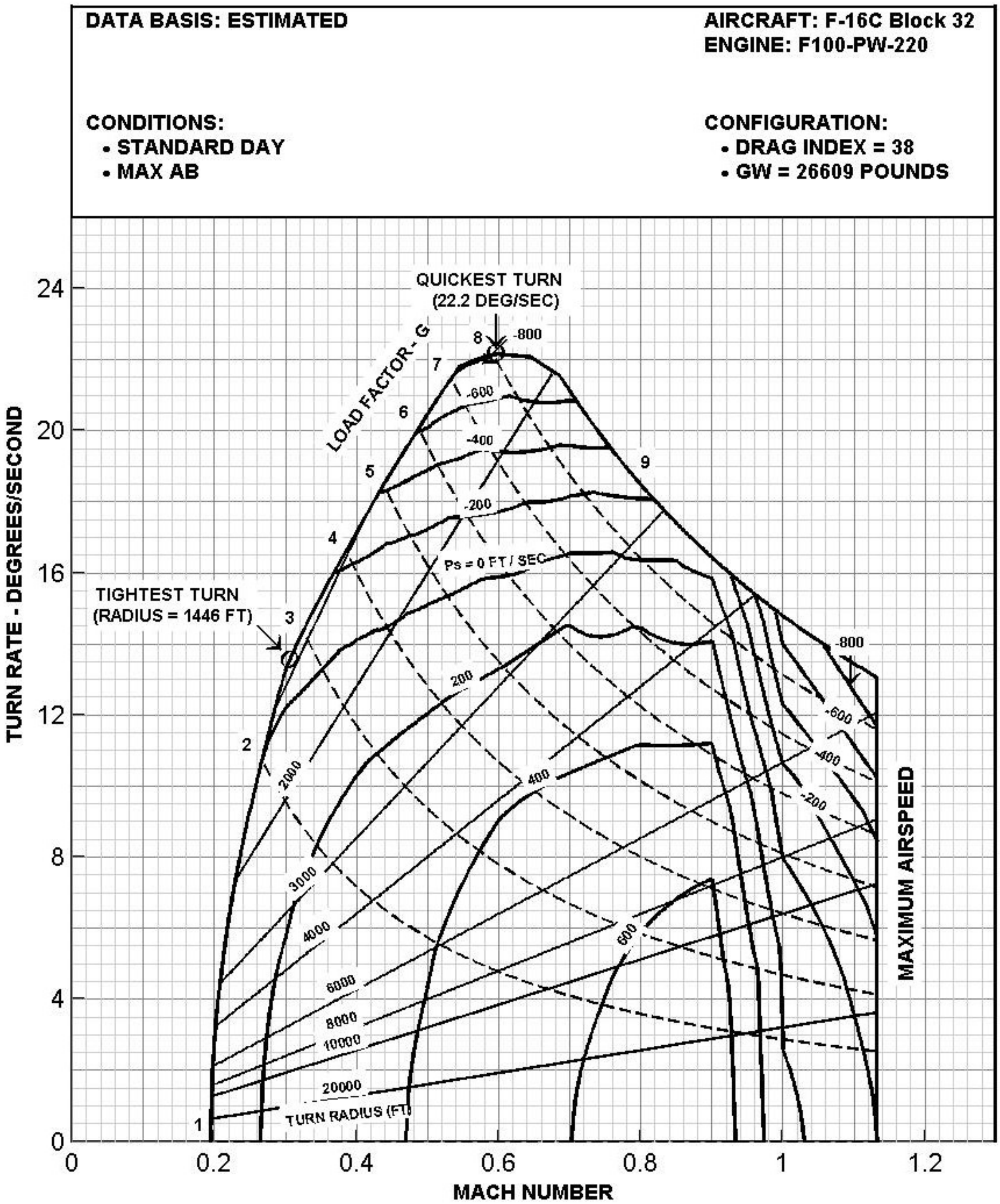
CONFIGURATION
GW : 23,976 Lbs



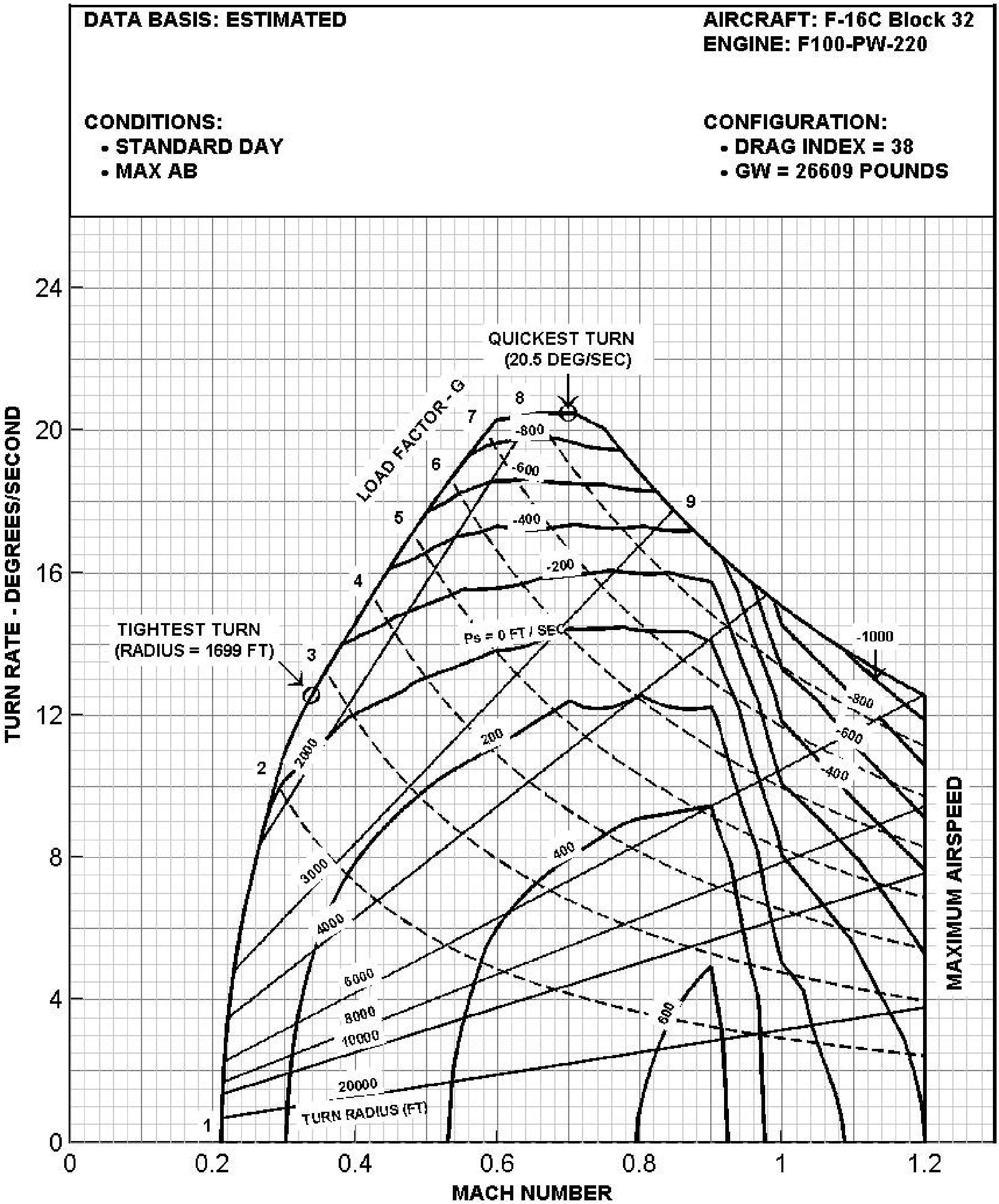
4.3.3 EM charts

EM charts have been drawn in combat configuration: FUEL 100 % + 2 AIM9M + 2 AIM120 + ALQ131

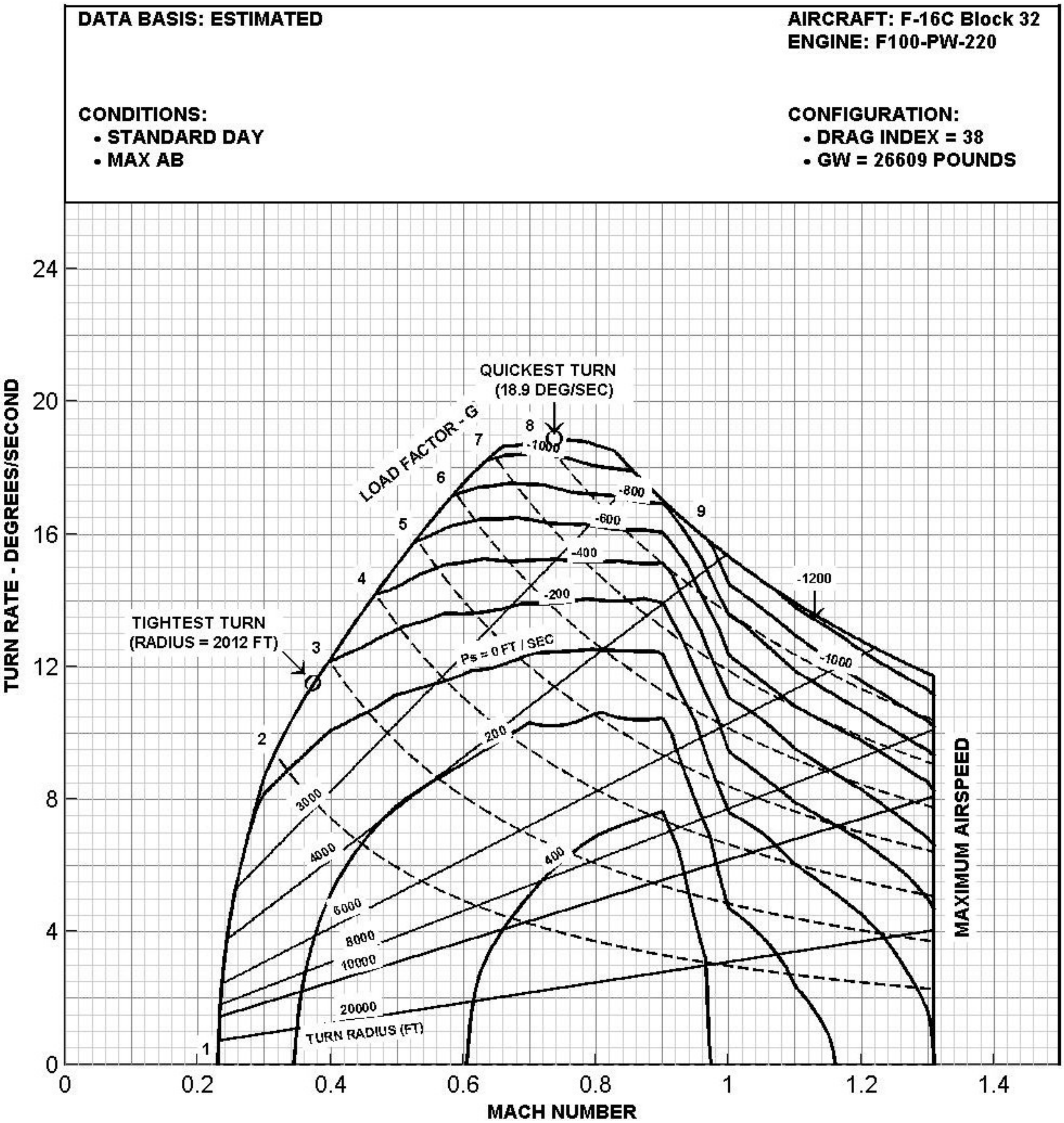
Turn Performance - Sea Level



Turn Performance - 5000 Feet



Turn Performance - 10000 Feet



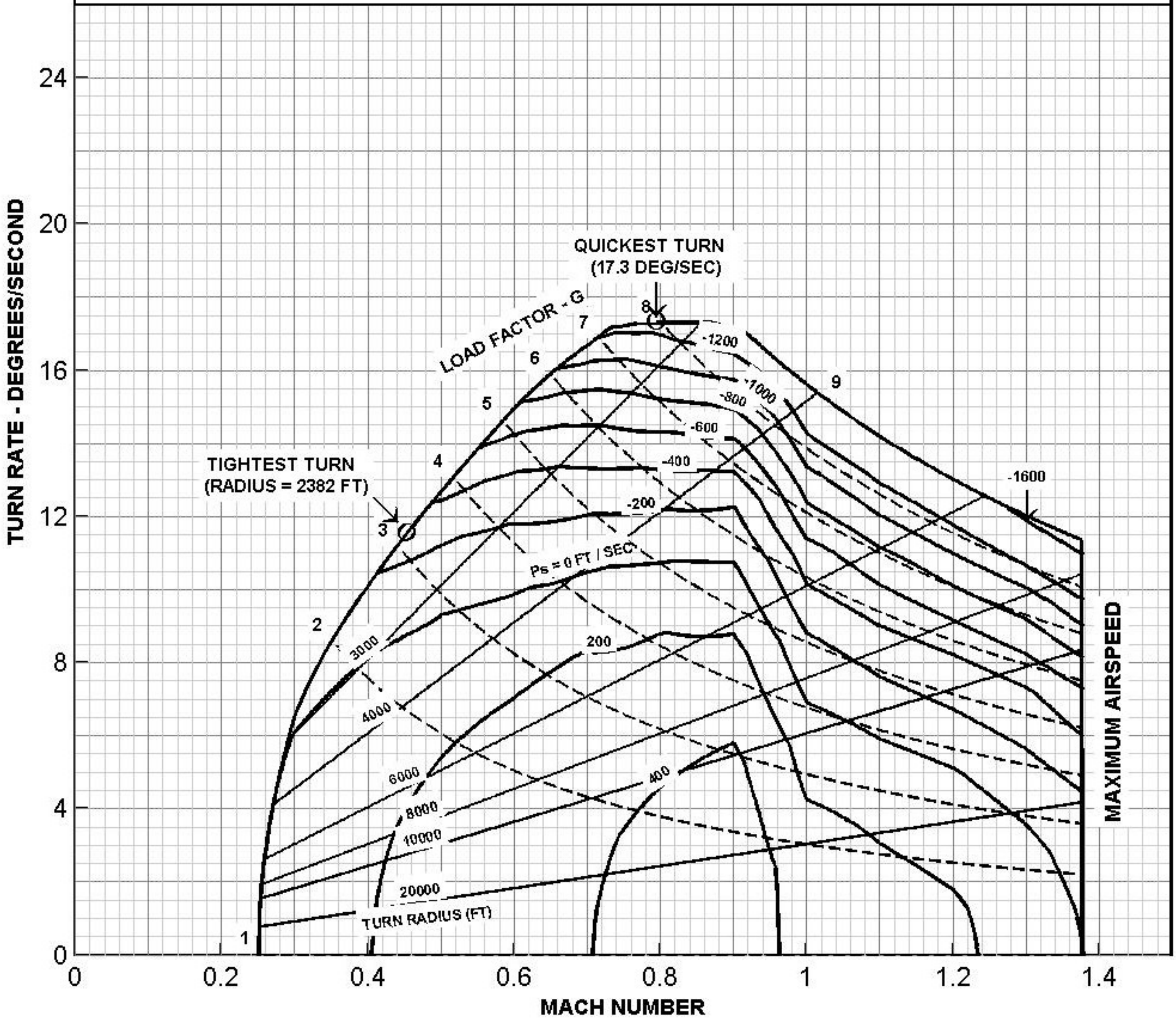
Turn Performance - 15000 Feet

DATA BASIS: ESTIMATED

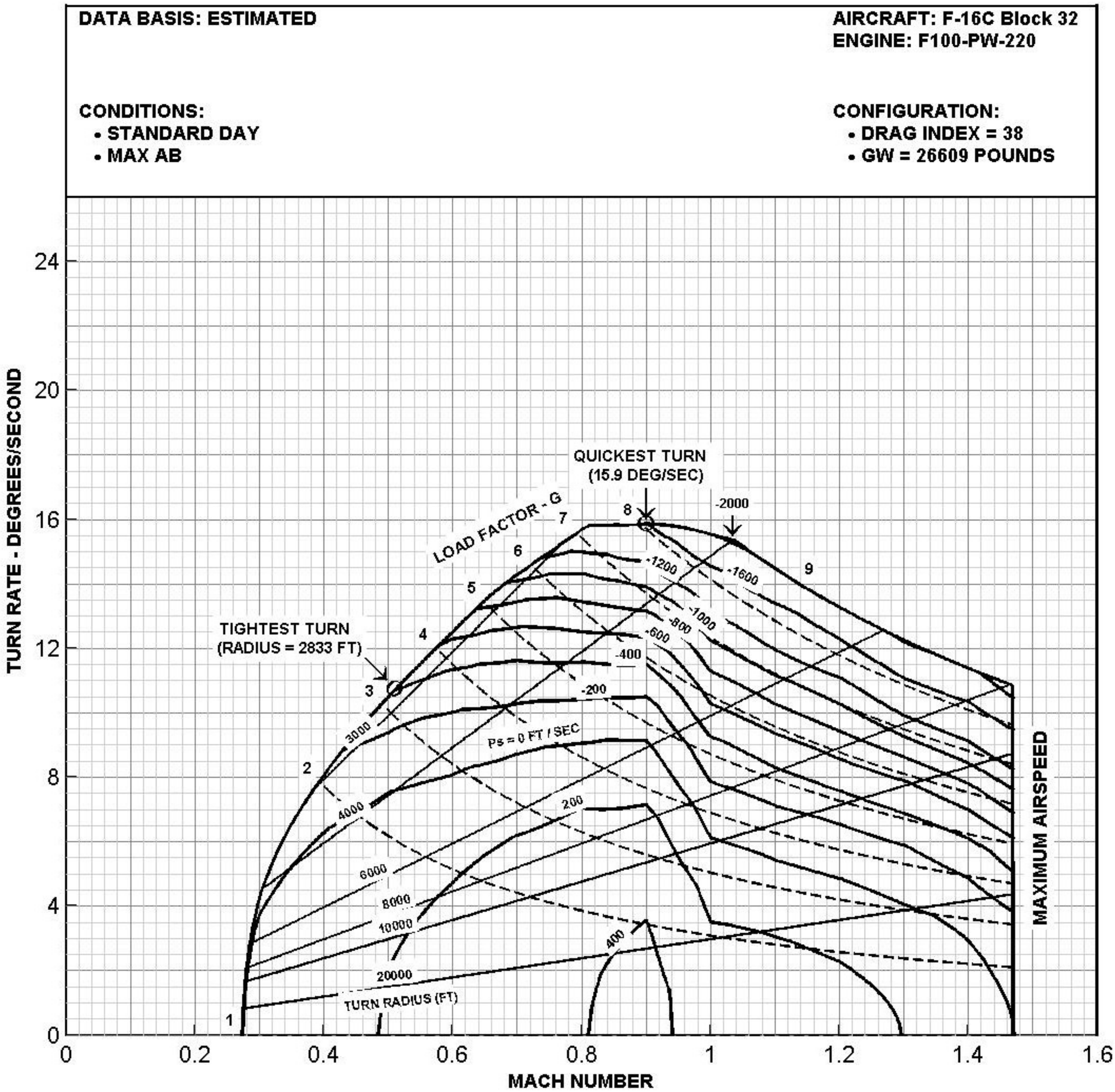
AIRCRAFT: F-16C Block 32
ENGINE: F100-PW-220

CONDITIONS:
- **STANDARD DAY**
- **MAX AB**

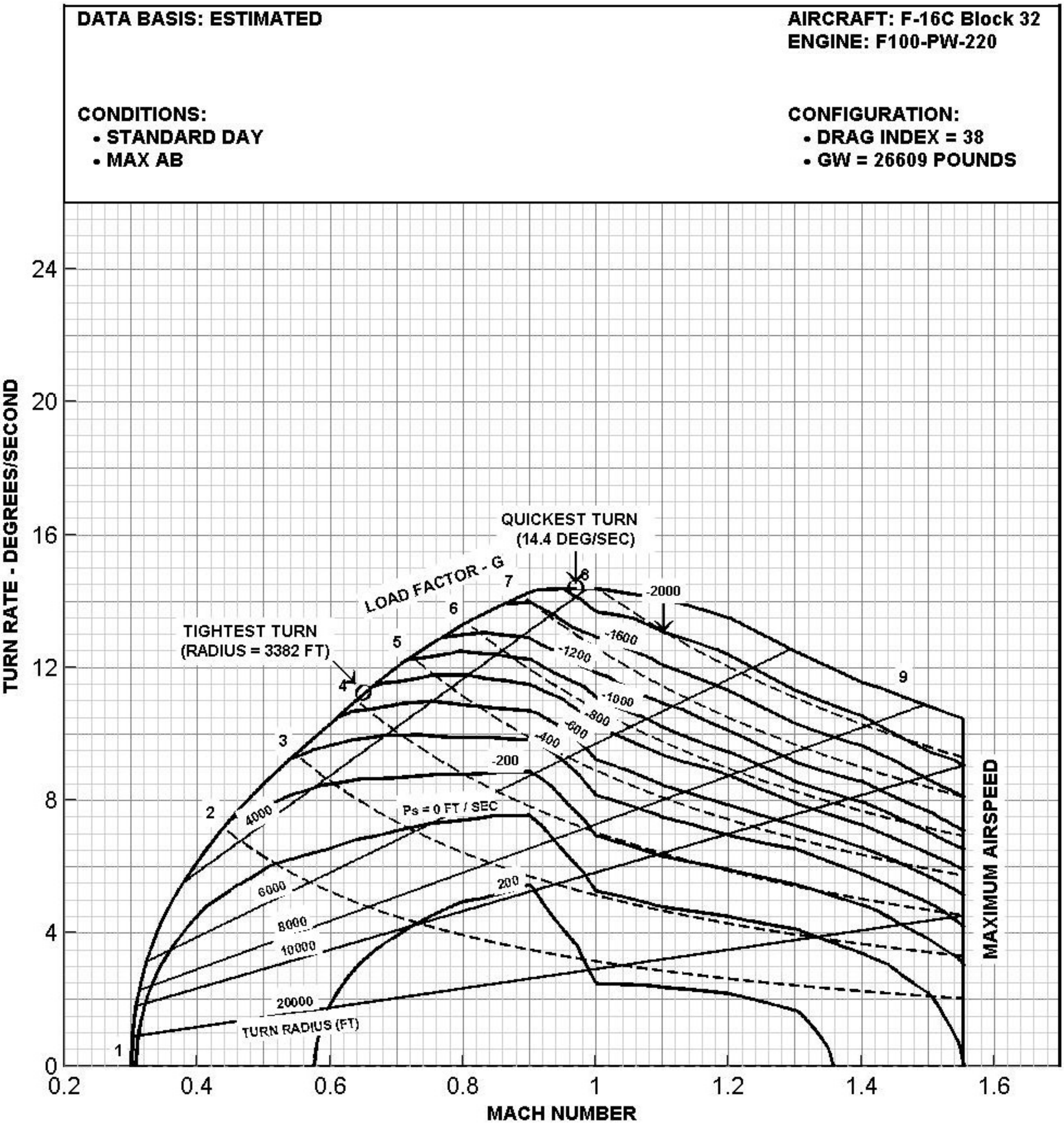
CONFIGURATION:
- **DRAG INDEX = 38**
- **GW = 26609 POUNDS**



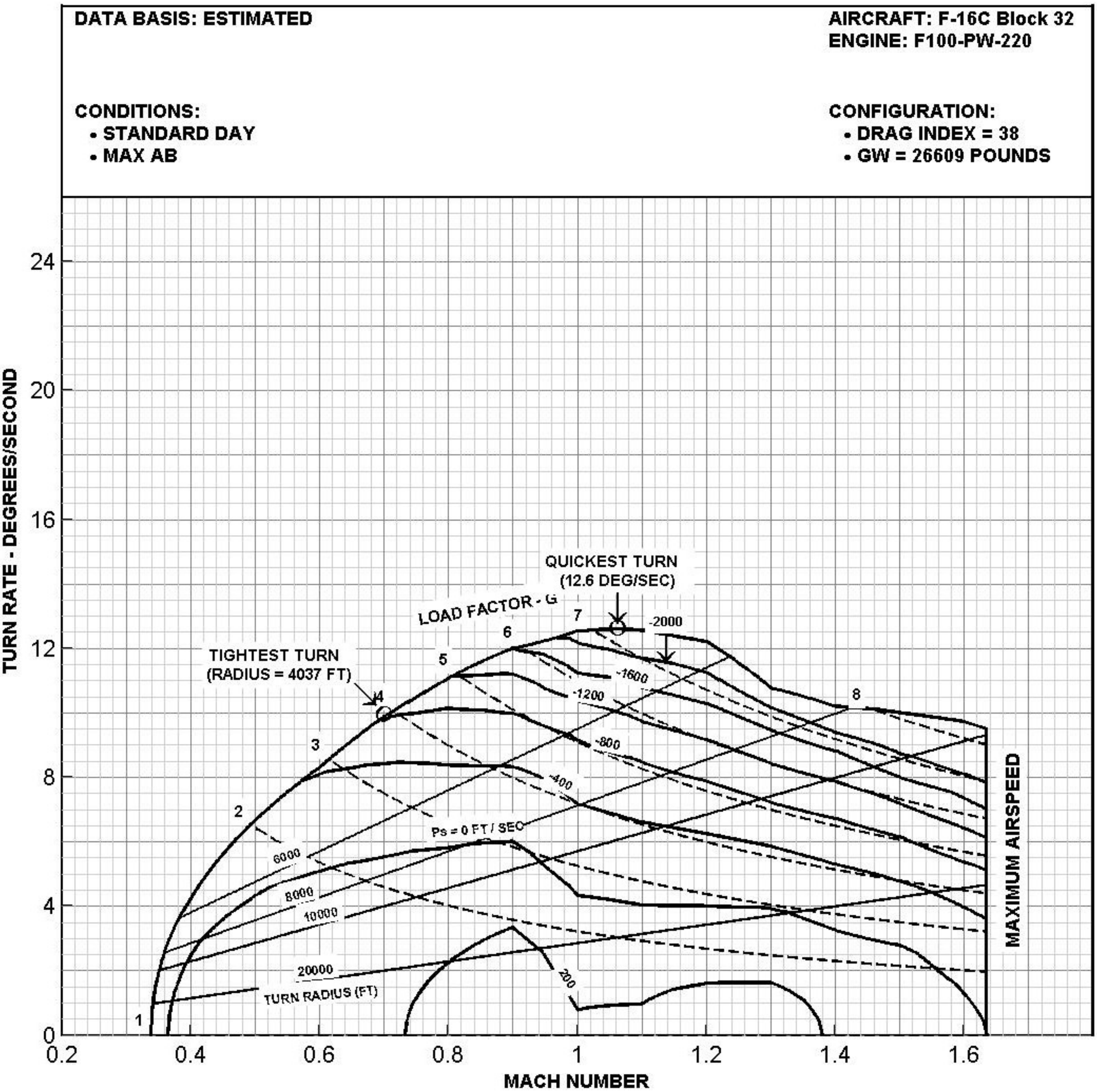
Turn Performance - 20000 Feet



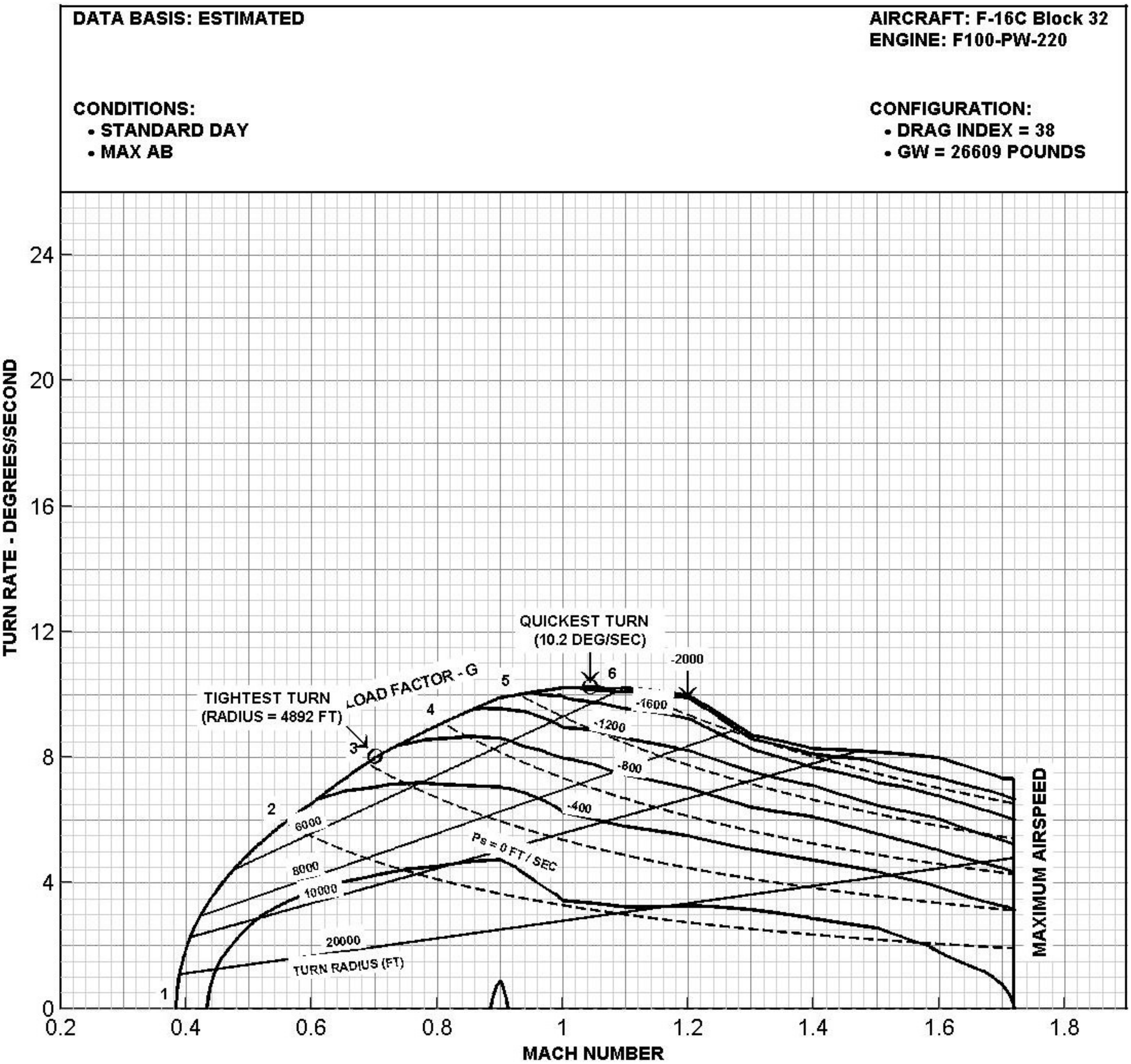
Turn Performance - 25000 Feet

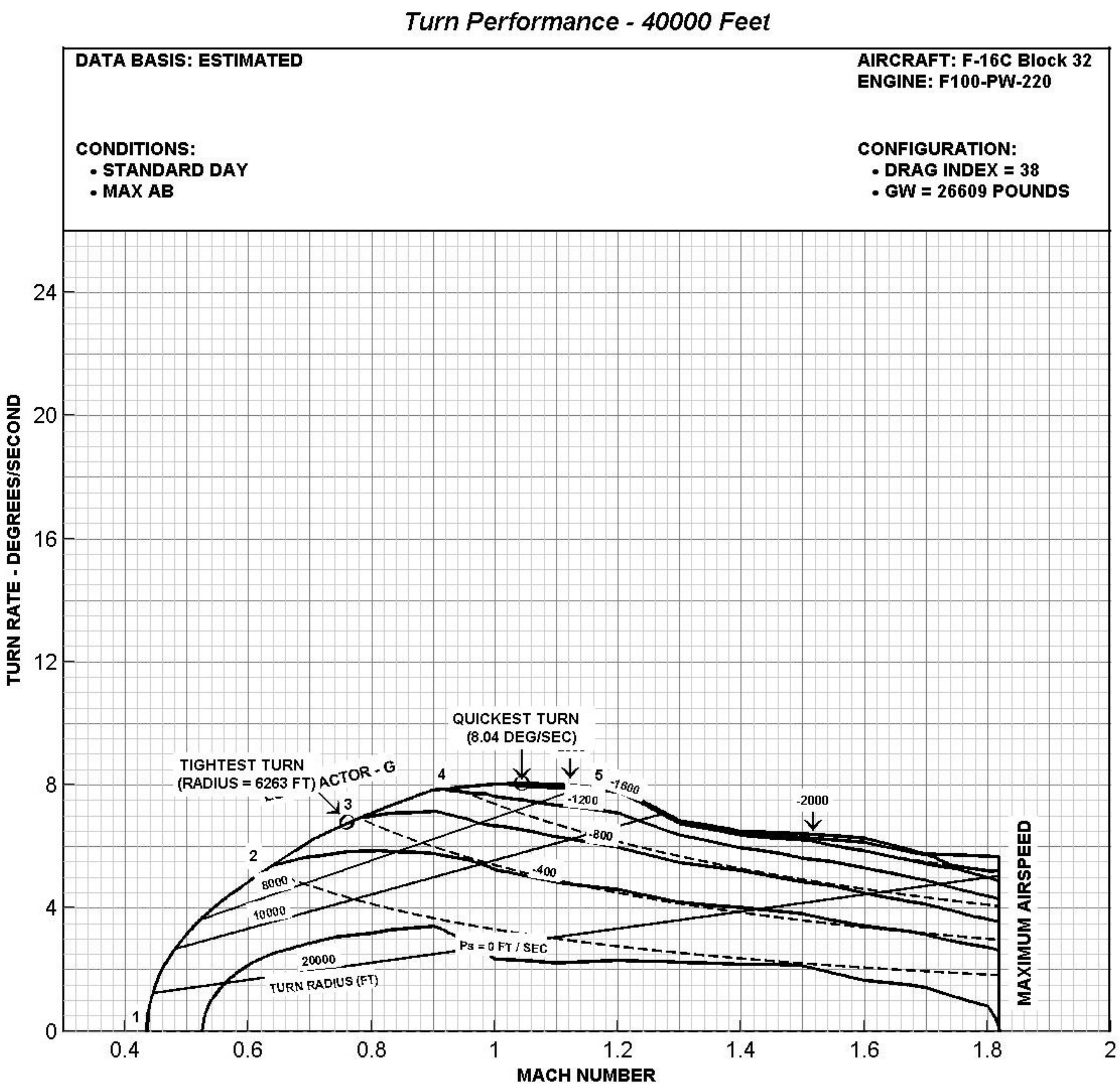


Turn Performance - 30000 Feet

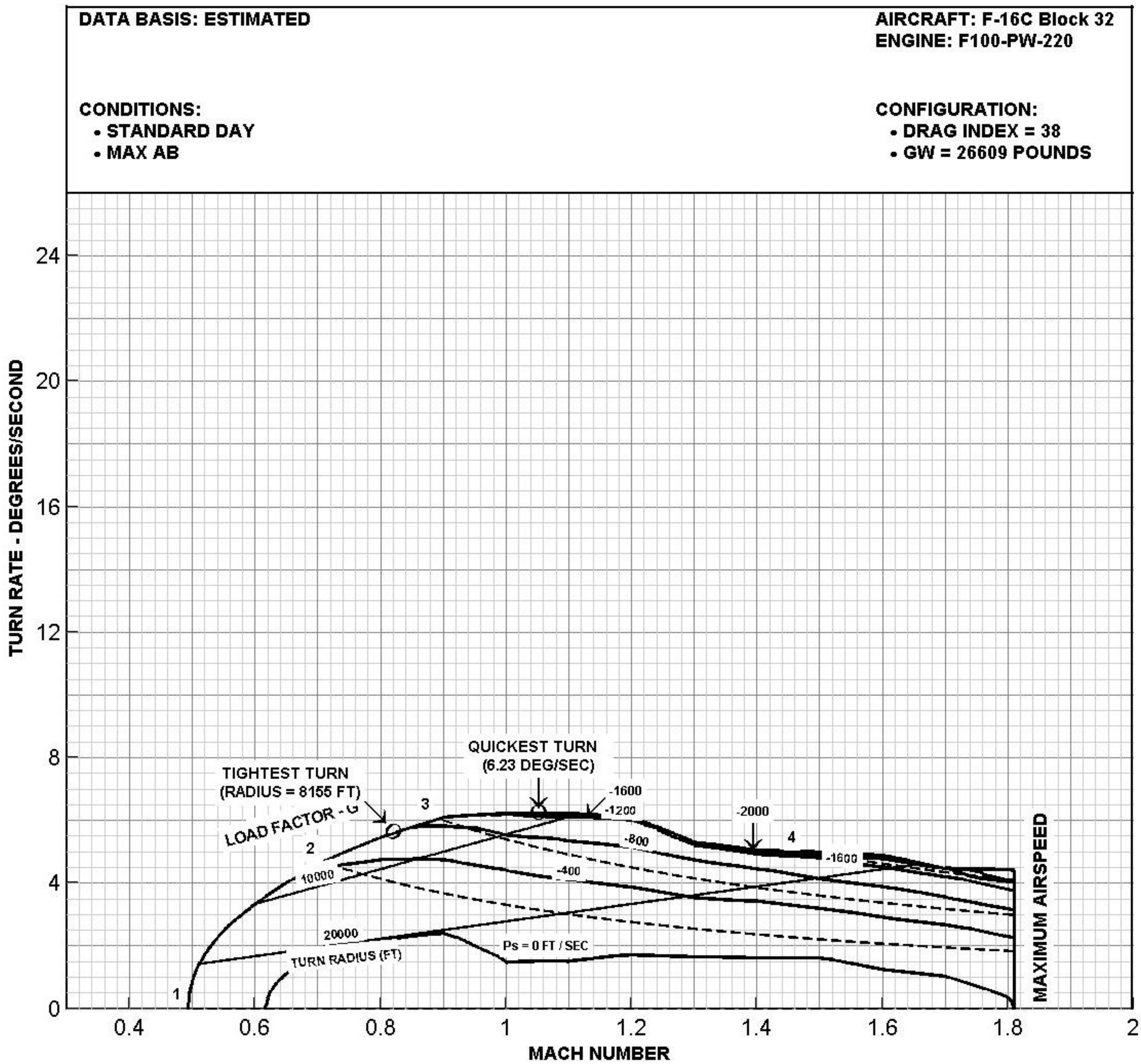


Turn Performance - 35000 Feet




Turn Performance - 40000 Feet
DATA BASIS: ESTIMATED
AIRCRAFT: F-16C Block 32
ENGINE: F100-PW-220
CONDITIONS:
• STANDARD DAY
• MAX AB
CONFIGURATION:
• DRAG INDEX = 38
• GW = 26609 POUNDS
TURN RATE - DEGREES/SECOND
MACH NUMBER
QUICKEST TURN
(8.04 DEG/SEC)
TIGHTEST TURN
(RADIUS = 6263 FT)
ACTOR - G
-1600
-1200
-800
-400
-2000
Ps = 0 FT / SEC
8000
10000
20000
TURN RADIUS (FT)
MAXIMUM AIRSPEED
0
4
8
12
16
20
24
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

Turn Performance - 45000 Feet



4.4 F16 C– Block 50

4.4.1 Acceleration charts

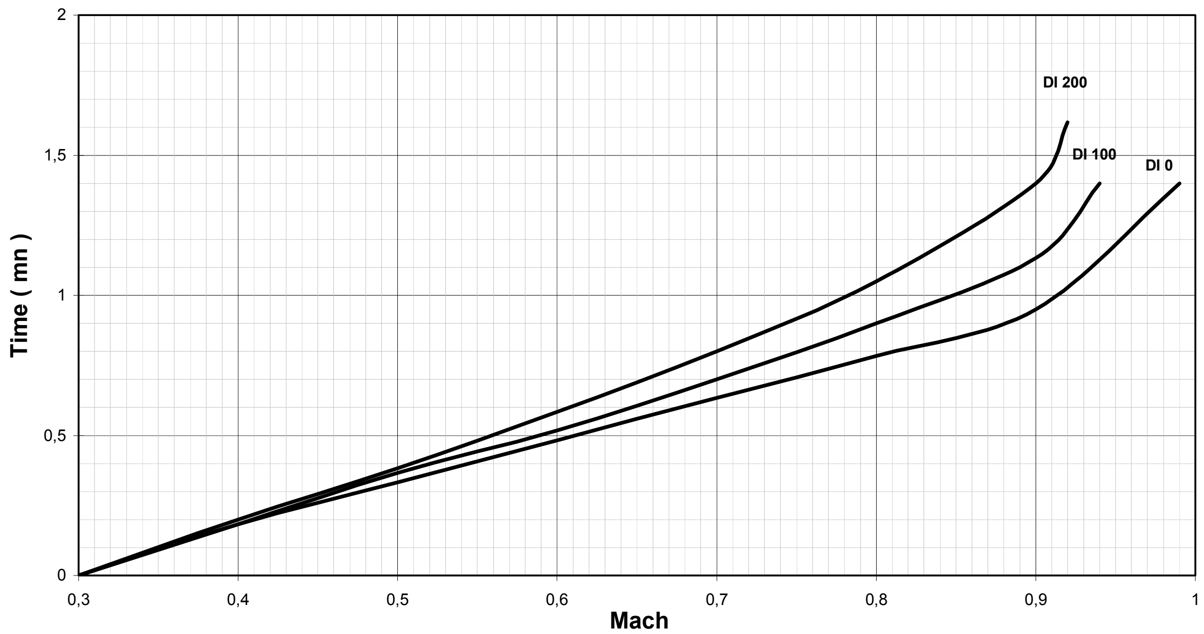
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs



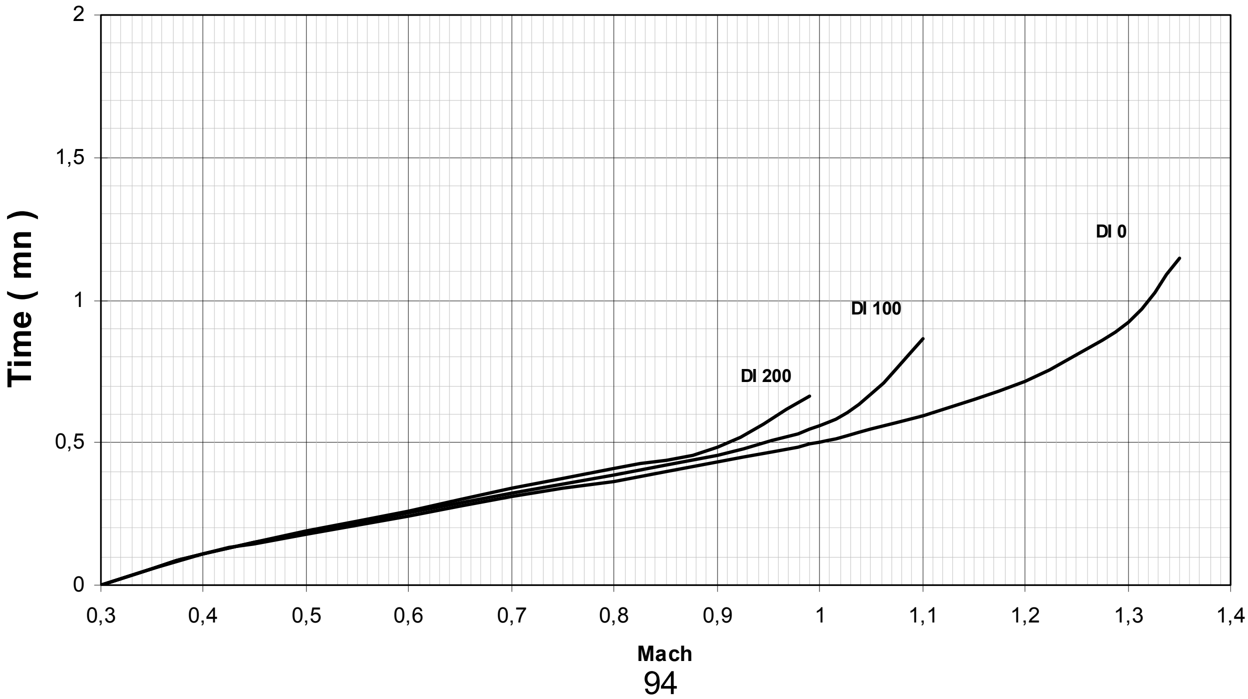
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 5000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs



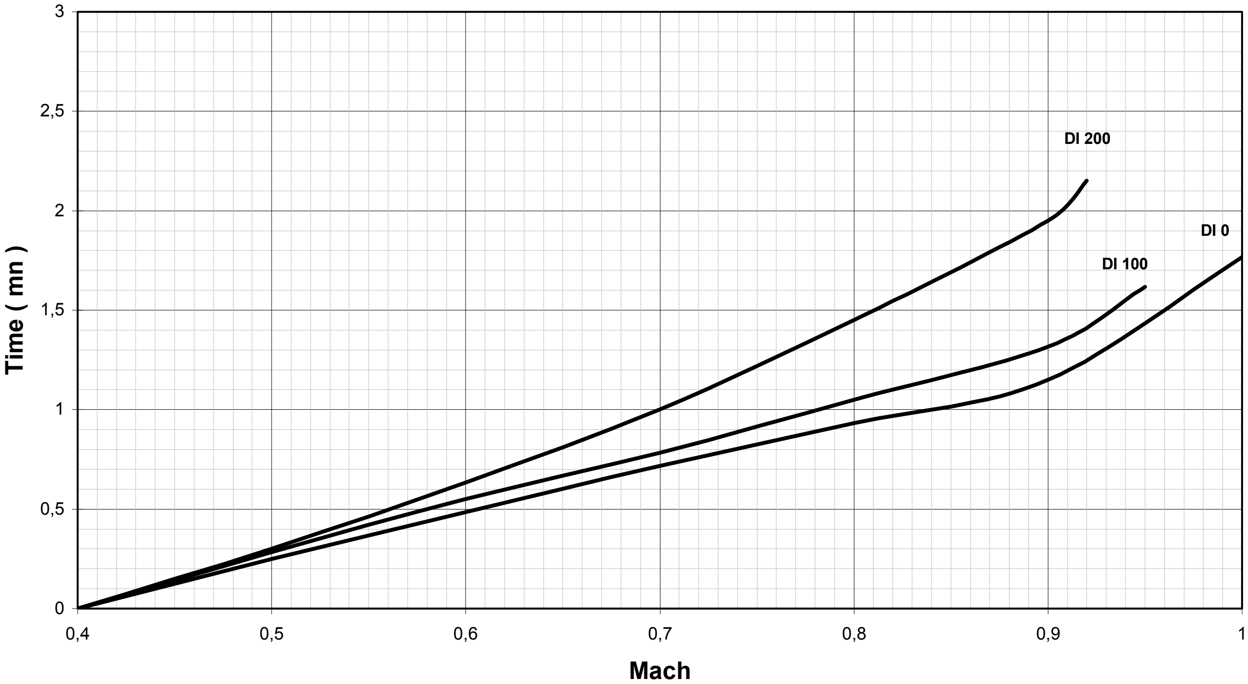
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 15000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs



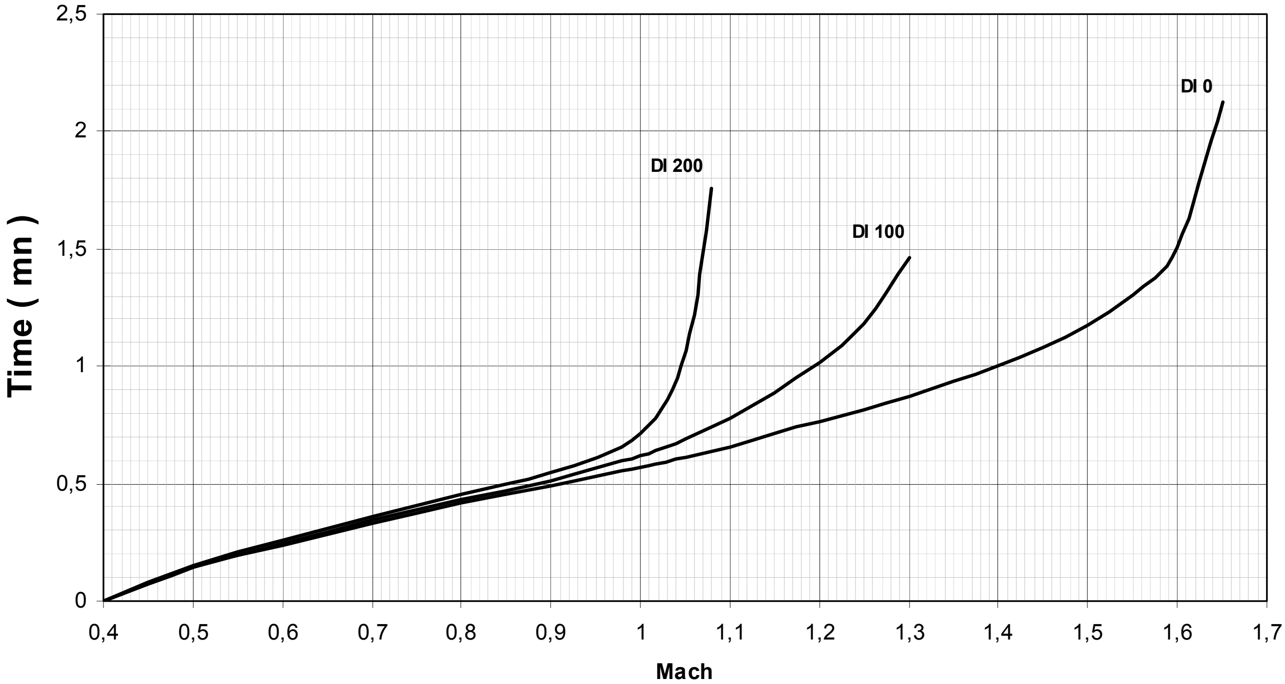
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 15000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs



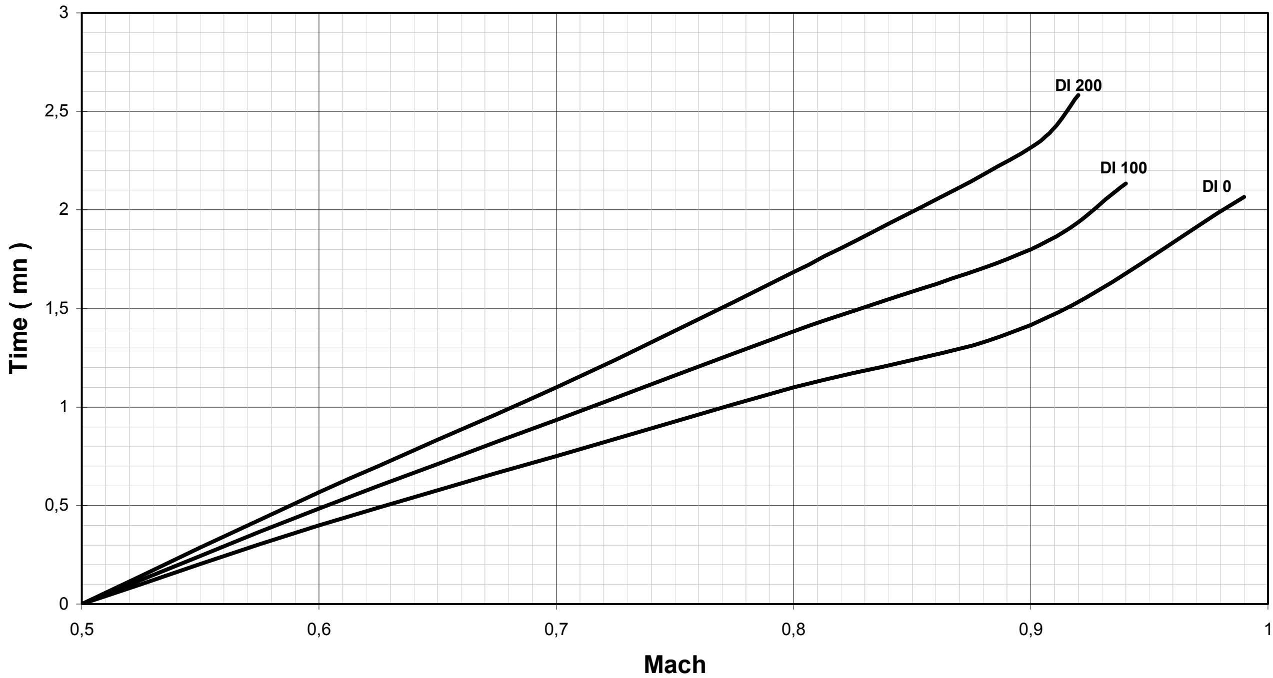
DATA BASIS : ESTIMATED

ACCELERATION
ALT 25000 ft

CONDITIONS :
- STANDARD DAY
- MIL POWER

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs



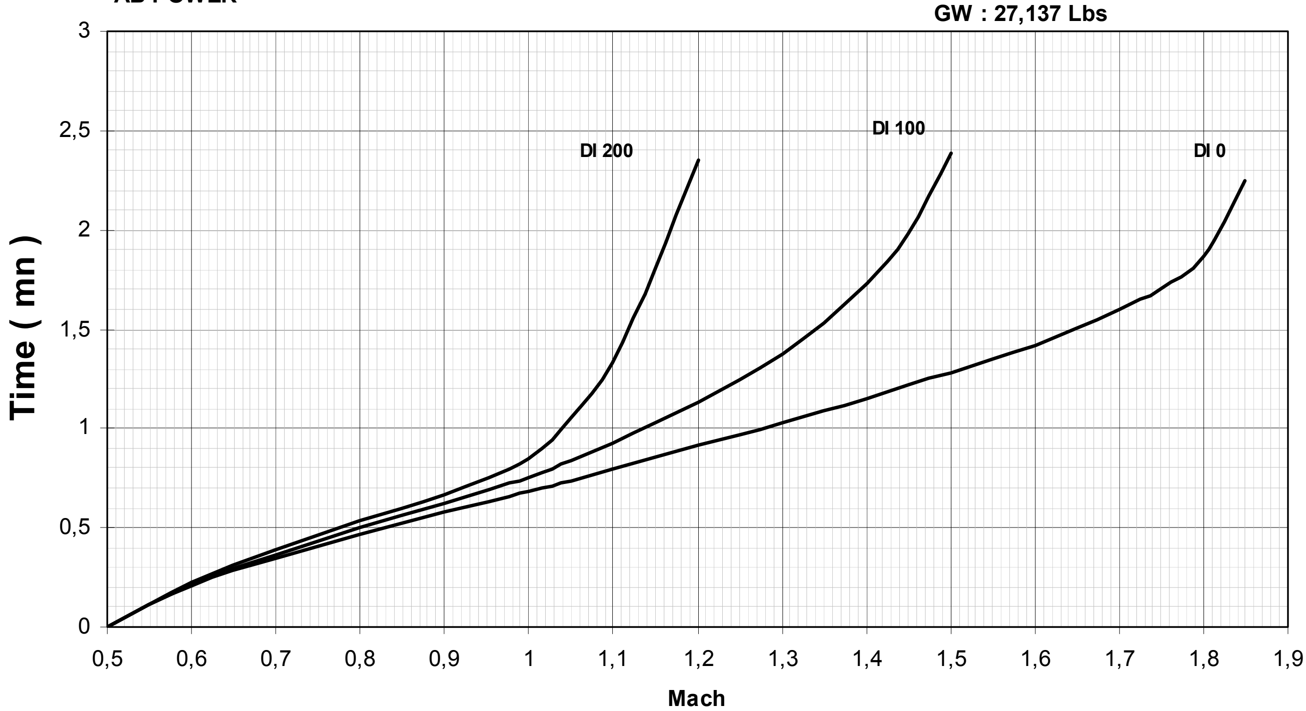
DATA BASIS : ESTIMATED

ACCELERATION
ALT 25000 ft

CONDITIONS :
- STANDARD DAY
- AB POWER

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs



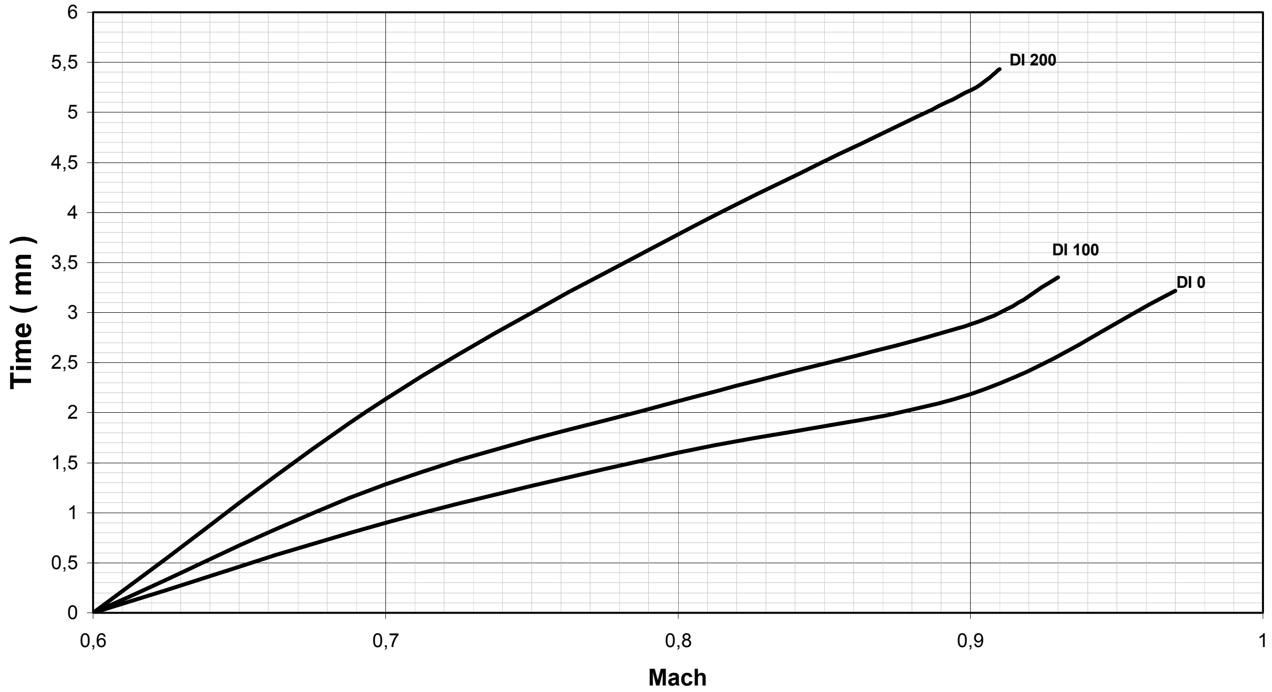
DATA BASIS : ESTIMATED

ACCELERATION
ALT 35000 ft

CONDITIONS :
- STANDARD DAY
- MIL POWER

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs



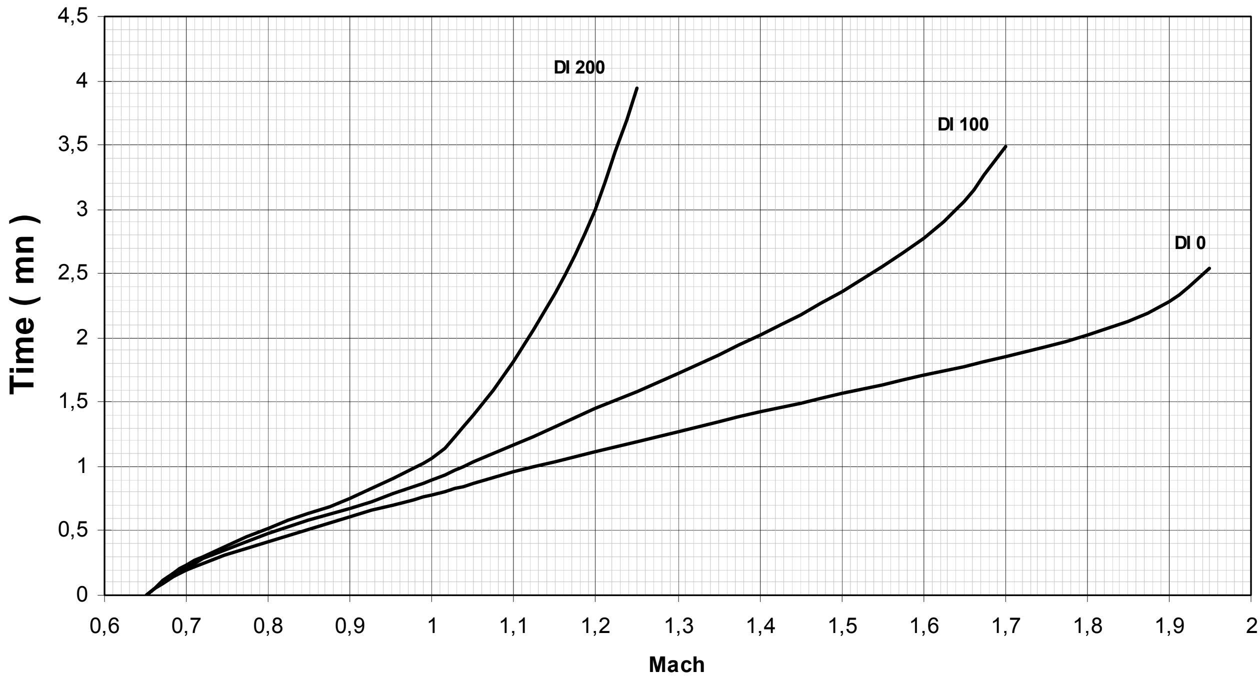
DATA BASIS : ESTIMATED

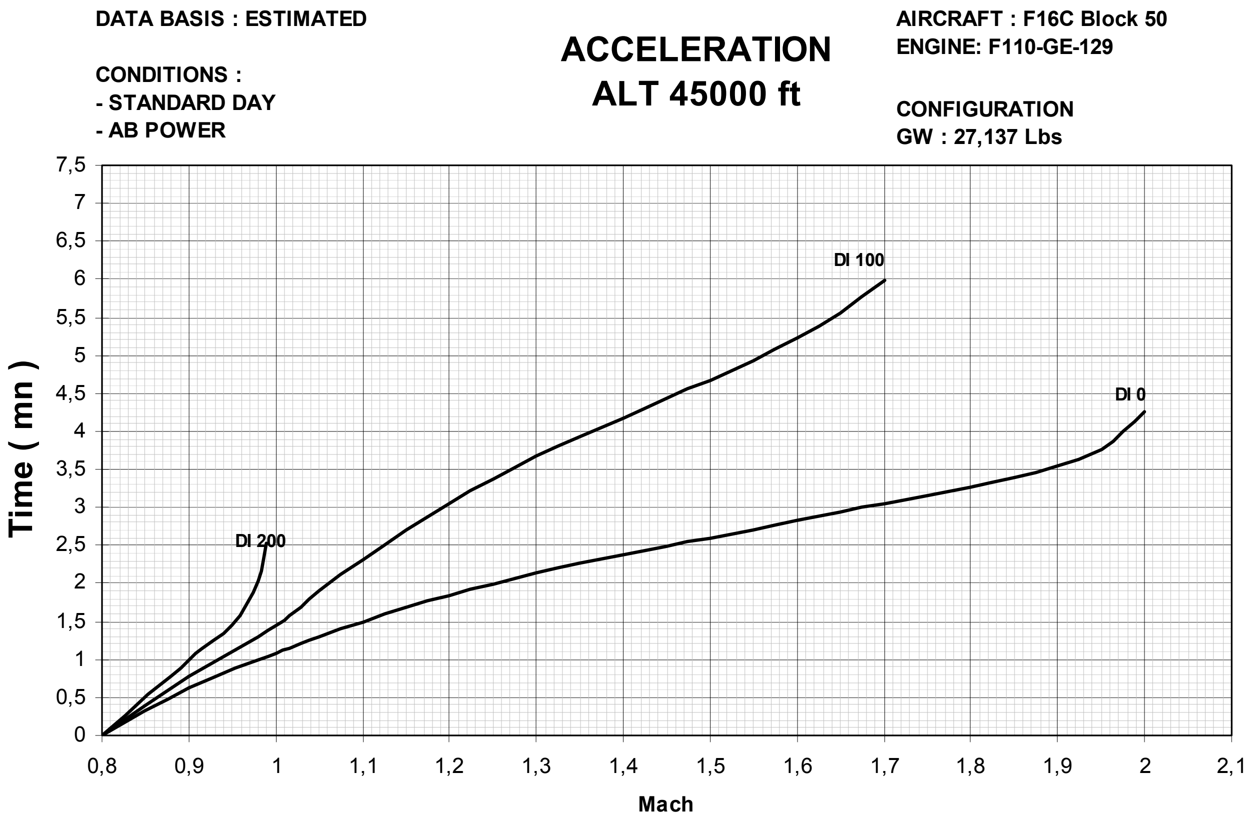
ACCELERATION
ALT 35000 ft

CONDITIONS :
- STANDARD DAY
- AB POWER

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 27,137 Lbs




DATA BASIS : ESTIMATED
CONDITIONS :
- STANDARD DAY
- AB POWER
ACCELERATION
ALT 45000 ft
AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129
CONFIGURATION
GW : 27,137 Lbs
Time (mn)
7,5
7
6,5
6
5,5
5
4,5
4
3,5
3
2,5
2
1,5
1
0,5
0
DI 100
DI 0
DI 200
0,8
0,9
1
1,1
1,2
1,3
1,4
1,5
1,6
1,7
1,8
1,9
2
2,1
Mach

4.4.2 Deceleration charts

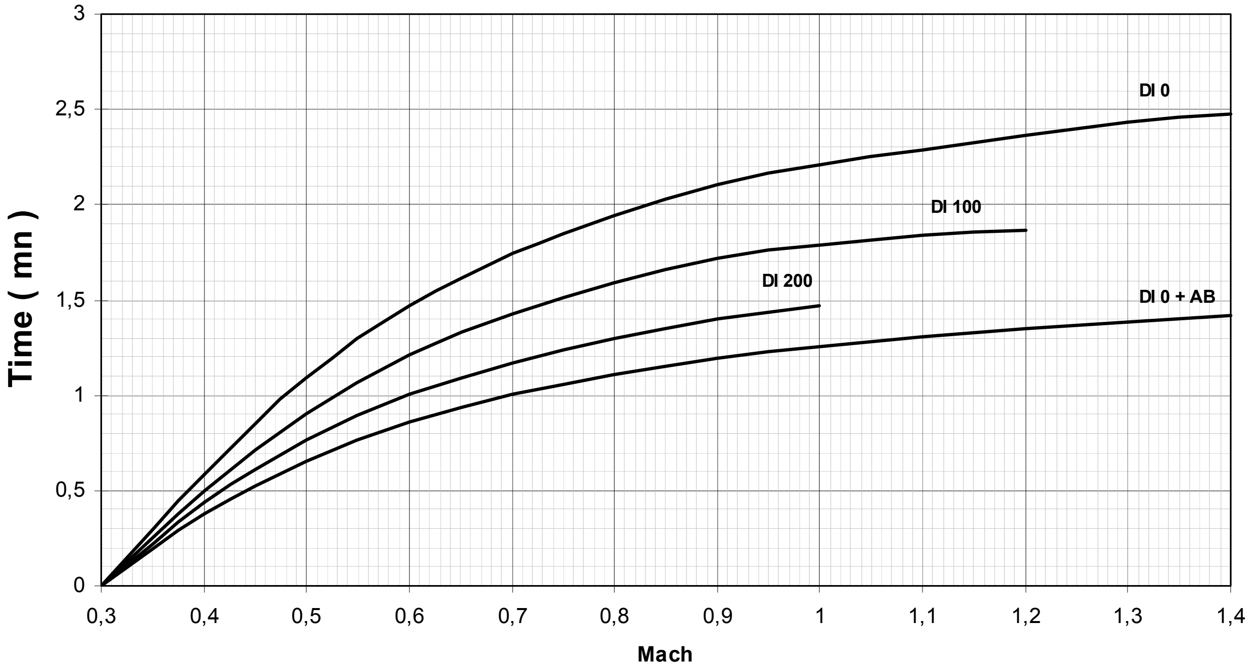
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 5 000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 26,037 Lbs



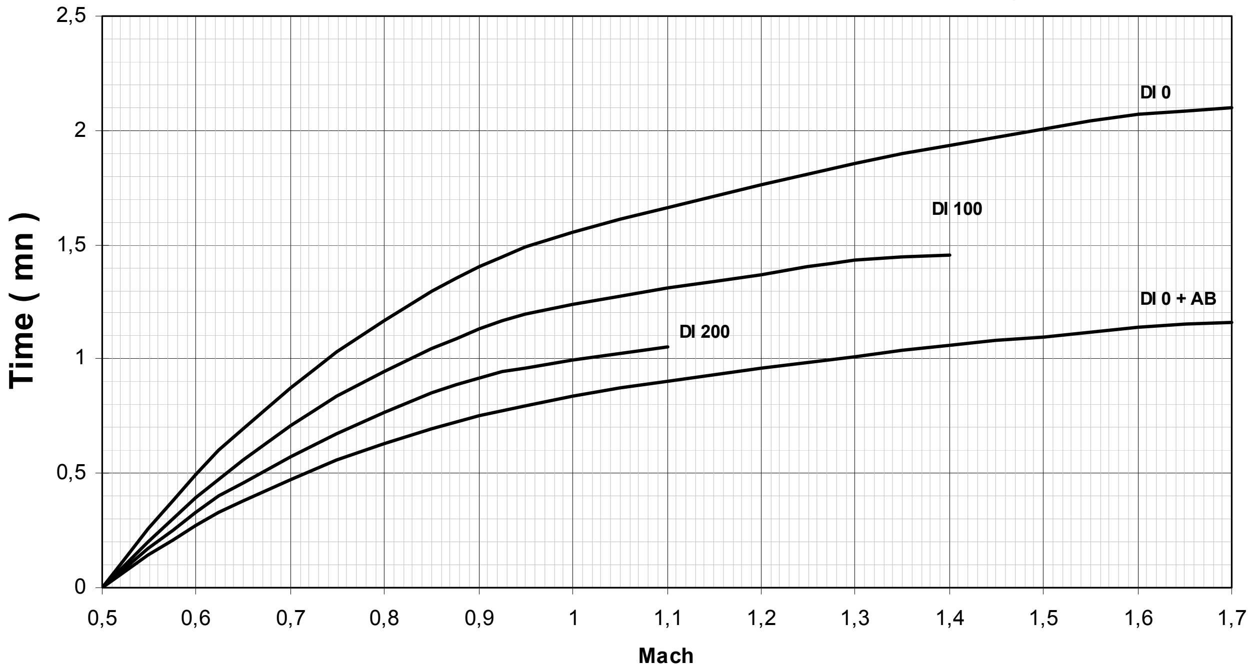
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 15 000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 26,037 Lbs



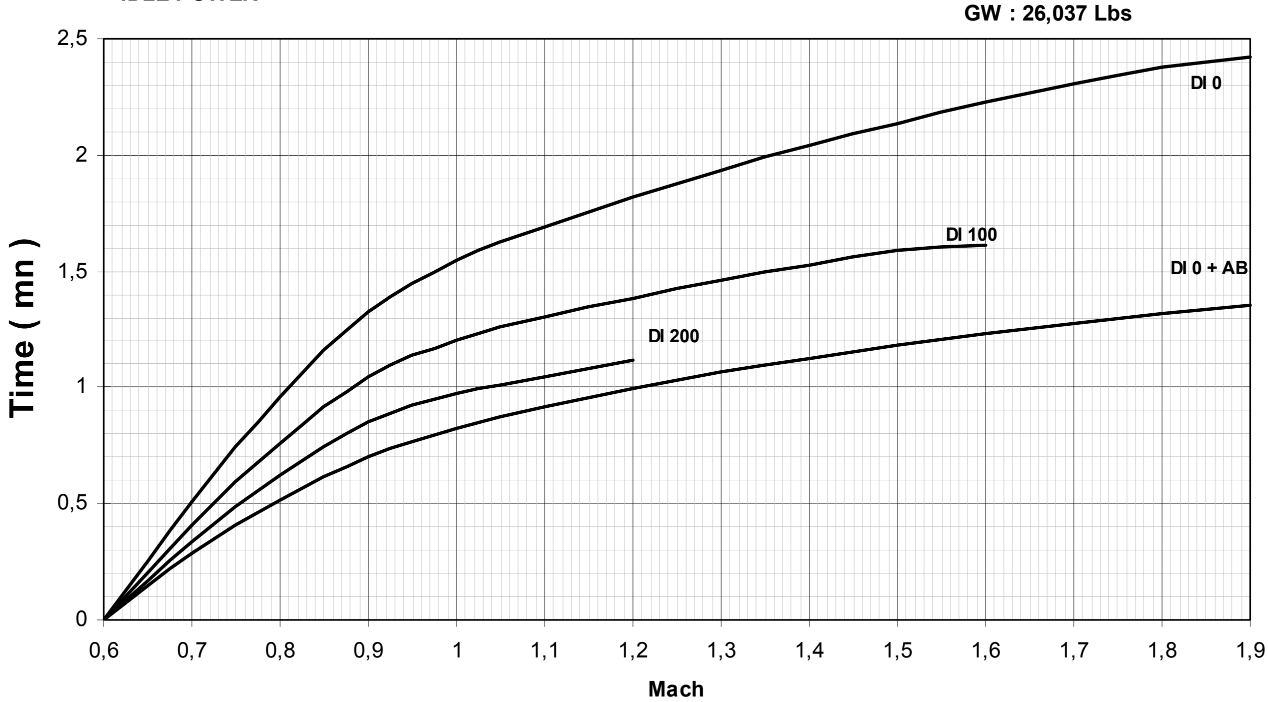
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 25 000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 26,037 Lbs



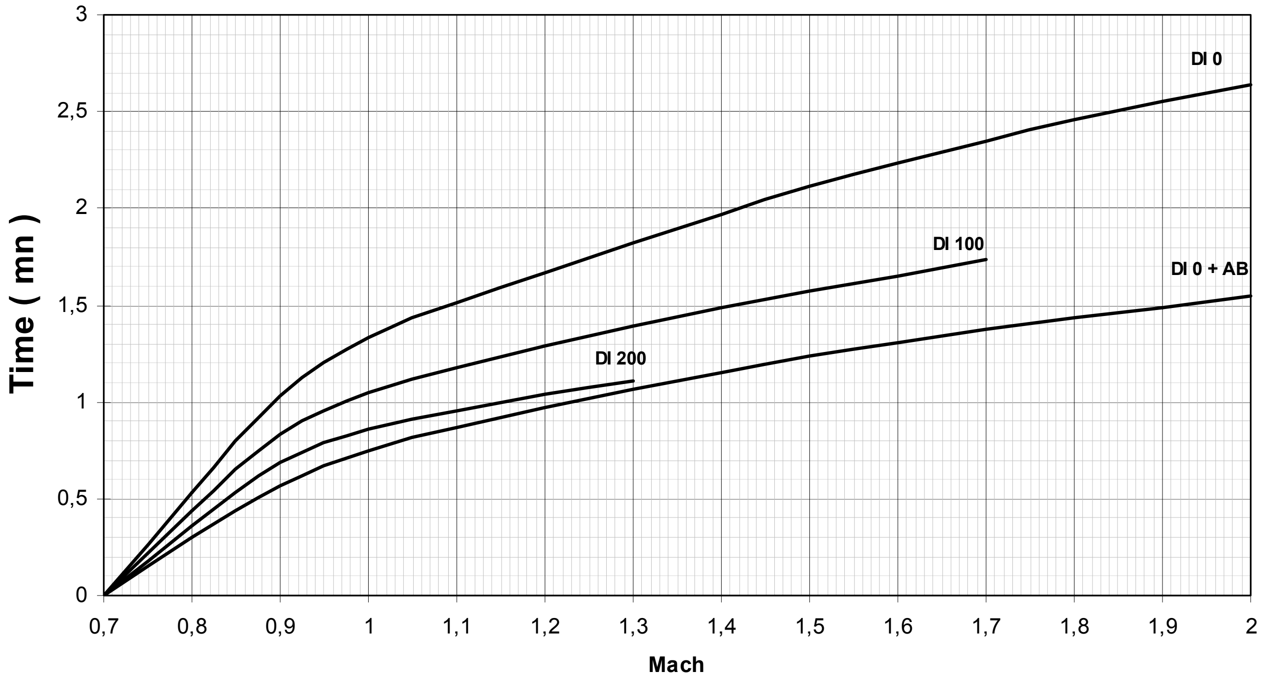
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 35 000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

CONFIGURATION
GW : 26,037 Lbs



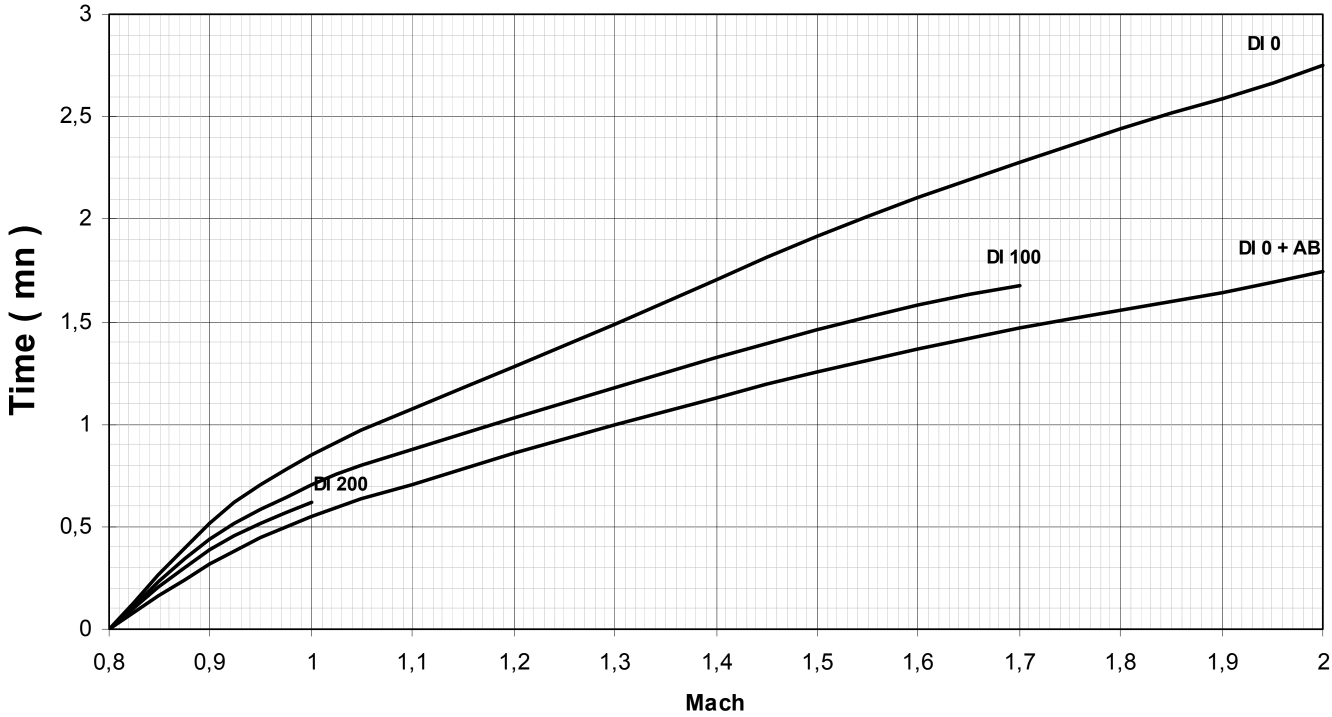
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 45 000 ft

AIRCRAFT : F16C Block 50
ENGINE: F110-GE-129

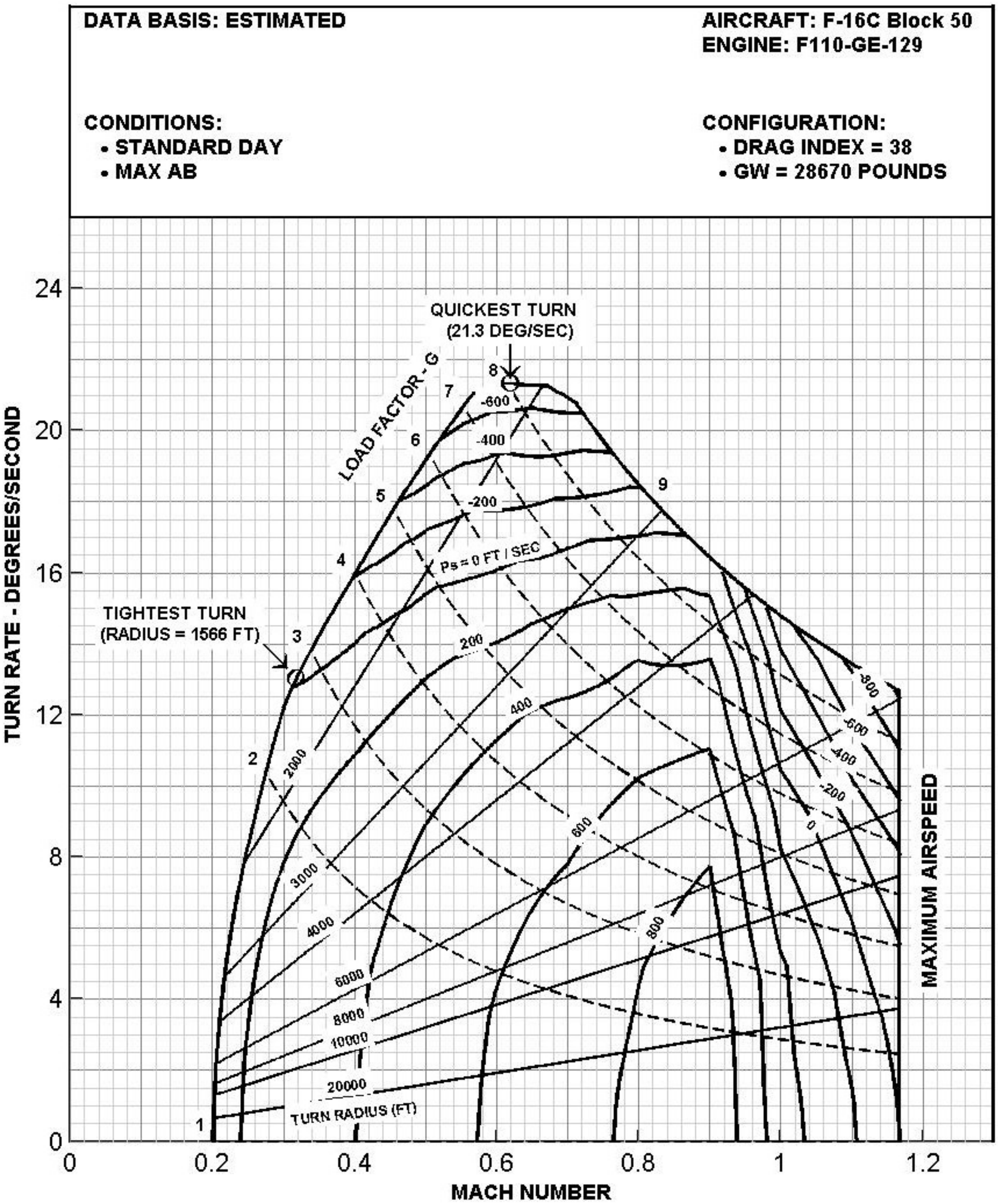
CONFIGURATION
GW : 26,037 Lbs



4.4.3 EM charts

EM charts have been drawn in combat configuration: FUEL 100 % + 2 AIM9M + 2 AIM120 + ALQ131

Turn Performance - Sea Level



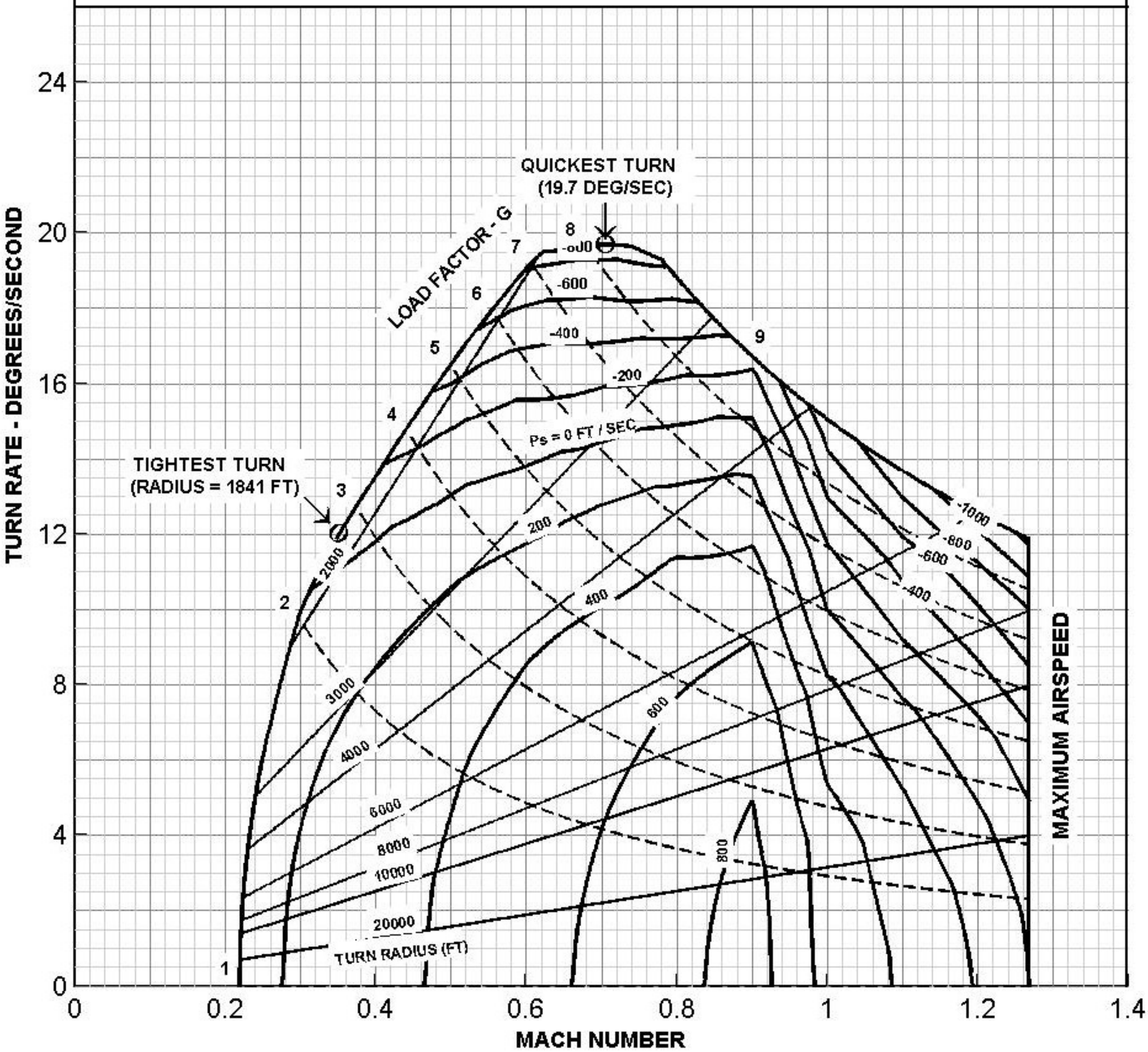
Turn Performance - 5000 Feet

DATA BASIS: ESTIMATED

AIRCRAFT: F-16C Block 50
ENGINE: F110-GE-129

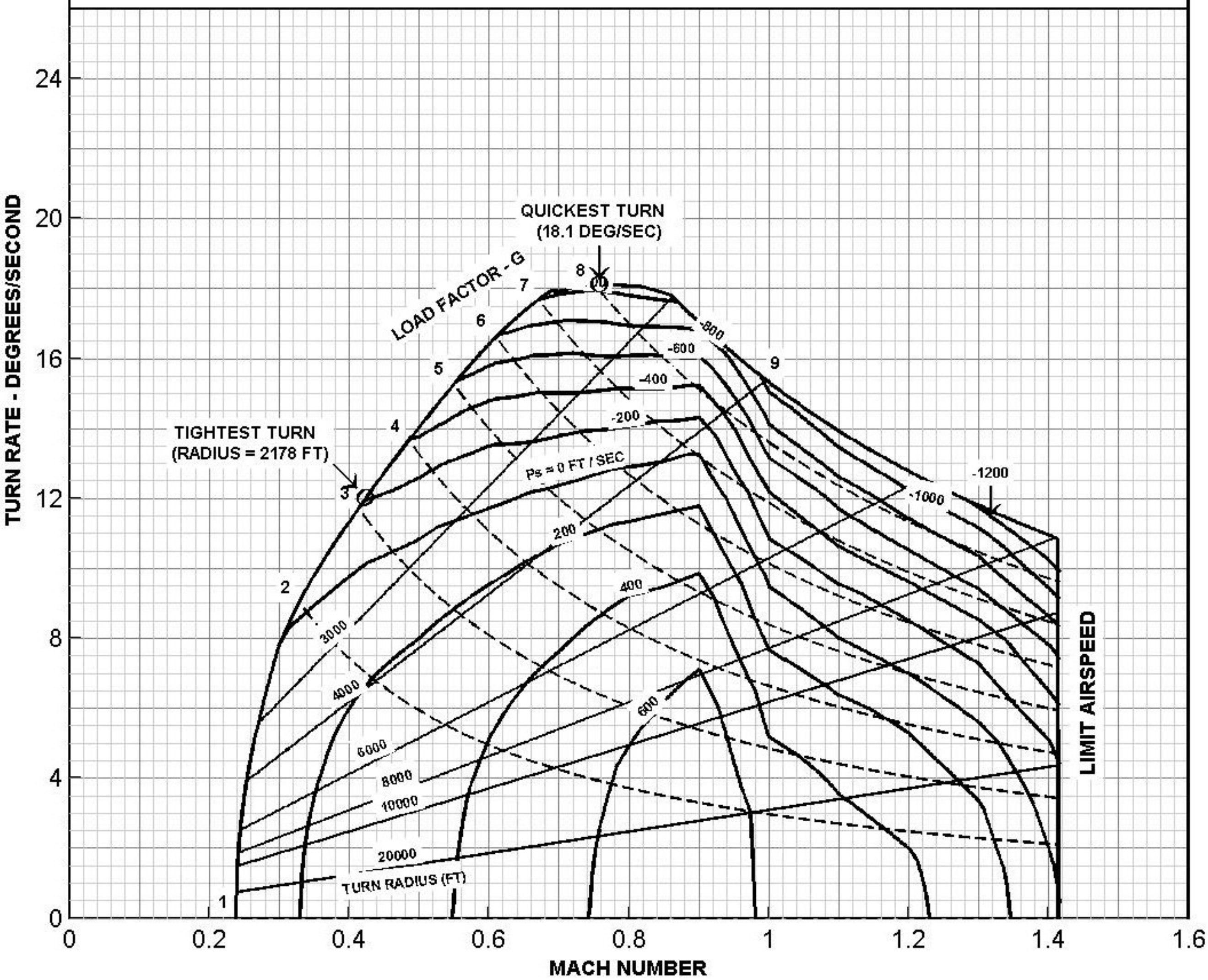
CONDITIONS:
- **STANDARD DAY**
- **MAX AB**

CONFIGURATION:
- **DRAG INDEX = 38**
- **GW = 28670 POUNDS**

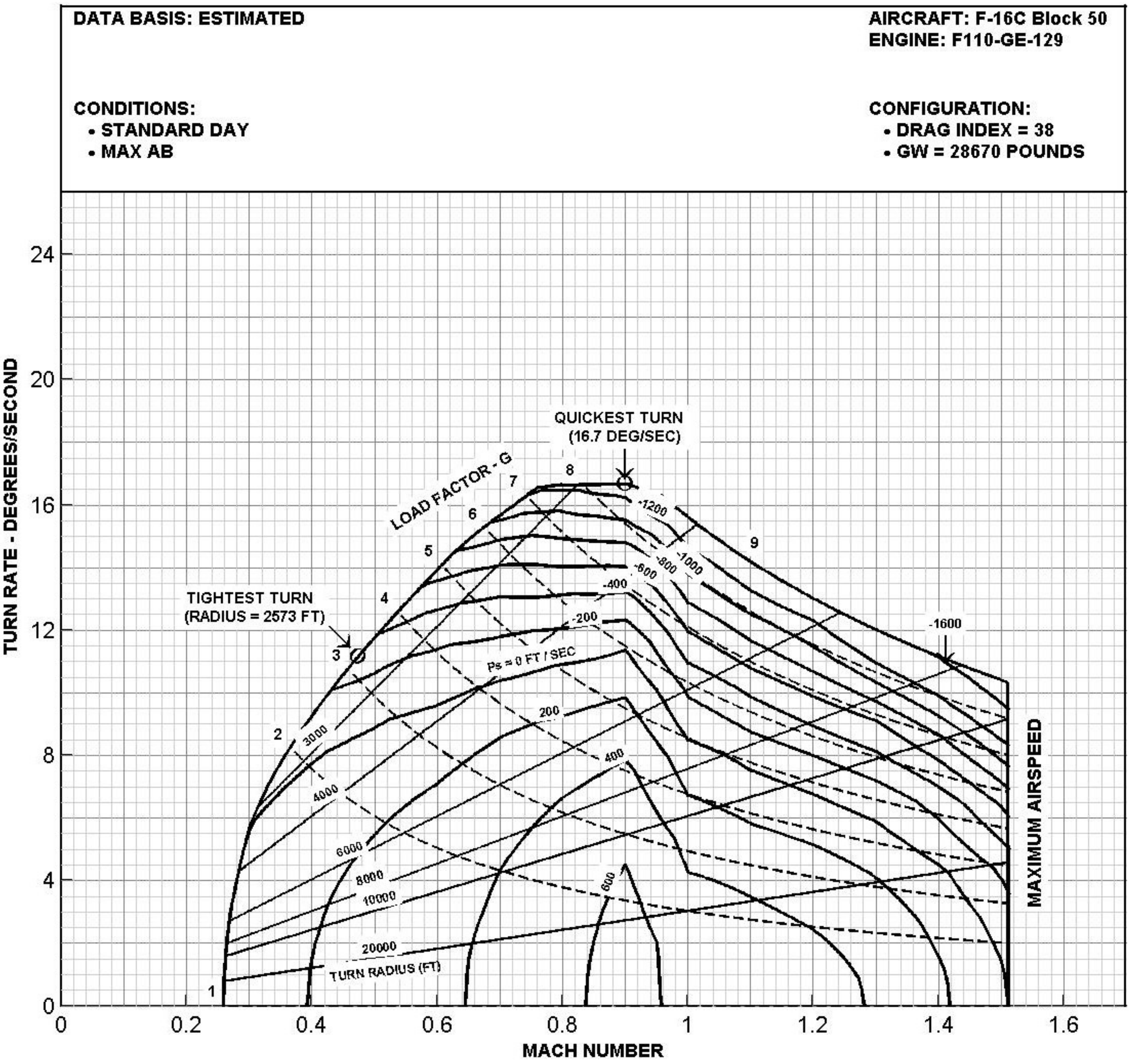


Turn Performance - 10000 Feet

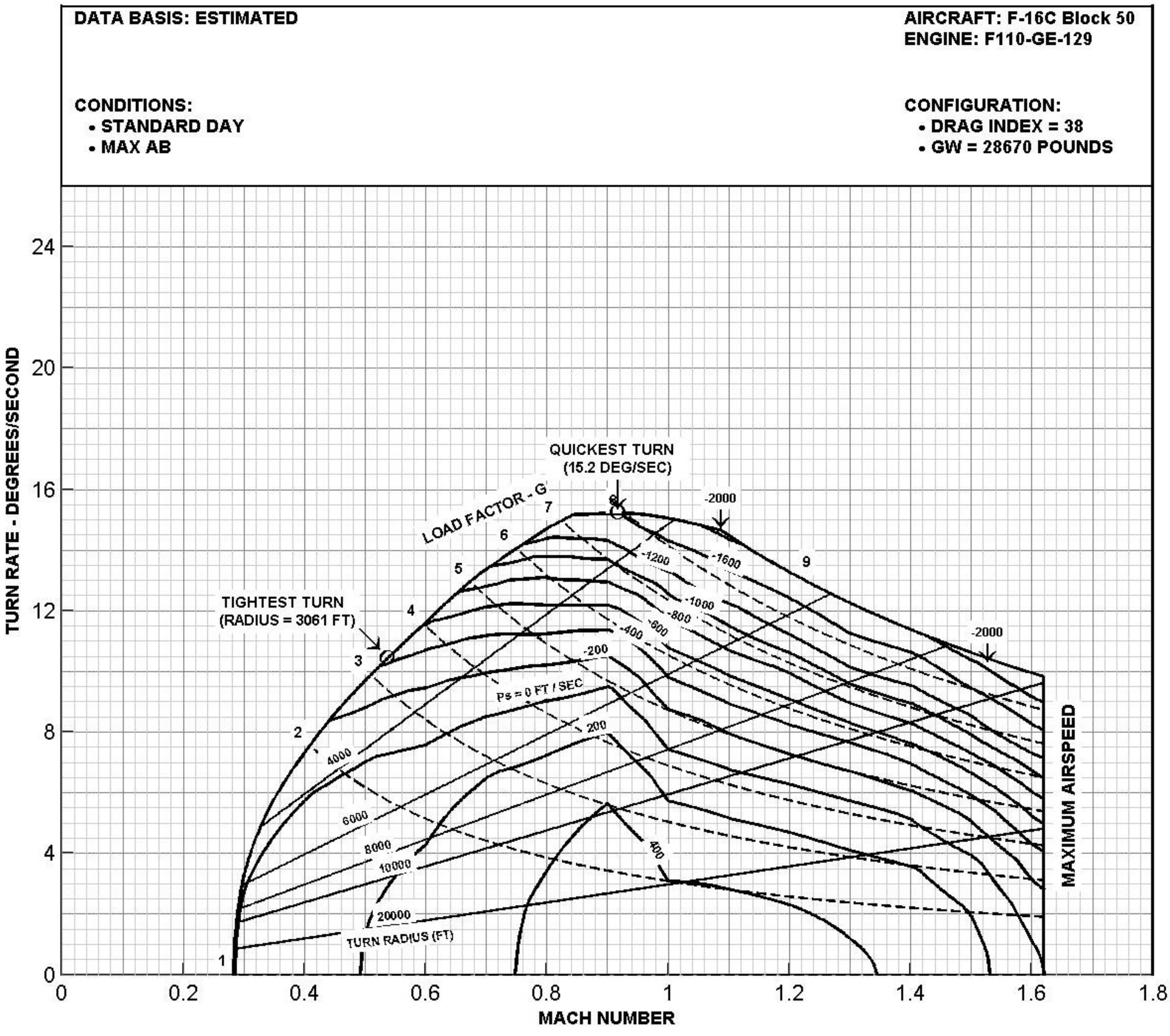
DATA BASIS: ESTIMATED	AIRCRAFT: F-16C Block 50 ENGINE: F110-GE-129
CONDITIONS: • STANDARD DAY • MAX AB	CONFIGURATION: • DRAG INDEX = 38 • GW = 28670 POUNDS



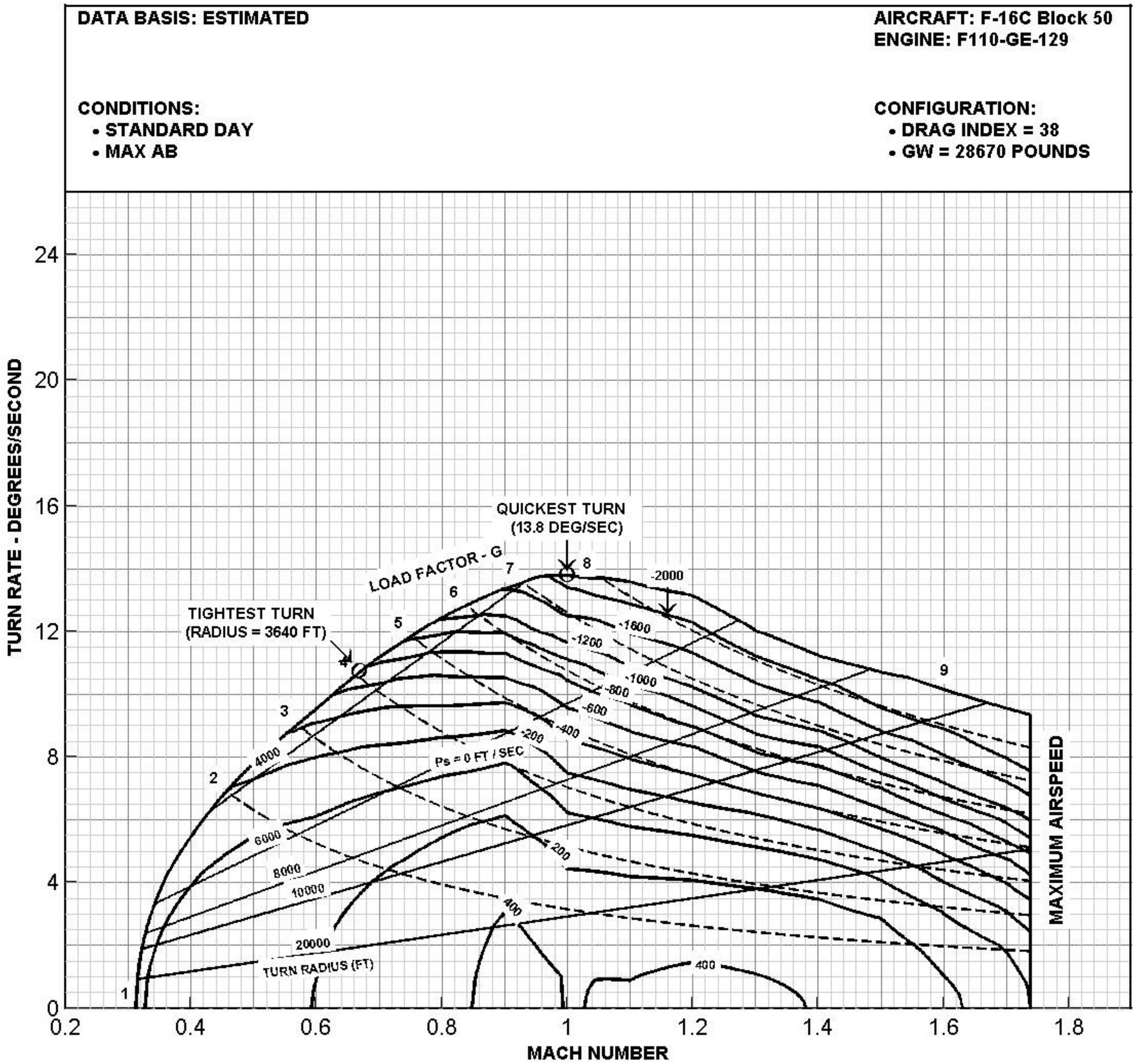
Turn Performance - 15000 Feet



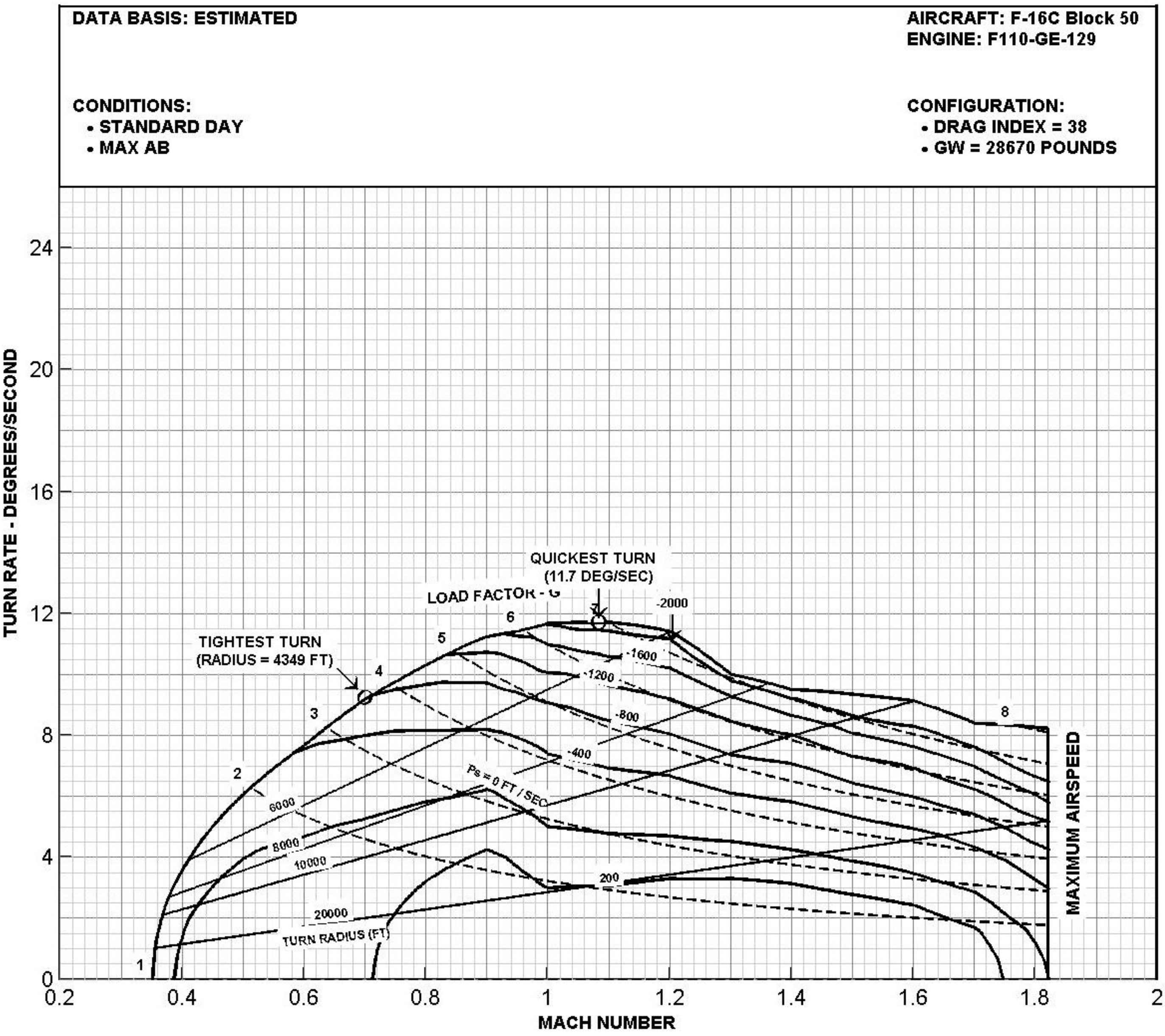
Turn Performance - 20000 Feet



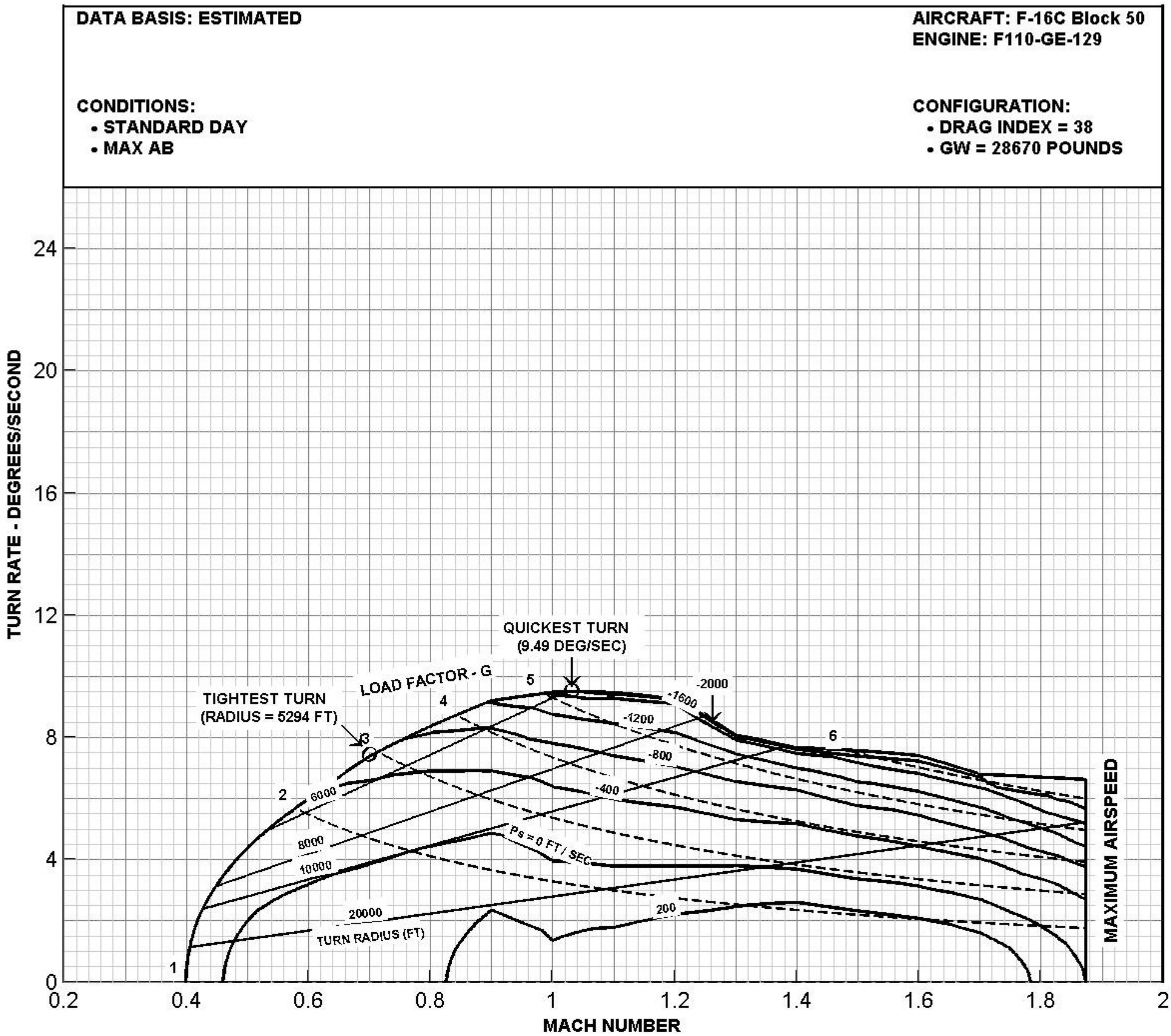
Turn Performance - 25000 Feet



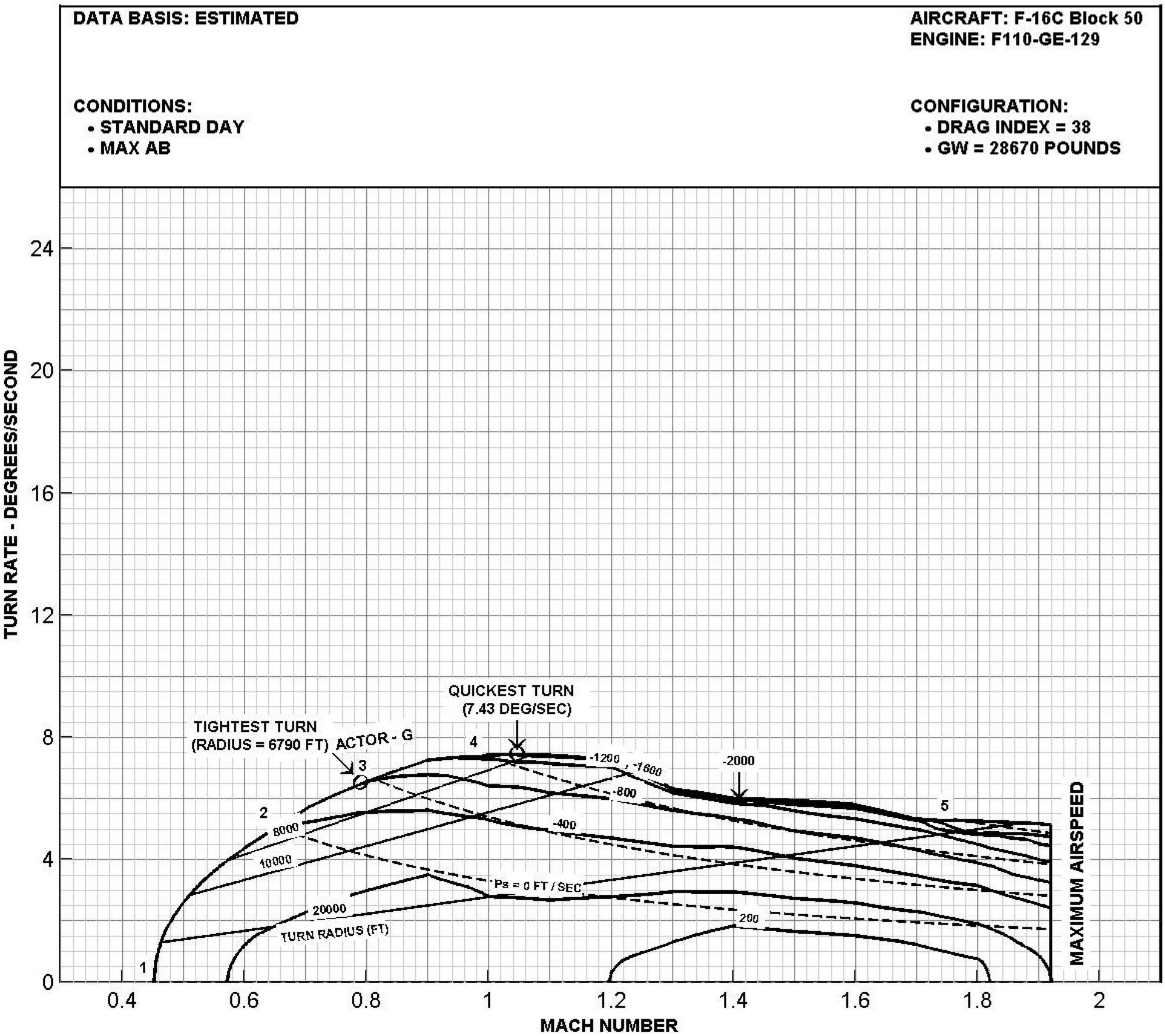
Turn Performance - 30000 Feet



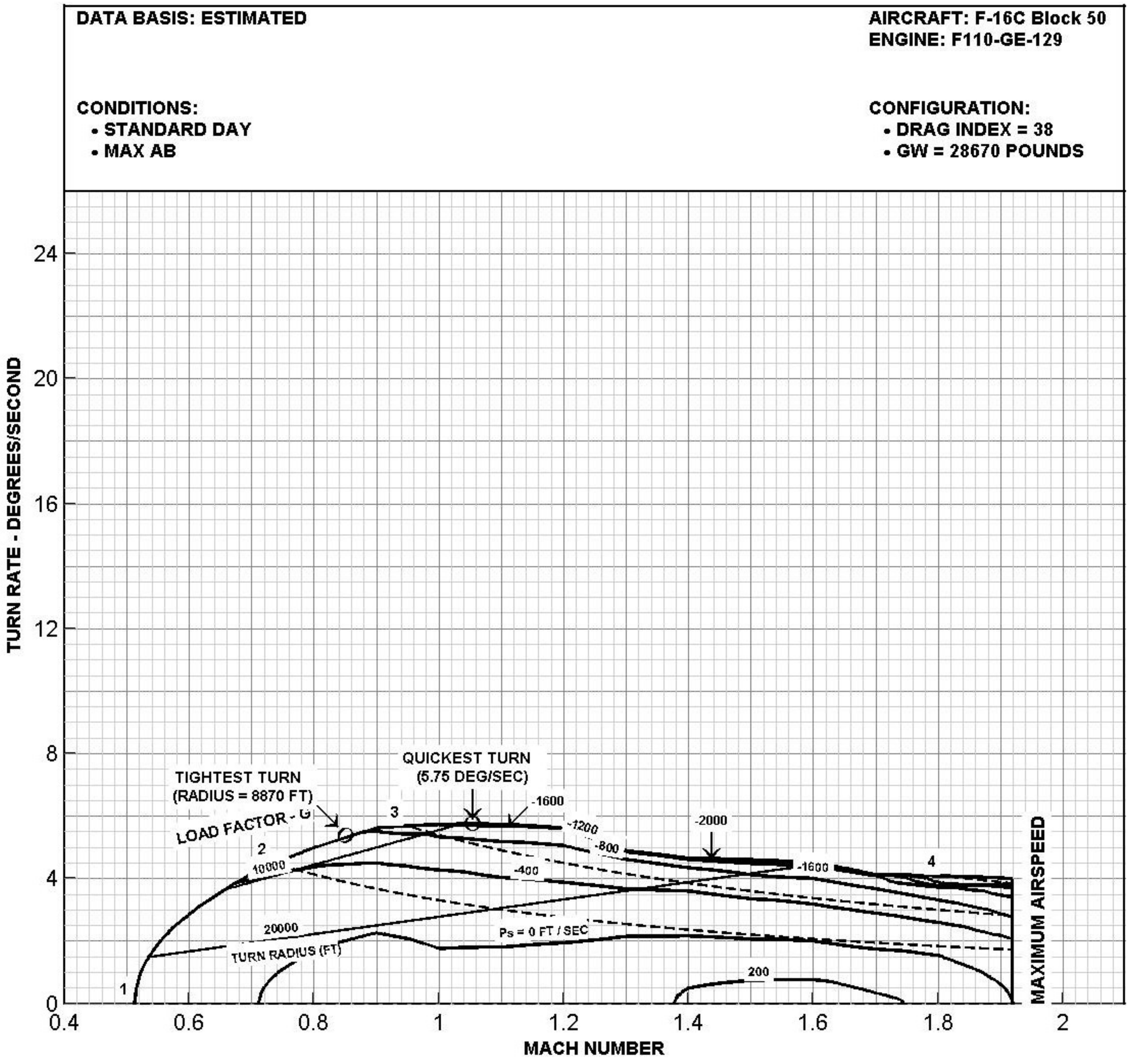
Turn Performance - 35000 Feet



Turn Performance - 40000 Feet

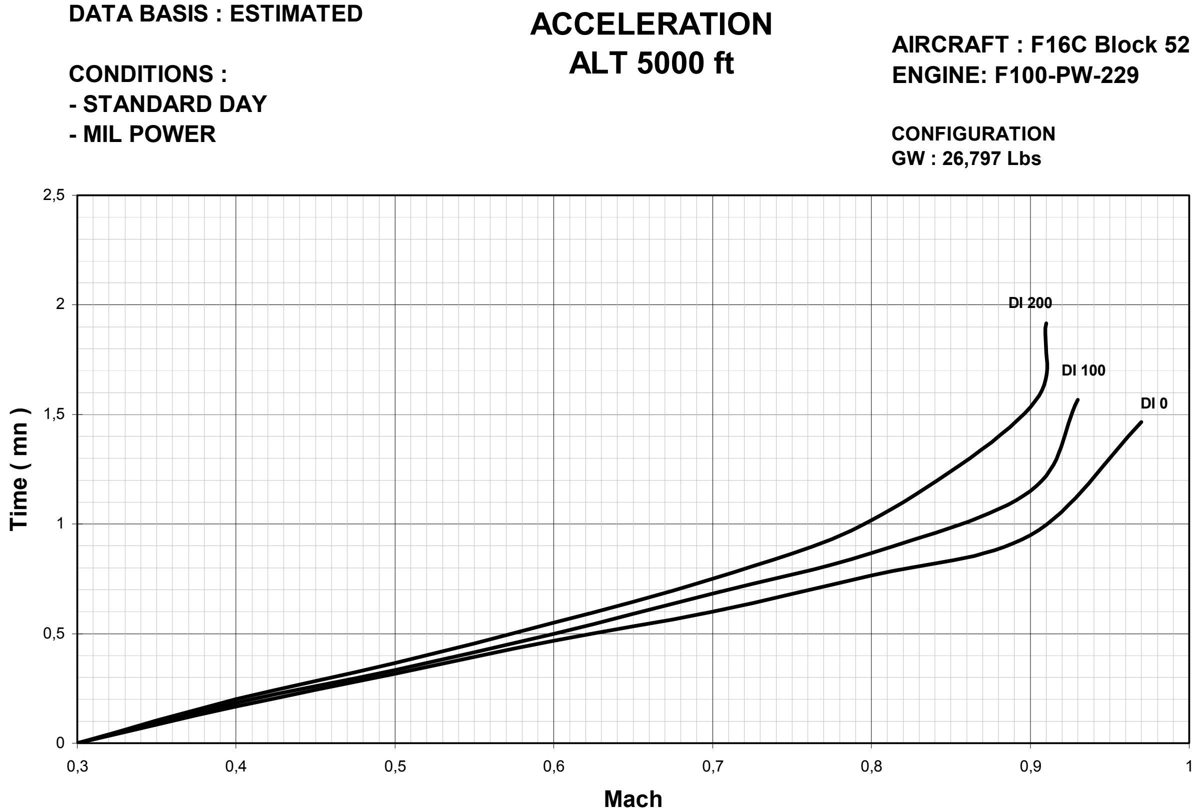


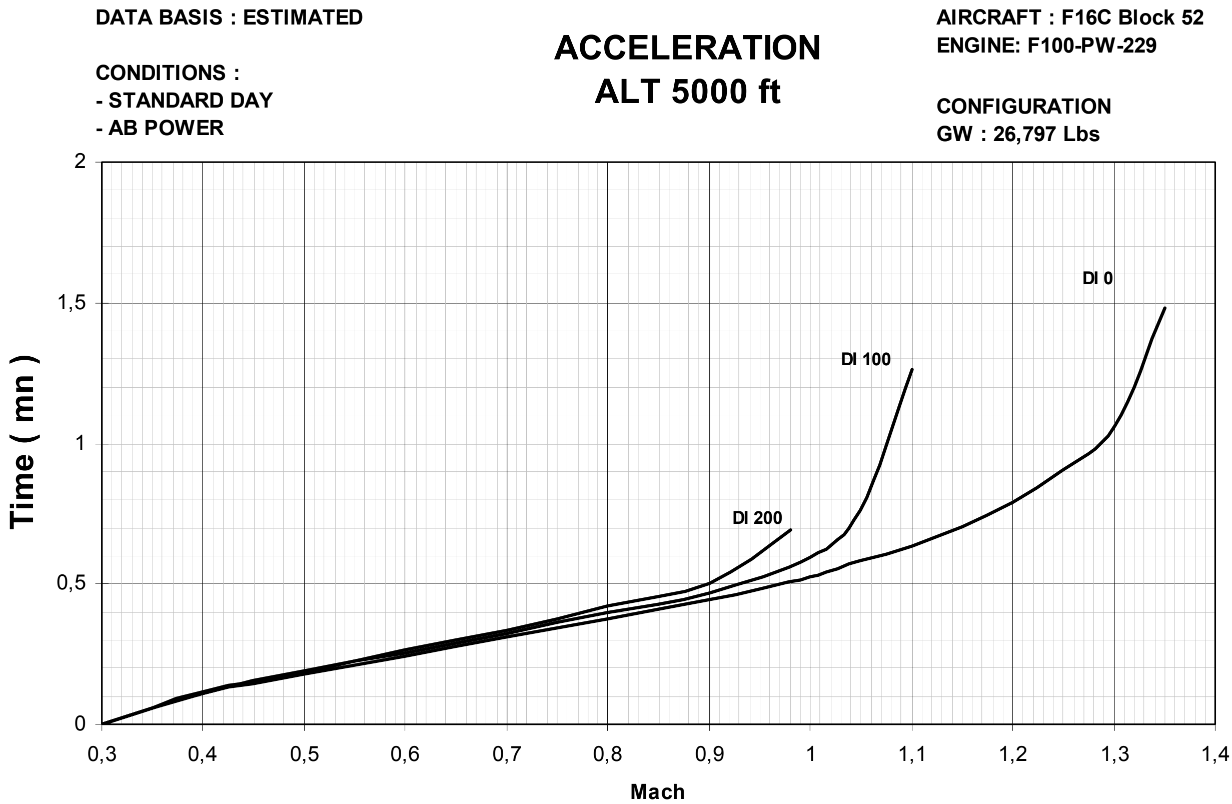
Turn Performance - 45000 Feet



4.5 F16 C– Block 52

4.5.1 Acceleration charts





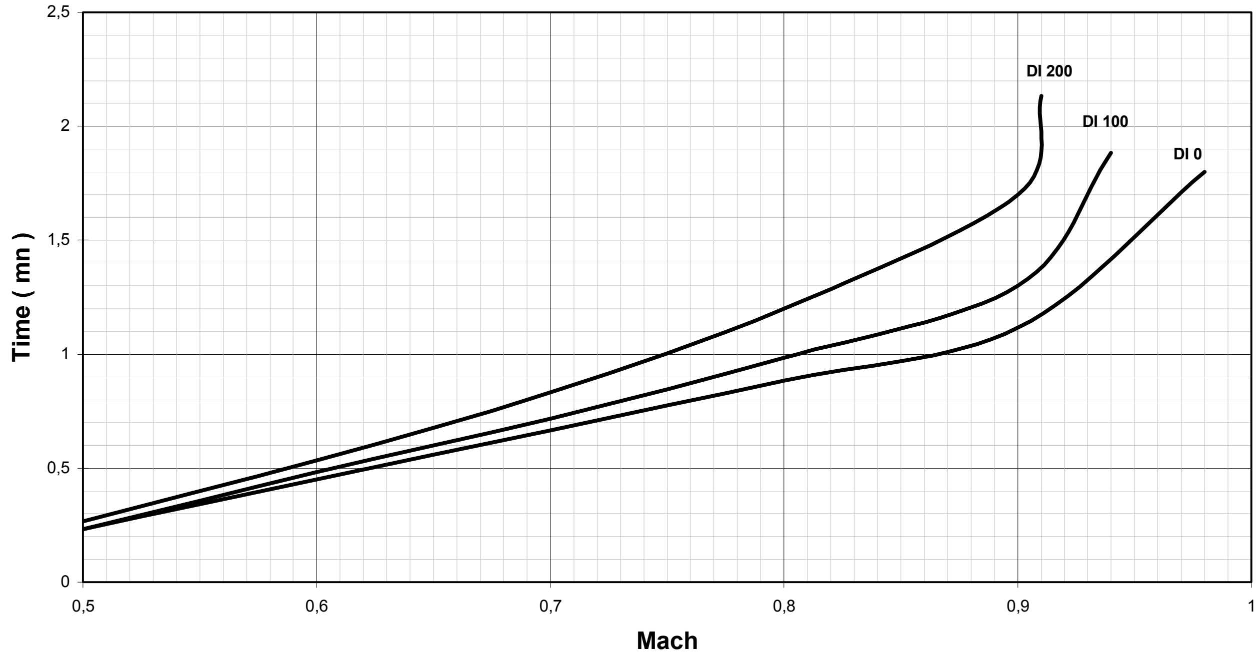
DATA BASIS : ESTIMATED

ACCELERATION
ALT 15000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONDITIONS :
- STANDARD DAY
- MIL POWER

CONFIGURATION
GW : 26,797 Lbs



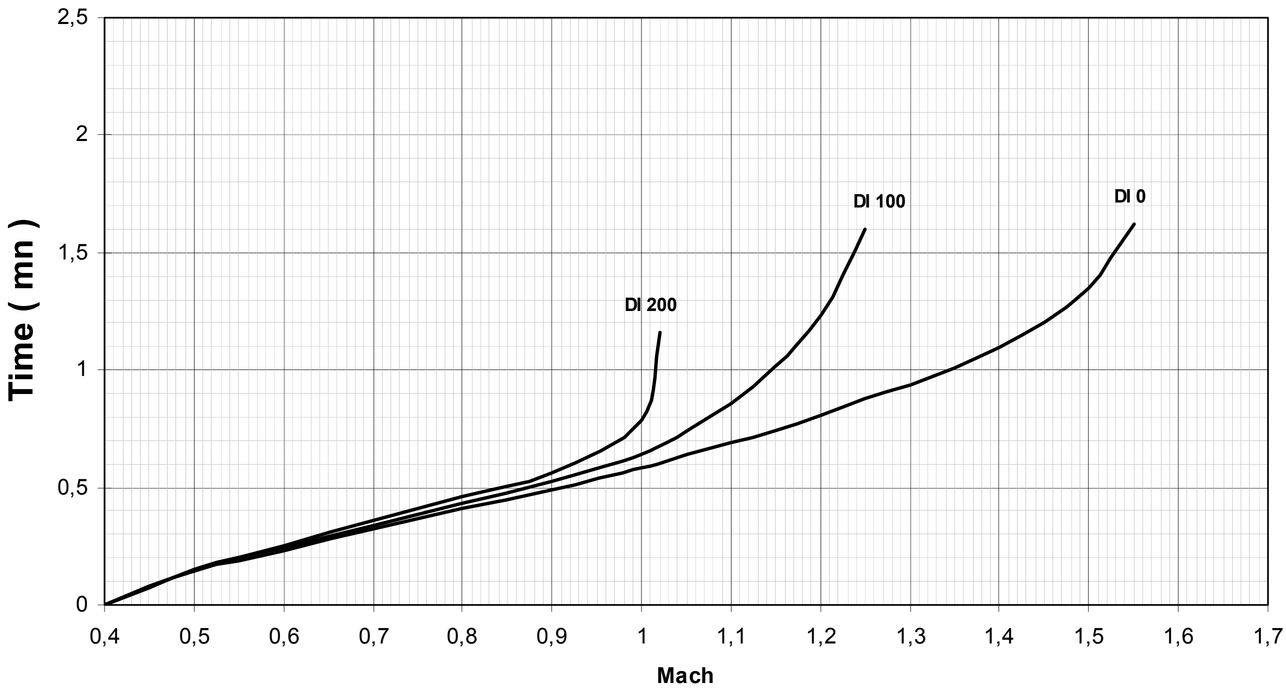
DATA BASIS : ESTIMATED

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

ACCELERATION
ALT 15000 ft

CONDITIONS :
- STANDARD DAY
- AB POWER

CONFIGURATION
GW : 26,797 Lbs



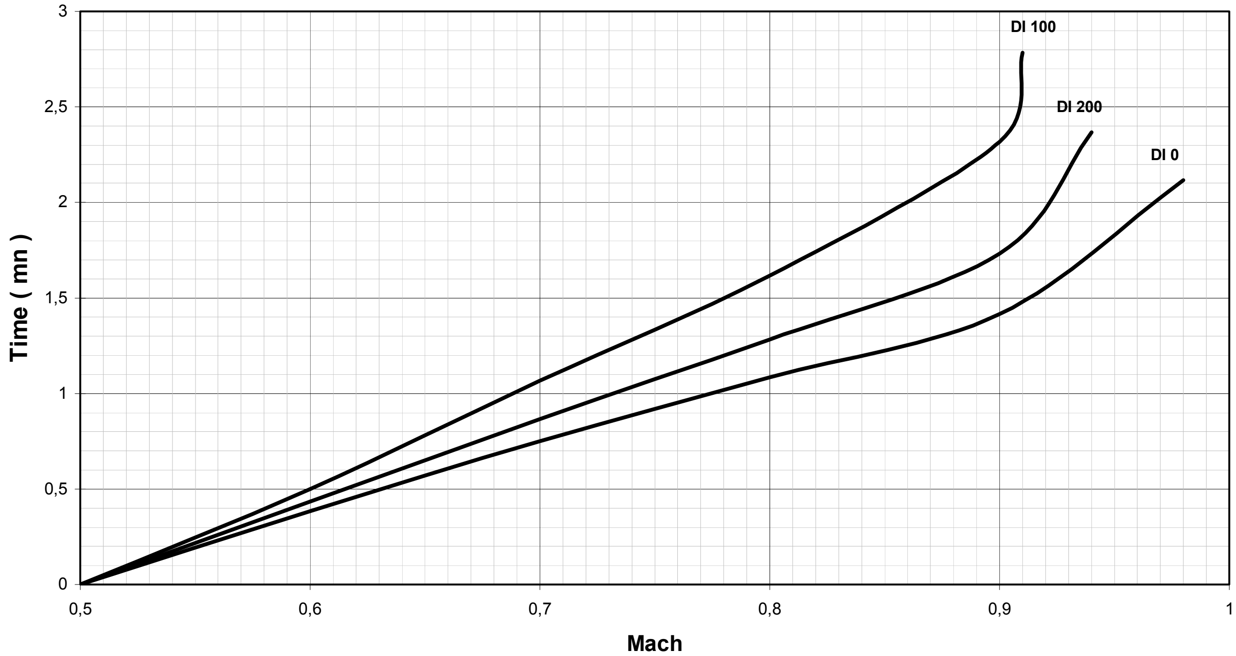
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 26,797 Lbs



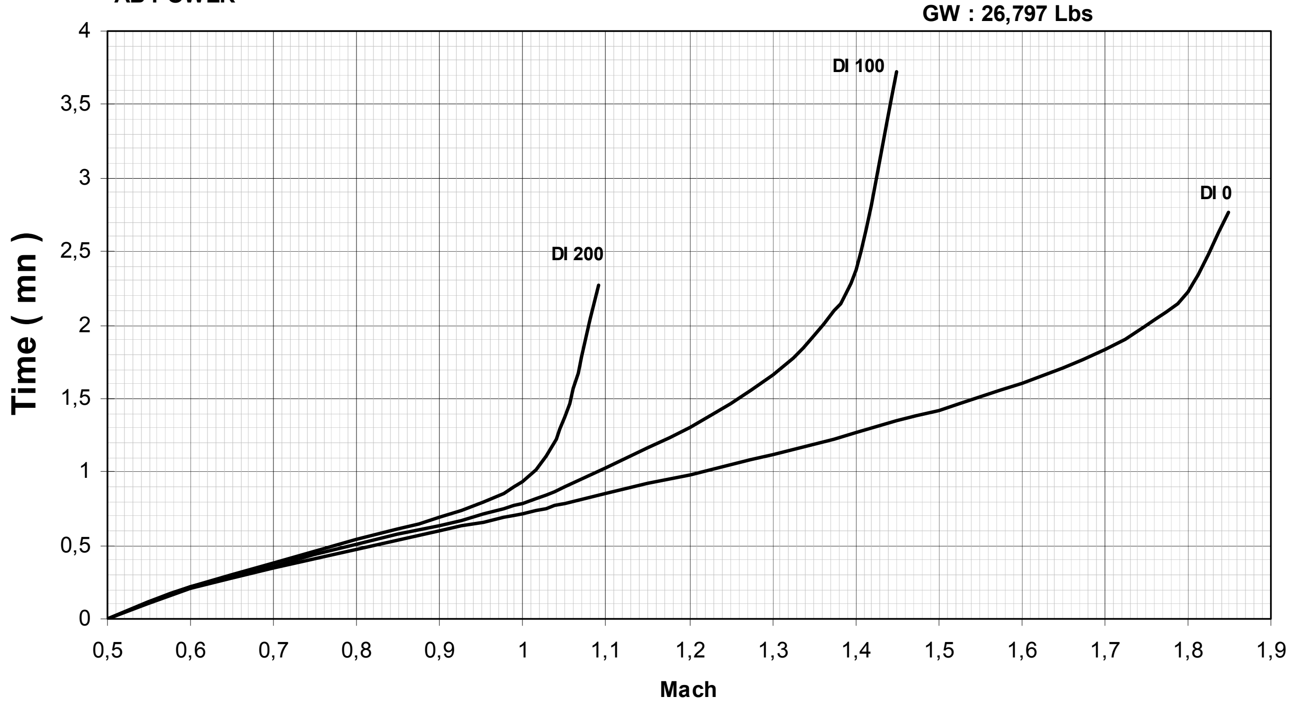
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 25000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 26,797 Lbs



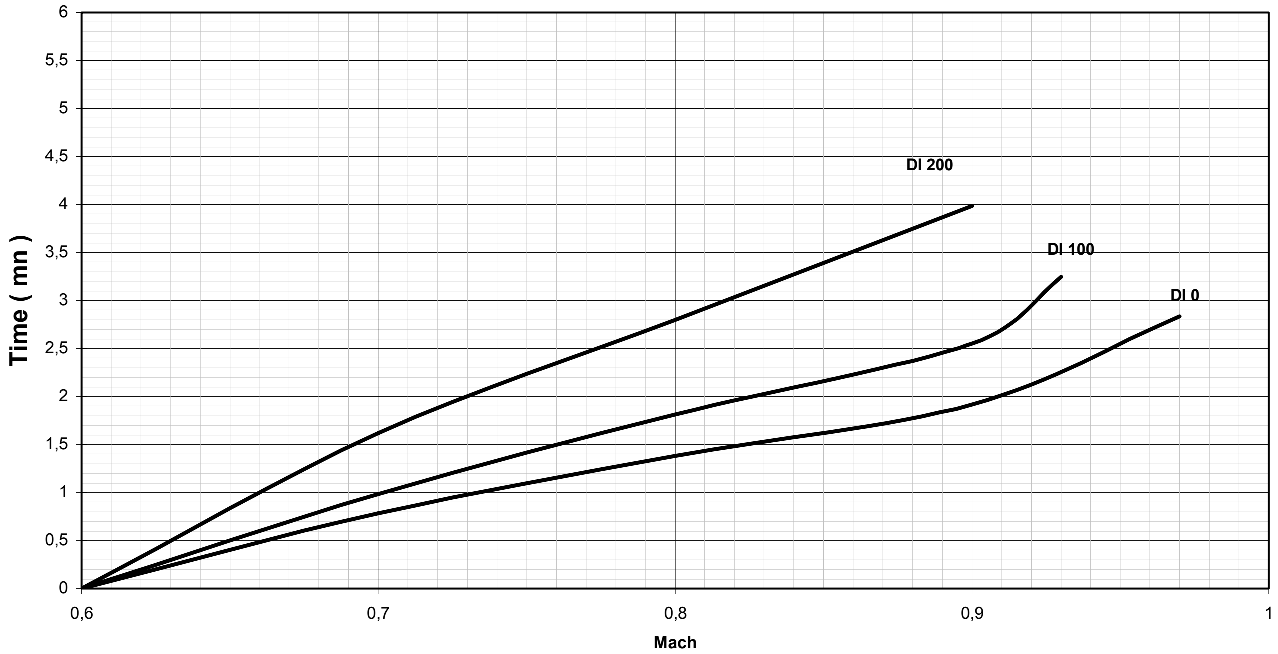
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- MIL POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 26,797 Lbs



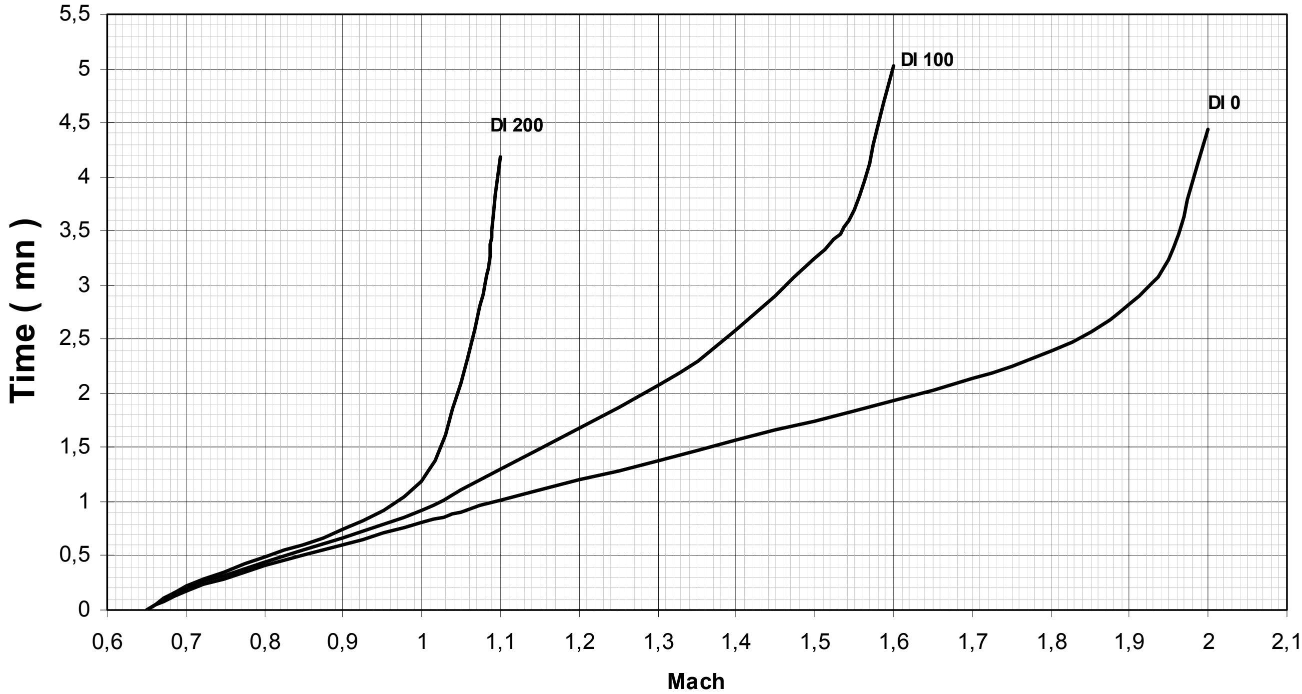
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 35000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 26,797 Lbs



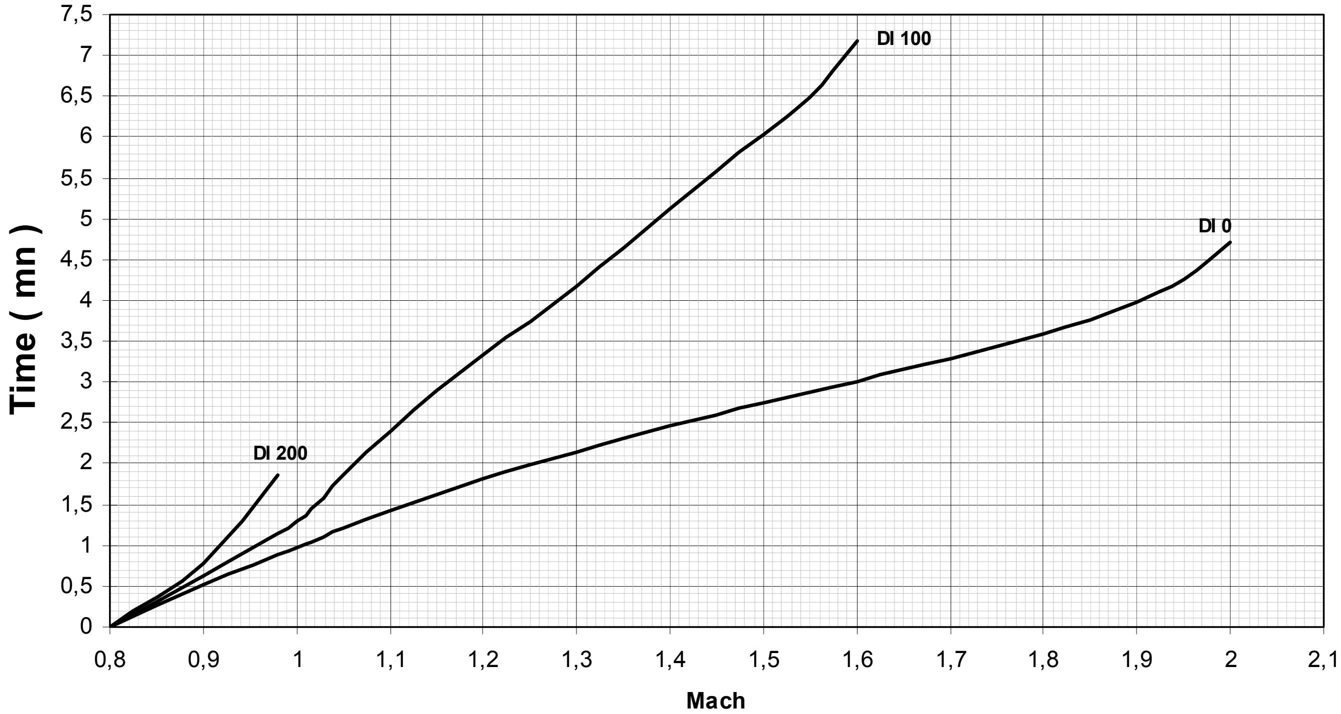
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- AB POWER

ACCELERATION
ALT 45000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 26,797 Lbs



4.5.2 Deceleration charts

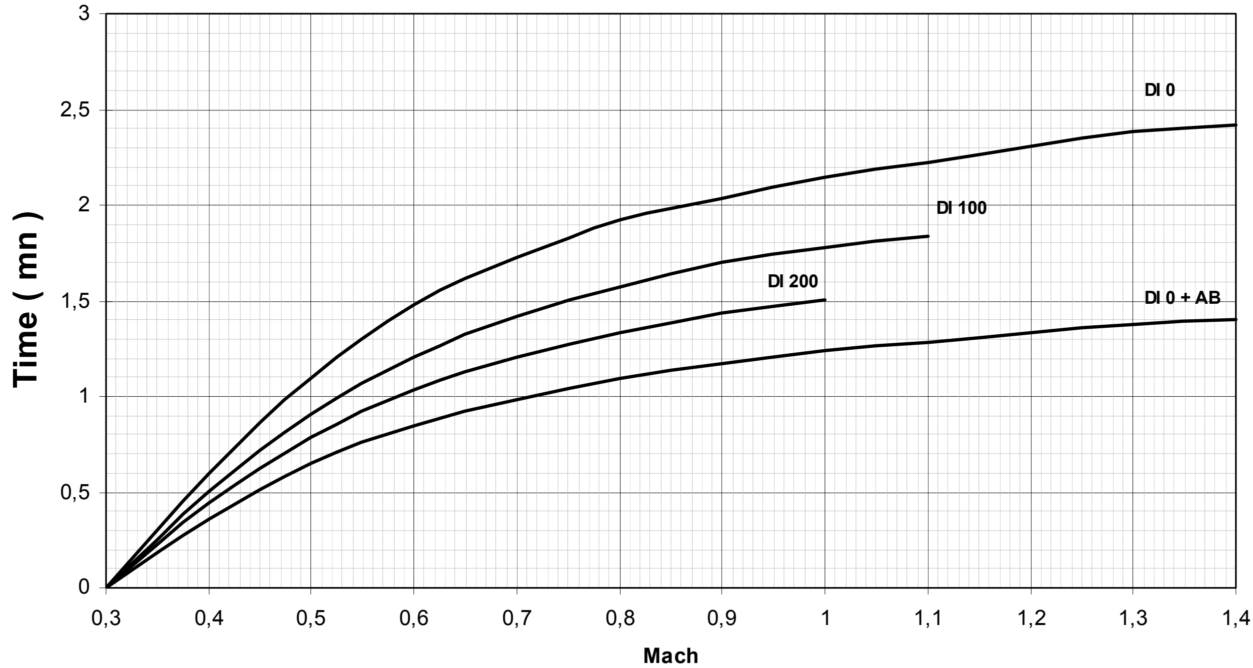
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 5 000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 25,697 Lbs



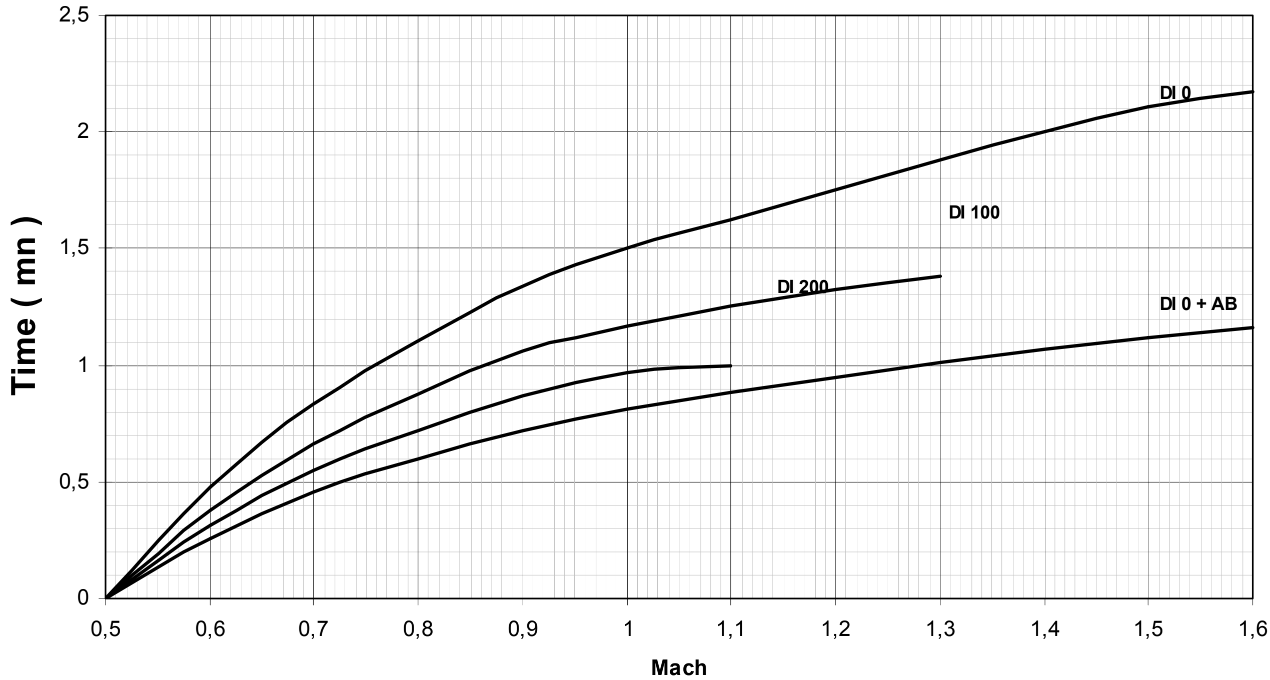
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 15 000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 25,697 Lbs



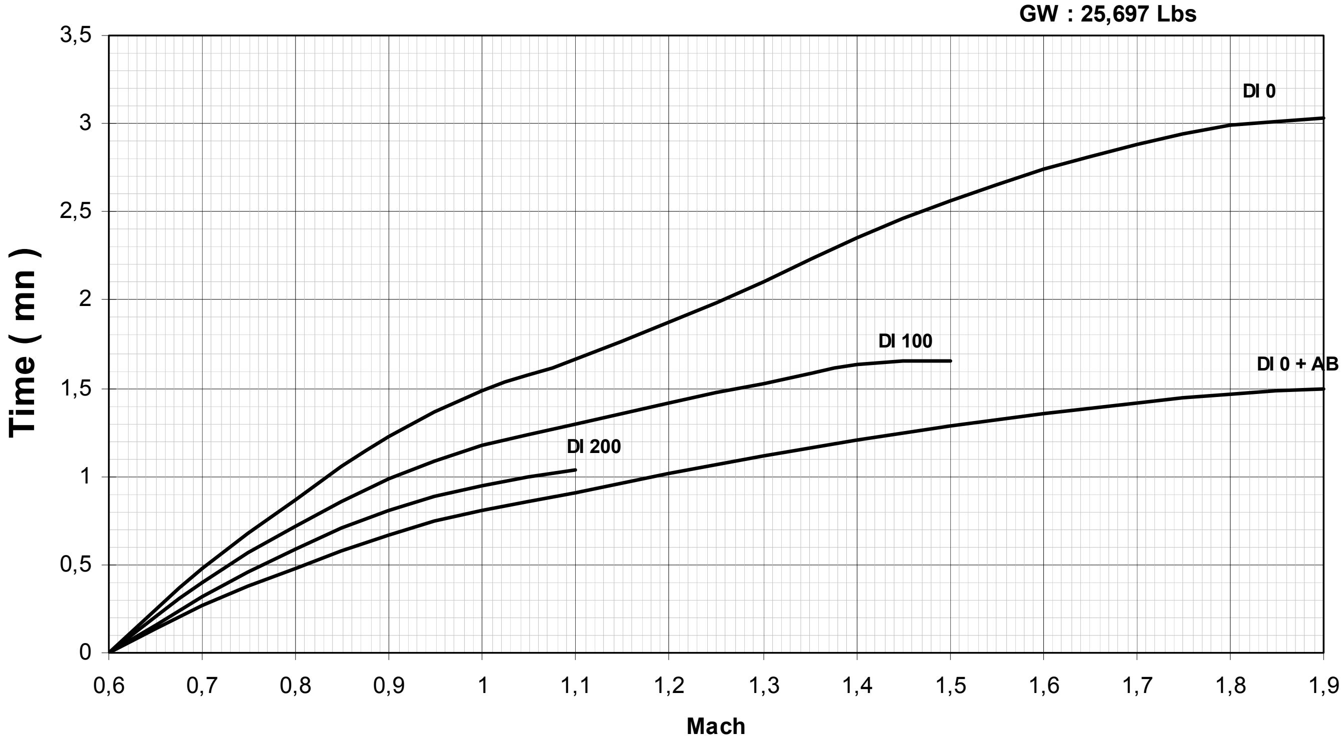
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 25 000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 25,697 Lbs



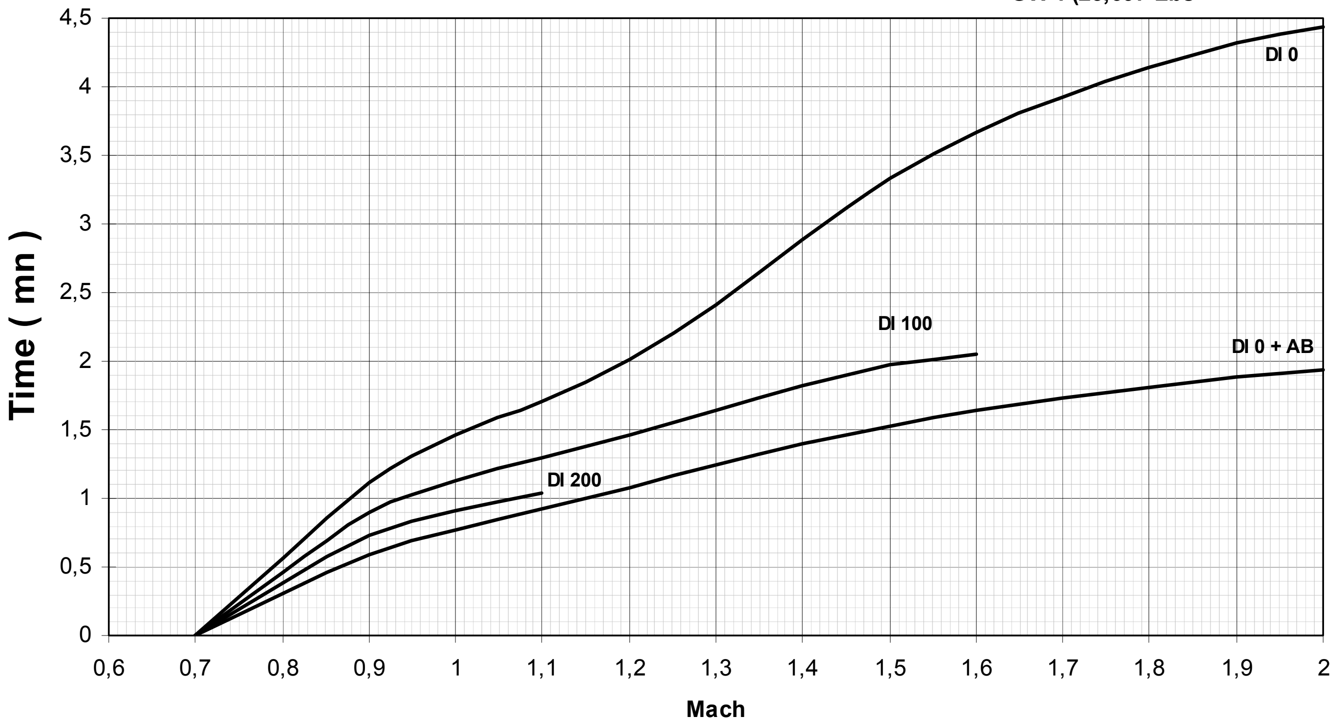
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 35 000 ft

AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : (25,697 Lbs



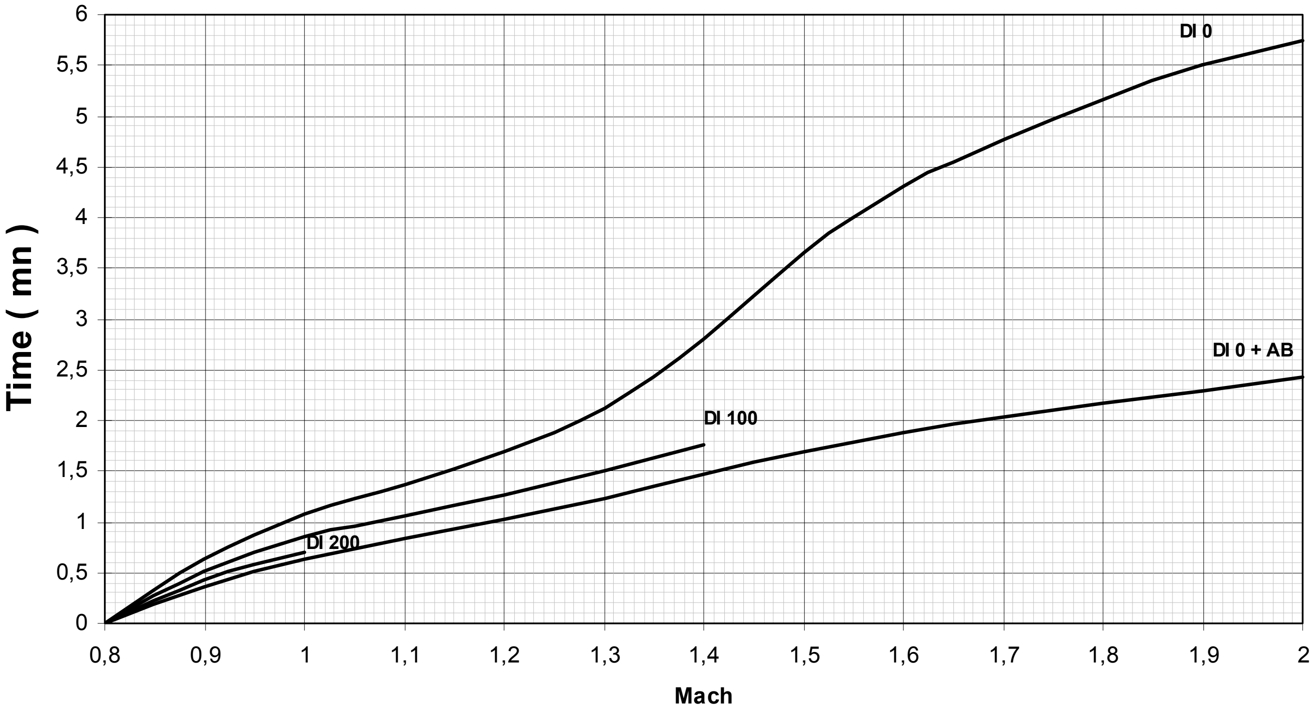
DATA BASIS : ESTIMATED

CONDITIONS :
- STANDARD DAY
- IDLE POWER

DECELERATION
ALT 45 000 ft

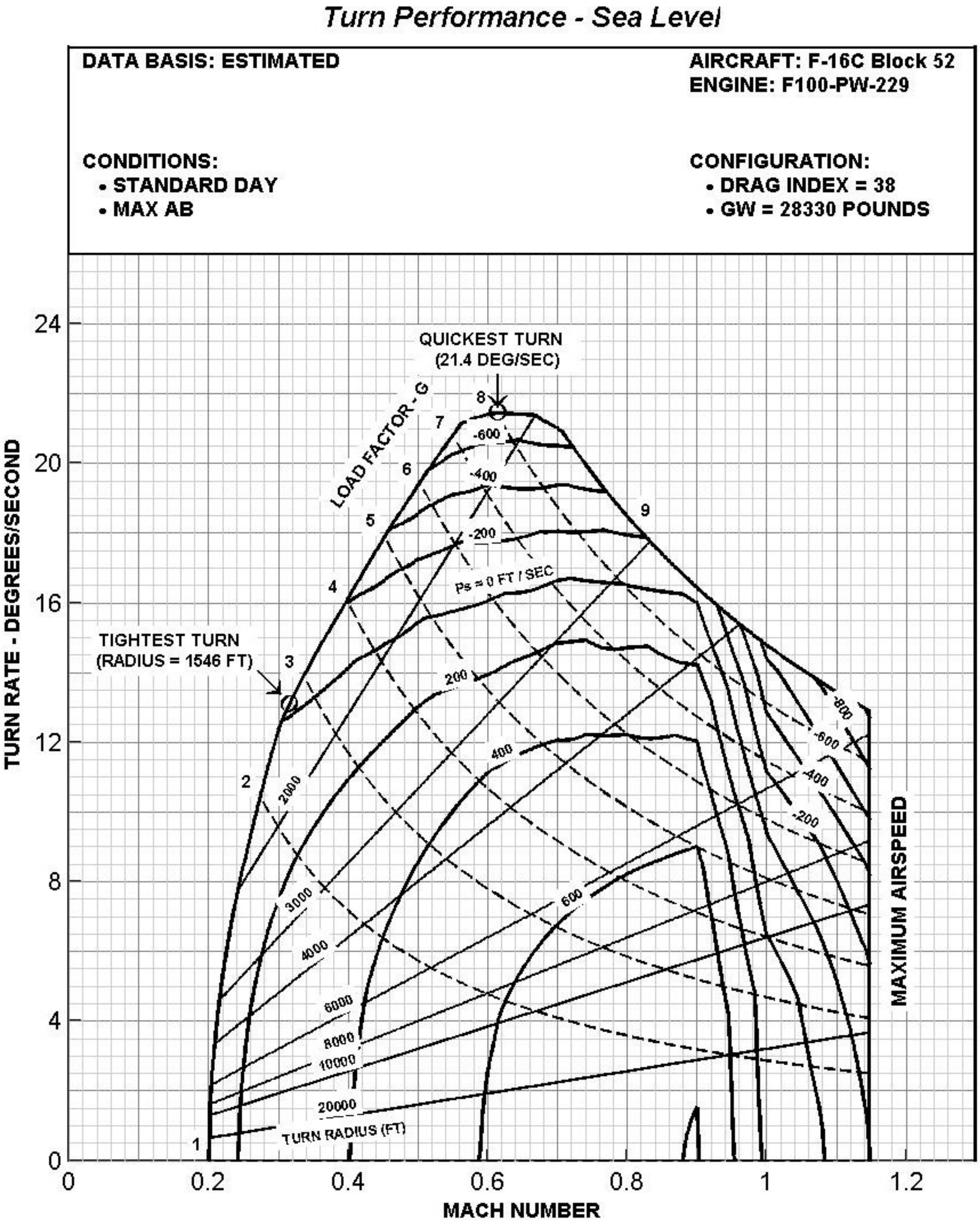
AIRCRAFT : F16C Block 52
ENGINE: F100-PW-229

CONFIGURATION
GW : 25,697 Lbs

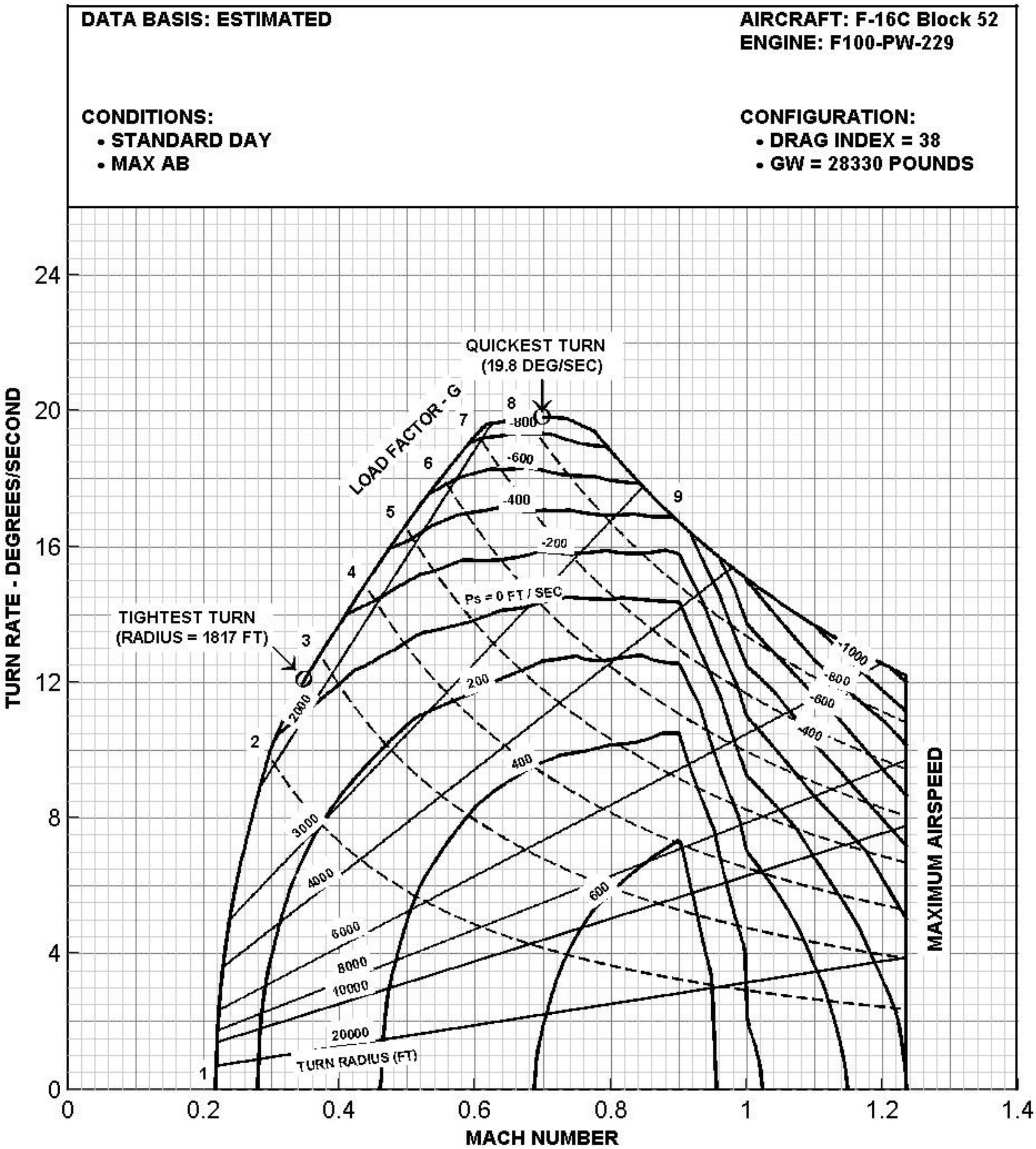


4.5.3 EM charts

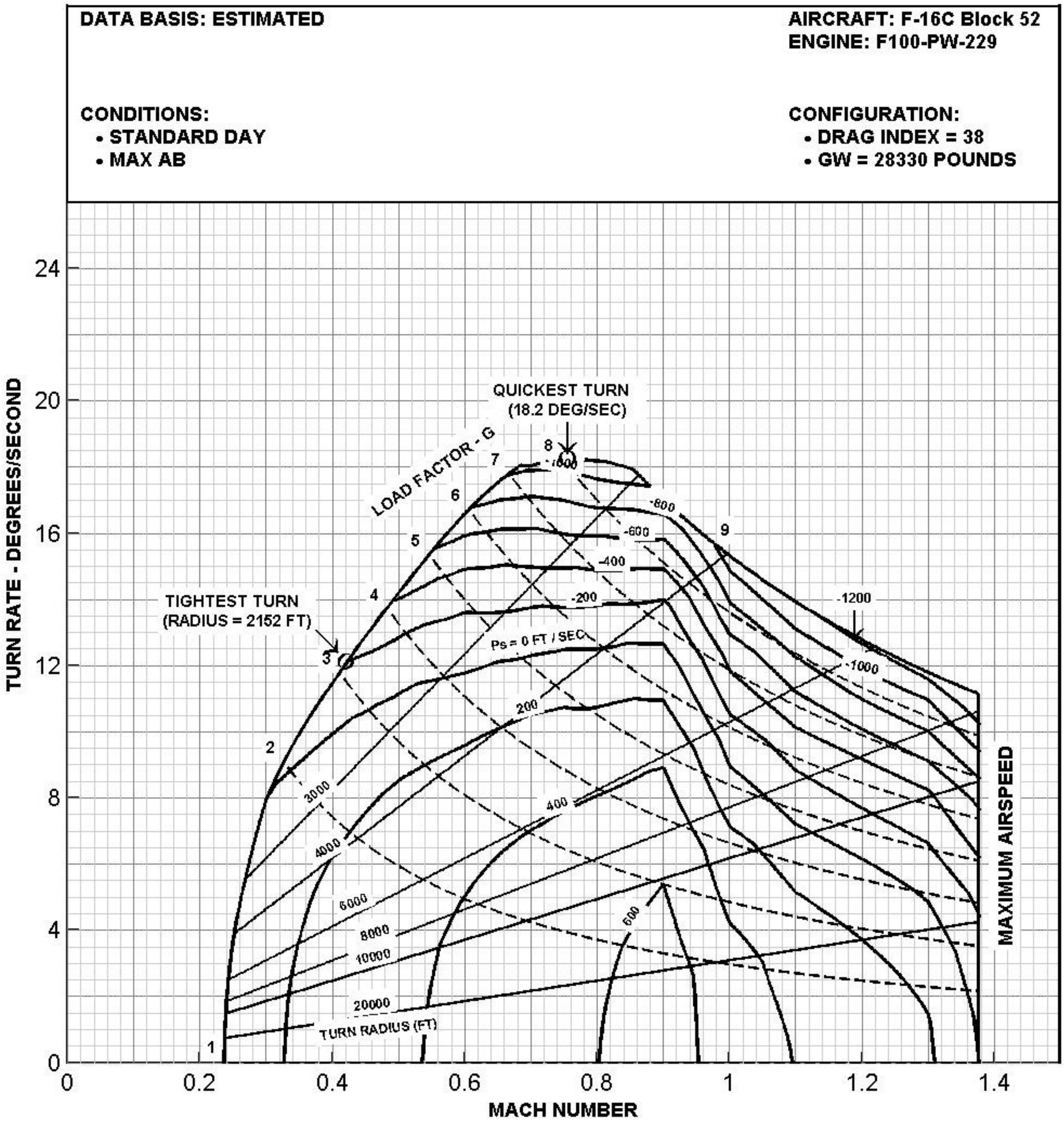
EM charts have been drawn in combat configuration: FUEL 100 % + 2 AIM9M + 2 AIM120 + ALQ131



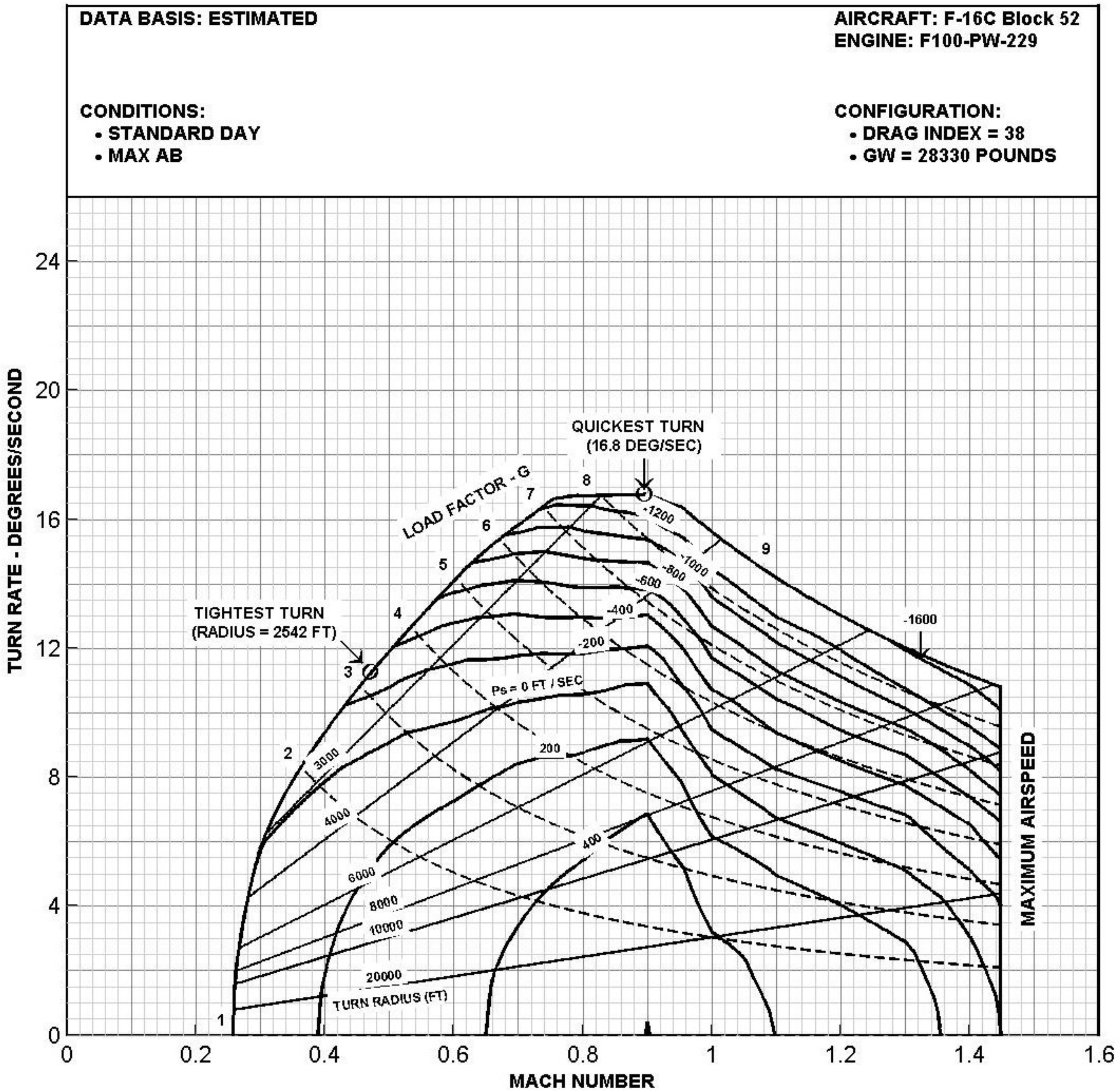
Turn Performance - 5000 Feet



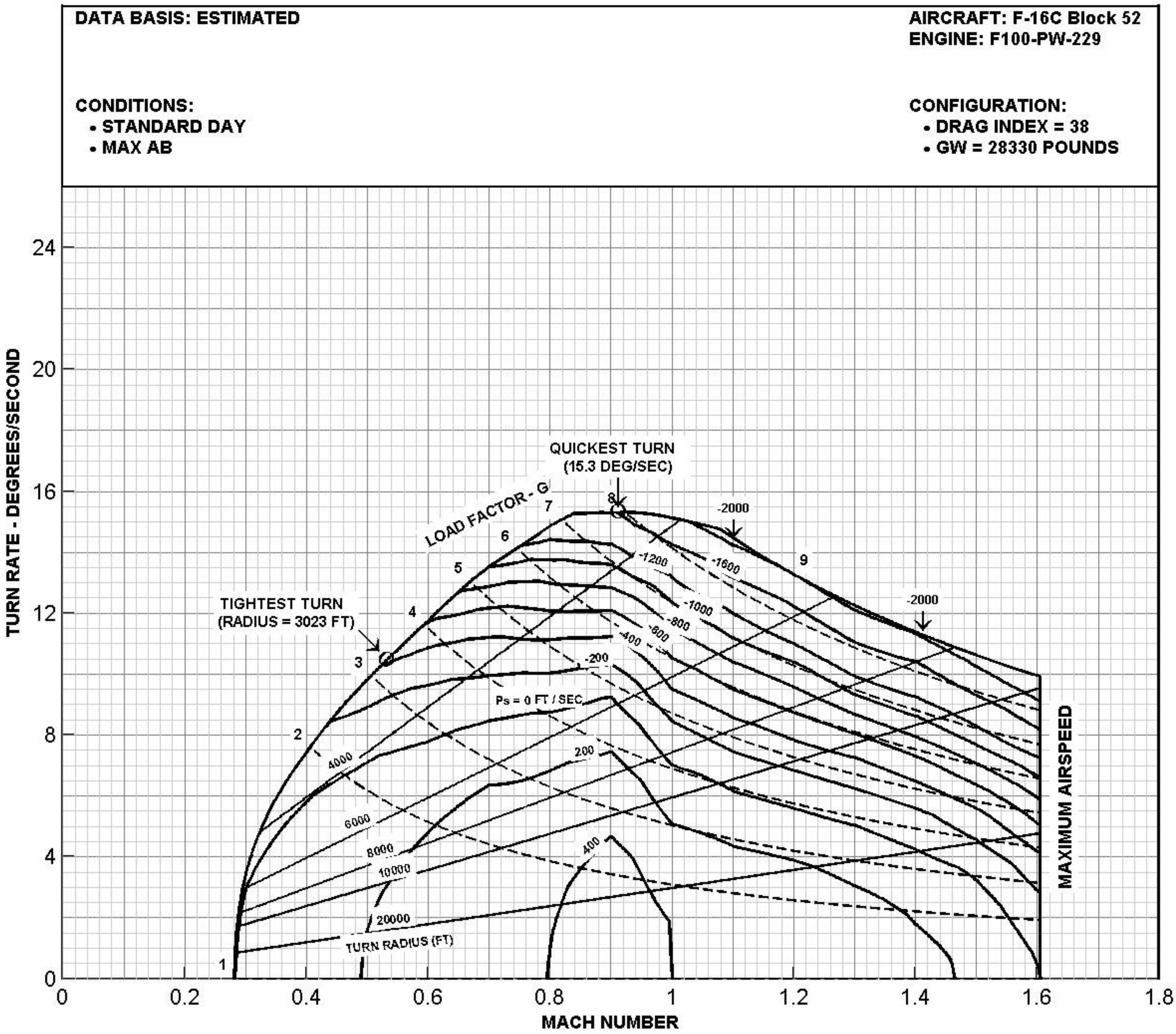
Turn Performance - 10000 Feet



Turn Performance - 15000 Feet



Turn Performance - 20000 Feet



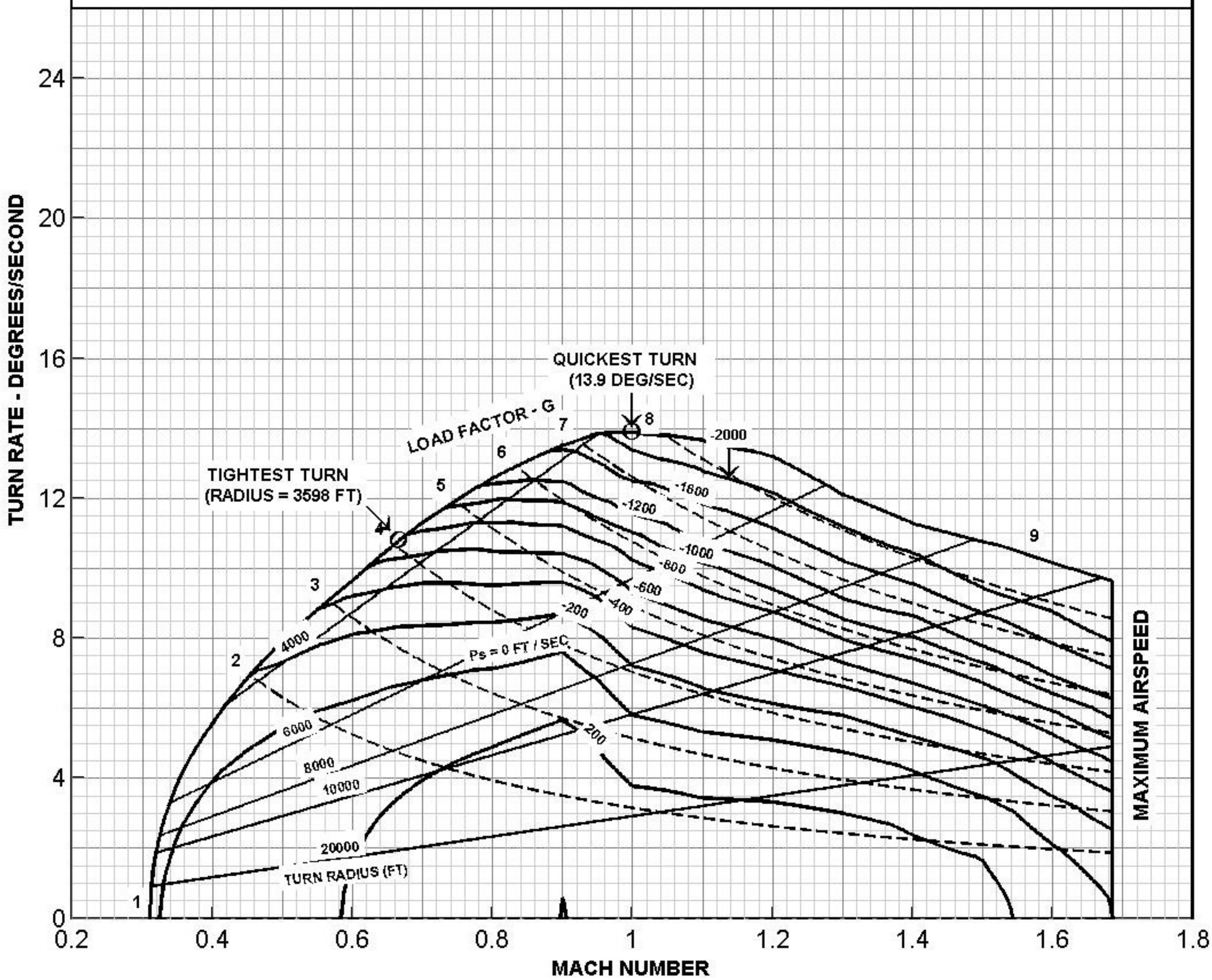
Turn Performance - 25000 Feet

DATA BASIS: ESTIMATED

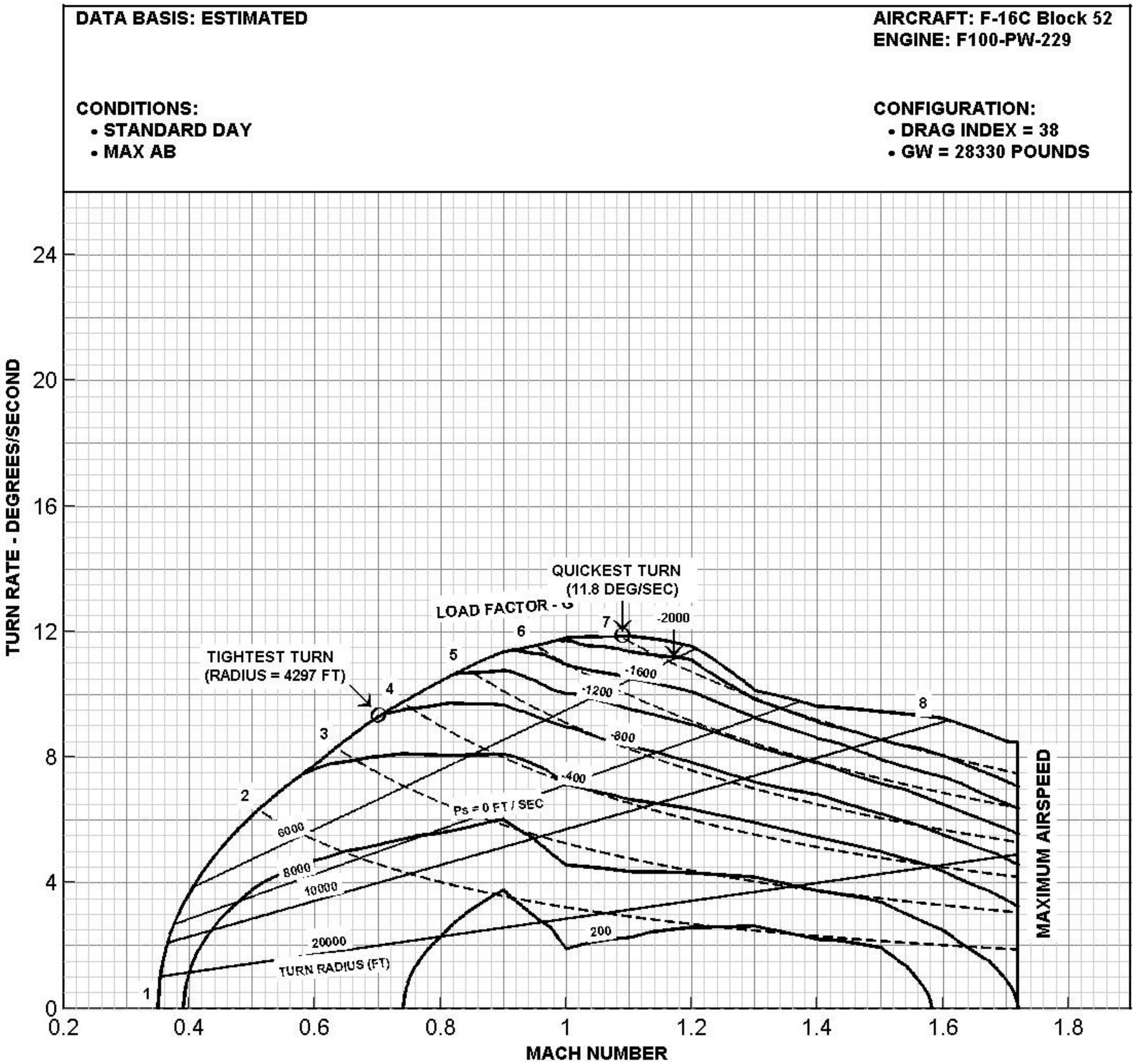
AIRCRAFT: F-16C Block 52
ENGINE: F100-PW-229

CONDITIONS:
- **STANDARD DAY**
- **MAX AB**

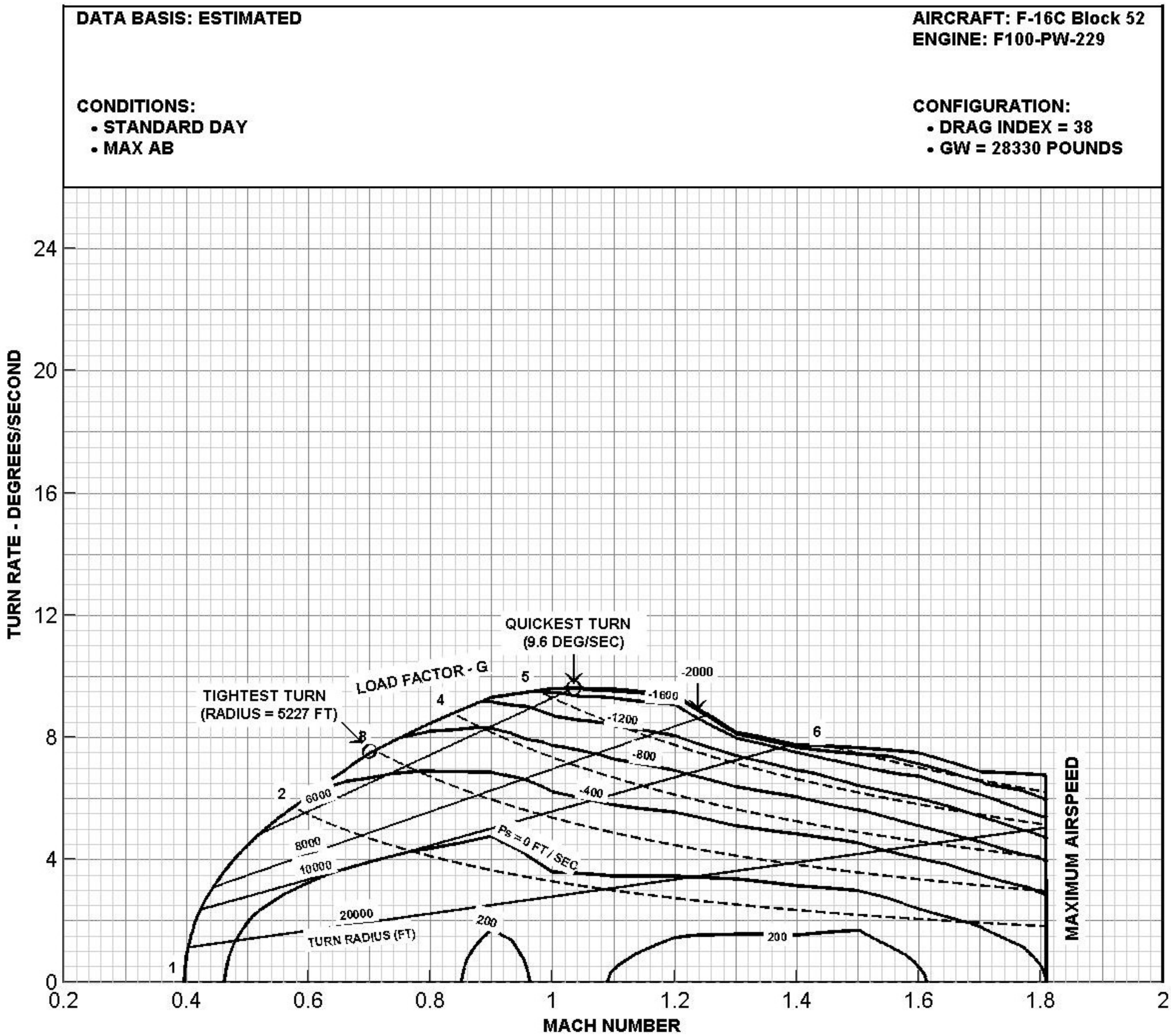
CONFIGURATION:
- **DRAG INDEX = 38**
- **GW = 28330 POUNDS**



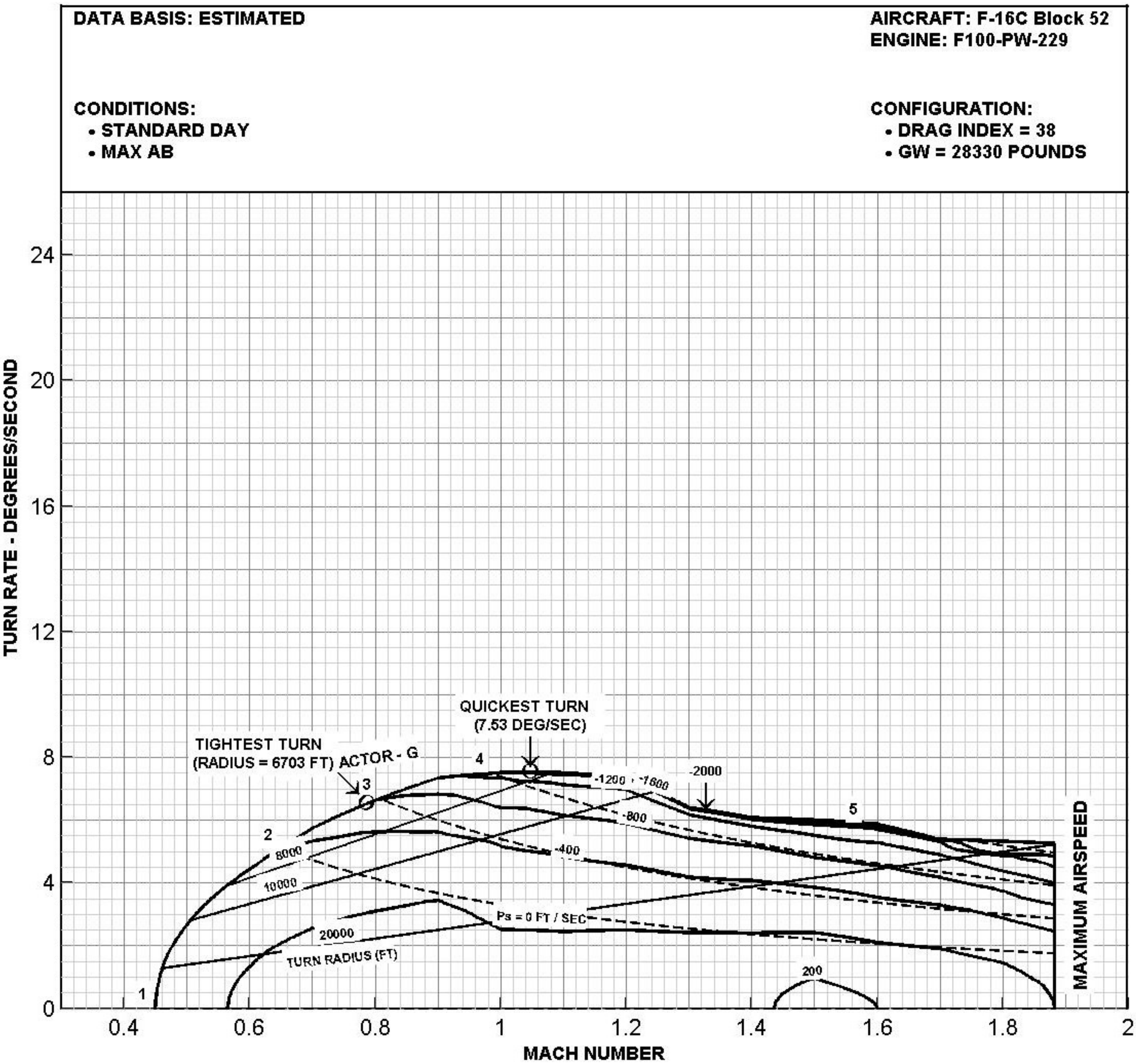
Turn Performance - 30000 Feet



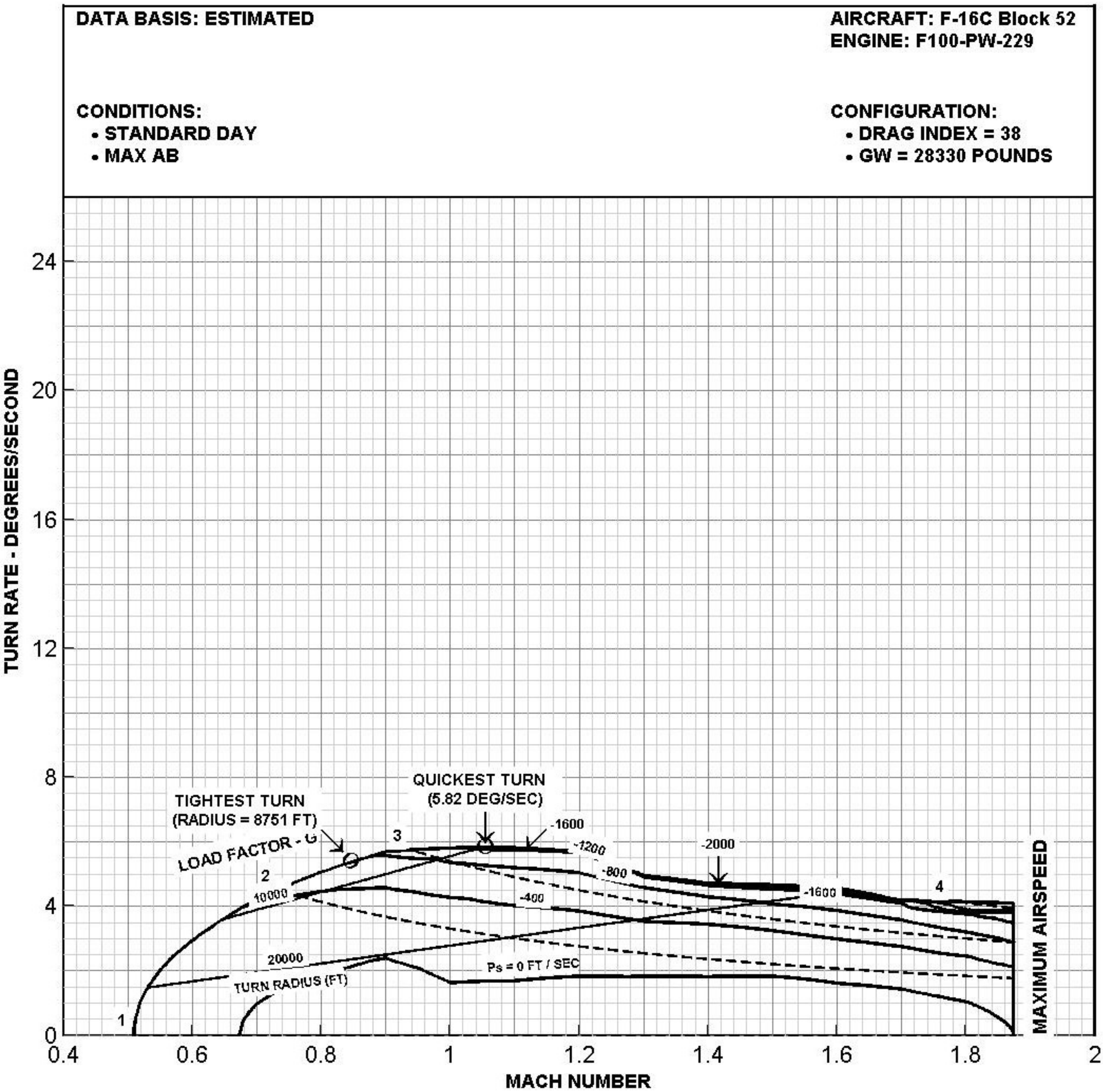
Turn Performance - 35000 Feet



Turn Performance - 40000 Feet



Turn Performance - 45000 Feet



5 Sources and Credits

5.1 Sources

AIAA Journal of Aircraft (various editions) for F-16 data

ADA128263(EM analysis)

Jane's website

http://techreports.larc.nasa.gov/ltrs/PDF/NASA-79-tp1538.pdf

http://www.usafa.af.mil/dfp/classes/315/Problem%20Sets/Problem%20set%201.pdf

http://home.att.net/~jbaugher4/f16.html

5.2 Credits

- FM designers :

  MAV- JP

  RAPTOR-ONE

- Data sources :

  ANTONIS

  SAINT

- BMS modifications :

  MIRV

  M.RIVERS

  SAINT

- Patch integration

  JEFFEL

  RATTY

- Beta Testers

  BAD- BOY

  SAPPY

  THE CELLULE RAPACE

A special thanks for the hard work of Bad Boy and Sappy, without their help and their efforts for testing the model, all of this would have been different.