ABSTRACT

Title of Document: DIESEL ENGINE STARTUP CHARACTERIZATION WITH PURE COMPONENT AND CONVENTIONAL NAVY FUELS

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In an effort to diminish the energy consumption of the Department of the Navy, strict energy goals have been implemented, to include the use of renewable fuels. Many of the renewable fuels that are currently being evaluated by the Department of the Navy are pure component or only have a few components of hydrocarbons. In order to determine and compare the startup performance of pure component, renewable fuels and conventional Navy fuels, three pure component fuels and standard naval aviation fuel were tested in a single-cylinder diesel engine, varying compression ratio and air-fuel equivalence ratio. It was found that startup performance is improved from any three of the following: decreasing air-fuel equivalence ratio, increasing compression ratio, and finally, increasing cetane number. Additionally, startup performance was affected by the density and bulk modulus of each of the tested fuels.

DIESEL ENGINE STARTUP CHARACTERIZATION WITH PURE COMPONENT AND CONVENTIONAL NAVY FUELS

By

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Chapter 1: Motivation and Objectives

In 2009, the Honorable Ray Maybus, current Secretary of the Navy (SECNAV), declared aggressive energy goals in order to diminish the energy consumption of the Department of the Navy [1]. One of those energy goals is to implement a "Great Green Fleet", which will consist of ships and aircraft using alternative sources of energy and multiple energy conservation measures during their scheduled deployment cycles throughout the 2016 calendar year [1]. Additionally, by the end of this decade, 50 percent of the Navy's fuel usage (both diesel and jet) will be replaced by renewable fuels. These proposed energy goals will enhance the Department of the Navy's combat capability while reducing an important military susceptibility; foreign oil dependency [1].

Before the Great Green Fleet can be deployed, the Navy conducted a provisional demonstration in July of 2012, as part of the Rim of the Pacific (RIMPAC) exercise, which is the world's largest international maritime exercise [1]. During that RIMPAC exercise, roughly 450,000 gallons of biofuel blends were expended, which consisted of 50-50 mixtures of biofuel (produced from used cooking oil and algae) and petroleum based marine diesel or aviation fuel [1]. In that single event, 350,000 gallons of hydroprocessed renewable diesel (HRD-76) and an equal amount of marine diesel (F-76) was consumed by naval surface ships, while naval aircraft burned 100,000 gallons of hydroprocessed renewable jet fuel (HRJ-5) and an equal amount of conventional naval aviation fuel (JP-5) [1]. In addition, the Navy has successful completed alternative fuel testing on the following platforms: F/A-18 E/F Super Hornet, F/A-18 C/D legacy Hornet, RCBX assault craft, MH-60S Seahawk

helicopter, MV-22 Osprey, T-45 training aircraft, EA-6B Prowler, MQ-8B Fire Scout unmanned aircraft, AV-8 Harrier, the Self Defense Test ship and the USS Ford [2].

Figure 1-1: The guided-missile cruiser USS Princeton (CG 59) receives biofuel from the Military Sealift Command's fleet replenishment oiler USNS Henry J. Kaiser (T-AO 187) during a replenishment at sea for RIMPAC 2012 [3]. U.S. Navy photo by Mass Communication Specialist Ryan J. Mayes.

By searching for an alternative to foreign oil, the readiness of the Department of the Navy and our nation are less affected by oil price volatility [4]. In years past, the Navy has suffered as much as $500 million dollars in additional fuel bills, which has been paid by using transferred funds from the Navy's Training and Readiness budget [3]. In doing so, readiness was traded for fuel, resulting in Sailors and Marines not being afforded the proper training opportunities [4].

Rich Kamin, who is the Navy Fuels Team Lead stationed out of Naval Air Station (NSA) Patuxent River stated that even though most of the Navy's testing of

biofuel has been conducted on camilena, an oil derived from mustard seed, the Navy is feedstock neutral [3]. Kamin stated that his team has looked at many different feedstocks, to include plant oil, vegetable oil and waste oils, which all produce an end product that is very similar [3].

Figure 1-2: Biofuel undergoes initial inspection as it is being pumped onboard the USS Nimitz (CVN 68) aircraft carrier during RIMPAC 2012 [3]. U.S. Photo by Mass Communication Specialist 2nd Class Robert Winn.

Leadership in energy innovation is nothing new for the Department of the Navy; dating back to the middle of the 19th Century for the transition from wind to coal-powered steam, from coal to oil in the early part of the 20th Century and finally, initiating nuclear power in the middle of the 20th Century [5]. Implementing the use

of renewable fuels will be the next chapter in the United States Navy's involvement in energy innovation.

Joelle Simonpietri, who is the U.S. Pacific Command's operational manager for energy and contingency basing, stated that the Department of Defense Alternative Fuel Policy requires that these new, renewable fuels must be "drop-in" fuels meeting existing fuel specifications, including using existing transportation and distribution methods and infrastructure [6]. Further adding to the challenge is the fact that the Navy operates in extremely harsh maritime environments, resulting in fuels being exposed to seawater, either during storage or transportation [7]. Additionally, the alternative fuels must have lifecycle greenhouse gas emissions no worse than conventional fuels, as well as being cost-competitive with petroleum fuels [6]. Lastly, Simonpietri stated that it is very important to the Navy that the production of these new biofuels complement food crops vice creating competition [6].

The Department of the Navy utilizes many different diesel engines, varying in displacement, compression ratio and application. Currently, conventional fuels used by the Navy must meet certain specifications for each engine and purpose [7]. Testing each of these engines would not be cost effective, as full engine testing requires that 100,000 gallons of the new fuel must be tested in order to achieve certification [7]. Even though the Navy has experience working with conventional fossil fuels, new techniques and procedures will need to be implemented to establish the use of alternative fuels [7].

Some of these new, renewable fuels are pure component or only have a few components of hydrocarbons, which is due to the fuel source and feedstock process. Typical Navy diesel and jet fuels, JP-5 and F-76 respectively, are composed of 100's of hydrocarbons in their boiling range. Because of this difference and the availability of these new fuels from different sources and feedstock processes, the Navy is interested in the research of potential pure component, hydrocarbon fuels.

One question that still remains is what are the startup characteristics of these new, alternative fuels? How well will these fuels actually start inside conventional navy diesel engines? What are acceptable criteria for startup times or characteristics with these new fuels? As of now, no such criteria exist. One important application regarding startup characteristics would be aboard nuclear powered submarines and aircraft carriers implement the use of emergency diesel generators to provide back-up power for their nuclear reactors. This research work looks to initiate the discussion of how does the startup performance of the new, renewable fuels compare to conventional Navy fuels.

Chapter 2: Background and Literature Review

In 1990, members of Wayne State University and the U.S. Army Tank Automotive Command investigated cold starting diesel conditions [8]. The experiments were conducted on a single cylinder, air cooled, four-stroke cycle engine in a cold room, varying fuels, ambient temperature and injection timing [8]. Conducting motoring tests, without fuel injection, the team found that compression pressure and temperature and dependent on ambient temperature and cranking speeds [8]. When testing was conducted at normal ambient temperatures with JP-5 and static injection timing of 23 degrees before top-dead center (BTDC), the regular four-stroke cycle process occurred [8]. When ambient temperature was moderately low, the engine may skip one cycle before each firing, i.e. operate in an irregular eight-stroke cycle process [8]. Furthermore, when ambient temperature was significantly lower than normal, the engine may skip two cycles before each firing, i.e. operate in an irregular twelve-stroke cycle process [8].

Members of Wayne State University and the U.S. Army Tank Automotive Command continued their research, releasing another SAE Technical Paper in 1992, investigating combustion instability during the cold starting of a single cylinder, direct injection, four-stroke cycle, air-cooled diesel engine [9]. Covering various fuels of different properties, the experiments were conducted at different ambient temperatures and injection timings, determining that the pattern of misfiring (i.e. one misfire equating to an eight-stroke cycle process, two misfires equating to a twelve-stroke cycle process, etc.) was repeatable and not random [9]. They determined that

the combustion instability was found to be related to speed, residual gas temperature and composition, accumulated fuel and ambient air temperature [9].

In 2008, members of Ford Motor Co. and the University of Nottingham investigated the effect of reducing compression ratio on the work output and heat release characteristics of a direct-injection diesel engine under cold-start conditions [10]. A single-cylinder, 500cc engine was used at compression ratios of 18.4:1 and 15.4:1; achieving the change in compression ratio by altering the piston bowl volume [10]. Engine speed was held at 300 revolutions per minute and ambient temperature was varied from 10, -10 and -20 degrees Celsius. They noted that the reduced compression ratio generally resulted in an increase of peak specific indicated work output, attributable to a reduction in blowby and heat transfer losses and lower peak rates of heat release increasing cumulative burn [10].

One of the most promising ways to meet the need to reduce greenhouse gas emissions is to reduce the compression ratio of diesel engine [11]. However, cold start requirements is a limiting factor in the reduction of compression ratio [11]. In 2010, a study was conducted to determine the effects of fuel characteristics in the cold start of diesel engines, testing eight fuels, with cetane numbers ranging from 47.3 to 70.9, as well as a range of volatility, at compression ratios of both 14:1 and 16:1 [11]. The results showed the impact of reduced compression ratio only to effect the idle phase, with the impact of volatility being unclear, but the increase in cetane number resulting in improved cold start performance [11].

Similar to the research above, experiments were performed to identify if low compression ratio is compatible with cold start requirements using an HSDI common

rail diesel four-cylinder engine [12]. Investigation was performed in order to meet future diesel engines emission standards, as reducing compression ratio could possibly be the most feasible method in reaching these strict requirements [12].

In an effort to understand the combustion characteristics of future diesel fuels, over twenty pure component hydrocarbon fuels and seven fuel blends were tested in a single-cylinder diesel engine, analyzing ignition delay as the primary combustion metric [13]. The pure component fuels included normal alkanes (C6 to C16), normal primary alkenes (C6 to C18), isoalkanes, cycloalkanes/-enes, and aromatic species [13]. The seven fuel blends consisted of five Fischer-Tropsch synthetic blends, conventional Navy jet fuel (F-76) and commercial diesel fuel [13]. Several ignition delay correlations were observed with respect to the physical properties of the fuels [13]. Generally, component fuels with lower liquid fuel density, kinematic viscosity, and liquid-air surface tension were observed to have longer ignition delays [13].

Hydrotreated Renewable Diesel (HRD) fuel, which is a processed vegetable oil from algae, was tested and compared to conventional Navy diesel fuel [14]. When compared to the diesel fuel, the high cetane value of the HRD (77 vs 43 for the diesel fuel), resulted in shorter ignition delays, longer combustion durations and lower peak cylinder pressures [14].

Similarly, Hydrotreated Renewable Jet (HRJ) fuel was tested in a military diesel engine across the entire speed-load operating range, observing ignition delay at each operating condition [15]. Results show that ignition delay values decreased as engine load and speed were increased [15].

Next, research was performed to identify the combustion differences between new, alternative diesel fuels and conventional fuels, in order to determine how much of an indicated combustion change is acceptable [16]. Three combustion criteria were tested: relative change in ignition delay, angle of peak pressure, and finally, relative maximum rate of heat release [16].

Lastly, a new, alternative fuel, which is derived from a Direct Sugar to Hydrocarbon (DSH) process, was compared to conventional Navy diesel fuel performance [17]. The DSH fuel, with a moderately higher cetane number than F76, produced later Start of Injection times due to its lower density, viscosity and bulk modulus [17]. However, because of the increased reactivity of DSH fuel, the ignition delay was reduced when compared to conventional Navy diesel fuel [17].

All of these mentioned experiments mainly focus on the steady state operation of the engine and fuel, which is outstanding work, but the question that still remains unanswered is; what are the startup characteristics of these pure component fuels in a conventional diesel engine? By performing new experiments, new insight will be provided as to the startup performance of pure component fuels, which can be compared to conventional Navy fuels currently being used.

Chapter 3: Experimental Setup

Waukesha CFR F5 Diesel Test Engine

The engine used in this study is a Waukesha Cooperative Fuels Research (CFR) F5 diesel test engine located in the Propulsion Laboratory at the United States Naval Academy (USNA) in Annapolis, MD.

Figure 3-1: A Waukesha CFR F5 Diesel Test Engine

The F5, which was introduced in 1938, has been a globally accepted standard for determining and certifying the ignition quality of diesel fuels [18]. The first key design feature of the F5 is its variable compression ratio cylinder head, which allows for continuous variation of the compression ratio during engine operation [18]. Compression ratio can be adjusted from as low as 8:1 and as high as 36:1 [18].

Typical engines in the Navy operate between 12:1 and 18:1. The second key feature to the F5 is its fuel injection system, which allows the adjustment of both the fuel flow rate and injection timing during engine operation [18]. Lastly, the F5 has a variable reluctance sensor located on the fuel injector pintle.

Sensors & Data Acquisition

A Kistler™ 6125 pressure transducer was mounted in the cylinder head of the engine, as well as a BEI H25 shaft encoder, located on the crankshaft. Data collection was performed using National Instruments™ data acquisition hardware with MATLAB software sampling at a rate of 50 kHz.

Fuels Tested

Currently, the standard diesel fuel used by the U.S. Navy is F-76, which has a minimum cetane number requirement of 42 and usually averages a cetane value of 49. F-76, similar to conventional, commercial diesel fuel, is comprised of hundreds of different molecules, varying both in size and structure.

The conventional aviation fuel used by the U.S. Navy, JP-5, does not have a minimum cetane number requirement, but usually averages a cetane value of 45. Often times, due to tactical logistics in the Navy and Marine Corps, JP-5 fuel is used as the "one fuel forward" in both jet and diesel engines. Currently, there is no maximum cetane number requirement for either F-76 or JP-5.

Because of the different sources, feedstocks and processes, pure component fuels are produced, which are very different from the conventional diesel and jet fuels used by the Department of the Navy. Three pure component fuels, normal heptane

(nC7), normal decane (nC10) and normal hexadecane (nC16) were chosen for this experiment. Key physical property data is included in the table below.

Physical Properties of Fuels @ 20°Celsius				
	Density	Bulk Modulus	Dynamic Viscosity	Cetane Number
Fuels	$kg \cdot m^{-3}$	Mpa	mPa·sec	Unitless
n-Heptane	684	907	0.41	55
n-Decane	730.0	1148.0	0.92	77.0
n-Hexadecane	774	1425	3.46	100
JP-5	803	1389	1.88	46

Table 3-1: Physical properties of fuels at 20 degrees Celsius [19].

Throughout this research, the startup performance of pure component fuels will be compared to conventional Navy fuels, providing insight as to which new, alternative fuels are the best choice for the Department of the Navy and its diesel engines. Conventional naval aviation fuel, JP-5, will be chosen as the comparison fuel to the three pure component fuels. JP-5, which nominally is a C12 fuel, was chosen because it is close to normal decane (nC10) and bounded by both normal heptane and normal hexadecane (i.e. nC7 and nC16 respectively). Also, as previously stated, JP-5 is often chosen as the "one-fuel forward" for Navy and Marine Corps operations, therefore, strengthening the decision to be chosen as the baseline fuel for the pure component fuels to be compared.

Energy Release Analysis

To further analyze the engine's in-cylinder pressure data, a conventional engine heat release analysis modeled after MIT's Single Zone approach ([20], [21], [22]) was utilized. This single zone model uses a first-law energy balance with combined unburned and burned single zone average properties to determine the rate

of energy release, also called the rate of heat release [17]. Time domain sampling was converted to crank angle degrees and engine wall heat transfer was accomplished with the conventional instantaneous spatially averaged Woschni coefficient [14]. This analysis becomes useful in calculating start of combustion and burn durations, with Start of Injection (SOI) determined by the Kistler pressure sensor and Start of Combustion (SOC) determined analytically as the 5% rise in instantaneous heat release above the SOI level [15].

Chapter 4: Experimental Results and Analysis

4.1 Air-Fuel Equivalence Ratio

For combustion to occur inside an engine, fuel must be vaporized in order to produce an ignitable mixture. When an engine is cold, more time is needed to vaporize the fuel. To compensate for this, more fuel, or a lower lambda value can be utilized. Some engines are even equipped with a cold-start injector, which provides a richer fuel mixture during startup. To determine if a richened fuel mixture improves startup performance with pure component fuels, a single pure component fuel and compression were chosen, while varying lambda.

However, in order to define and quantify startup performance, a metric, or efficiency needed to be created in order to determine a method to decipher when the engine was firing, or when combustion was occurring. When gross indicated mean effective pressure (GMEP) is a strong, positive number, combustion has occurred and torque is produced. By utilizing the data from the in-cylinder pressure sensor, G_iMEP was found, indicating when combustion occurred. In order to observe startup performance at various times during the startup process, the 1^{st}, 5^{th}, 10^{th} and 25^{th} fires were found (i.e. G_iMEP) and plotted versus the total number of engine cycles. The ratio of firing cycles to total cycles is defined as startup efficiency, or η_{START}. A startup efficiency of 100% would equate to a perfect start, or no misfires, while a startup efficiency of 0% would equate to all misfires, or no firing cycles occurred. The equation for startup efficiency is shown below:

$$\eta_{start} = \frac{Firing\ Cycles}{Total\ Cycles} \tag{4-1}$$

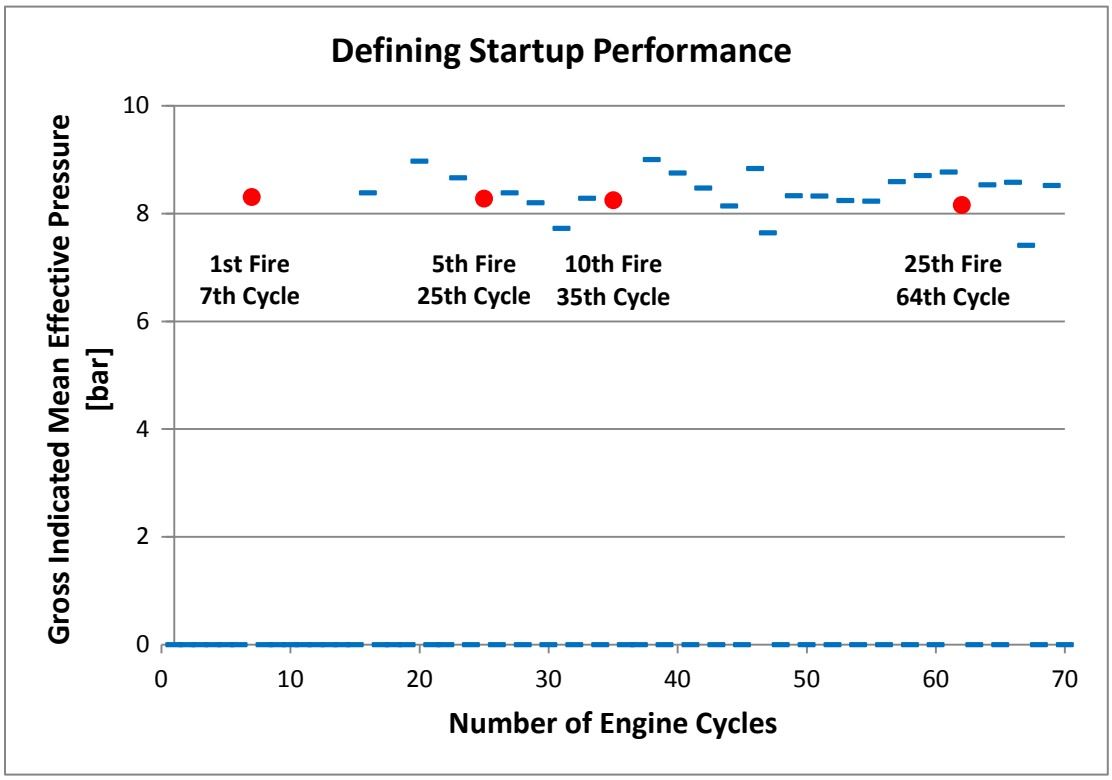


Figure 4-1: Depicts startup performance by plotting GMEP versus total number of cycles.

The air-fuel equivalence ratio, commonly referred to as lambda (λ), was the first variable tested to see the effects on startup performance. Lambda is the ratio of the actual air-fuel ratio (AFR_{actual}) to the stoichiometric air-fuel ratio (AFR_{stoich}). Looking at equation 4-1 below, a lean fuel mixture would equate to $\lambda > 1.0$, while a rich fuel mixture would equate to $\lambda < 1.0$.

$$\lambda = \frac{AFR_{actual}}{AFR_{stoich}} \tag{4-2}$$

Normal decane fuel was utilized at a compression ratio of 11.9:1. The initial test was performed using a lambda value of 1.55, while each subsequent test utilized a lower lambda value, or a richer fuel mixture. One additional lean fuel mixture was performed (i.e. $\lambda = 1.69$) during the testing to solidify the graphical trends.

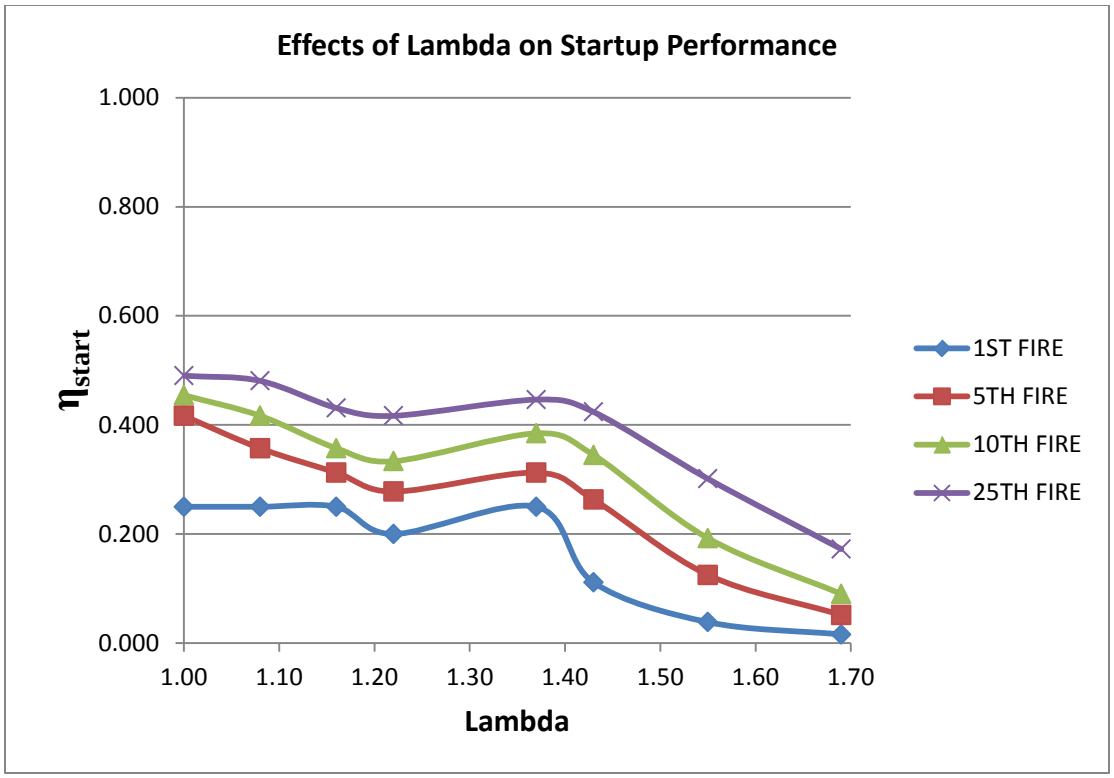


Figure 4-2: Effects of lambda on startup performance utilizing normal decane fuel at a compression ratio of 11.9:1.

The graph in figure 4-2 shows the effects of lambda on startup performance on normal decane fuel at a compression ratio 11.9:1. From this graph, it is clear that startup efficiency, or startup performance, increases as the fuel mixture is richened, or as lambda decreases. However, it is worth noting that startup performance stays relatively constant after lambda drops below 1.35. Another interesting relationship is this figure shows that startup efficiency for the 1st, 5th, 10th and 25th fires are all behaving similarly.

Trying to start the engine with too lean of a fuel mixture, results in not enough fuel molecules being present for combustion to occur. As the fuel mixture is richened, combustion occurs more frequently, resulting in improved startup efficiency. However, as the fuel mixture is further richened, or where lambda

dropped below 1.35, startup performance did not improve. It can be hypothesized, that further richening the fuel mixture, or over injecting, may cool the temperature of the air in the cylinder, which could slow the reaction and worsen startup performance. Regarding the similarity in startup efficiency across the different firing metrics (i.e. 5^{th} fire, 10^{th} fire, etc.), this may prove that regardless of which metric is chosen, an accurate measure of startup performance will be found.

4.2 Compression Ratio

Normal Heptane (nC7)

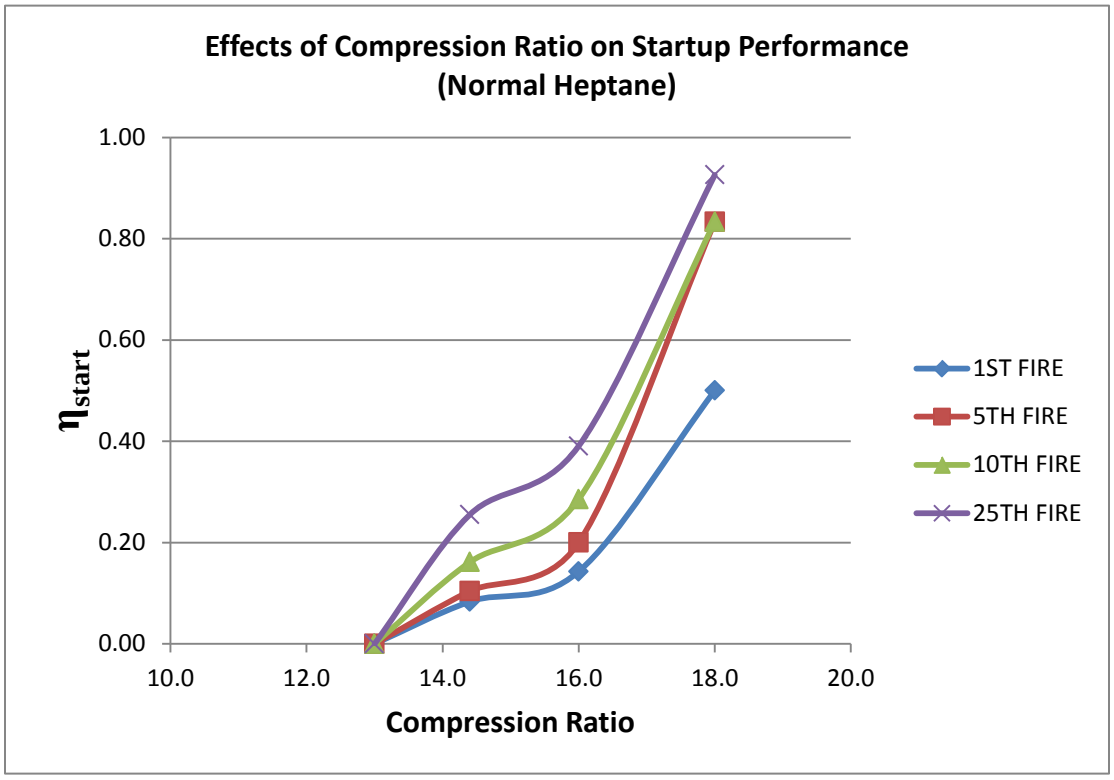


Figure 4-3: Effects of compression ratio on startup performance utilizing normal heptane fuel.

The next metric that was chosen to vary was compression ratio. All fuels were tested at various compression ratios to determine the effects. The graph in

figure 4-3 shows the effects of compression ratio on startup performance when using normal heptane fuel. From this graph, it is clear that startup efficiency increases as compression ratio increases. Notice that startup efficiency was 0% at a compression ratio of 13.0:1, which means the engine did not fire during the 30-second sampling period. Also, this figure shows that startup efficiency for the 1^{st}, 5^{th}, 10^{th} and 25^{th} fires are all behaving similarly. Notice when increasing the compression ratio from 14.4:1 to 16.0:1, the improvement in startup performance is marginal when compared to the improvement from 16.0:1 to 18.0:1. Lastly, even at a high compression ratio of 18.0:1, startup efficiency has still not reached 100%.

Startup performance increases as compression ratio increases because the temperature in the cylinder at the end of the compression stroke is higher. Temperature in the cylinder is higher because in-cylinder pressure is higher, which again, ties back to increased compression ratio. When utilizing the Arrhenius equation, which is a formula for temperature dependence of reactions rates, it becomes clear that rates of reactions increase exponentially with temperature. Any little increase in temperature results in much more reactivity, combustion occurs more effectively, which equates to a better startup.

Because normal heptane fuel has a relatively low cetane number of 55, compression ratio plays a substantial factor in startup performance. With a low enough cetane number and a low enough compression ratio, startup performance will degrade so significantly, that combustion will not occur, as observed at a compression ratio of 13.0:1. Finally, because each firing metric trend is similar, this may prove

that regardless of which metric is chosen (i.e. 5th fire, 10th fire, etc.); an accurate measure of startup performance will be found.

Normal Decane (nC10)

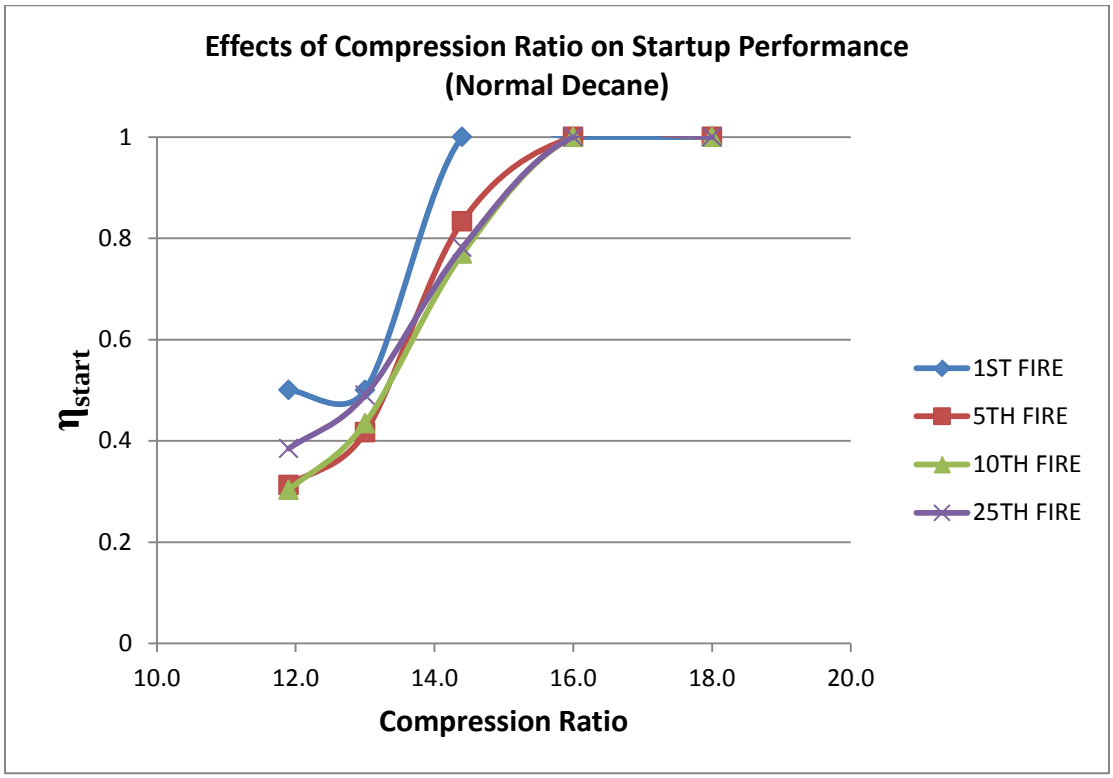


Figure 4-4: Effects of compression ratio on startup performance utilizing normal decane fuel.

The graph in figure 4-4 shows the effects of compression ratio on startup performance when using normal decane fuel. From this graph, it is clear that startup efficiency increases as compression ratio increases. Notice that, for normal decane, unlike normal heptane, the startup efficiency does reach 100%, considered a perfect engine startup. This is due to the higher cetane number of normal decane (i.e. CN = 77). Because of the high cetane value, further increasing the compression ratio past 16.0:1 has no effect on improving startup efficiency.

Similar to normal heptane, this figure shows the efficiency for the 1st, 5th, 10th and 25th fires are all behaving similarly.

Normal Hexadecane (nC16)

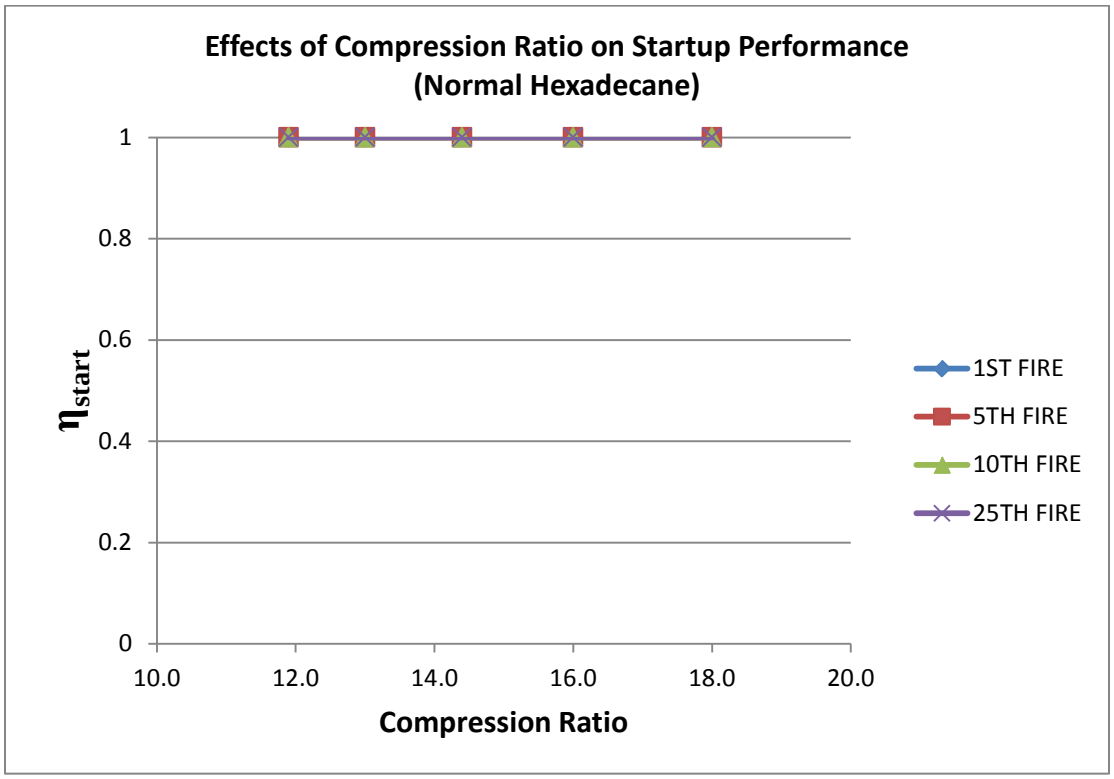


Figure 4-5: Effects of compression ratio on startup performance utilizing normal hexadecane fuel.

The graph in figure 4-5 shows the effects of compression ratio on startup performance when using normal hexadecane fuel. From this graph, it is clear that startup efficiency stayed constant as compression ratio increased. It is believed that this is due to the higher cetane number of normal hexadecane (i.e. CN = 100). The cetane value is so high, that regardless of the compression ratio (relative to the common compression ratios used in Navy diesel engines), this fuel will produce perfect engine startups.

Looking at a comparison of all three pure component fuels, it is safe to conclude that increasing the compression ratio of the engine improves startup performance.

Conventional Naval Aviation Fuel (JP-5)

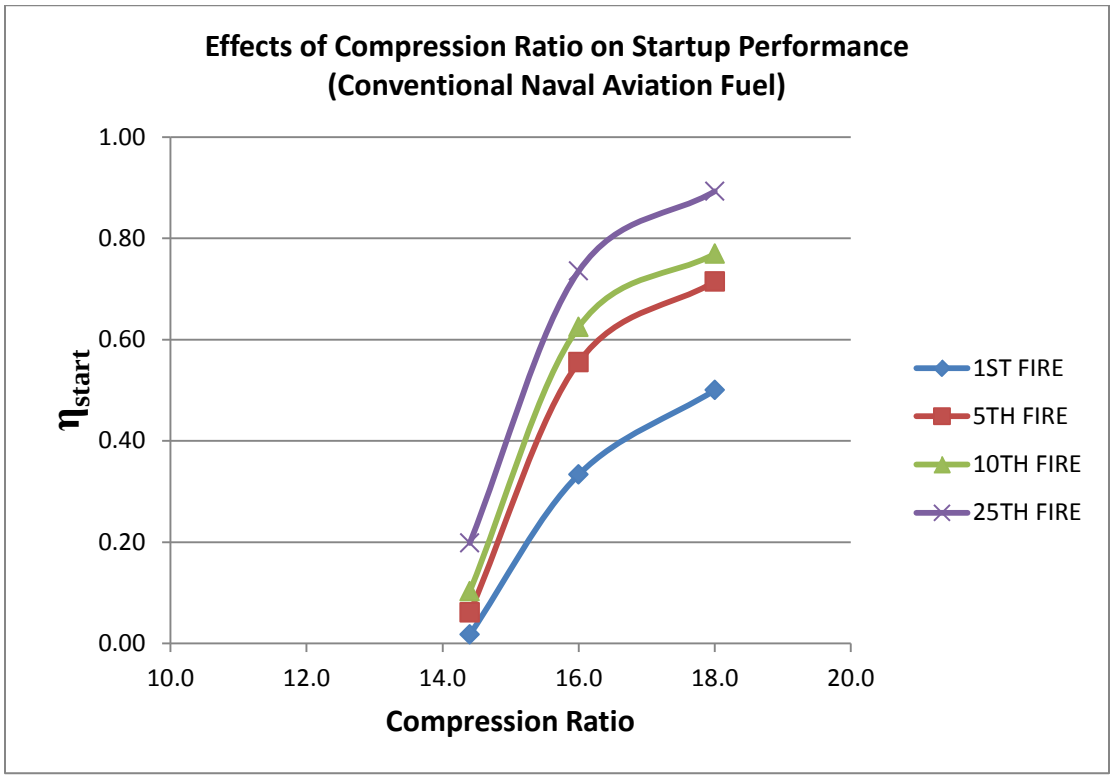


Figure 4-6: Effects of compression ratio on startup performance utilizing conventional naval aviation fuel (JP-5).

The graph in figure 4-6 shows the effects of compression ratio on startup performance when using conventional naval aviation fuel. From this graph, it is clear that startup efficiency, just like in the cases with pure component fuels, increases as compression ratio increases. Also, another similarity to the trends observed on the pure component fuel figures is the startup efficiency for the 1st, 5th, 10th and 25th fires all behaving similarly.

Looking at a comparison of all three pure component fuels and JP-5, the trend that increasing the compression ratio of the engine improves startup performance still holds true.

Comparison across the Fuel Types

Next, a study across all three pure component fuels and JP-5 was created to compare the startup performance at each firing point metric (i.e. 1st fire, 5th fire, 10th fire and 25th fire).

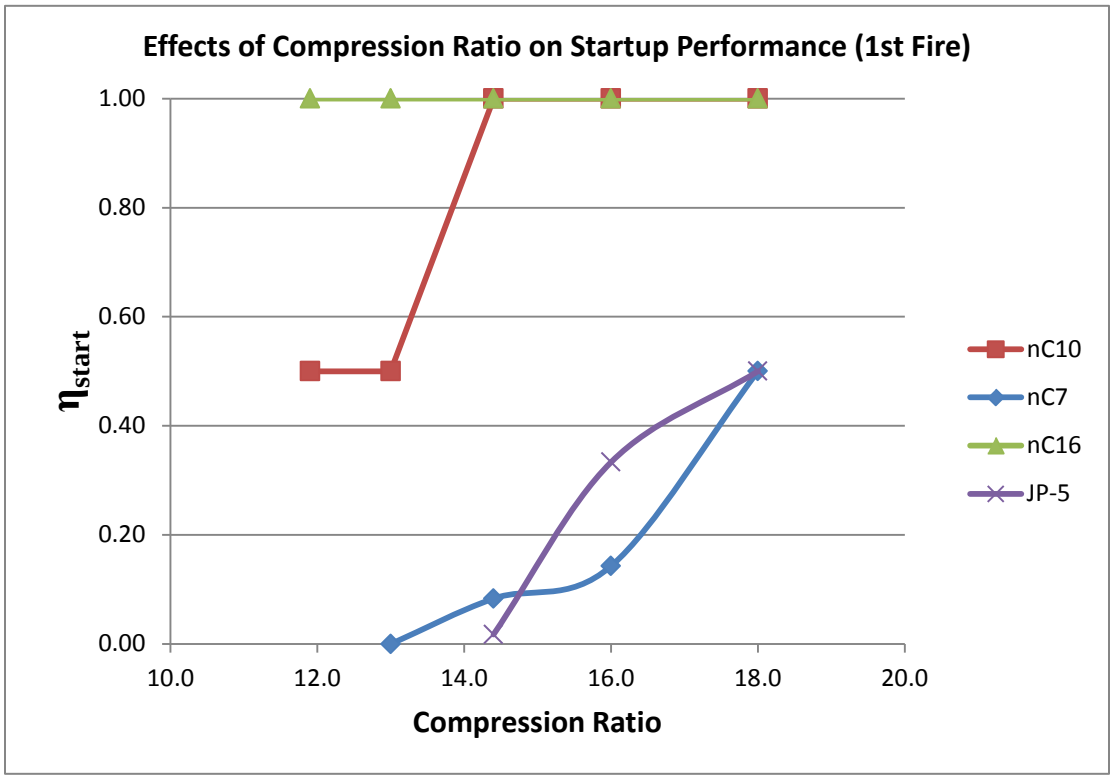


Figure 4-7: Effects of compression ratio on startup performance utilizing normal heptane, normal decane, normal hexadecane and conventional naval aviation fuel.

The graph in figure 4-7 shows the effects of compression ratio on startup efficiency. From this graph, it is clear that startup efficiency increases as compression ratio increases. Notice that startup efficiency for normal hexadecane

stays constant at 100% due to the high CN of the fuel. Normal decane reaches 100% startup efficiency at a relatively low compression ratio of 14.4:1. However, normal heptane and JP-5 both have extremely poor startup efficiencies at a compression ratio of 14.4:1, which supports the basis that cetane number has an effect on startup performance. Those two fuels also have an identical startup efficiency of 50% at a compression ratio of 18:1, meaning the engine fired on every other cycle. What is interesting is the difference in startup efficiency, nearly 20%, between those two fuels at a compression ratio of 16:1. Even though JP-5 contains a lower cetane value than normal heptane, it achieved 33% efficiency, compared to the 14% efficiency of normal heptane. Overall, startup efficiency for normal heptane and JP-5 are lower for the 1st fire, then what will be observed in the next three figures. This could indicate that the "1st fire" startup performance metric may not be the most accurate indicator of startup performance, as the engine is cold. This may occur due to other factors, such as: pure air is being combusted, no residuals exhaust gases lingering in the cylinder from previous combustion events, or the ambient temperature of the combustion chamber and cylinder walls is much lower than a subsequent fire.

The graphs in figure 4-8, 4-9 and 4-10, which look at the startup performance of the 5th, 10th and 25th fire, all behavior in similar fashion, showing similar trends for all fuel types. They may prove to be a more consistent and accurate approach to predicating engine startup performance of pure component and conventional fuels utilized by the Department of the Navy.

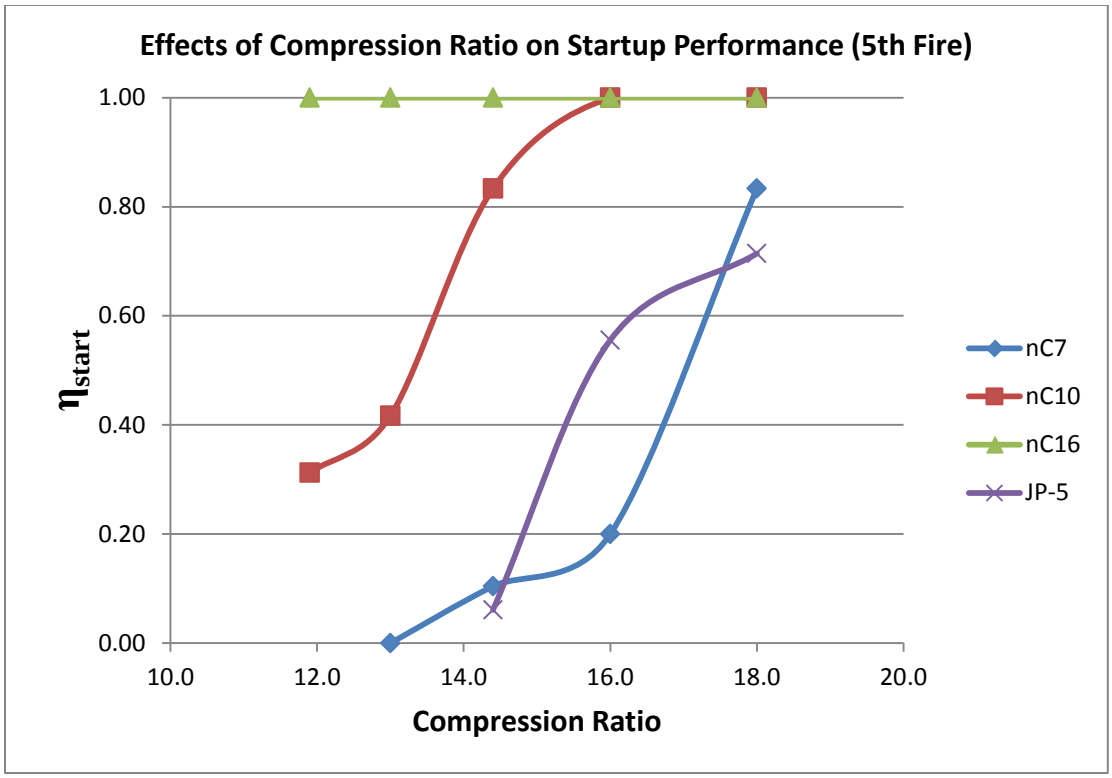


Figure 4-8: Effects of compression ratio on startup performance utilizing normal heptane, normal decane, normal hexadecane and conventional naval aviation fuel.

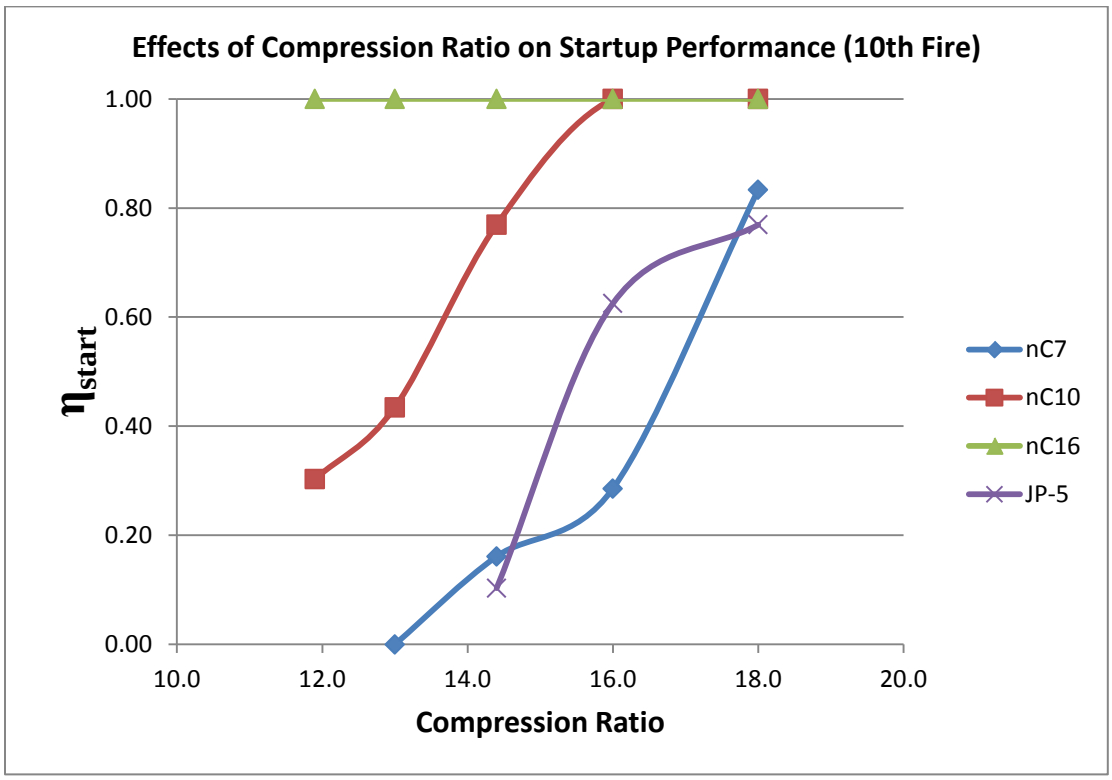


Figure 4-9: Effects of compression ratio on startup performance utilizing normal heptane, normal decane, normal hexadecane and conventional naval aviation fuel.

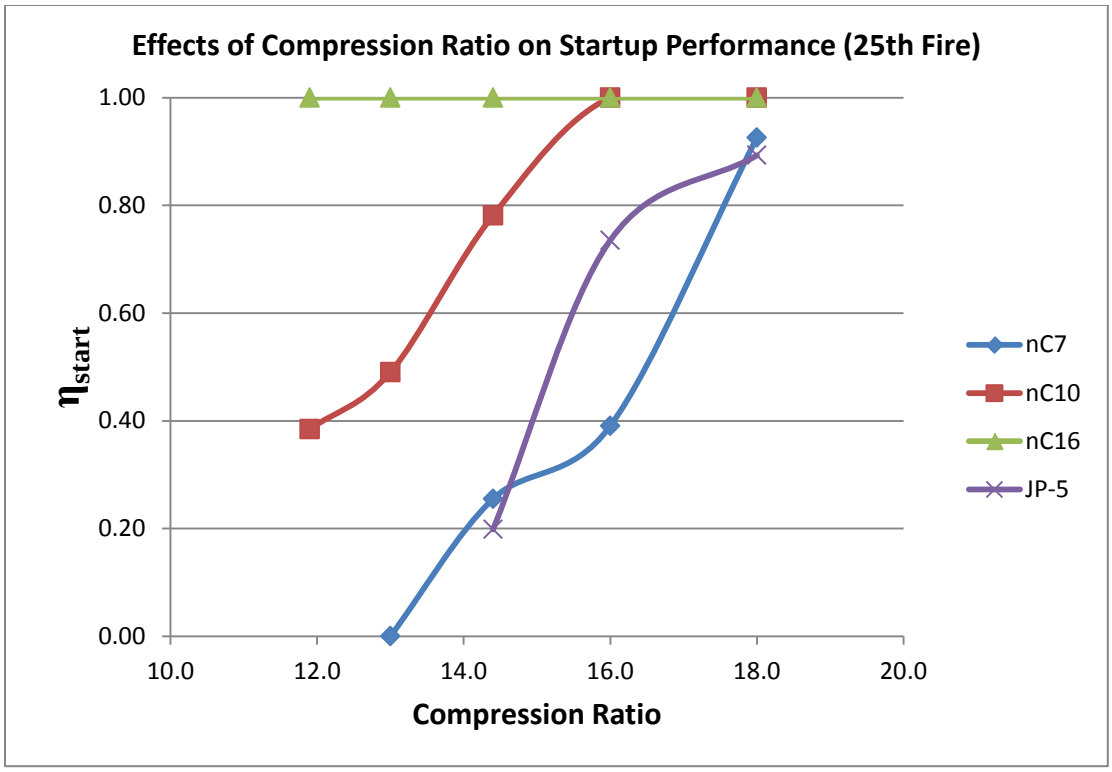


Figure 4-10: Effects of compression ratio on startup performance utilizing normal heptane, normal decane, normal hexadecane and conventional naval aviation fuel.

From this graph, it is clear that startup efficiency increases as compression ratio increases. Notice that startup efficiency for normal hexadecane stays constant at 100% due to the high cetane value of the fuel. Next, normal heptane experiences a relatively linear improvement in startup performance from across the ranges of compression ratio. To provide an additional metric, the slope of each line, or the rate of change of startup efficiency over the rate of change of compression ratio, is calculated.

$$\mathbf{m}_{\mathbf{start,CR}} = \frac{\boldsymbol{\Delta\eta_{start}}}{\boldsymbol{\Delta Compression\ Ratio}} \tag{4-3}$$

Table 4-1 lists the values of m_{start} for all three pure component fuels and conventional Navy jet fuel.

$m_{start,CR}$ (average slope)				
	nC16	**nC10**	**nC7**	**JP-5**
1st Fire	0.00	0.08	0.10	0.13
5th Fire	0.00	0.11	0.17	0.18
10th Fire	0.00	0.11	0.17	0.19
25th Fire	0.00	0.10	0.19	0.19

Table 4-1: Lists all values of the rate of change of startup efficiency over the rate of change of compression ratio.

The first argument that is strengthened by Table 4-1 is the observation that the first fire may not be the best indicator of startup performance, possibly due to previously mentioned factors, such as absence of residual exhaust gases in the combustion chamber, ambient temperature of cylinder walls and combustion chamber, etc.

When looking at the remaining firing metrics (i.e. 5^{th} fire, 10^{th} fire and 25^{th} fire), an additional argument is supported by Table 4-1. As cetane number decreases, startup performance becomes more reliant on compression ratio. This is an outstanding observation. For example, normal hexadecane (nC16), as previously stated, does not see a change in startup efficiency as compression ratio increases. Therefore, the rate of change of startup efficiency is obviously zero, as shown in the table above. Next, normal decane, which has a cetane value of 77, sees roughly a 10-11% increase in startup performance per every nominal value increase in compression ratio. As cetane value is further decreased, the increase in startup performance improves. Normal heptane and JP-5, which have cetane numbers of 55 and 46 respectively, see an increase of approximately 18% +/- 1% for every nominal increase in compression ratio.

Lastly, still continuing to look at the 5th, 10th and 25th fire, each fuel sees a +/- 1% change when comparing m_{start}. Therefore, between the 5th, 10th and 25th fires, it does not matter which metric is chosen to characterize startup performance, the overall behavior is the same and an accurate prediction of startup performance will be achieved.

4.3 Cetane Number

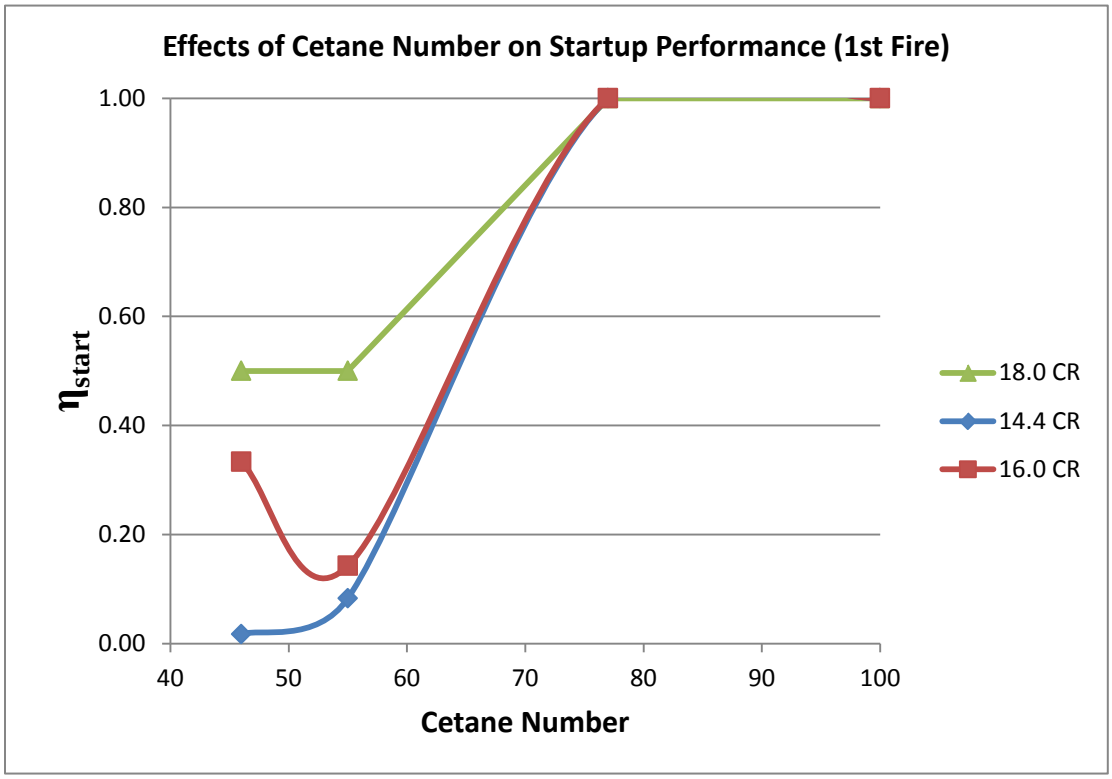


Figure 4-11: Effects of cetane number on startup performance at various compression ratios.

The graph in figure 4-11 shows the effects of cetane number on startup efficiency. From this graph, it is clear that startup efficiency increases as cetane number increases, except for the 16.0:1 compression ratio trend. JP-5, which has a lower cetane value than normal heptane, actually produces a higher startup efficiency.

When looking at these next three figures, 4-12, 4-13 and 4-14, all have trends that behave similarly.

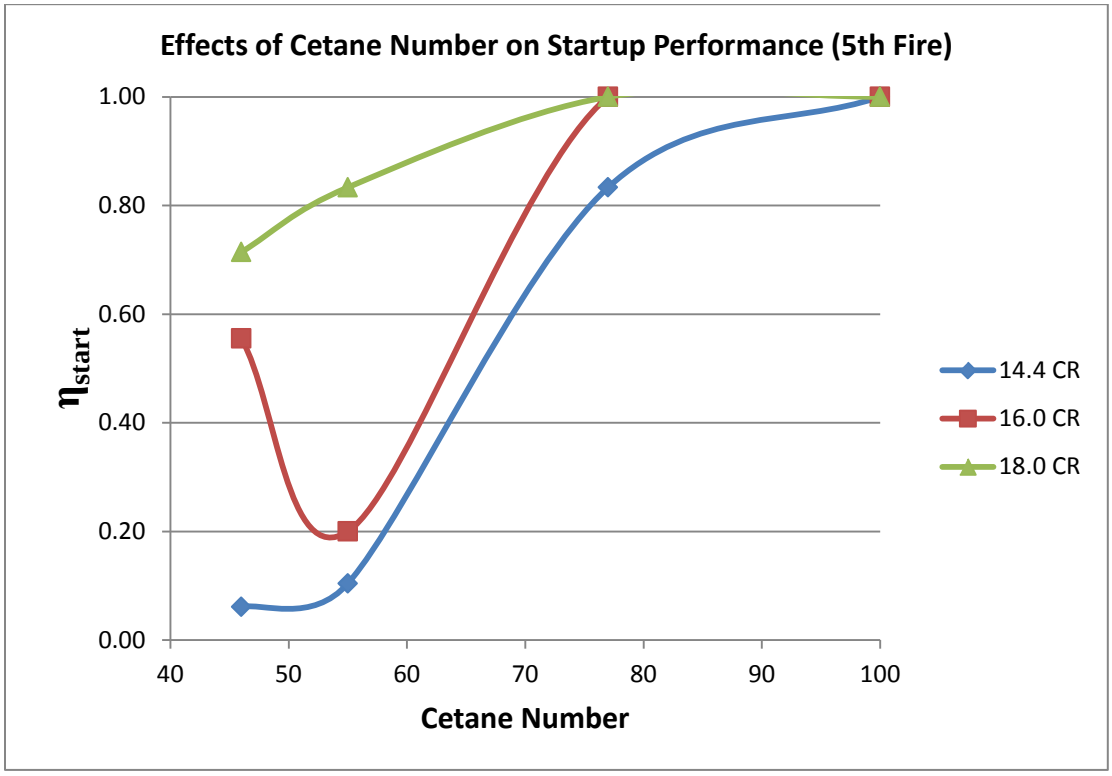


Figure 4-12: Effects of cetane number on startup performance at various compression ratios.

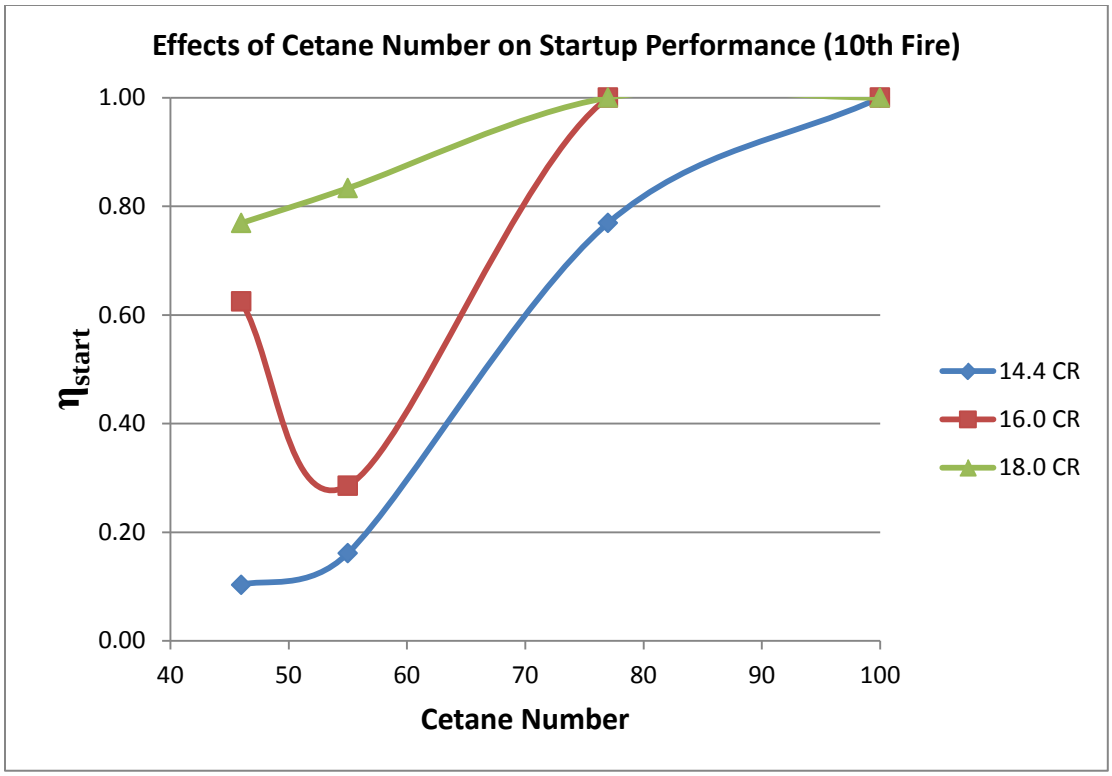


Figure 4-13: Effects of cetane number on startup performance at various compression ratios.

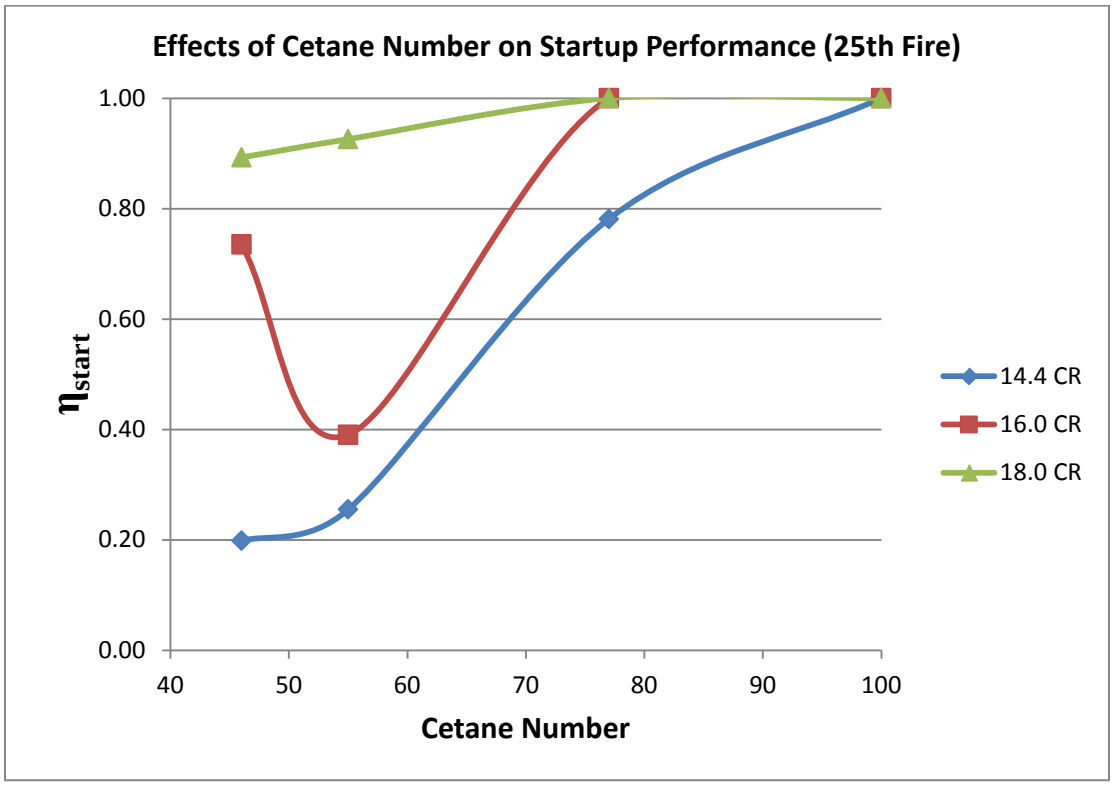


Figure 4-14: Effects of cetane number on startup performance at various compression ratios.

The graphs in figures 4-12, 4-13 and 4-14 show the effects of cetane number on startup efficiency. From this graph, it is clear that startup efficiency increases as cetane number increases, except for the 16.0:1 compression ratio trend. Normal heptane has a higher cetane value than conventional naval aviation fuel (55 vs. 46), but produced a much lower startup efficiency.

A higher cetane value equates to shorter ignition delay, or more easily ignitable [23]. In the next section, it will be discussed more thoroughly why startup performance improves with shorter ignition delays.

To provide an additional metric, the slope of each line, or the rate of change of startup efficiency over the rate of change of cetane value, is calculated.

$$\mathbf{m}_{\mathbf{start,CN}} = \frac{\Delta\eta_{\mathbf{start}}}{\Delta \mathit{Cetane\ Number}} \tag{4-3}$$

Table 4-2 lists the values of m_{start} for all three pure component fuels and conventional Navy jet fuel.

$m_{start,CN}$ (Average Slope)			
	14.4 CR	**16.0 CR**	**18.0 CR**
1st Fire	0.018	0.012	0.009
5th Fire	0.017	0.008	0.005
10th Fire	0.017	0.007	0.004
25th Fire	0.015	0.005	0.002

Table 4-2: Lists all values of the rate of change of startup efficiency over the rate of change of compression ratio.

The data above proves that changes in cetane value have a greater affect on startup performance at lower compression ratios.

4.4 Start of Injection, Pressures and Temperature

Start of Injection (SOI)

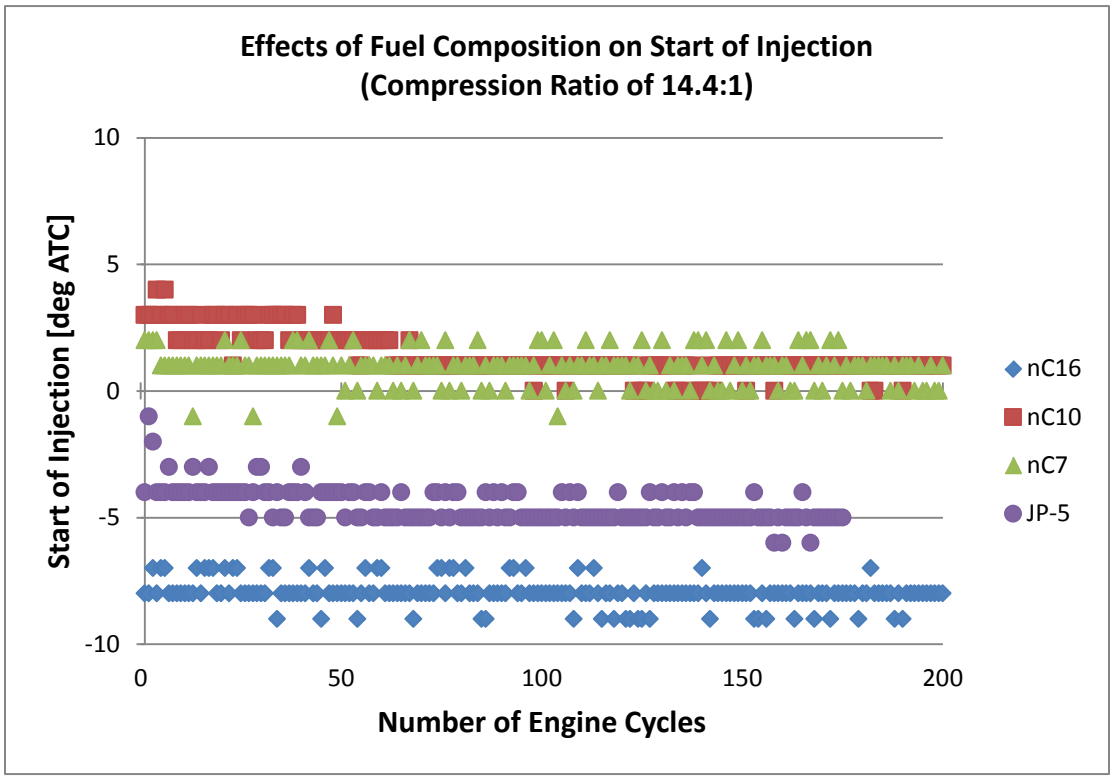


Figure 4-15: Effects of fuel composition on the start of injection at a compression ratio of 14.4:1.

The graph in figure 4-15 shows the effects of fuel composition on the start of injection. Positive numbers on the y-axis will be degrees after top dead center; negative numbers will be degrees before top dead center. From this graph, it is clear that normal hexadecane has the earliest start of injection; earlier than JP-5 and both pure component fuels, normal heptane and normal decane respectively.

Bulk modulus and fuel density play a large role in start of injection. Normal hexadecane has a higher density and bulk modulus than both normal heptane and normal decane. In other words, C16 is a much stiffer molecule when compared to the less dense, or "squishy" C7 molecule. When the fuel is being injected, it takes more

time for the fuel pump to send the fuel to the injector and in turn, enter the cylinder for combustion to occur. Because of this, start of injection occurs later for less dense fuels.

However, JP-5, which is denser than all three pure components fuels [13], has a later start of injection than normal hexadecane. This is because JP-5 has a lower bulk modulus than normal hexadecane, which results in later start of injection values. JP-5, unlike the three pure component fuels, is comprised of 100's of molecules of differing sizes and structures, which may lead to this discrepancy. Another discrepancy is normal decane has similar start of injection values to normal heptane, even though their density and bulk modulus values differ. From observation of this engine, as compression ratio is increased, start of injection advances.

As compression ratio is increased, in-cylinder pressure is increased, therefore, suggesting that the higher in-cylinder pressures would oppose the fuel pump, making it more difficult for the fuel pump to inject the fuel into the cylinder, resulting in retardation of start of injection.

Or, another suggestion to explain what is occurring may be the result of higher in-cylinder temperatures (ideal gas law). As compression ratio is increased, higher in-cylinder temperatures occur. Because fuel density and speed of sound are both functions of temperature, we see a change in bulk modulus from a temperature. Since speed of sound is dominant (i.e. the speed of sound term is square), bulk modulus is increased, making a stiffer molecule, leading to earlier start of injection times.

Both of the next two figures, 4-16 and 4-17, show similarly behaved trends, just at higher compression ratios.

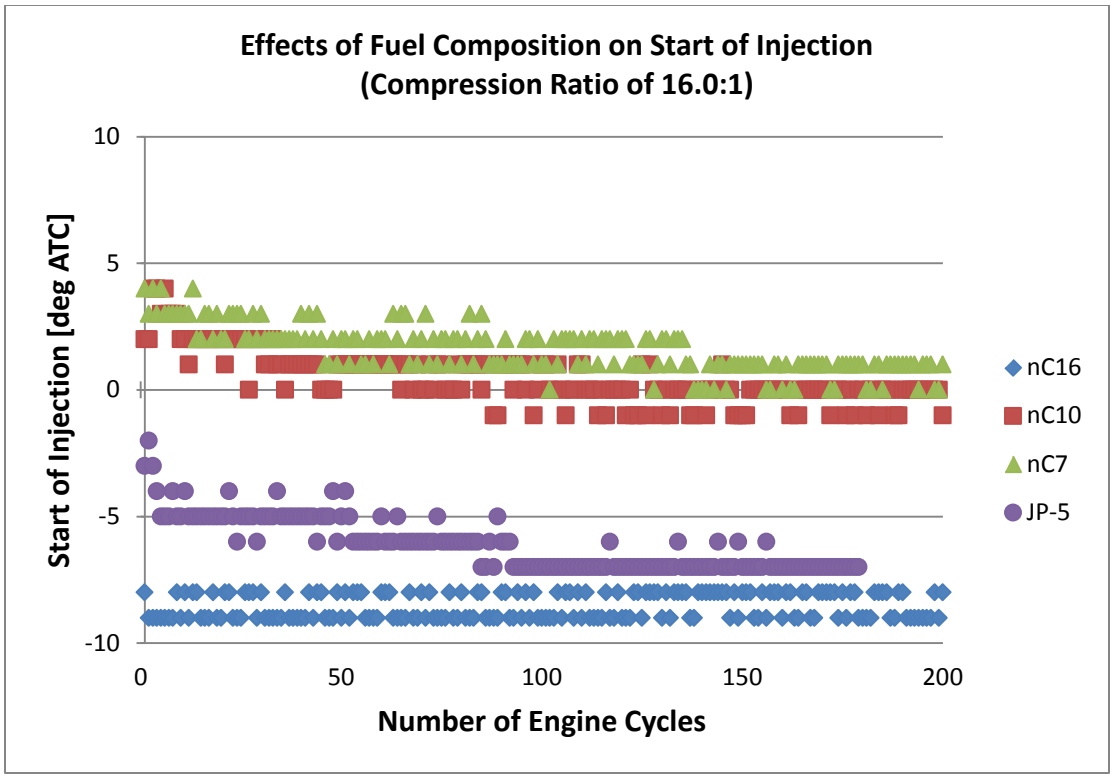


Figure 4-16: Effects of fuel composition on the start of injection at a compression ratio of 16.0:1.

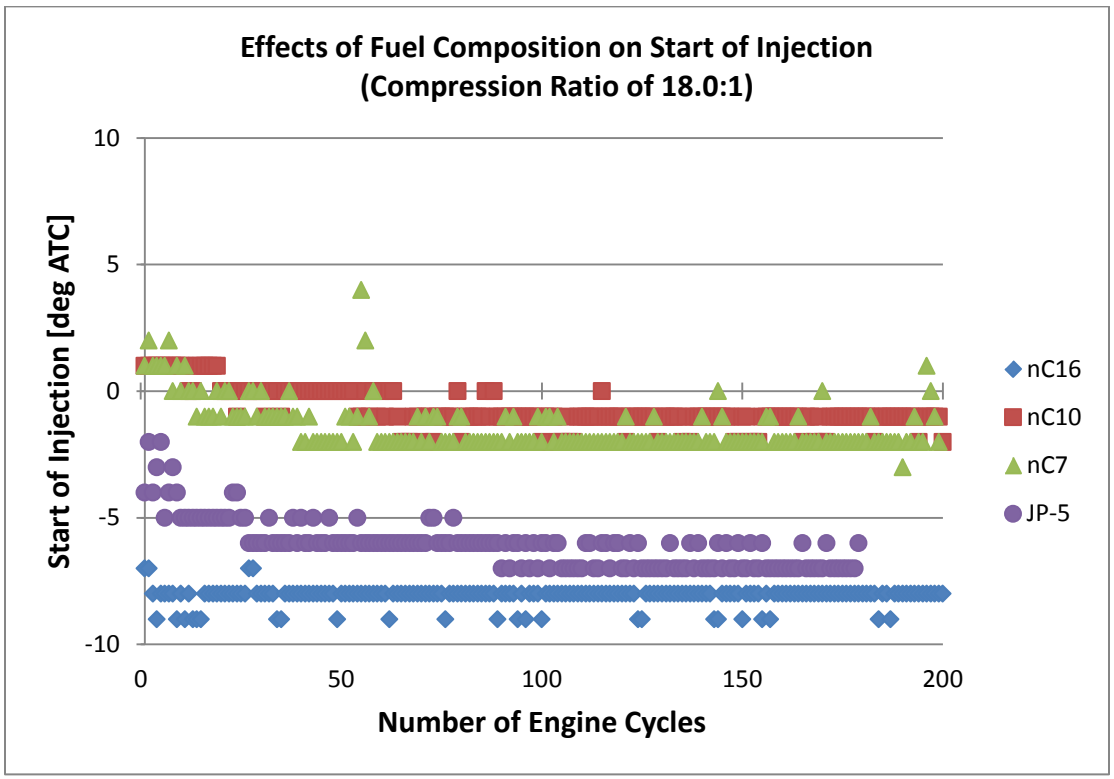


Figure 4-17: Effects of fuel composition on the start of injection at a compression ratio of 18.0:1.

Pressure during Start of Injection (PSOI)

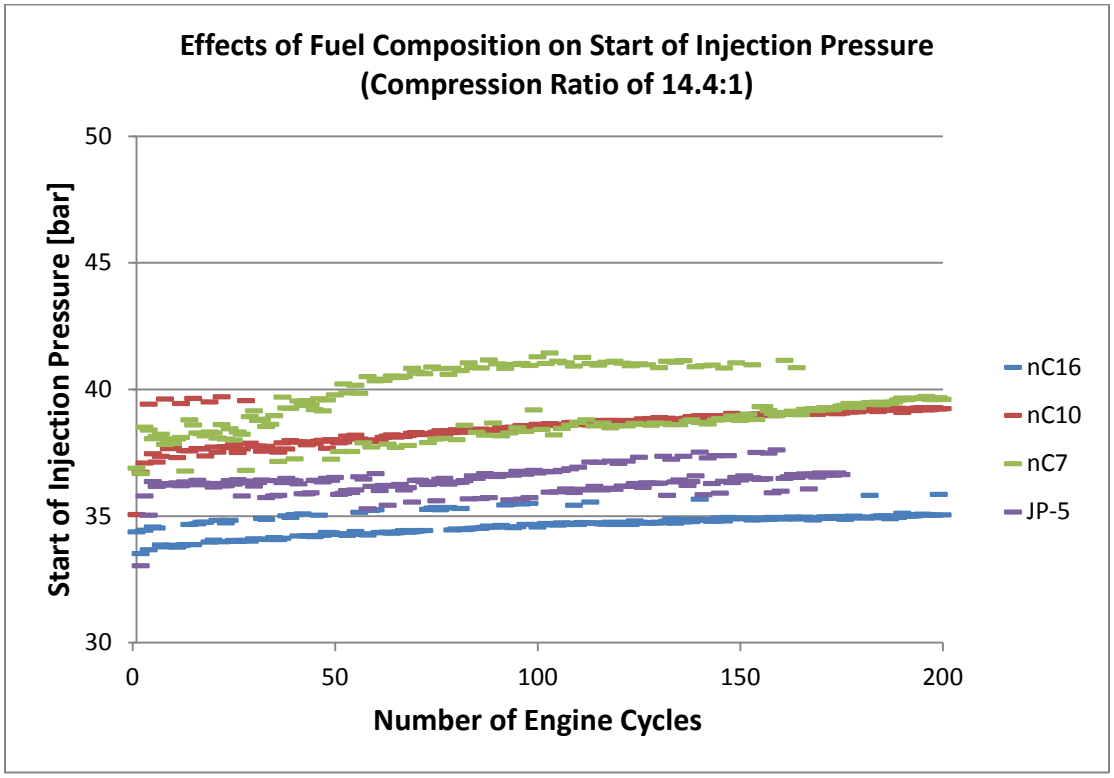


Figure 4-18: Effects of fuel composition on the pressure during the start of injection at a compression ratio of 14.4:1.

The graph in figure 4-18 shows the effects of fuel composition on the pressure during the start of injection. From this graph, it is clear that normal hexadecane has the lowest pressure during the start of injection. This is due to the fact that the start of injection for normal hexadecane occurs earlier in the compression stroke when compared to the three other fuels tested in this experiment. The piston is physically lower in the cylinder, creating a larger volume in the cylinder, which equates to a lower pressure.

Normal heptane, opposite of normal hexadecane, achieves the highest pressure at start of injection. One factor is the start of injection occurs later in the combustion process when pressures are higher. Additionally, the poor startup

performance of normal heptane may equate to higher pressures during the start of injection, due to the pattern misfiring. It is believed that, as a misfire occurs; unburnt fuel may be left in the combustion chamber. When the next compression stroke occurs, that amount of additional unburnt air-fuel charge occupies the combustion chamber along with the newly injected air-fuel mixture. More air fuel molecules are present in the combustion chamber, improving the sealing characteristics around the piston rings, which mimics a compression ratio increase, resulting in higher in-cylinder pressures.

These conclusions all come back to fuel density and bulk modulus. The higher the bulk modulus and fuel density, the earlier the fuel can be physically injected into the cylinder, resulting in earlier start of injection values and lower pressures during the start of injection.

The next two figures follow similar trends:

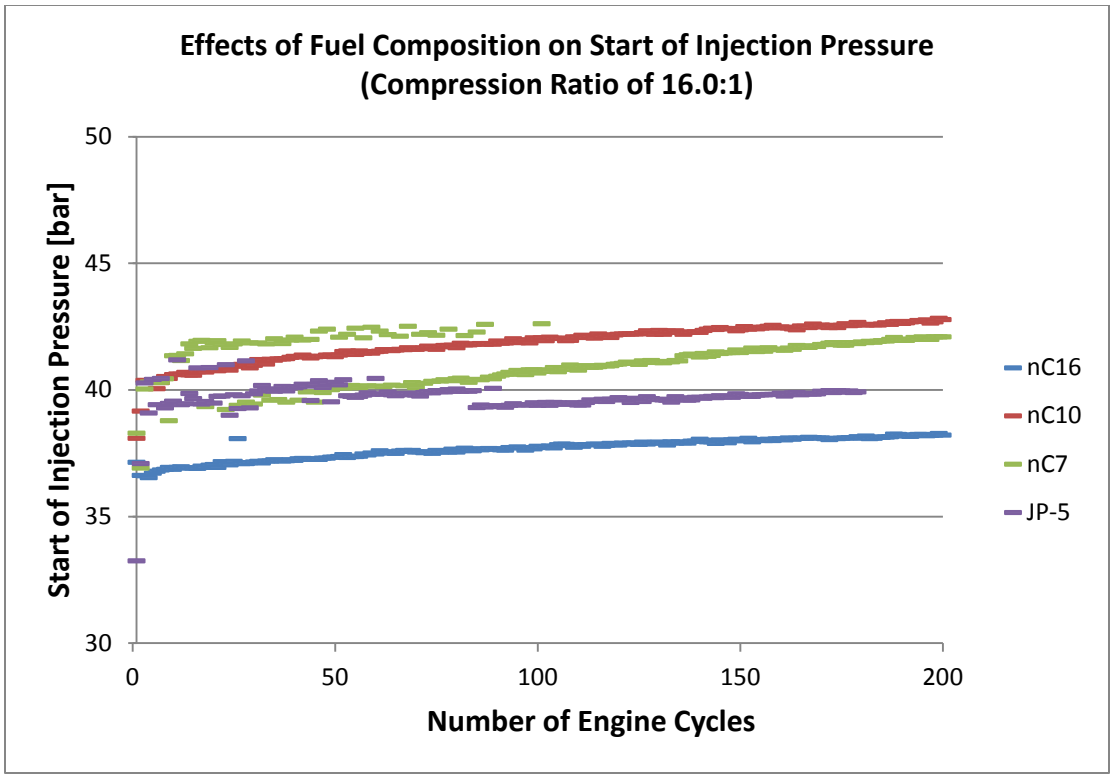


Figure 4-19: Effects of fuel composition on the pressure during the start of injection at a compression ratio of 16.0:1.

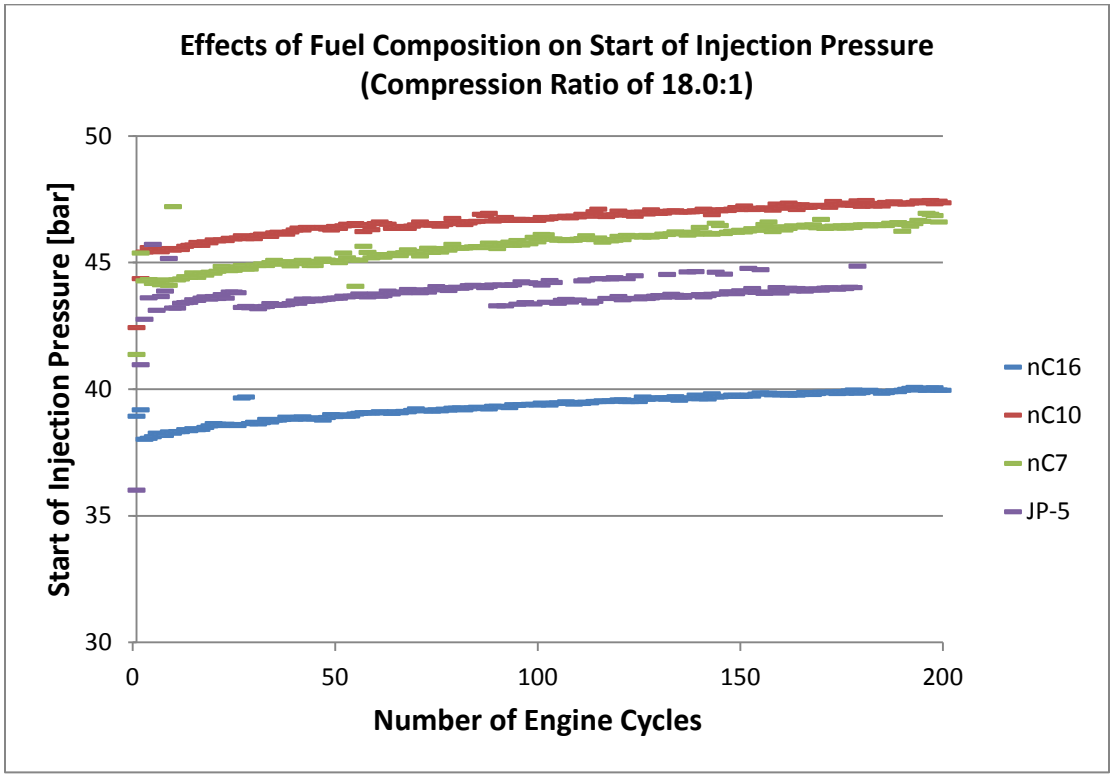


Figure 4-20: Effects of fuel composition on the pressure during the start of injection at a compression ratio of 18.0:1.

As compression ratio is increased, in-cylinder pressures increase, resulting in higher pressures at the start of injection across the board for all four fuels.

However, similar to what was observed on the start of injection figures, normal decane, when compared to normal heptane, ends up having higher pressures at start of at compression ratios of 16.0:1 and 18.0:1. Due to the higher density and bulk modulus of normal decane, one would assume that pressures at start of injection would be lower since the fuel is physically be injected earlier in the compression stroke.

Also, JP-5, when compared to normal hexadecane, achieves lower pressures at start of injection, even though it is denser. However, JP-5 has a lower bulk modulus, resulting in a later start of injection value.

Lastly, based on the trends observed to this point, normal heptane may not be a solid choice as replacement fuel for conventional Navy diesel. Normal heptane has too low of a cetane value to be effectively used across the ranges of compression ratios that the Navy diesel engines operate.

Temperature during Start of Injection (TSOI)

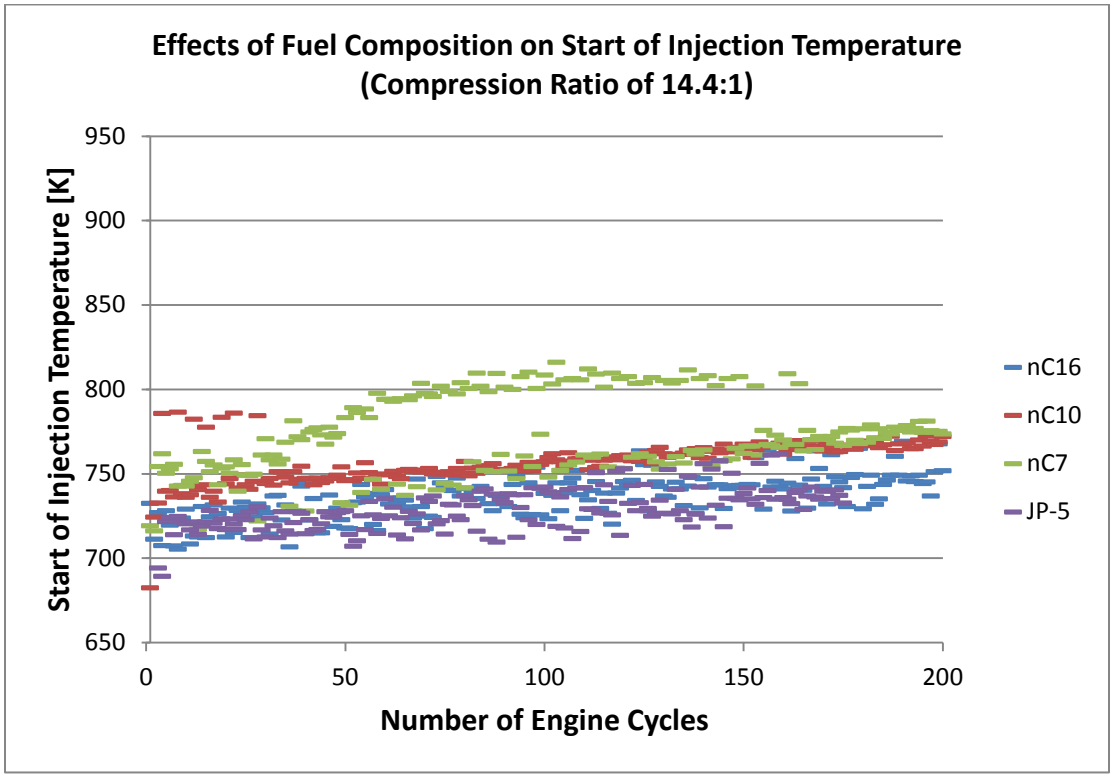


Figure 4-21: Effects of fuel composition on the temperature during the start of injection at a compression ratio of 14.4:1.

The graph in figure 4-21 shows the effects of fuel composition on the temperature during the start of injection. It is apparent that the trends associated with the temperature during start of injection (TSOI) are related to trends observed for both the start of injection figures and the pressure during start of injection figures. The later the fuel is injected into the cylinder during the compression stroke (i.e. SOI), the higher the in-cylinder pressures are. By utilizing the ideal gas law, in-cylinder temperature can be calculated from in-cylinder pressure. The ideal gas law is show below, where P is the in-cylinder pressure at time of injection, V is the volume of the cylinder at time of injection, m is the mass of the air in the cylinder at

the end of the intake stroke, R is the gas constant, and T, which we are solving for, is the in-cylinder temperature at time of injection.

$$\mathbf{pV = mRT} \tag{4-4}$$

From Figure 4-21, normal heptane achieves the highest temperature at start of injection when alternating between a fire and misfire. This is believed to occur because, as previously discussed, when a misfire occurs, unburnt fuel may be left in the combustion chamber, which may lead to increased sealing around the piston wings as well new face to the TEAM.

Figures 4-22 and 4-23 follow similar trends as Figure 4-21. These figures also follow trends previously observed for both start of injection and pressure at start of injection. As compression ratio is increased, temperature at start of injection for all four fuels is increased.

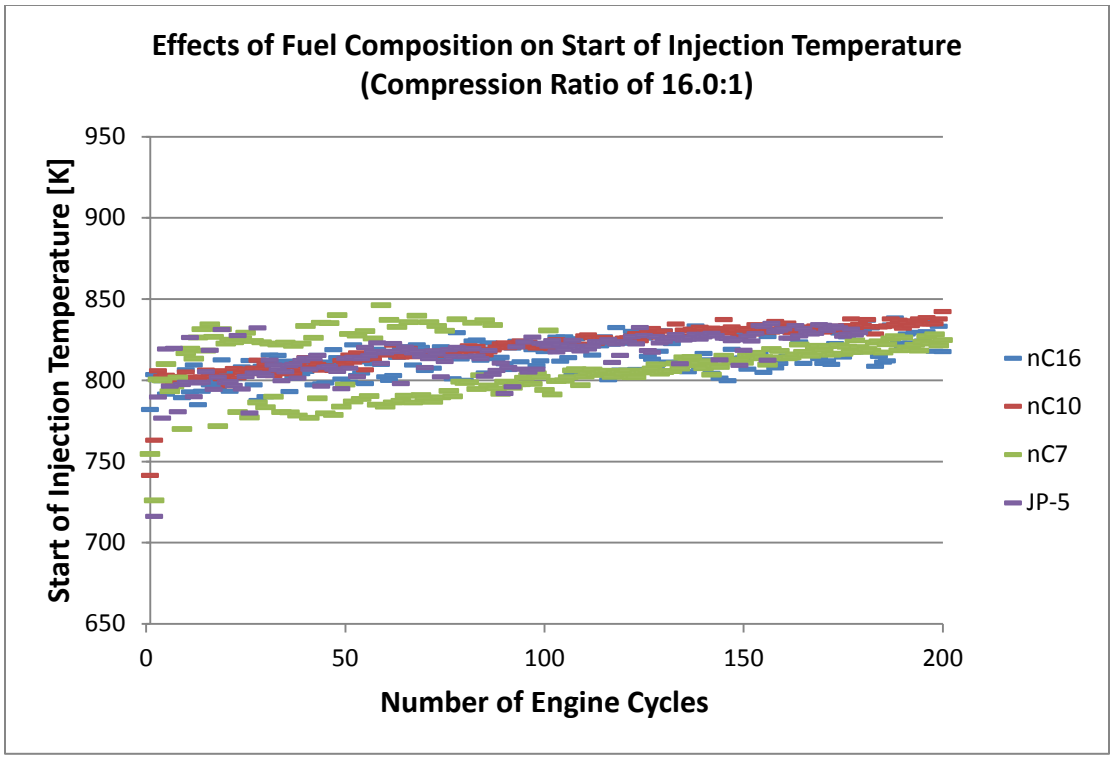


Figure 4-22: Effects of fuel composition on the temperature during the start of injection at a compression ratio of 16.0:1.

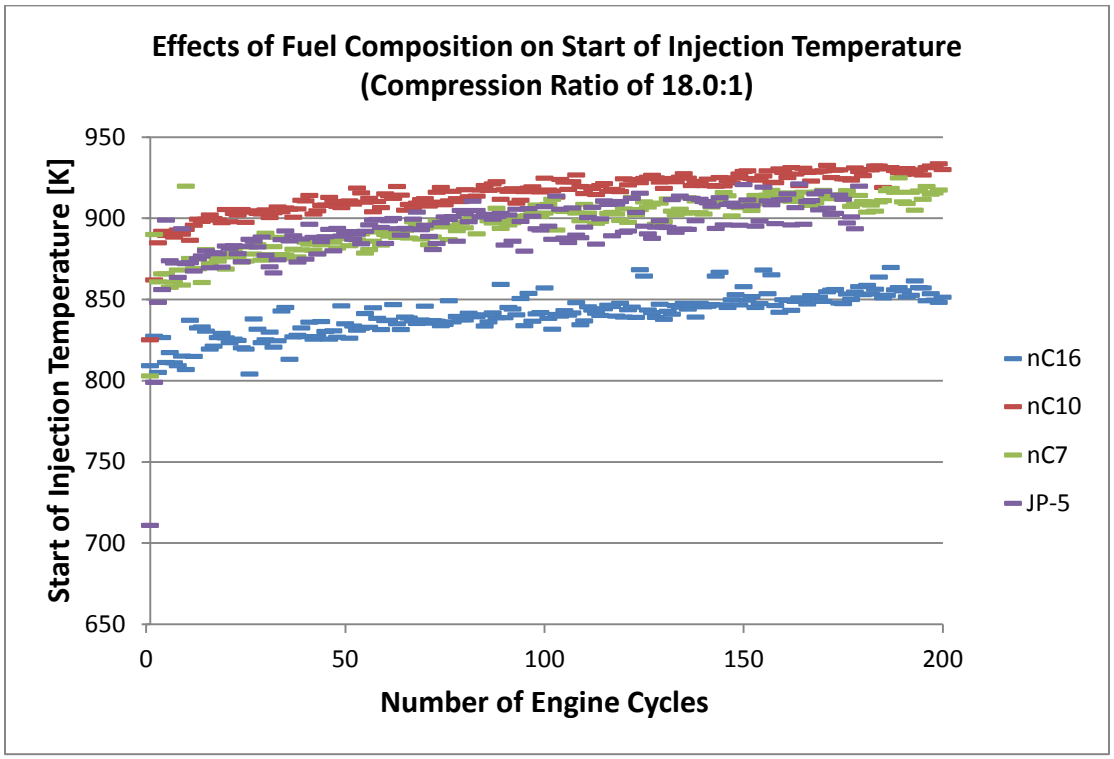


Figure 4-23: Effects of fuel composition on the temperature during the start of injection at a compression ratio of 18.0:1.

4.5 Ignition Delay

Effects of Fuel Composition

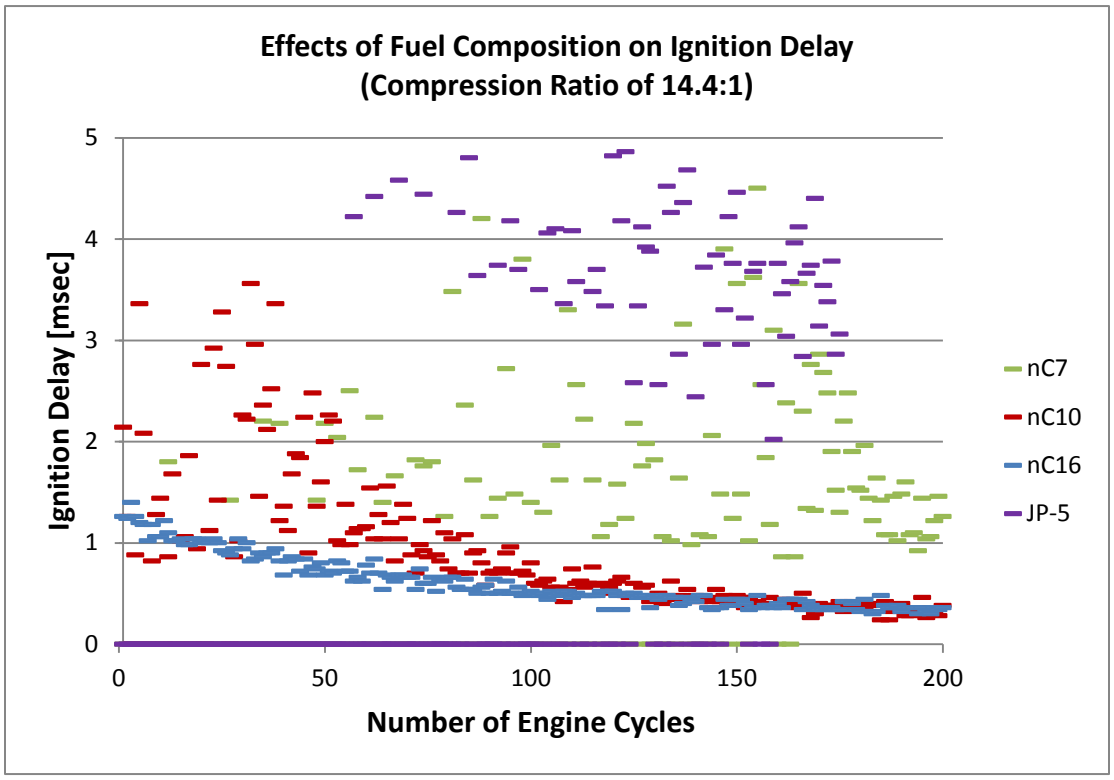


Figure 4-24: Effects of fuel composition on ignition delay at a compression ratio of 14.4:1.

The graph in figure 4-24 shows the effects of fuel composition on ignition delay. Ignition delay is defined as the time it takes between the start of injection to the start of combustion. From this graph, normal hexadecane achieves the shortest, and most consistent, ignition delay trend, which is due to an important factor. Normal heptane, due to a pattern of misfiring, experiences the longest, most inconsistent ignition delay trend. These trends prove previous studies that cetane is a measure of ignitability and cetane number is inversely proportional to ignition delay. As cetane number is increased, ignition delay is decreased.

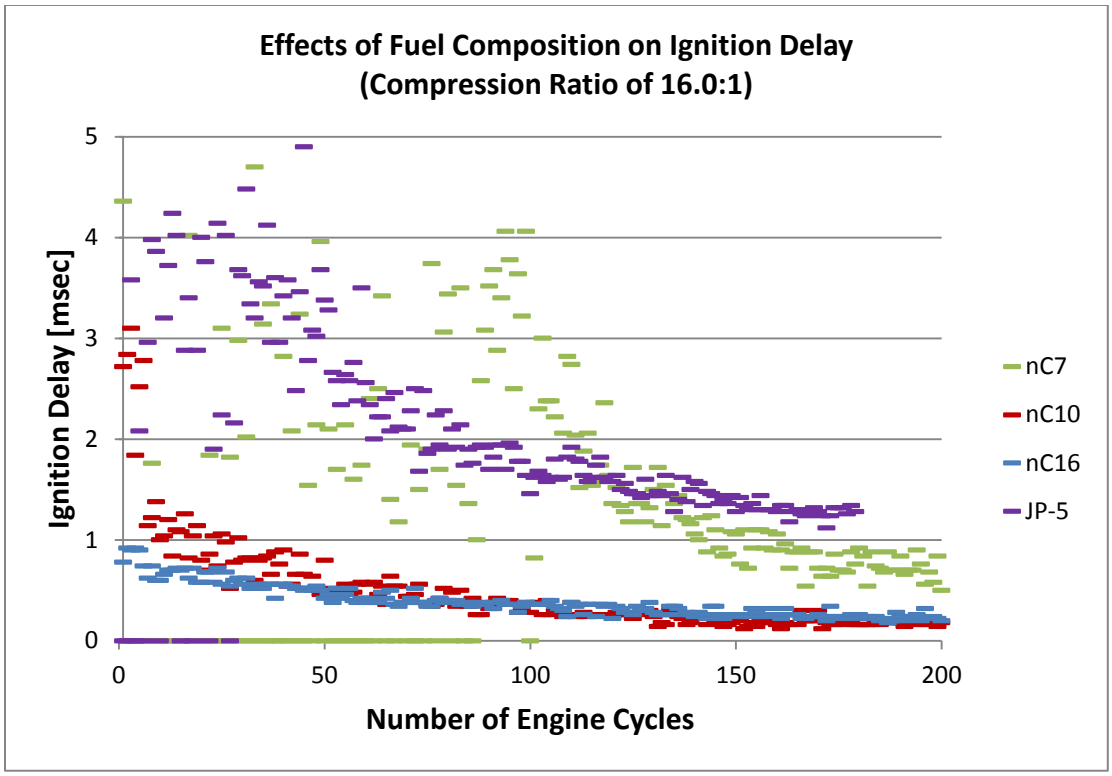


Figure 4-25: Effects of fuel composition on ignition delay at a compression ratio of 16.0:1.

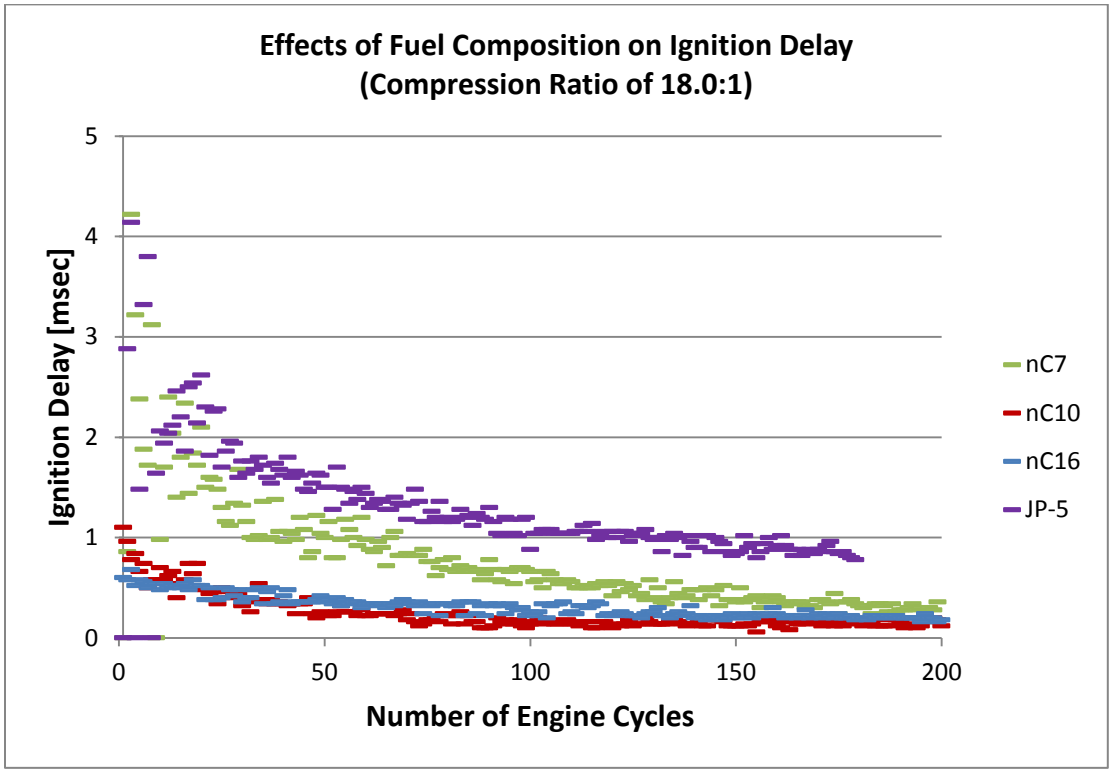


Figure 4-26: Effects of fuel composition on ignition delay at a compression ratio of 18.0:1.

Effects of Compression Ratio

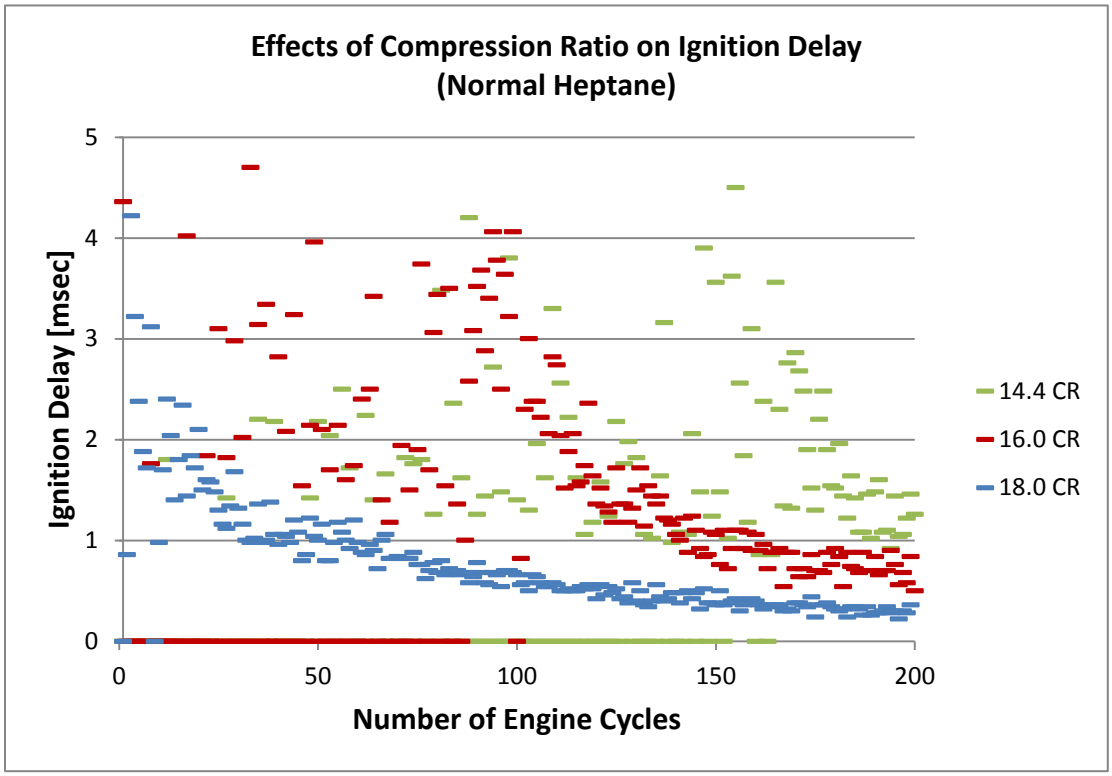


Figure 4-27: Effects of compression ratio on ignition delay for normal heptane fuel.

The graph in figure 4-27 shows the effects of compression ratio on ignition delay for normal heptane fuel. From this graph, it is clear that, as compression ratio is increased, ignition delay decreases and becomes more consistent, due to the elimination of misfiring.

Figures 4-28, 4-29 and 4-30 prove to provide similar trends for all four fuels testing in this experiment. Additionally, these figures prove to support the conclusion that higher cetane value (i.e. more easily ignitable) equates to shorter ignition delay.

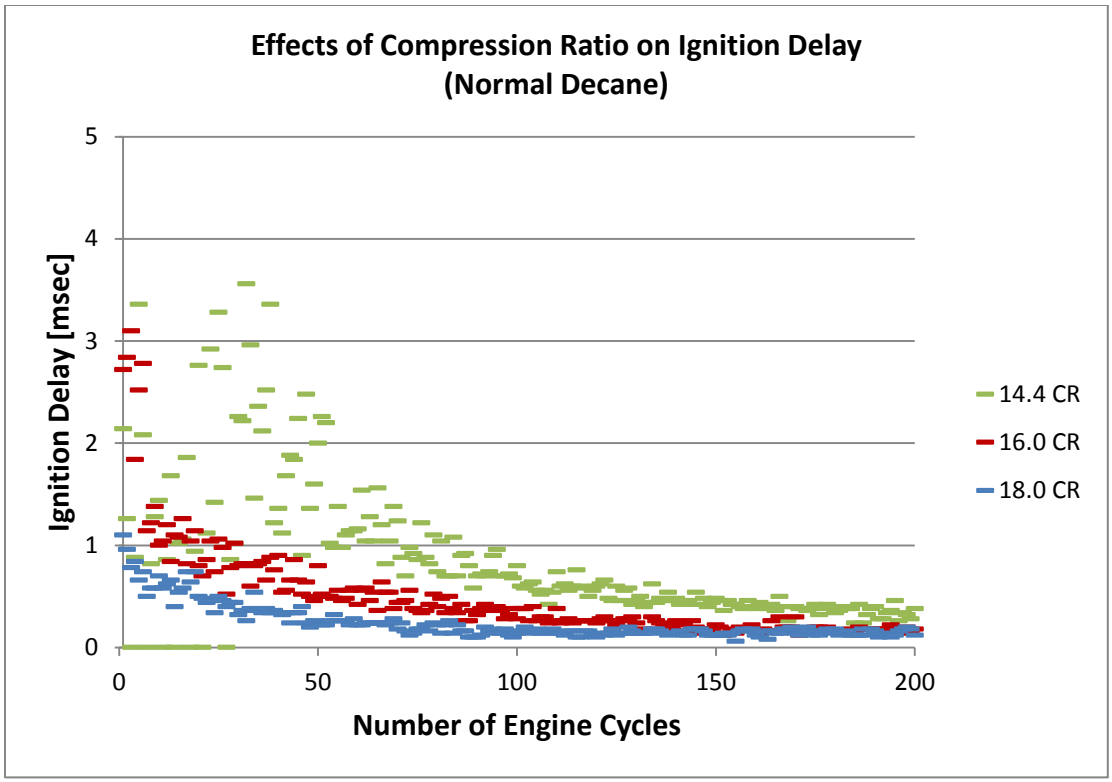


Figure 4-28: Effects of compression ratio on ignition delay for normal decane fuel.

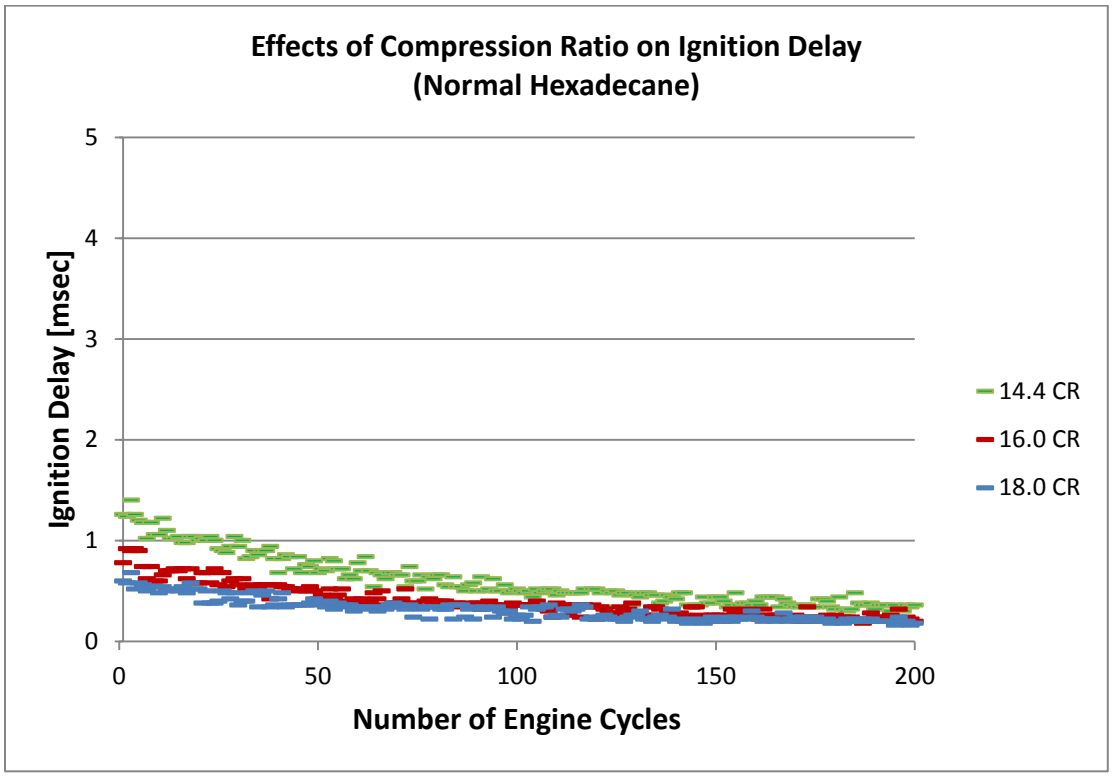


Figure 4-29: Effects of compression ratio on ignition delay for normal hexadecane fuel.

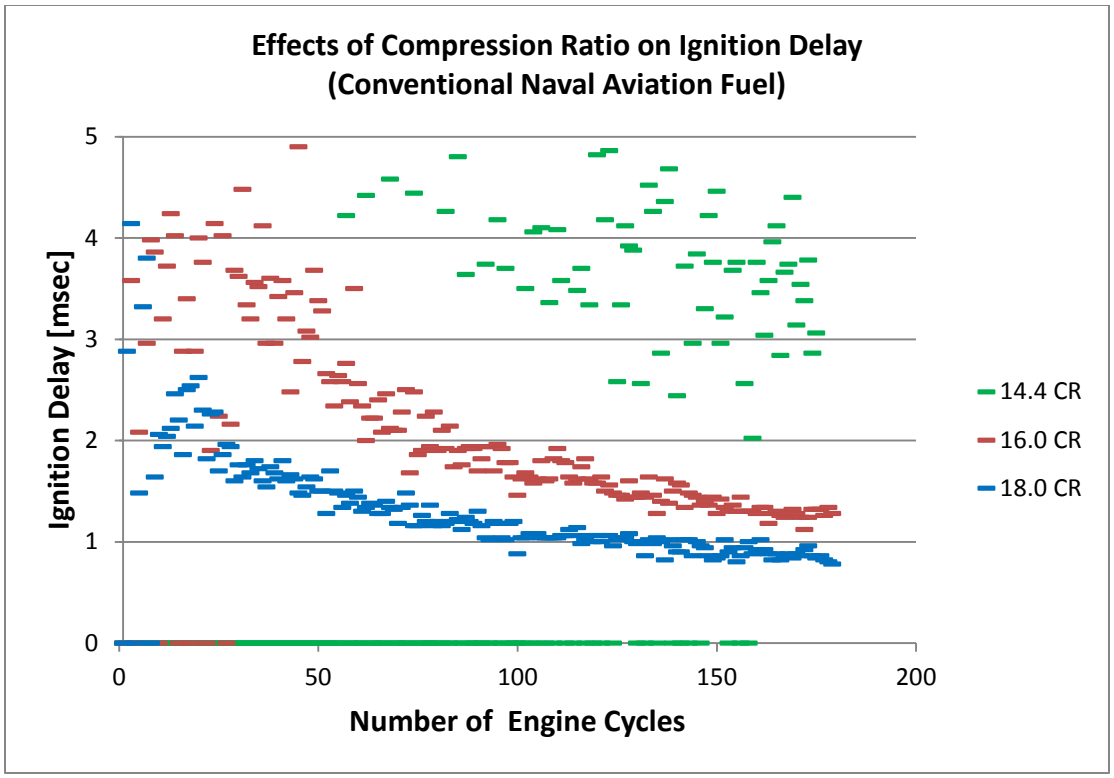


Figure 4-30: Effects of compression ratio on ignition delay for conventional naval aviation fuel.

Normal hexadecane, being the fuel with the highest cetane value, has the shortest and most consistent ignition delay trends, while both normal heptane and conventional Navy diesel fuel, being the fuels with the lowest cetane values, have the longest and most inconsistent ignition delay trends.

These figures prove that ignition delay, which is a measure of cetane value; provide an excellent indicator of startup performance, even for pure component fuels. With that conclusion, and evaluating replacement fuels on a combustion perspective, the Department of the Navy should pursue replacement fuels, such as normal decane or hexadecane, which consistently show higher startup performance and efficiency than conventional naval aviation fuel.

Chapter 5: Conclusions and Recommendations for Future Work

Conclusions

The following observations below were made throughout this research and prove to be substantial indicators of startup performance for pure component fuels.

Ignition Delay (IGD)

Ignition delay proves to be an accurate measure of cetane value, which has been proven in literature discussing steady state performance. As cetane value and compression ratio are increased, ignition delay is shortened and becomes more consistent for all fuels tested in this research.

Start of Injection (SOI)

Start of injection, along with the pressures and temperatures associated with the start of injection, are related to the density and bulk modulus of the fuel, which previous literature has proven. However, cetane value may play an important role in effecting start of injection, which ultimately effects startup performance.

Cetane Number (CN)

Cetane number is an outstanding indicator of startup performance. As cetane number is increased, startup performance increases. From a combustion standpoint, pure component fuels, such as normal decane, or even better, normal hexadecane, both of which have higher cetane values than conventional Navy jet fuel, would prove to be adequate replacement renewable fuel for the Department of the Navy.

Compression Ratio (CR)

Compression Ratio is directly related to startup performance for pure component fuels. As compression ratio is increased, startup performance increases. The startup performance of fuels with lower cetane values is more susceptible to changes in compression ratio. Typical navy diesel engines operate with compression ratios of anywhere between 12.0:1 and 18.0:1, which supports choosing a replacement, renewable fuel such as normal hexadecane from a combustion perspective.

Air-Fuel Equivalence Ratio (λ)

Air-Fuel Equivalence Ratio, or lambda, is also an important factor in the startup performance of pure component fuels. As lambda is decreased, or the fuel mixture is richened, startup performance increases. However, below a lambda value of 1.35, startup performance stays relatively constant; therefore, it is not an economical choice to richen fuel mixtures beyond that point.

Comparison to Conventional Navy Jet Fuel (JP-5)

The startup performance trends of pure component fuels and conventional Navy jet fuel behave similarly. Also, normal decane and normal hexadecane, both of which, have a much higher cetane value than JP-5, outperformed conventional Navy jet fuel in all categories related to startup performance.

In summary, the observations made in this research follow closely to the steady state trends that are observed in previous literature. With regards to a combustion perspective, the Navy should look to replace F-76 and JP-5 with a pure

component fuel, such as normal decane or normal hexadecane, at a lambda value of no less than 1.35, preferably in an engine with a higher compression ratio (i.e.16.0:1 or 18.0:1).

Recommendations for Future Work

It was observed that not only do fuel density and cetane number have a large effect on startup performance, but so does bulk modulus. Currently, the Navy has been interested in further researching the effects of bulk modulus on startup performance, as there currently is no standard for fuel bulk modulus.

Injection timing may play an important role in compensating or adjusting start of injection parameters, which are related to bulk modulus. Further research must be performed to determine the limits and effects of bulk modulus and injection timing on the startup performance of pure component fuels in Navy diesel engines.

Appendix A: Kistler 6125 Pressure Sensor

Pressure – PAE

KISTLER
measure. analyze. innovate.

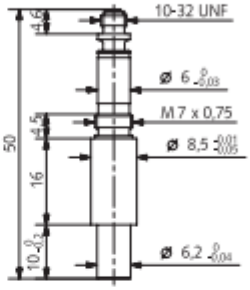
ThermoCOMP®-
Quartz Pressure Sensor Type 6125B...

Ground-insulated high temperature pressure sensor for cylinder pressure measurements in internal combustion engines. Doesn't need additional cooling and measures with minimal thermal shock error and load change drift due to its ThermoCOMP® diaphragm. The ground insulated design avoids electrical interferences due to ground loops.

Technical Data

Range	bar	0 ... 250
Calibrated partial range	bar	0 ... 50
Overload	bar	300
Sensitivity	pC/bar	≈–16
Natural frequency	kHz	≈75
Linearity, all ranges	%FSO	≤±0,5
Acceleration sensitivity		
axial	bar/g	<0,002
radial	bar/g	<0,003
Operating temperature range	°C	–50 ... 350
Sensitivity shift		
200 ... ±150 °C	%	≤±2
200 ... ±50 °C	%	≤±1
Thermal shock		
at 1500 min⁻¹, 9 bar IMEP		
Δp	bar	≤-0,3
ΔIMEP	%	<-2
Δp_{max}	%	<-1
Insulation resistance at 20°C	Ω	≥10^{13}
Ground insulation	Ω	≥10^{8}
Shock resistance	g	2000
Tightening torque	Nm	10
Weight, with cable	g	29
Connector, ceramic insulator	Type	10-32 UNF

1 bar = 10^5 Pa = 10^5 N · m^{-2} = 1,0197... at = 14,503... psi;
1 psi = 0,06894... bar; 1 g = 9,80665 m · s^{-2};
1 Nm = 0,73756... lbft; 1 g = 0,03527... oz



- Ground-insulated
- Very small load change drift
- Very small thermal shock
- Available with oilproof viton cable Type 1983AC1

Description

The use of polystable quartz elements assures safely against twinning even under high mechanical loads. This guarantees a practically constant sensitivity over the temperature range of -50°C ... 350°C.

The ground insulation and the extremely small thermal errors are the outstanding features of this sensor.

The sensor is available with high temperature connecting cable Type 1967A1, L=1 m, or with oilproof viton cable Type 1983AC1, L=1 m (refer to ordering code).

Application

The non cooled sensor Type 6125 is mainly used for precise measurements in spark ignited and Diesel engines under restricted space conditions. Thanks to its ground insulation this sensor is ideal for mounting in test cells with electrical ground loop problems. It is also very well suited for transient engine testing due to the very small load change drift.

The special Type 6125BU20 with its thicker diaphragm is very suitable for knock measurements.

Kistler Instrumente AG, PO Box, CH-8408 Winterthur
Tel +41 52-224 11 11, Fax 224 14 14, info@kistler.com, www.kistler.com

KISTLER
measure. analyze. innovate.

Mounting example

The sensor can directly be mounted in the cylinder head (B11/B21 version, Fig. 1) or across water ducts by means of a mounting sleeve Type 6433A/34A (Fig. 2). It should be installed flush with the combustion chamber in order to avoid pipe oscillations.

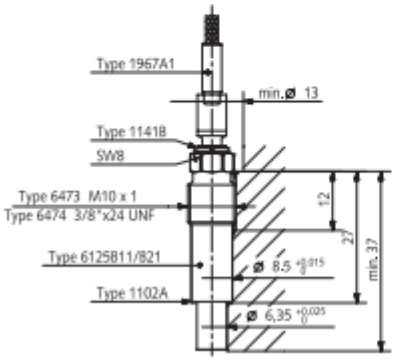


Fig. 1

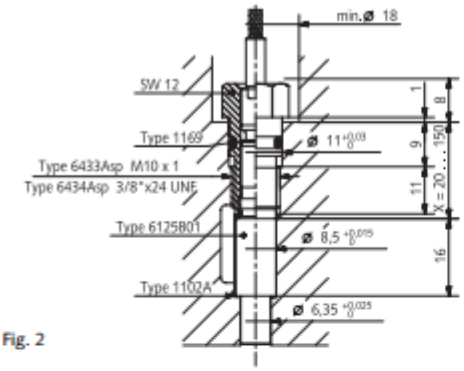


Fig. 2

Scope of delivery	**Type**
• Sensor with cable 1967A1 or 1983AC1	6125B...
• Coupling 10-32UNF neg. – BNC pos.	1721
• Seals	1102A

Accessories	**Type**
• Torque wrench. 5...40Nm	1371B
• Tubular socket wrench WS8	1373
• Step drill	1337
• Screw tap M10x1	1353
• Extraction tool	1317
• Mounting sleeve M10x1 incl. O-ring	6433A...
• Mounting sleeve 3/8"x24UNF incl. O-ring	6434A...
• O-ring for mounting sleeve	1169
• Mounting nut M10x1	6473
• Mounting nut 3/8"x24UNF	6474
• Clamping ring for nut	1141B
• Copper seal	1102
• Nickel seal	1102A
• Spare cable 10-32 UNF, l=1m	1967A1
• Adapter M10x1 for pressure generator Type 6906A	6952A1
• Adapter 3/8"x24UNF for pressure generator Type 6906A	6952A2
• Sensor dummy	6469A

Ordering Code:

6125B:	without mounting nut, without cable
6125B01:	without mounting nut, with cable Type 1967A1
6125B02:	without mounting nut, with cable Type 1983AC1
6125B10:	with mounting nut M10x1, without cable
6125B11:	with mounting nut M10x1, with cable Type 1967A1
6125B12:	with mounting nut M10x1, with cable Type 1983AC1
6125B20:	with mounting nut 3/8"x24UNF, without cable
6125B21:	with mounting nut 3/8"x24UNF, with cable Type 1967A1
6125B22:	with mounting nut 3/8"x24UNF, with cable Type 1983AC1

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Appendix B: BEI H25 Shaft Encoder

Model H25® Absolute Encoder

BEI SENSORS

Long considered the industry standard for shafted incremental encoders, the Model H25 is now available in an absolute version with up to 13 Bits of resolution. It incorporates many of the great standard features of the incremental version, including: EMI shielding, 40-lb ABEC 7 bearings, matched thermal coefficients on critical components, and custom optics. This encoder features a 12 or 13 Bit absolute parallel gray code output, a selection line for count direction, and an output latch as standard. Output is standard gray code with options for natural binary or SSI compatible signals. Signals can be provided in either a single-ended multi-voltage line driver (TTL compatible when provided with 5 volts) or as an open-collector style of output. Typical applications include dam gate control, cranes, telescopes, tool changers, and robotics.

The H25 Absolute Encoder is available with the following certification:

CE EN 55011 and EN 61000-6-2

Mechanical Specifications

Shaft Diameter: 3/8" (1/2"as special feature)
Flat On Shaft: 3/8" Shaft: 0.80 long X 0.03" deep; 1/2" Shaft: 0.80 long X 0.04" deep (1/2" shaft w/flat must be ordered as a special feature)
Shaft Loading: 3/8" shaft: Up to 40 pounds axial and 35 pounds radial; 1/2" shaft: Up to 90 pounds axial and 80 pounds radial
Shaft Runout: 0.0005 T.I.R. at midpoint regardless of shaft diameter
Starting Torque at 25°C: Without shaft seal 1.0 in-oz (max); With shaft seal 2.5 in-oz (max); 1/2" shaft with shaft seal:3.5 in-oz (max)
Bearings: Class ABEC 7 standard, ABEC 5 for 1/2" shaft
Shaft Material: 416 stainless steel
Bearing Housing: Die cast aluminum with protective finish; stainless steel (special feature)
Cover: Die cast aluminum; stainless steel (special feature)
Bearing Life: 2 X 10^8 revs (1300 hrs at 2500 RPM) at rated load 1 X 10^{10} revs (67,000 hrs at 2500 RPM) at 10% of rated load
Maximum RPM: 12,000 RPM nominal, 8000 RPM with 1/2" shaft (see Frequency Response, below) 30,000 RPM available on units with 3/8" shaft—consult with factory
Moment of Inertia: 4.1 X 10^{-4} oz-in-sec²; 5.2 X 10^{-4} oz-in-sec² with 1/2" shaft
Weight: 13 oz typical, 14.5 oz typical with 1/2" shaft

Electrical Specifications

Code: 12 or 13 bits NB or GC; excess gray and BCD available
Counts Per Shaft Turn: 4096 or 8192
Count Transition Accuracy: ± 1/2 bit maximum
Supply Voltage: 5–28 VDC
Current Requirements: 120 mA typical
Output Formats: Parallel: Gray Code, Natural Binary and Binary Coded Decimal; Serial: Serial Synchronous Interface (SSI) compatible; Analog: 4–20 mA, 0–10V
Voltage/Output: (see note 3)
28W/V: Line Driver, 5–28 VDC in, V_{out} = V_{in}
28W/5: Line Driver, 5–28 VDC in, V_{out} = 5 VDC
28W/OC: Open Collector, 5–28 VDC in OC_{out}
SSI: 5–28 VDC In/5V_{out}
Protection Level: Reverse, overvoltage and output short circuit protection
Frequency Response: 100kHz (1200 RPM for 12-bits, 600 RPM for 13-bits)
Output Termination Pinouts: see Table 1, back page

Environmental Specifications

Enclosure Rating: NEMA 4 & 13 (IP 66) when ordered with shaft seal (on units with an MS connector) or a cable gland (on units with cable termination).
Temperature: Operating, 0° to 70° C; extended temperature testing available (see note 5); Storage, -25° to 90° C unless extended temperature option called out.
Shock: 50 g's for 11 msec duration
Vibration: 5 to 2000 Hz @ 20 g's
Humidity: 98% RH without condensation

Connector

MS3112E14-19P, 19–pin connector on encoder body, mates to MS3116J14-19S (or equivalent)

NOTES & TABLES: All notes and tables referred to in the text can be found on the back of this page.

H25 Absolute Encoder Ordering Options for assistance call 800-350-2727

Use this diagram, working from left to right to construct your model number (example: **H25E-F4-SS-12GC-28V/V-CW-SM14/19**).
All notes and tables referred to can be found on the back of these pages.

H25

TYPE: Heavy Duty 2.5 inch Dia.

X = Express Encoder

HOUSING :
D = Square Flange
E = 2.5 inch dia. servo mount
G = 2.62 inch dia. servo mount
See dimensions

FACE MOUNTS:
F1
F4 See note 1

SHAFT SEAL CONFIGURATION:
SS = Shaft Seal
See note 2

NUMBER OF BITS:
12 = 12-Bits, 4096 counts per turn
13 = 13 Bits, 8192 counts per turn
(Excess gray codes and BCD available–consult factory)

CODE TYPE:
GC = Gray Code
NB = Natural Binary
BCD = Binary Coded Decimal
X = Excess gray code

VOLTAGE/OUTPUT:
28W/V = 5–28 V_{in}/V_{out}
28W/5 = 5–28 V_{in}/5V_{out}
28W/OC = 5–28 V_{in}/OC_{out}
A1 = 4–20mA; A2 = 0–10V
SI = RS–422 Serial Asynchronous
S3 = Serial Synchronous Interface
See note 3

DIRECTION OF COUNT:
CW = Clockwise increasing count
CCW = Counter clockwise increasing count

OUTPUT TERMINATION LOCATION:
E = End
S = Side

TERMINATION TYPE:
M14/19 = 19 pin connector
CS= Cable with gland seal
Cable length specified in inches (i.e. C18 = Pigtail 18" long)
M18 = MS3102R18-1P (S3 output only)

SPECIAL FEATURES:
S = Special features specified on purchase order (consult factory)
See note 4

EXPRESS ENCODERS: Items highlighted with are standard Express Encoders and ship in one to three days.

BEI SENSORS
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7230 Hollister Ave., Goleta, CA 93117-2807 | www.beisensors.com

Specification No. 02067-001 Rev.11-11

Model H25® Absolute Encoder

BEI SENSORS

Serial Synchronous Interface (SSI)

SSI output provides effective synchronization in a closed-loop control system. A clock pulse train from a controller is used to clock out sensor data: one bit of position data is transmitted to the controller per one clock pulse received by the sensor. The use of a differential driver permits reliable transmission of data over long distances in environments that may be electrically noisy. The encoder utilizes a clock signal, provided by the user interface, to time the data transmission. Receiving electronics must include an appropriate receiver as well as line terminating resistors.

Features : • Synchronous transmission • Transmission lengths to 1000 feet • Accepts clock rates from 100 KHz to 1.8 MHz

Data Transmission Sequence

1. Output driver of the encoder is a MAX 491 transceiver in transmit mode. The recommended receiver is a MAX 491 transceiver in receive mode.
2. Controller provides a series of pulses (or differential pulse pairs) on the CLOCK input lines.
3. On the first HIGH-to-LOW CLOCK transition, the encoder latches its data at the current position and prepares to transmit.
4. Controller reads data on the falling edge of the next 15 clock cycles.
5. The first bit is a START bit and is always HIGH.
6. Next comes 13 data bits beginning with the most significant bit (MSB) and ending with the parity bit. On 12 bit encoders, bit 13 is LOW. When parity is not ordered, parity is LOW.
7. After the last CLOCK HIGH-to-LOW transition, a minimum of 40 microseconds must pass before the beginning of the next CLOCK series.

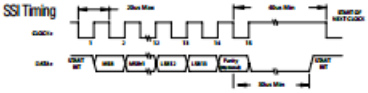
Interfacing Long Data Lines

Cable impedance can create a transmission delay, in effect, shifting the phase relationship between the clock pulse and the data. If this phase shift exceeds 180°, then the wrong bit position will be sampled by the receiver. As a result, the maximum allowable clock frequency is a function of the cable length. For 24 AWG, stranded, 3 pair cable (BEI part number 37048-003 or equivalent) the group delay is 1.36ns/ft. The table below shows the maximum transmission rate allowable as a function of cable length to ensure a phase shift of less than 90°.

CLOCK, Maximum (kHz) = 92,000 / Cable Length (ft)CW

Cable Length (ft)	50	100	200	300	500	1000
Max Freq (kHz)	1800	900	500	300	200	100

SSI Timing



Ordering SSI : HOW TO SPECIFY SSI OUTPUT IN THE ENCODER MODEL NUMBER: Use the designation, S3 between the **Code Format** designation and the **Connector** designation. **Example: H25D-SS-12GC-S3-CW-SM18**

Output Code and Terminations

	PARALLEL CODE		TERMINATION TYPE	
	Gray Code	Natural Binary	Cable	M14/19 Conn
	12 Bit	12 Bit		
MSB	G_{12}	2^{12}	WHT/BLK	A
	G_{11}	2^{11}	WHT/BRN	B
	G_{10}	2^{10}	WHT/RED	C
	G_9	2^9	WHT/ORN	D
	G_8	2^8	WHT/YEL	E
	G_7	2^7	WHT/GRN	F
	G_6	2^6	WHT/BLU	G
	G_5	2^5	WHT/VIO	H
	G_4	2^4	WHT/GRY	J
	G_3	2^3	WHT	K
	G_2	2^2	GRY/BLK	L
LSB_{-1}	G_1	2^1	GRY/BRN	M
LSB_0			GRY/RED	N
	0V (CIRCUIT COMMON)1		GRY/ORN	P
	DIRECTION OF COUNT		ORN	R
	CASE GROUND		GRN	S
	0V (CIRCUIT COMMON)		BLK	T
	LATCH CONTROL		YEL	U
	+V (SUPPLY VOLTAGE)		RED	V
	SHIELD DRAIN		BARE	—

1Pin P is available for a tri-state option

SSI Output Termination Table

	M18 Conn	M14/19 Conn	Cable Conn
DATA +	A	A	YEL
DATA-	H	B	WHT/YEL
CLOCK+	B	C	BLU
CLOCK-	I	D	WHT/BLU
DIR CONTROL	C	R	ORN
CASE GROUND	G	S	GRN
CIRCUIT COMMON	F	T	BLK
+V SUPPLY VOLTAGE	D	V	RED
SHIELD DRAIN	—	—	BARE

Direction of Count: Standard is CW increasing when viewed from the shaft end. Pin R is normally HI (or N/C) and is pulled up internally to +V. To reverse the count direction, Pin R must be pulled LO (COMMON).

Latch control: Encoder outputs are active and provide continuous parallel position information when Pin U is HI (or N/C). Pin U is pulled up internally to +V. When Pin U is LO (COMMON) the encoder outputs are latched at the logic state that is present when the latch is applied and will stay latched until Pin U is no longer grounded.

M18 Connector is a MS3102R18-1P, 10-pin connector on the encoder body and mates to an MS3106F18-1S connector or can be used with a standard cable/connector assembly, BEI P/N 924-31186-18XX (Where XX = 10, 20 30 or 50 for a 10, 20, 30, or 50 foot length). This is the preferred connector for SSI output.

M14/19 Connector is a MS3112E14-19P, 19-pin connector on the encoder body and mates to an MS3116J14-19S or equivalent.

Figures

Figure 1 Gray Code

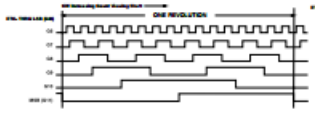
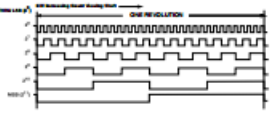
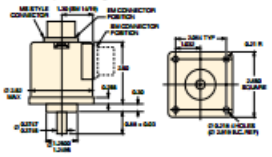


Figure 2 Natural Binary

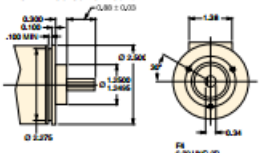


Dimensions

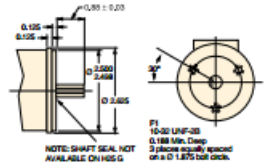
H25D - Square Flange



H25E - 2.50 Servo Mount



H25G - 2.62 Dia Servo Mount



Notes

1. Mounting is usually done either using the D-style square flange mount, E- or G-style servo mounts, or one of the standard face mounts, F1 for example. Consult factory for additional face mount options.
2. The shaft seal is recommended in virtually all installations. The most common exceptions are applications requiring a very low starting torque or those requiring operation at both high temperature and high speed.
3. **Output IC's:** Output IC's are available as either Line Driver (LD) or NPN Open Collector (OC) types. Open Collectors require pull-up resistors, resulting in higher output source impedance (sink impedance is similar to that of line drivers). In general, use of a Line Driver style output is recommended. Line Drivers source or sink current and their lower impedance mean better noise immunity and faster switching times. **Warning:** Do not connect any line driver outputs directly to circuit common/0V, which may damage the driver. Unused outputs should be isolated and left floating. Our applications specialists would be pleased to discuss your system requirements and the compatibility of your receiving electronics with Line Driver type outputs.

28V/V: Multi-voltage Line Driver (7272*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard (Note: $V_{out} = V_{in}$). This driver is TTL compatible when used with 5 volt supply. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 120 mA typical (plus load current). This is the recommended replacement for 3904R and 7406R open collector outputs with internal pullup resistors. It is also a direct replacement for any 4469, 88C30, 8830 or 26LS31 line driver

28V/5: Multi-voltage Line Driver (7272*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard, internally regulated with 5V (TTL compatible) logic out. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 90 mA typical (plus load current). **Note:** Limit encoder load to 2.5W max at ambient. Example at 12 VDC: 2.5W (+12VDC minus +5VDC) = 357 mA total allowed current. Consult factory for your specific requirements.

28V/OC: NPN Open Collector (3904*, 7273*). Current sink of 80 mA max. Current sourced by external pull- up resistor. Output can be pulled up to voltage other than supply voltage (30 V max). Input voltage 5 to 28 VDC */- 5% standard. Supply current is 120 mA typical. This replaces prior IC's with designations of 3904, 7406, 3302, 681 and 689.

4. Special –S at the end of the model number is used to define a variety of non-standard features such as special shaft lengths, voltage options, or special testing. Please consult the factory to discuss your special requirements.
5. Extended temperature ratings are available in the following ranges: -40 to 70°C, -40 to 85°C. Some models can operate down to -55°C. Extended temperature ranges can affect other performance factors. Consult with factory for more specific information.

* Products manufactured prior to April 2007 used the line driver IC number instead of voltage output in model number.

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Appendix C: Raw Data for Normal Hexadecane

nC16 @ 11.9 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	9.592606	12.16169	10.02631	11.43277	6.160558	7.880659	6.280704	8.804792	8.347271	11.73267
IGDtime (ms)	3.66	2.14	3.24	2.3	4.32	3.66	4.2	3.44	3.28	1.64
SOI (deg ATC)	-5	-5	-6	-5	-5	-5	-5	-5	-5	-5
PSOI (bar)	29.35333	29.46983	29.47401	29.58931	29.01809	29.36731	29.27253	29.27872	29.33657	29.71754
TSOI (K)	594.2914	596.2274	597.5734	590.9715	588.9229	599.6417	590.2419	589.0225	597.5183	600.4231
nC16 @ 13.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	10.54923	10.34239	10.87011	8.534394	8.442105	8.605267	8.676742	8.520022	8.664864	8.273839
IGDtime (ms)	2	1.7	1.22	1.52	2.16	1.68	1.56	1.24	1.98	1.52
SOI (deg ATC)	-2	-1	-1	-2	-2	-2	-3	-3	-3	-2
PSOI (bar)	34.15668	34.87455	35.23696	33.84805	33.98846	33.96055	33.60942	33.67471	33.66063	33.95416
TSOI (K)	675.5765	684.9439	689.9491	669.1474	672.9423	668.1165	664.0062	673.6507	666.8436	673.5796
nC16 @ 14.4 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	8.237356	8.663102	8.520574	8.393301	8.365439	8.347744	8.299325	8.351226	8.188841	8.26446
IGDtime (ms)	1.26	1.24	1.4	1.26	1.2	1.18	1.02	1.18	1.06	1.06
SOI (deg ATC)	-8	-8	-7	-8	-7	-7	-8	-8	-8	-8
PSOI (bar)	34.37019	33.51538	34.42687	33.66434	34.55417	34.51622	33.84482	33.77598	33.82169	33.83325
TSOI (K)	732.4767	711.2614	726.907	707.282	728.0521	719.4884	707.1735	705.2003	723.6385	729.0111
nC16 @ 15.1 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	8.265386	8.119507	8.06219	7.960097	7.91362	7.873094	7.829763	7.867069	7.923222	7.828389
IGDtime (ms)	1.08	1.08	1.06	1.18	0.96	1	0.84	0.84	0.96	1.04
SOI (deg ATC)	-7	-7	-6	-6	-6	-7	-7	-7	-6	-7
PSOI (bar)	35.78282	35.93643	36.65333	36.63408	36.71342	36.00521	36.17023	36.14504	36.81726	36.10397
TSOI (K)	736.3215	737.1194	755.0483	751.1604	752.7266	740.8953	740.4215	737.9784	757.2435	740.2943
nC16 @ 16.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	8.132829	8.17624	8.250623	8.042352	7.927719	7.772664	7.73522	7.685922	8.225786	7.917849
IGDtime (ms)	0.78	0.92	0.9	0.92	0.9	0.74	0.62	0.74	0.6	0.6
SOI (deg ATC)	-8	-9	-9	-9	-9	-9	-9	-9	-8	-9
PSOI (bar)	37.13204	36.61971	36.60672	36.52975	36.70834	36.78806	36.83713	36.86091	36.93124	36.85423
TSOI (K)	781.9852	803.4532	800.3103	799.6786	791.4043	793.6694	800.26	801.3848	789.2453	806.4807
nC16 @ 18.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	7.558117	7.850352	7.87023	7.409896	7.964315	7.884437	7.82797	7.878071	7.26114	7.827967
IGDtime (ms)	0.6	0.58	0.68	0.52	0.58	0.56	0.5	0.54	0.54	0.48
SOI (deg ATC)	-7	-7	-8	-9	-8	-8	-8	-8	-9	-8
PSOI (bar)	38.93498	39.17997	38.02107	38.06192	38.12235	38.25716	38.22604	38.17687	38.31351	38.26229
TSOI (K)	809.0593	827.2879	804.9786	826.5368	811.165	817.1643	810.9744	809.1991	814.9781	806.7223

nC16 @ 11.9 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	9.329254	8.352554	9.311675	7.339822	8.673634	8.401896	6.283917	8.751988	6.88317	8.979047
IGDtime (ms)	2.78	3.2	2.88	3.5	2.78	3.16	4.06	3.08	3.72	2.7
SOI (deg ATC)	-6	-5	-5	-5	-5	-5	-5	-4	-5	-5
PSOI (bar)	28.69201	29.27516	29.78857	29.26375	29.45482	29.38954	29.48476	30.10544	29.41199	29.59438
TSOI (K)	587.7383	593.6942	598.5394	595.0323	591.8836	597.0353	598.0946	606.1277	597.5904	597.5922
nC16 @ 13.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	8.350073	8.460942	8.445812	8.392651	8.074576	8.269395	8.44478	8.303031	8.306095	8.370055
IGDtime (ms)	1.36	1.68	1.94	1.7	0.82	1.58	1.26	1.54	1.62	1.46
SOI (deg ATC)	-2	-2	-3	-2	-3	-3	-3	-3	-3	-3
PSOI (bar)	33.99224	33.96855	33.78684	34.06317	33.85447	33.72815	33.85714	33.72448	33.86141	33.84886
TSOI (K)	673.2482	670.7741	674.37	676.2137	669.9808	677.3507	673.1177	669.2063	672.8697	674.1848
nC16 @ 14.4 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	8.114097	8.113956	8.120299	8.167428	8.117257	8.085482	8.177652	8.095867	8.200064	8.144521
IGDtime (ms)	1.22	1.1	1.02	1.02	1.04	0.98	0.98	1.04	1.04	1
SOI (deg ATC)	-8	-8	-8	-7	-8	-7	-7	-7	-8	-8
PSOI (bar)	33.76694	33.82962	33.86841	34.66346	33.86594	34.68536	34.74351	34.75197	33.9652	34.04389
TSOI (K)	708.2815	713.0517	712.5143	730.52	712.092	724.4652	731.5384	726.3905	723.1723	712.5031
nC16 @ 15.1 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	7.850231	7.384965	7.699268	8.190234	7.783157	7.8779	7.80621	7.855115	7.799437	7.826965
IGDtime (ms)	0.86	0.86	0.9	0.92	0.82	0.86	0.8	0.84	0.8	0.9
SOI (deg ATC)	-7	-5	-6	-5	-6	-7	-7	-7	-7	-7
PSOI (bar)	36.06672	37.47174	36.82127	36.76004	36.90192	36.18259	36.13201	36.0981	36.06481	36.08843
TSOI (K)	746.105	758.9139	758.3596	748.7673	758.9409	752.3546	755.7073	755.7809	754.9635	741.5144
nC16 @ 16.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	8.136604	7.775985	8.152702	8.170279	7.793708	7.754029	7.730054	8.235697	7.764395	7.792634
IGDtime (ms)	0.66	0.7	0.7	0.72	0.7	0.72	0.62	0.72	0.58	0.58
SOI (deg ATC)	-8	-9	-8	-8	-9	-9	-9	-8	-9	-9
PSOI (bar)	36.93887	36.96206	36.90269	36.92112	36.9083	36.90148	36.98396	36.93582	37.02472	37.04236
TSOI (K)	792.6967	809.3252	784.8842	793.089	800.706	797.0851	798.8597	795.798	812.4317	804.3769
nC16 @ 18.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	7.401201	7.899147	7.487365	7.39042	7.394001	7.809569	7.994417	7.997295	7.963434	7.990378
IGDtime (ms)	0.54	0.5	0.52	0.52	0.5	0.54	0.48	0.58	0.52	0.52
SOI (deg ATC)	-9	-8	-9	-9	-9	-8	-8	-8	-8	-8
PSOI (bar)	38.33	38.32722	38.39408	38.3676	38.438	38.40342	38.41759	38.48682	38.55132	38.64067
TSOI (K)	837.18	814.8054	832.3933	833.0677	830.4172	819.4879	821.112	826.563	829.1222	826.1942

nC16 @ 11.9 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	8.351715	8.458194	8.396158	8.316134	7.264735	7.989243	8.48492	8.190267	8.258492	8.240287
IGDtime (ms)	3.22	3.32	2.74	2.96	3.14	3.1	2.92	2.62	3.18	2.6
SOI (deg ATC)	-5	-5	-5	-5	-6	-6	-5	-5	-5	-5
PSOI (bar)	29.48207	29.60507	29.64518	29.54779	29.5715	29.67201	29.62808	29.67004	29.69341	29.69484
TSOI (K)	597.1711	602.1547	601.9985	604.7794	611.3328	614.5068	603.2908	604.0755	603.401	604.4904
nC16 @ 13.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.903737	8.327278	8.260909	8.456133	8.315477	8.247883	8.112253	8.148782	8.133586	8.153358
IGDtime (ms)	0.9	1.26	1.06	1.82	1.44	1.26	1.02	1.1	0.88	1.12
SOI (deg ATC)	-4	-3	-3	-3	-3	-3	-3	-3	-3	-3
PSOI (bar)	33.88143	33.9335	33.87513	33.89977	33.8648	33.89872	33.89507	33.85007	33.84751	33.93345
TSOI (K)	682.4065	677.0251	677.0807	674.1416	674.9663	677.7828	673.031	674.584	671.6865	680.1214
nC16 @ 14.4 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	8.261015	8.124455	8.000712	8.040136	8.085526	8.128764	8.188399	8.147025	8.186876	8.132367
IGDtime (ms)	1.02	1	1.04	1	0.92	0.9	0.88	0.94	1.04	0.94
SOI (deg ATC)	-7	-8	-7	-7	-8	-8	-8	-8	-8	-8
PSOI (bar)	34.82157	33.98284	34.72288	34.82811	34.02152	33.98317	34.03004	34.03245	34.00597	34.08804
TSOI (K)	729.4873	715.1846	728.1779	733.2294	730.0105	712.198	724.4334	731.976	729.7183	726.9342
nC16 @ 15.1 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.800249	7.834245	8.20088	7.758359	7.808372	7.83944	7.770191	7.824298	8.24658	7.702081
IGDtime (ms)	0.7	0.8	0.84	0.82	0.68	0.84	0.82	0.64	0.78	0.66
SOI (deg ATC)	-6	-7	-6	-7	-7	-7	-7	-7	-5	-7
PSOI (bar)	36.82321	36.12704	36.22643	36.202	36.13095	36.09291	36.1259	36.1746	36.78944	36.12852
TSOI (K)	757.0479	754.3675	745.5628	753.2357	756.4121	743.3043	742.4183	741.3508	746.1997	754.5276
nC16 @ 16.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	8.231295	8.183316	7.759241	7.768796	7.61918	7.688124	8.185929	8.205004	7.658744	8.255142
IGDtime (ms)	0.68	0.68	0.58	0.72	0.56	0.68	0.54	0.6	0.62	0.56
SOI (deg ATC)	-8	-8	-9	-9	-9	-8	-8	-8	-9	-8
PSOI (bar)	36.93804	37.16119	37.07504	37.0369	37.17985	38.07077	37.08568	37.08126	37.12224	37.14427
TSOI (K)	793.1916	801.0062	805.346	808.1191	807.5395	812.1756	797.0565	787.5421	808.5359	789.7444
nC16 @ 18.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.937491	7.950466	7.97529	7.993213	8.029119	7.764484	7.914098	7.954332	7.930838	7.948385
IGDtime (ms)	0.38	0.5	0.38	0.38	0.4	0.5	0.48	0.42	0.48	0.36
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-7	-7	-8	-8
PSOI (bar)	38.61953	38.56613	38.61936	38.58603	38.60023	38.57064	39.65568	39.68738	38.6351	38.69361
TSOI (K)	823.2912	825.5236	824.7027	820.1703	819.4402	803.9953	837.9856	831.5917	823.2511	825.1499

nC16 @ 11.9 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	8.293117	8.341693	8.382585	8.398162	8.323548	8.192285	7.844094	8.144195	8.157756	8.149086
IGDtime (ms)	3	2.02	2.14	1.78	2.5	2.64	2.28	2.66	2.24	2.28
SOI (deg ATC)	-5	-5	-5	-5	-5	-5	-6	-5	-5	-5
PSOI (bar)	29.70184	29.78247	29.72955	29.82791	29.86363	29.84095	29.91547	29.88051	29.94676	29.89708
TSOI (K)	601.0145	606.4994	607.55	602.599	607.472	603.4436	617.1464	606.1409	607.8193	605.0992
nC16 @ 13.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	8.144747	8.208028	8.233365	8.232792	8.269812	8.096242	8.216472	8.169515	8.128284	8.02161
IGDtime (ms)	0.86	1.24	1.26	1.02	0.92	0.88	1.38	0.56	0.92	0.64
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
PSOI (bar)	33.88577	33.94545	33.92234	34.02501	33.89849	33.97201	33.88893	34.04584	33.94043	34.08956
TSOI (K)	675.1944	675.9242	677.5012	678.7855	675.8251	674.9791	671.7974	675.54	678.1054	681.3956
nC16 @ 14.4 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	8.059072	8.013389	8.156301	7.723291	8.094522	8.137708	8.10806	7.671672	7.559145	7.681316
IGDtime (ms)	1	0.82	0.84	0.9	0.86	0.9	0.9	0.94	0.82	0.68
SOI (deg ATC)	-8	-7	-7	-9	-8	-8	-8	-8	-8	-8
PSOI (bar)	34.08212	34.89476	34.86727	34.06874	34.14296	34.06853	34.11521	34.99741	34.94146	35.05484
TSOI (K)	714.203	736.7939	737.1194	722.5894	731.4483	706.6771	727.8802	744.3692	742.6308	744.624
nC16 @ 15.1 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	8.056811	7.711033	7.640085	7.712819	7.743079	7.792371	7.750435	7.792072	7.761655	8.246057
IGDtime (ms)	0.68	0.78	0.68	0.64	0.76	0.76	0.62	0.62	0.56	0.78
SOI (deg ATC)	-5	-6	-6	-6	-6	-6	-6	-6	-7	-5
PSOI (bar)	36.84885	36.78467	36.92061	36.87627	36.86187	36.7817	36.93089	36.91109	36.15631	36.96606
TSOI (K)	747.1785	753.2664	759.0797	752.1492	753.9544	754.2285	761.5994	761.6127	741.1825	747.4984
nC16 @ 16.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	7.696507	7.803732	7.649001	7.727287	7.610726	8.151517	7.728273	7.692456	7.725639	7.617513
IGDtime (ms)	0.62	0.52	0.52	0.56	0.52	0.56	0.56	0.42	0.56	0.56
SOI (deg ATC)	-9	-9	-9	-9	-9	-8	-9	-9	-9	-9
PSOI (bar)	37.17091	37.11675	37.18697	37.1857	37.23206	37.20962	37.19255	37.20365	37.23313	37.21114
TSOI (K)	815.396	811.0402	815.2867	809.6915	811.6612	792.8927	801.1799	804.0411	804.0053	805.3869
nC16 @ 18.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	7.955375	8.029838	7.927667	7.467625	7.481427	7.88537	7.912338	7.803993	7.998549	8.131559
IGDtime (ms)	0.4	0.4	0.48	0.5	0.34	0.46	0.5	0.34	0.36	0.42
SOI (deg ATC)	-8	-8	-8	-9	-9	-8	-8	-8	-8	-8
PSOI (bar)	38.63032	38.67817	38.80198	38.69984	38.78371	38.78273	38.80275	38.89336	38.82434	38.82116
TSOI (K)	829.8224	820.4928	824.5941	842.7444	845.0222	813.1168	826.9298	827.7784	832.3888	827.1422

nC16 @ 11.9 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	7.737068	8.08725	8.121497	7.938687	8.043436	8.132413	8.168966	7.727846	7.970396	7.975262
IGDtime (ms)	2.3	1.48	2.12	2.64	1.68	1.76	2.16	1.66	1.54	1.64
SOI (deg ATC)	-7	-5	-5	-5	-5	-5	-6	-7	-6	-6
PSOI (bar)	29.45413	30.00506	29.94323	29.92621	29.9011	29.9875	29.49947	29.55775	29.52384	29.48334
TSOI (K)	608.0891	611.0351	611.0508	607.2647	614.6507	611.0602	605.0695	615.8766	611.5119	598.2377
nC16 @ 13.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	8.214047	8.239765	8.063627	8.128505	7.740268	8.125419	8.055964	8.11836	7.981513	8.085537
IGDtime (ms)	1.1	1.2	0.7	0.86	0.86	0.7	0.72	0.68	0.7	0.86
SOI (deg ATC)	-3	-3	-3	-3	-4	-3	-3	-3	-3	-3
PSOI (bar)	34.00733	33.99365	33.96261	34.05491	34.04329	34.04523	34.04755	34.03559	34.12803	34.09933
TSOI (K)	676.6808	674.0874	675.4453	677.9544	685.3999	677.4702	675.3199	677.4389	677.3301	680.1518
nC16 @ 14.4 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	8.15043	8.021204	8.09942	8.189799	7.674886	8.221574	8.092531	8.153066	8.093088	8.105468
IGDtime (ms)	0.82	0.86	0.84	0.72	0.84	0.68	0.76	0.74	0.8	0.68
SOI (deg ATC)	-8	-7	-8	-8	-9	-7	-8	-8	-8	-8
PSOI (bar)	34.20181	35.08073	34.21005	34.22053	34.18503	35.03078	34.22594	34.34008	34.32533	34.27068
TSOI (K)	722.5013	735.2754	714.9886	715.0422	747.0903	737.2429	718.753	729.6408	722.6492	717.8642
nC16 @ 15.1 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	7.82316	8.110751	7.718288	8.11703	7.799197	7.808533	8.276783	7.766815	7.735281	7.741658
IGDtime (ms)	0.64	0.66	0.64	0.66	0.62	0.64	0.66	0.6	0.54	0.6
SOI (deg ATC)	-6	-5	-6	-5	-6	-6	-5	-6	-6	-6
PSOI (bar)	36.99259	37.01629	36.99139	36.87415	36.95277	37.04254	37.02507	37.02244	36.97454	36.99405
TSOI (K)	760.7027	752.6149	761.8126	745.2914	755.5317	760.3216	756.0454	762.1788	760.579	761.6957
nC16 @ 16.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	7.685326	8.261147	7.728648	8.139405	8.210898	7.598837	7.747014	7.747788	8.289423	7.818185
IGDtime (ms)	0.54	0.54	0.52	0.52	0.5	0.52	0.5	0.54	0.5	0.42
SOI (deg ATC)	-9	-8	-9	-8	-8	-9	-9	-9	-8	-9
PSOI (bar)	37.27322	37.28269	37.27942	37.25282	37.26686	37.24665	37.29857	37.30046	37.34226	37.3394
TSOI (K)	810.3932	797.0839	815.2963	797.7794	798.2874	811.089	818.8276	813.8874	800.744	810.7021
nC16 @ 18.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	7.886155	7.936235	7.984888	8.103925	8.003149	7.983213	8.022194	7.95978	7.46178	7.855633
IGDtime (ms)	0.48	0.34	0.36	0.36	0.36	0.36	0.36	0.38	0.42	0.36
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-9	-8
PSOI (bar)	38.87902	38.90375	38.81388	38.86959	38.82792	38.84498	38.77425	38.88211	38.99367	38.91567
TSOI (K)	835.9518	825.4514	827.0989	836.3678	830.2463	825.4233	830.6156	826.6019	845.9395	835.0566

nC16 @ 11.9 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	7.686872	8.015535	8.127865	8.083093	8.053331	8.068882	7.970138	7.973913	7.941549	7.979706
IGDtime (ms)	1.66	1.44	1.64	1.42	1.64	1.64	1.42	1.56	1.42	1.64
SOI (deg ATC)	-7	-6	-6	-6	-6	-6	-6	-6	-6	-6
PSOI (bar)	29.52673	29.49418	29.53286	29.53759	29.51011	29.56111	29.48811	29.533	29.55888	29.5736
TSOI (K)	617.175	607.3108	610.7361	610.2054	609.407	612.9378	608.7691	608.8933	613.1758	609.7471
nC16 @ 13.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	7.572776	8.094693	8.045595	7.584363	7.734245	8.225537	8.04296	8.081802	8.036874	8.169772
IGDtime (ms)	0.7	0.6	0.86	0.68	0.74	0.8	0.7	0.68	0.7	0.94
SOI (deg ATC)	-4	-3	-3	-4	-4	-3	-3	-3	-3	-3
PSOI (bar)	34.07818	34.1363	34.13965	34.19825	34.1135	34.12418	34.18849	34.22497	34.18855	34.09313
TSOI (K)	678.6052	677.019	683.0579	687.2994	681.0453	678.4174	683.1907	682.8728	679.4056	677.5501
nC16 @ 14.4 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.137112	8.170351	8.078251	7.726485	8.198684	8.110591	8.225916	8.166698	8.120057	8.133608
IGDtime (ms)	0.72	0.7	0.82	0.8	0.72	0.72	0.62	0.66	0.62	0.78
SOI (deg ATC)	-8	-8	-8	-9	-8	-7	-8	-8	-7	-7
PSOI (bar)	34.27364	34.29613	34.22535	34.27015	34.37627	35.14474	34.28874	34.24834	35.21993	35.23729
TSOI (K)	717.3556	732.8157	733.1209	743.6661	736.2762	738.2324	719.7951	716.2713	737.4775	740.6017
nC16 @ 15.1 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	7.776231	7.86145	8.089217	7.793274	7.673325	8.391139	8.236287	8.255879	7.779938	7.698812
IGDtime (ms)	0.62	0.54	0.6	0.64	0.58	0.46	0.48	0.58	0.56	0.54
SOI (deg ATC)	-7	-6	-5	-6	-6	-6	-6	-5	-6	-7
PSOI (bar)	36.21268	37.05875	37.04182	37.02309	37.00721	36.33242	36.38945	37.14107	37.12167	36.3486
TSOI (K)	742.1931	764.0413	752.8591	763.2888	761.2716	738.1624	749.3935	756.935	763.7506	743.3066
nC16 @ 16.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.221269	7.738579	8.1648	8.158222	8.270303	7.62541	7.727821	7.785389	7.7494	8.223153
IGDtime (ms)	0.46	0.38	0.52	0.42	0.46	0.52	0.4	0.38	0.42	0.38
SOI (deg ATC)	-8	-9	-8	-8	-8	-9	-9	-9	-9	-8
PSOI (bar)	37.36662	37.43643	37.32175	37.37	37.36479	37.38146	37.46124	37.42118	37.5072	37.46527
TSOI (K)	798.6458	821.7129	802.9362	804.3693	797.9536	811.2551	810.0778	819.012	809.8298	802.0512
nC16 @ 18.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	7.950692	7.916661	7.982666	7.92689	7.939883	7.994032	8.061872	8.015359	7.82921	7.900345
IGDtime (ms)	0.38	0.34	0.4	0.32	0.38	0.34	0.36	0.36	0.3	0.34
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	38.9747	38.98621	38.92542	38.93887	39.01432	39.04459	39.06485	39.06546	39.05467	39.0707
TSOI (K)	826.158	833.5535	830.9531	832.1839	841.1857	832.709	844.9069	838.3241	831.3987	836.9063

nC16 @ 11.9 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	8.046633	7.887252	7.848852	7.942388	7.865709	7.925351	7.940415	7.920458	7.87053	7.895415
IGDtime (ms)	2.04	1.54	1.34	1.44	1.4	1.48	1.62	1.34	1.4	1.26
SOI (deg ATC)	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
PSOI (bar)	29.52638	29.51235	29.51628	29.50564	29.50089	29.59022	29.52481	29.48402	29.55184	29.54402
TSOI (K)	606.1944	601.2907	609.5748	612.2737	604.5627	608.3933	608.4737	603.0546	610.7581	612.3561
nC16 @ 13.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.945015	8.00817	8.154657	8.084442	8.068123	7.9129	8.040198	8.122814	8.167267	8.151285
IGDtime (ms)	0.76	0.7	0.68	0.88	0.68	0.78	0.7	0.56	0.64	0.76
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
PSOI (bar)	34.03723	34.18016	34.19348	34.07295	34.21827	34.21639	34.15632	34.25265	34.21306	34.18177
TSOI (K)	673.127	677.337	678.466	677.3488	677.241	681.2937	674.8543	678.4874	681.2349	681.316
nC16 @ 14.4 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	8.227552	8.181764	8.190201	8.240508	8.194887	8.193472	8.100075	7.730219	8.185321	8.186062
IGDtime (ms)	0.7	0.84	0.7	0.54	0.68	0.66	0.62	0.68	0.68	0.66
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-9	-8	-8
PSOI (bar)	34.34454	34.3365	34.35332	34.31284	34.3331	34.36234	34.42353	34.35849	34.37031	34.39475
TSOI (K)	732.0394	735.6701	732.5285	735.4067	734.3272	730.2277	723.7139	746.814	730.4843	717.4878
nC16 @ 15.1 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.780013	7.770301	8.238154	7.78512	6.745917	7.356423	7.339146	7.489302	7.62412	7.75762
IGDtime (ms)	0.5	0.6	0.62	0.46	0.54	0.42	0.66	0.42	0.54	0.44
SOI (deg ATC)	-7	-6	-5	-6	-2	-2	-5	-5	-6	-6
PSOI (bar)	36.39913	37.05724	37.04581	37.09205	38.96113	38.69388	37.81901	37.74913	37.15666	37.17212
TSOI (K)	745.9822	759.1709	751.1841	765.4221	768.8239	765.8124	765.0394	761.918	765.4103	765.6661
nC16 @ 16.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	8.213312	8.250942	7.836632	7.826586	7.759542	7.737157	8.15963	7.792229	7.650693	8.17506
IGDtime (ms)	0.42	0.38	0.38	0.48	0.42	0.5	0.36	0.34	0.38	0.38
SOI (deg ATC)	-8	-8	-9	-9	-9	-9	-8	-9	-9	-8
PSOI (bar)	37.59043	37.54875	37.51726	37.49895	37.48493	37.57371	37.60247	37.56193	37.60409	37.53745
TSOI (K)	799.8839	802.7982	814.0332	820.6164	817.9101	818.3366	809.3231	821.8001	820.0922	806.0733
nC16 @ 18.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.975592	7.464341	8.01144	7.919875	7.908601	7.90143	7.936706	8.011178	7.927557	8.034793
IGDtime (ms)	0.34	0.34	0.32	0.34	0.3	0.34	0.32	0.36	0.38	0.36
SOI (deg ATC)	-8	-9	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	39.1068	39.07358	39.08577	39.04091	39.11204	39.06929	39.11515	39.10596	39.15708	39.22383
TSOI (K)	837.0412	846.7877	835.042	831.383	839.1503	838.5367	836.7302	835.0819	837.3054	845.7624

nC16 @ 11.9 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	7.979947	7.829466	7.884422	7.891998	7.841248	7.824512	7.938731	7.787803	7.932276	7.784896
IGDtime (ms)	1.42	1.54	1.26	1.28	1.24	1.24	1.26	1.2	1.2	1.4
SOI (deg ATC)	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
PSOI (bar)	29.62836	29.54015	29.59293	29.53395	29.58711	29.53798	29.59249	29.63618	29.56246	29.56146
TSOI (K)	608.0053	614.1321	613.2236	608.7415	615.7596	614.0344	612.6414	609.3257	612.4594	611.3494
nC16 @ 13.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.015928	7.582251	8.165433	8.062622	8.068165	8.062826	8.114601	8.102007	8.111332	8.15888
IGDtime (ms)	0.56	0.52	0.46	0.7	0.72	0.54	0.52	0.54	0.54	0.58
SOI (deg ATC)	-3	-4	-3	-3	-3	-3	-3	-3	-3	-3
PSOI (bar)	34.33276	34.30238	34.27439	34.28414	34.25144	34.27326	34.27308	34.30566	34.2903	34.26654
TSOI (K)	681.9197	690.1511	683.2335	679.1603	680.931	682.7784	681.2951	676.3205	682.6641	678.266
nC16 @ 14.4 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.187202	8.251991	7.653861	8.095464	8.094087	7.675935	8.115527	8.210442	8.197712	8.224434
IGDtime (ms)	0.66	0.54	0.74	0.6	0.6	0.66	0.52	0.64	0.62	0.66
SOI (deg ATC)	-8	-8	-8	-7	-7	-8	-7	-7	-8	-8
PSOI (bar)	34.42415	34.42232	35.25056	35.30227	35.33091	35.24575	35.31849	35.33025	34.43877	34.48322
TSOI (K)	724.7577	724.0153	748.3721	744.4454	741.8015	751.2209	739.9888	747.4637	736.7962	741.3615
nC16 @ 15.1 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.280563	7.68399	7.789384	7.755517	7.642105	7.705408	7.857775	7.707441	7.840207	7.884216
IGDtime (ms)	0.44	0.5	0.44	0.44	0.52	0.44	0.44	0.46	0.48	0.62
SOI (deg ATC)	-5	-6	-6	-6	-6	-6	-6	-6	-6	-7
PSOI (bar)	37.17397	37.15952	37.18632	37.13014	37.13093	37.32794	37.24045	37.21162	37.21502	36.514
TSOI (K)	751.3909	765.7759	760.9278	758.5578	761.1023	764.043	761.7814	761.8511	762.3352	751.4908
nC16 @ 16.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	7.718901	8.106543	7.73715	7.748049	7.668495	7.635337	8.177353	7.691076	7.731575	8.301069
IGDtime (ms)	0.42	0.52	0.38	0.38	0.34	0.34	0.4	0.42	0.38	0.4
SOI (deg ATC)	-9	-8	-9	-9	-9	-9	-8	-9	-9	-8
PSOI (bar)	37.5495	37.51187	37.5314	37.49284	37.60542	37.53882	37.56118	37.53971	37.65951	37.54547
TSOI (K)	814.5378	807.4457	814.2076	820.603	819.2006	819.3996	800.9043	829.2545	813.0877	799.8963
nC16 @ 18.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.050125	7.924308	8.048924	8.052019	7.864041	7.401551	8.091516	8.006994	8.091646	7.982639
IGDtime (ms)	0.34	0.32	0.36	0.24	0.34	0.32	0.34	0.22	0.34	0.34
SOI (deg ATC)	-8	-8	-8	-8	-8	-9	-8	-8	-8	-8
PSOI (bar)	39.16038	39.14473	39.17135	39.13146	39.18124	39.1504	39.20552	39.16813	39.24589	39.24382
TSOI (K)	835.3109	836.9105	836.4611	833.8326	834.4688	849.2243	836.2132	839.4541	837.4794	837.368

nC16 @ 11.9 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	7.941076	7.408916	7.822508	7.797951	7.837476	7.407692	7.881775	7.489738	7.791239	7.867347
IGDtime (ms)	1.44	1.22	1.3	1.02	1.42	1.38	1.26	1.02	1.22	1.06
SOI (deg ATC)	-6	-7	-6	-6	-6	-7	-6	-7	-6	-6
PSOI (bar)	29.60747	29.62903	29.63624	29.68014	29.54074	29.62715	29.5873	29.66721	29.63751	29.65152
TSOI (K)	612.4134	621.4516	611.3303	609.3699	598.0993	619.3294	606.6003	623.0932	608.8132	613.2401
nC16 @ 13.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	7.747251	8.047439	8.023242	7.597651	8.041284	7.970949	8.087011	8.045668	8.110618	7.975725
IGDtime (ms)	0.54	0.62	0.52	0.52	0.66	0.74	0.54	0.58	0.54	0.54
SOI (deg ATC)	-4	-3	-3	-4	-3	-3	-3	-3	-3	-3
PSOI (bar)	34.26031	34.30313	34.37724	34.3209	34.30603	34.2991	34.34104	34.33022	34.37538	34.35674
TSOI (K)	690.366	677.3963	682.9982	688.2364	677.4078	680.7546	680.3239	681.3502	684.0612	681.776
nC16 @ 14.4 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	8.110753	8.171458	8.239431	8.147575	7.728902	7.732716	8.270653	8.235825	8.35654	8.211575
IGDtime (ms)	0.66	0.56	0.54	0.64	0.54	0.54	0.5	0.56	0.58	0.5
SOI (deg ATC)	-7	-8	-8	-8	-9	-9	-8	-8	-8	-8
PSOI (bar)	35.29712	34.45679	34.48056	34.50228	34.50864	34.50949	34.54465	34.59794	34.55482	34.55654
TSOI (K)	741.384	739.7171	735.2004	742.3686	751.2347	732.1225	727.9685	737.0969	736.5171	732.1222
nC16 @ 15.1 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	8.291547	8.373261	7.755407	7.826729	7.862775	8.161584	7.757091	8.138253	8.285619	7.75855
IGDtime (ms)	0.5	0.52	0.48	0.34	0.48	0.46	0.48	0.42	0.46	0.42
SOI (deg ATC)	-6	-6	-7	-6	-6	-5	-6	-5	-5	-6
PSOI (bar)	36.42488	36.52143	36.54931	37.25219	37.27711	37.23162	37.2092	37.31691	37.32154	37.29122
TSOI (K)	740.7354	750.1047	748.2202	765.3866	764.6807	754.2919	761.2515	761.2602	754.2017	766.3461
nC16 @ 16.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	7.898722	7.79605	7.709999	8.177642	8.149789	7.736282	7.760891	7.713323	7.699236	8.179608
IGDtime (ms)	0.4	0.4	0.36	0.38	0.38	0.34	0.36	0.38	0.36	0.38
SOI (deg ATC)	-9	-9	-9	-8	-8	-9	-9	-9	-9	-8
PSOI (bar)	37.62753	37.69064	37.66068	37.59655	37.67278	37.63249	37.66003	37.68584	37.67113	37.66734
TSOI (K)	820.1347	824.053	824.6411	812.364	804.4539	822.9539	819.1765	813.3389	814.0855	810.1567
nC16 @ 18.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	8.094407	8.038301	7.9822	8.090129	7.961489	8.105432	8.069887	7.894107	7.445294	7.936805
IGDtime (ms)	0.32	0.32	0.36	0.22	0.36	0.36	0.24	0.32	0.22	0.34
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-9	-8
PSOI (bar)	39.25436	39.18396	39.22741	39.26265	39.28098	39.24715	39.23685	39.21669	39.32696	39.32289
TSOI (K)	841.3741	839.3265	839.4669	840.4889	833.6113	836.0646	841.6163	838.6424	859.1334	838.7669

nC16 @ 11.9 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	7.811927	7.533826	7.415244	7.89238	7.773093	7.831697	7.789549	7.801817	7.770112	7.894345
IGDtime (ms)	1.24	1.44	1.26	1.26	1.18	1.3	1.2	1.08	0.98	1.04
SOI (deg ATC)	-6	-7	-7	-6	-6	-6	-6	-6	-6	-6
PSOI (bar)	29.56433	29.63602	29.59884	29.61608	29.5417	29.63964	29.58666	29.61774	29.63146	29.66882
TSOI (K)	607.626	623.1714	619.3384	614.5219	612.6691	613.0848	611.1189	608.1488	612.6941	608.4409
nC16 @ 13.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.074848	8.003603	8.201685	8.040442	7.676953	7.741058	8.035729	8.125871	8.080724	8.095021
IGDtime (ms)	0.7	0.64	0.52	0.6	0.72	0.42	0.72	0.5	0.48	0.62
SOI (deg ATC)	-3	-3	-3	-3	-4	-4	-3	-3	-3	-3
PSOI (bar)	34.47121	34.42003	34.47571	34.3613	34.43312	34.32548	34.39352	34.37989	34.44368	34.41157
TSOI (K)	687.5138	682.0122	682.8986	685.039	685.932	687.6588	684.0943	682.1119	681.1726	684.9053
nC16 @ 14.4 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.171001	8.15276	8.162427	8.106866	8.137262	8.137911	8.2018	7.72997	8.199084	8.239872
IGDtime (ms)	0.64	0.5	0.52	0.62	0.5	0.5	0.56	0.48	0.5	0.52
SOI (deg ATC)	-8	-7	-7	-8	-8	-7	-8	-8	-8	-8
PSOI (bar)	34.62029	35.43356	35.46511	34.53582	34.56521	35.46202	34.66306	35.49583	34.66108	34.55768
TSOI (K)	730.4376	743.5173	748.5662	725.9371	723.9238	744.4567	725.7791	753.8526	725.5479	738.2443
nC16 @ 15.1 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	7.761706	7.771508	7.8566	7.801892	8.287816	7.711422	8.237533	7.76267	8.130044	7.873554
IGDtime (ms)	0.44	0.42	0.48	0.34	0.44	0.4	0.4	0.38	0.42	0.34
SOI (deg ATC)	-6	-6	-7	-6	-5	-6	-6	-6	-6	-7
PSOI (bar)	37.31684	37.34978	36.68065	37.42169	37.29158	37.34938	36.66903	37.35555	36.72295	36.58837
TSOI (K)	770.112	766.7791	750.7662	769.2728	754.9599	765.5003	740.3707	767.993	745.4498	769.4758
nC16 @ 16.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.317513	7.666372	7.774325	8.130665	7.637509	8.1946	7.790644	8.237548	7.732358	7.689821
IGDtime (ms)	0.32	0.38	0.4	0.36	0.36	0.36	0.28	0.34	0.38	0.36
SOI (deg ATC)	-8	-9	-9	-8	-9	-8	-9	-8	-9	-9
PSOI (bar)	37.63482	37.61497	37.71727	37.71067	37.74649	37.72298	37.61543	37.70307	37.66216	37.76354
TSOI (K)	806.6325	819.763	823.9864	811.2559	820.7186	805.7375	818.7901	808.9886	811.8473	817.5707
nC16 @ 18.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.090761	8.014232	7.994236	7.376244	7.953257	7.61846	8.012728	7.947722	7.853931	7.620273
IGDtime (ms)	0.32	0.34	0.32	0.24	0.34	0.3	0.28	0.3	0.22	0.26
SOI (deg ATC)	-8	-8	-8	-9	-8	-9	-8	-8	-8	-9
PSOI (bar)	39.31522	39.3025	39.27159	39.39014	39.36378	39.39128	39.38494	39.39967	39.40096	39.37089
TSOI (K)	845.0003	844.0942	840.3846	850.5756	833.7936	853.7499	836.4666	840.9777	841.9179	857.1042

nC16 @ 11.9 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.851365	7.802017	7.724661	7.726291	7.698054	7.806843	7.911846	7.778884	7.525967	7.793107
IGDtime (ms)	1.26	1.02	0.98	0.88	1.08	1.12	1.08	1.12	1.06	0.94
SOI (deg ATC)	-6	-6	-6	-6	-6	-6	-6	-6	-7	-6
PSOI (bar)	29.57458	29.62961	29.64659	29.66098	29.64591	29.70069	29.69766	29.61487	29.64261	29.66316
TSOI (K)	609.6772	611.6397	608.4516	615.3646	609.2924	604.1768	611.2877	608.5692	617.144	614.0659
nC16 @ 13.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	8.162781	8.097684	8.054892	8.10351	8.126101	8.246189	7.649606	8.034694	7.88746	8.114643
IGDtime (ms)	0.4	0.52	0.54	0.56	0.54	0.58	0.54	0.54	0.66	0.4
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-4	-3	-3	-3
PSOI (bar)	34.39696	34.49445	34.41983	34.5199	34.4561	34.42677	34.41365	34.46232	34.43569	34.46085
TSOI (K)	680.9521	686.7067	684.1265	684.9576	680.1495	679.9316	692.8876	679.0809	682.8547	685.7516
nC16 @ 14.4 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	8.186505	8.229824	8.181474	8.110766	8.19048	8.198075	8.194292	7.792869	8.157028	8.192966
IGDtime (ms)	0.5	0.48	0.5	0.44	0.52	0.48	0.5	0.52	0.52	0.46
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-9	-7	-8
PSOI (bar)	34.65209	34.69318	34.66046	34.67867	34.63837	34.7285	34.66226	34.70959	35.41931	34.66299
TSOI (K)	723.3587	737.1742	744.5925	728.054	738.7065	744.4927	747.3186	751.9222	737.479	723.459
nC16 @ 15.1 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.86365	7.827857	7.840732	8.250409	7.805408	7.818741	7.688711	7.843172	7.705838	7.740702
IGDtime (ms)	0.42	0.4	0.36	0.36	0.34	0.32	0.32	0.4	0.34	0.42
SOI (deg ATC)	-6	-7	-6	-5	-6	-6	-6	-6	-6	-6
PSOI (bar)	37.31879	36.71486	37.43486	37.45827	37.42782	37.44734	37.44689	37.48191	37.46261	37.35799
TSOI (K)	764.7428	755.7505	770.1255	763.7738	765.1484	770.1472	767.7805	770.7731	769.9241	767.5616
nC16 @ 16.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.731383	7.702506	7.735121	8.203293	7.741593	8.153546	8.253276	7.674385	8.306834	7.706562
IGDtime (ms)	0.36	0.36	0.36	0.36	0.4	0.34	0.32	0.3	0.24	0.38
SOI (deg ATC)	-9	-9	-9	-8	-9	-8	-8	-9	-8	-9
PSOI (bar)	37.71851	37.76018	37.78089	37.70859	37.83096	37.8608	37.84082	37.79453	37.72648	37.8281
TSOI (K)	819.8232	820.891	826.5479	811.6294	826.5903	813.8982	802.7739	825.4382	803.231	822.0052
nC16 @ 18.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.992105	7.992835	8.05617	8.021163	8.027884	8.080105	8.010198	8.045912	8.122534	8.018682
IGDtime (ms)	0.22	0.26	0.34	0.2	0.32	0.34	0.34	0.36	0.24	0.26
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	39.44518	39.4083	39.37937	39.4416	39.46198	39.44083	39.50541	39.47343	39.41518	39.43852
TSOI (K)	838.2478	831.7038	840.7146	839.6709	843.0329	840.2407	841.6843	847.8981	834.285	836.7662

nC16 @ 11.9 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.890312	7.738707	7.315867	7.827633	7.779259	7.739665	7.704165	7.815409	7.791698	7.39001
IGDtime (ms)	1.08	1.44	1.2	1	0.88	1.08	1.08	1.12	1.12	1
SOI (deg ATC)	-6	-6	-7	-6	-6	-6	-6	-6	-6	-7
PSOI (bar)	29.69452	29.57274	29.64494	29.71306	29.65723	29.67564	29.66884	29.63018	29.68771	29.68712
TSOI (K)	613.5368	609.211	619.1019	611.7925	612.5463	600.4054	610.6974	611.7243	612.1604	618.7371
nC16 @ 13.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.029189	8.153108	8.059956	7.715288	8.117555	7.690136	7.985224	8.118618	8.111104	8.105597
IGDtime (ms)	0.52	0.54	0.46	0.52	0.56	0.44	0.54	0.4	0.48	0.44
SOI (deg ATC)	-3	-3	-3	-4	-3	-4	-3	-3	-3	-3
PSOI (bar)	34.51596	34.47027	34.46593	34.50036	34.49444	34.50123	34.53924	34.53537	34.46724	34.5329
TSOI (K)	683.4105	681.6456	684.3344	692.6502	684.9977	690.6692	685.5624	685.227	682.3788	683.3883
nC16 @ 14.4 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.108167	8.031782	8.191822	8.129434	7.646622	8.093741	8.160413	7.575379	8.208265	8.122357
IGDtime (ms)	0.5	0.48	0.48	0.48	0.48	0.48	0.52	0.34	0.52	0.52
SOI (deg ATC)	-8	-8	-7	-8	-9	-8	-8	-9	-8	-8
PSOI (bar)	34.73894	34.72206	35.54548	34.71529	34.72339	34.68837	34.67133	34.74822	34.6574	34.69921
TSOI (K)	734.4476	740.0003	745.2859	729.4021	738.5399	726.5238	720.1021	738.5168	741.482	745.2972
nC16 @ 15.1 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.877044	7.7152	8.289848	8.239086	8.312095	7.719362	7.79798	8.151208	8.324152	8.153964
IGDtime (ms)	0.3	0.34	0.44	0.3	0.3	0.3	0.32	0.3	0.3	0.3
SOI (deg ATC)	-6	-6	-5	-5	-6	-6	-7	-5	-5	-5
PSOI (bar)	37.44142	37.3676	37.51993	37.46962	36.78835	37.45969	36.83331	37.54204	37.59188	37.52459
TSOI (K)	773.5975	765.3569	758.4947	761.1912	752.3315	770.6076	758.105	763.6499	760.1157	762.4068
nC16 @ 16.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.306118	7.768097	7.733297	7.776043	7.750026	8.15826	7.749965	7.703246	8.241163	7.733342
IGDtime (ms)	0.34	0.36	0.26	0.36	0.36	0.24	0.36	0.34	0.36	0.22
SOI (deg ATC)	-8	-9	-9	-9	-9	-8	-9	-9	-8	-9
PSOI (bar)	37.77332	37.82627	37.83476	37.85639	37.84928	37.76507	37.81016	37.87794	37.82594	37.82328
TSOI (K)	803.5462	815.448	822.6391	821.1785	826.662	800.2279	822.0836	832.3154	806.2772	823.6406
nC16 @ 18.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.072395	8.088446	8.016299	7.94845	8.119983	8.048466	8.086754	8.078571	8.047924	8.063962
IGDtime (ms)	0.24	0.32	0.32	0.3	0.32	0.36	0.34	0.22	0.24	0.22
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	39.43134	39.49264	39.46795	39.51442	39.51174	39.5367	39.51049	39.54321	39.52015	39.58118
TSOI (K)	845.4656	843.3645	841.4881	840.0816	844.1573	846.3786	845.5363	839.7436	847.585	839.1768

nC16 @ 11.9 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.69563	7.74158	7.711322	7.727588	7.789168	7.300818	7.819468	7.78011	7.765342	7.700108
IGDtime (ms)	1.08	0.92	1.1	1.02	0.96	0.98	1.1	0.76	1.04	0.88
SOI (deg ATC)	-6	-6	-6	-6	-6	-7	-6	-6	-6	-6
PSOI (bar)	29.61	29.67988	29.6341	29.78746	29.67307	29.65593	29.66355	29.72844	29.71659	29.72343
TSOI (K)	609.7792	604.3729	613.9281	614.9091	611.1972	621.1926	609.4218	611.9613	609.4	612.4379
nC16 @ 13.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	8.154268	8.187651	8.115607	8.193118	8.156673	8.173683	8.071038	7.812098	8.192643	8.22169
IGDtime (ms)	0.52	0.56	0.56	0.42	0.46	0.4	0.5	0.46	0.38	0.56
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-3	-4	-3	-3
PSOI (bar)	34.59361	34.51014	34.55545	34.52761	34.69116	34.53306	34.54417	34.57891	34.59085	34.50347
TSOI (K)	685.5272	687.2745	685.1799	685.5374	692.1505	684.0337	689.7432	690.353	684.7803	688.4611
nC16 @ 14.4 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.658663	7.691771	8.279389	7.654435	7.843241	8.210803	7.665887	8.149694	8.225685	8.196548
IGDtime (ms)	0.48	0.34	0.5	0.48	0.5	0.46	0.48	0.48	0.36	0.46
SOI (deg ATC)	-9	-9	-8	-9	-9	-8	-9	-8	-8	-8
PSOI (bar)	34.72613	34.75177	34.66424	34.79232	34.75191	34.72896	34.71539	34.72613	34.72349	34.74998
TSOI (K)	743.0872	746.0757	734.1676	763.5553	755.2812	728.0004	755.027	745.1579	742.4151	736.7739
nC16 @ 15.1 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.751816	7.773057	7.804619	7.831068	7.857123	7.898993	7.875931	7.757059	7.79388	7.753535
IGDtime (ms)	0.44	0.3	0.3	0.3	0.3	0.34	0.32	0.32	0.28	0.26
SOI (deg ATC)	-6	-6	-7	-7	-7	-7	-6	-6	-6	-6
PSOI (bar)	37.54791	37.54704	36.79102	36.96496	36.80814	36.78251	37.5249	37.58437	37.55819	37.61585
TSOI (K)	772.6159	767.499	769.3973	764.7433	756.5169	758.9558	774.2828	772.7665	772.8005	774.5791
nC16 @ 16.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.719678	7.793577	8.347271	8.31724	7.672584	8.275566	8.305533	8.348524	8.247908	7.762449
IGDtime (ms)	0.34	0.32	0.28	0.28	0.26	0.34	0.3	0.32	0.38	0.28
SOI (deg ATC)	-9	-9	-8	-8	-9	-8	-8	-8	-8	-9
PSOI (bar)	37.89062	37.85646	37.89744	37.89893	37.84755	37.93331	37.85748	37.89302	37.91995	37.93301
TSOI (K)	822.8354	830.0608	806.6419	806.3356	825.8465	814.7112	812.8319	807.7009	817.7572	830.4717
nC16 @ 18.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	8.084185	7.982393	8.005665	7.503179	7.559719	8.051217	8.072112	8.066742	8.136067	8.171221
IGDtime (ms)	0.24	0.26	0.24	0.22	0.22	0.22	0.2	0.24	0.26	0.26
SOI (deg ATC)	-8	-8	-8	-9	-9	-8	-8	-8	-8	-8
PSOI (bar)	39.57761	39.51343	39.51683	39.55236	39.51299	39.68322	39.60504	39.61576	39.65552	39.65235
TSOI (K)	843.6652	845.1984	838.9818	868.2843	864.2264	843.5052	841.9419	838.9568	847.0268	837.678

nC16 @ 11.9 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	7.767567	7.764082	7.312988	7.800128	7.829619	7.923528	7.755001	7.829949	7.860328	7.823528
IGDtime (ms)	0.96	0.92	0.86	1.06	1.02	1.02	0.88	1.04	0.92	1.04
SOI (deg ATC)	-6	-6	-7	-6	-6	-6	-6	-6	-6	-6
PSOI (bar)	29.76269	29.69276	29.68858	29.69592	29.6949	29.76466	29.7167	29.70859	29.726	29.77394
TSOI (K)	612.6064	612.3363	624.3667	610.0792	614.0864	612.0799	609.4936	612.1742	616.6416	609.6332
nC16 @ 13.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.203757	8.15149	8.165075	8.087255	8.045728	8.020342	8.153323	8.044555	8.06952	8.040754
IGDtime (ms)	0.38	0.38	0.52	0.36	0.36	0.48	0.48	0.44	0.5	0.3
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
PSOI (bar)	34.61358	34.59432	34.63456	34.69512	34.65	34.58373	34.65859	34.60822	34.6398	34.64191
TSOI (K)	685.4737	689.3347	688.0269	689.6306	691.2996	688.734	690.7508	688.6299	690.6245	689.144
nC16 @ 14.4 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.173517	8.149169	8.189556	8.216728	8.141984	8.114851	8.162253	8.109332	8.231821	8.099958
IGDtime (ms)	0.44	0.48	0.48	0.46	0.46	0.38	0.4	0.46	0.44	0.42
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-7
PSOI (bar)	34.72738	34.79149	34.88209	34.71168	34.86222	34.76593	34.81207	34.77527	34.86397	35.66178
TSOI (K)	735.9655	740.93	744.9435	741.0185	731.1168	742.5916	747.7964	726.5321	729.6731	746.9976
nC16 @ 15.1 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	7.758344	7.790536	7.970056	7.839912	7.844845	7.849202	8.22872	7.783934	7.749242	7.795846
IGDtime (ms)	0.3	0.26	0.3	0.32	0.28	0.28	0.28	0.28	0.26	0.28
SOI (deg ATC)	-6	-6	-7	-7	-6	-7	-5	-6	-6	-6
PSOI (bar)	37.65074	37.52454	36.99474	36.91981	37.63287	36.90996	37.68776	37.66923	37.6978	37.63988
TSOI (K)	772.8648	770.7603	767.5828	760.574	772.1917	755.1127	759.6458	775.3901	777.4547	773.6183
nC16 @ 16.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.315719	7.853668	8.209797	8.149643	8.303508	8.285368	7.771373	7.716613	8.241439	8.312461
IGDtime (ms)	0.26	0.26	0.26	0.34	0.34	0.32	0.26	0.28	0.26	0.24
SOI (deg ATC)	-8	-9	-8	-8	-8	-8	-9	-9	-8	-8
PSOI (bar)	37.88985	37.81638	37.94442	37.89806	37.94536	37.90726	37.89935	37.9748	37.97361	38.04201
TSOI (K)	811.0288	822.5004	810.3263	811.0164	809.4202	805.2074	830.3833	833.2917	808.3153	816.3731
nC16 @ 18.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	7.96941	7.971857	8.002719	8.006286	8.071678	8.09558	8.079883	8.173955	8.023601	8.052004
IGDtime (ms)	0.3	0.22	0.22	0.2	0.24	0.26	0.22	0.24	0.32	0.2
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	39.65688	39.59628	39.66091	39.70152	39.5658	39.6561	39.65235	39.62085	39.75943	39.62996
TSOI (K)	842.594	840.9581	846.1509	845.1503	847.5672	844.0543	846.1201	839.1544	847.6248	845.3874

nC16 @ 11.9 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	7.739771	7.790107	7.43812	7.748922	7.817675	7.840504	7.744858	7.681174	7.589983	7.696726
IGDtime (ms)	0.7	1.02	0.64	0.92	1.02	0.82	0.98	0.7	0.8	0.7
SOI (deg ATC)	-6	-6	-7	-6	-6	-6	-6	-6	-6	-6
PSOI (bar)	29.78274	29.78378	29.77693	29.80538	29.74637	29.81794	29.87955	29.82044	29.82766	29.85281
TSOI (K)	613.1504	604.5165	623.913	614.2123	605.6885	610.3034	614.249	606.5617	605.857	614.1154
nC16 @ 13.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.063087	8.136619	8.109625	8.158985	8.148487	8.249898	7.6729	8.057622	8.123148	8.094174
IGDtime (ms)	0.4	0.36	0.52	0.38	0.4	0.52	0.38	0.4	0.4	0.42
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-4	-3	-3	-3
PSOI (bar)	34.64374	34.65711	34.65344	34.70211	34.66462	34.69906	34.65184	34.70063	34.66558	34.64626
TSOI (K)	686.5593	689.0607	688.6172	688.7664	688.7361	689.0496	688.7879	688.8814	686.4449	684.7264
nC16 @ 14.4 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.254221	7.735981	8.194707	8.147844	8.111799	8.199292	8.203082	8.188805	8.225172	8.209257
IGDtime (ms)	0.48	0.48	0.36	0.34	0.36	0.36	0.44	0.38	0.38	0.44
SOI (deg ATC)	-8	-9	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	34.81778	34.84356	34.78694	34.8003	34.92878	34.79808	34.93837	34.88828	34.89707	34.8838
TSOI (K)	742.0076	763.3313	743.4303	743.4579	729.3342	741.0751	741.7475	742.812	743.0083	743.1051
nC16 @ 15.1 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.284225	7.958044	7.772754	7.713972	8.211025	7.827097	7.845066	8.223159	7.691936	8.323724
IGDtime (ms)	0.28	0.32	0.26	0.28	0.3	0.26	0.3	0.26	0.26	0.26
SOI (deg ATC)	-5	-7	-6	-6	-6	-6	-6	-5	-6	-5
PSOI (bar)	37.60069	37.00128	37.6423	37.66898	36.88885	37.68238	37.64129	37.77443	37.71398	37.77513
TSOI (K)	760.483	762.8631	770.2533	774.223	747.1672	774.8725	775.0744	771.4993	776.9028	760.4977
nC16 @ 16.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.217609	8.358795	8.240157	8.254246	8.152503	8.312113	7.836001	8.288524	7.860321	8.25598
IGDtime (ms)	0.28	0.26	0.22	0.34	0.34	0.26	0.22	0.24	0.26	0.26
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-9	-8	-9	-8
PSOI (bar)	38.00739	37.94853	37.94237	37.88574	38.018	37.9316	37.90704	38.01926	38.04665	37.97815
TSOI (K)	812.407	804.253	808.4566	801.3182	813.4901	799.7603	819.0377	813.5146	828.3951	813.7472
nC16 @ 18.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	7.949693	7.979514	7.544299	7.511237	7.953642	8.008352	8.042837	7.908098	7.993054	7.514722
IGDtime (ms)	0.22	0.2	0.18	0.2	0.22	0.2	0.18	0.2	0.24	0.2
SOI (deg ATC)	-8	-8	-9	-9	-8	-8	-8	-8	-8	-9
PSOI (bar)	39.69468	39.61805	39.81377	39.692	39.7063	39.71047	39.72081	39.77003	39.75474	39.712
TSOI (K)	845.7498	846.6992	864.2293	866.6048	846.638	845.0994	849.8282	852.9798	846.5764	857.9063

nC16 @ 11.9 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.387914	7.771166	7.827604	7.787555	7.797864	7.70138	7.74677	7.374394	7.377382	7.794576
IGDtime (ms)	0.88	0.92	0.9	0.8	1.02	0.94	0.72	0.74	0.88	0.92
SOI (deg ATC)	-7	-6	-6	-6	-6	-6	-6	-7	-7	-6
PSOI (bar)	29.84814	29.84119	29.85224	29.818	29.80806	29.90989	29.83619	29.8103	29.84453	29.87186
TSOI (K)	627.4999	609.2035	612.4481	608.6089	614.5849	615.34	610.7555	624.3999	625.0506	614.4152
nC16 @ 13.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	8.166632	8.069714	8.131528	8.114995	8.143191	7.758921	8.040634	8.161971	8.119335	7.610284
IGDtime (ms)	0.38	0.4	0.34	0.5	0.4	0.42	0.36	0.34	0.44	0.48
SOI (deg ATC)	-3	-3	-3	-3	-3	-4	-3	-3	-3	-4
PSOI (bar)	34.73326	34.73126	34.78804	34.7195	34.75105	34.73791	34.74462	34.76553	34.7497	34.72537
TSOI (K)	692.5436	692.6697	688.387	690.052	694.1782	699.3538	688.7404	689.7017	691.3408	693.9933
nC16 @ 14.4 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	8.182128	8.241934	7.676426	7.750591	8.160366	7.731233	8.172371	8.250819	8.215871	8.222283
IGDtime (ms)	0.44	0.4	0.34	0.36	0.48	0.36	0.38	0.38	0.36	0.4
SOI (deg ATC)	-8	-8	-9	-9	-8	-9	-8	-8	-8	-8
PSOI (bar)	34.90861	34.89874	34.83833	34.8826	34.84391	34.91408	34.86275	34.9338	34.90855	34.91803
TSOI (K)	743.6516	743.3746	759.499	765.3072	729.0789	763.8921	742.0132	745.5014	741.9993	740.8992
nC16 @ 15.1 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.936639	8.415246	7.881837	7.746741	7.883156	7.752176	7.852545	7.810454	7.722923	7.694337
IGDtime (ms)	0.28	0.2	0.36	0.3	0.28	0.28	0.28	0.32	0.14	0.22
SOI (deg ATC)	-7	-6	-7	-7	-7	-6	-6	-6	-6	-6
PSOI (bar)	36.97321	37.01946	36.93944	36.97852	36.96877	37.67262	37.67262	37.90473	37.78021	37.74805
TSOI (K)	773.8773	769.252	772.8612	762.5409	765.3605	775.996	776.59	781.2316	775.6399	777.3169
nC16 @ 16.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	8.199283	8.180964	7.825806	7.752457	8.206921	7.691529	8.321092	8.284372	8.264824	7.908534
IGDtime (ms)	0.26	0.24	0.24	0.32	0.28	0.24	0.24	0.32	0.26	0.26
SOI (deg ATC)	-8	-8	-9	-9	-8	-9	-8	-8	-8	-9
PSOI (bar)	38.0202	38.08717	37.94459	38.03862	38.02341	37.99515	38.04597	37.99675	38.05424	38.05959
TSOI (K)	806.7917	813.5758	829.8292	816.7661	804.7605	826.7941	811.5262	807.5022	810.3705	830.9666
nC16 @ 18.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.913547	8.061282	8.030832	8.188238	7.549103	7.969849	7.444731	7.890114	7.961459	8.081095
IGDtime (ms)	0.22	0.2	0.24	0.2	0.24	0.22	0.22	0.24	0.3	0.24
SOI (deg ATC)	-8	-8	-8	-8	-9	-8	-9	-8	-8	-8
PSOI (bar)	39.72715	39.75898	39.73042	39.80499	39.84977	39.82237	39.838	39.77621	39.82451	39.77397
TSOI (K)	849.4522	851.6985	844.9594	847.3445	868.0086	853.5781	865.1909	846.2672	842.0428	849.7713

nC16 @ 11.9 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.761655	7.451654	7.865871	7.863477	7.786808	7.717429	7.892365	7.445058	7.407024	7.598827
IGDtime (ms)	0.7	0.82	0.88	0.88	0.84	0.72	0.76	0.76	0.76	0.78
SOI (deg ATC)	-6	-7	-6	-6	-6	-6	-6	-7	-6	-6
PSOI (bar)	29.83688	29.85116	29.82037	29.91359	29.85626	29.95358	29.97621	29.87623	30.36638	29.90715
TSOI (K)	615.4619	625.8711	614.5094	617.3987	612.7378	616.4941	615.33	623.2874	624.0561	606.1327
nC16 @ 13.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	8.072829	8.07763	8.004806	8.147816	8.097255	8.138763	8.121534	7.991928	8.091137	8.127931
IGDtime (ms)	0.4	0.38	0.36	0.46	0.36	0.38	0.38	0.38	0.4	0.32
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
PSOI (bar)	34.70327	34.77056	34.74069	34.81964	34.79003	34.79129	34.79883	34.7866	34.81904	34.82002
TSOI (K)	684.4001	692.4793	690.8501	689.0168	688.5485	692.6402	692.2394	688.9599	691.1584	688.6993
nC16 @ 14.4 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	8.143647	8.109563	7.770224	8.174195	8.172071	8.131469	8.175277	7.712003	8.081982	8.103386
IGDtime (ms)	0.36	0.44	0.44	0.44	0.44	0.34	0.42	0.38	0.36	0.34
SOI (deg ATC)	-8	-8	-9	-8	-8	-8	-8	-9	-8	-8
PSOI (bar)	34.87802	34.93437	34.95067	34.87837	34.9185	34.95142	34.91275	34.83131	34.92951	34.91291
TSOI (K)	744.3982	727.8692	758.9992	743.1968	740.0871	729.5855	746.855	763.4896	753.0822	742.5136
nC16 @ 15.1 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.832451	8.343773	7.885611	7.839095	7.837526	7.837236	7.964687	7.81018	7.807014	7.893591
IGDtime (ms)	0.28	0.3	0.3	0.28	0.16	0.18	0.26	0.22	0.22	0.28
SOI (deg ATC)	-7	-6	-7	-7	-6	-7	-7	-6	-6	-6
PSOI (bar)	36.98785	37.07296	37.1277	37.03993	37.9149	37.12254	37.0554	37.79803	37.80309	37.8136
TSOI (K)	761.2894	763.5312	775.9784	762.5314	775.4847	765.2281	762.9661	776.5575	779.4901	779.5509
nC16 @ 16.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	8.280978	8.291156	7.846805	7.730646	8.332882	8.27315	7.726482	7.798913	8.169366	8.272178
IGDtime (ms)	0.22	0.32	0.26	0.26	0.26	0.22	0.22	0.24	0.24	0.26
SOI (deg ATC)	-8	-8	-9	-9	-8	-8	-9	-9	-8	-8
PSOI (bar)	38.02464	38.09096	38.04381	38.09028	38.08271	38.07906	38.12217	38.10484	38.09886	38.09992
TSOI (K)	814.9555	813.6694	830.2123	823.5375	810.2983	817.4625	831.6749	830.7707	813.3822	810.3385
nC16 @ 18.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	8.031276	8.032452	7.984261	8.102865	8.027944	8.006044	8.073421	8.028802	8.000383	8.020887
IGDtime (ms)	0.22	0.2	0.22	0.22	0.2	0.22	0.28	0.2	0.22	0.24
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	39.81239	39.76899	39.83127	39.76334	39.79499	39.87128	39.86229	39.79129	39.83296	39.88242
TSOI (K)	849.4355	843.3183	848.7304	850.9989	849.8167	847.1774	852.3196	850.0605	851.2354	848.8375

nC16 @ 11.9 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.463876	7.436078	7.814299	7.834069	7.748352	7.77793	-0.6506	-0.41244	-0.62961	-0.61752
IGDtime (ms)	0.9	0.76	0.9	0.76	0.72	0.76	0	0	0	0
SOI (deg ATC)	-7	-7	-6	-6	-6	-6	-4	-3	-4	-4
PSOI (bar)	29.90542	29.91205	29.90311	29.94725	29.91359	29.98507	26.02856	26.07511	26.08667	26.05274
TSOI (K)	625.6102	626.3736	616.1777	618.4187	609.8937	614.7022	519.3672	513.1061	514.159	525.3514
nC16 @ 13.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.249349	8.122077	7.982501	8.074092	8.078785	8.036302	8.141658	8.128279	8.075607	8.102176
IGDtime (ms)	0.4	0.34	0.32	0.34	0.36	0.36	0.36	0.32	0.4	0.34
SOI (deg ATC)	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
PSOI (bar)	34.90567	34.82688	34.79772	34.80621	34.90683	34.90455	34.89195	34.86943	34.87469	34.92464
TSOI (K)	691.7272	689.0813	694.2893	686.246	692.9629	693.6557	690.484	693.2686	692.6639	693.3769
nC16 @ 14.4 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.079723	7.650964	8.157815	8.250258	8.276734	8.174729	8.240051	8.15403	7.739271	8.131996
IGDtime (ms)	0.34	0.36	0.36	0.34	0.34	0.42	0.42	0.4	0.34	0.32
SOI (deg ATC)	-8	-9	-8	-8	-8	-8	-8	-8	-9	-8
PSOI (bar)	34.96023	34.89692	34.95662	34.91914	34.97397	34.86148	34.91783	34.98548	34.94522	34.95108
TSOI (K)	732.0978	761.2937	748.1846	745.1581	741.6251	730.4786	747.8217	749.5139	765.0918	729.1545
nC16 @ 15.1 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.302535	7.796193	7.768714	7.750835	7.689745	7.70236	8.22621	7.857485	7.839708	7.815101
IGDtime (ms)	0.14	0.26	0.26	0.24	0.26	0.24	0.24	0.26	0.24	0.22
SOI (deg ATC)	-5	-6	-6	-6	-6	-6	-5	-7	-6	-6
PSOI (bar)	37.84034	37.79806	37.80251	37.77796	37.82944	37.82359	37.88849	37.16235	37.77295	37.86603
TSOI (K)	766.9053	778.627	776.0552	777.4137	778.1517	778.743	771.1238	767.1161	777.999	782.7829
nC16 @ 16.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.355013	8.267665	8.238342	7.863912	8.243623	7.830923	8.269568	8.286792	7.814779	7.685629
IGDtime (ms)	0.24	0.2	0.34	0.24	0.24	0.22	0.22	0.26	0.22	0.26
SOI (deg ATC)	-8	-8	-8	-9	-8	-9	-8	-8	-9	-9
PSOI (bar)	38.0738	38.03158	38.08499	38.0679	38.08566	38.0956	38.10906	38.09558	38.14438	38.098
TSOI (K)	811.971	809.832	822.4505	829.1053	814.3539	826.6873	819.6378	817.3454	829.6642	831.1535
nC16 @ 18.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.06191	8.044214	8.064268	8.061	7.97457	8.024591	7.947193	8.046298	8.086453	7.972378
IGDtime (ms)	0.2	0.24	0.22	0.2	0.24	0.2	0.2	0.22	0.18	0.2
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	39.87446	39.85471	39.89646	39.82873	39.90207	39.84464	39.93445	39.96555	39.83844	39.86652
TSOI (K)	854.5722	855.6631	855.953	847.8523	847.3864	853.3149	849.938	854.4134	857.8091	852.9753

nC16 @ 11.9 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	-0.64203	-0.60933	-0.65191	-0.39951	-0.3635	-0.61366	-0.58564	-0.59914	-0.59991	-0.5785
IGDtime (ms)	0	0	0	0	0.04	0	0	0	0	0
SOI (deg ATC)	-4	-4	-4	-3	-3	-4	-4	-4	-4	-4
PSOI (bar)	26.03808	26.06951	25.9712	26.01452	26.02845	26.04601	26.0834	26.04335	26.13086	26.27187
TSOI (K)	518.6426	521.1879	512.1092	515.1227	514.6491	515.2927	517.7096	513.3221	524.0833	526.0734
nC16 @ 13.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.020466	8.060911	7.685066							
IGDtime (ms)	0.26	0.38	0.3							
SOI (deg ATC)	-3	-3	-4							
PSOI (bar)	34.82844	34.89416	34.9595							
TSOI (K)	690.2069	691.171	704.7751							
nC16 @ 14.4 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.08147	8.14978	8.180376	8.060511	8.179068	8.091072	8.244806	7.662351	8.14895	7.80092
IGDtime (ms)	0.44	0.32	0.3	0.32	0.48	0.38	0.36	0.36	0.38	0.32
SOI (deg ATC)	-8	-7	-8	-8	-8	-8	-8	-9	-8	-9
PSOI (bar)	34.91609	35.81453	34.92788	34.97568	34.99494	34.99634	34.8892	34.95388	34.93991	35.09553
TSOI (K)	742.3953	749.1575	731.7704	734.9866	743.5706	746.1883	749.1738	760.3529	749.0146	769.1832
nC16 @ 15.1 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.237102	7.772285	8.293767	8.272938	8.290007	7.749538	7.827504	7.761989	7.654359	8.250525
IGDtime (ms)	0.22	0.22	0.24	0.28	0.24	0.14	0.26	0.22	0.26	0.22
SOI (deg ATC)	-5	-6	-6	-6	-5	-6	-6	-6	-6	-5
PSOI (bar)	37.83318	37.81538	37.15484	37.16832	37.89344	37.89499	37.78974	37.89025	37.85144	37.89506
TSOI (K)	765.2478	775.4187	754.5585	754.2303	771.715	781.0673	779.8924	773.9252	776.2369	768.7048
nC16 @ 16.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	7.792619	7.770352	8.248222	8.208914	8.370937	8.349333	7.745235	7.751718	8.188639	8.290578
IGDtime (ms)	0.22	0.24	0.24	0.24	0.2	0.22	0.18	0.2	0.28	0.24
SOI (deg ATC)	-9	-9	-8	-8	-8	-8	-9	-9	-8	-8
PSOI (bar)	38.17902	38.06598	38.08318	38.13571	38.12423	38.13534	38.14891	38.24528	38.23948	38.20704
TSOI (K)	836.8959	832.259	808.5905	814.5823	811.072	811.947	833.9485	838.277	822.7496	821.1995
nC16 @ 18.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.007638	7.99912	8.030075	7.527373	7.981569	7.982159	7.494026	8.018356	8.055403	8.103394
IGDtime (ms)	0.2	0.18	0.22	0.2	0.22	0.2	0.22	0.2	0.22	0.2
SOI (deg ATC)	-8	-8	-8	-9	-8	-8	-9	-8	-8	-8
PSOI (bar)	39.93577	39.95701	39.92305	39.90726	39.84359	39.86462	39.90925	39.92588	39.89995	39.95004
TSOI (K)	858.6297	853.2383	856.2127	863.7655	850.8955	852.4949	869.7342	855.8287	857.1805	855.2159

nC16 @ 11.9 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	-0.58091	-0.59811	-0.60572	-0.3735	-0.57924	-0.58988	-0.57328	-0.3507		
IGDtime (ms)	0	0	0	0.06	0	0	0	0.26		
SOI (deg ATC)	-4	-4	-4	-3	-4	-4	-4	-3		
PSOI (bar)	26.22422	26.28868	26.15543	26.21393	26.29738	26.23326	26.23723	26.17753		
TSOI (K)	525.1709	525.6008	527.2567	519.4193	525.9935	528.5575	525.3583	524.2435		
nC16 @ 13.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP										
IGDtime (ms)										
SOI (deg ATC)										
PSOI (bar)										
TSOI (K)										
nC16 @ 14.4 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	8.227058	8.227841	8.155336	8.209028	8.237687	8.242037	8.105545	8.150029	7.608019	8.261445
IGDtime (ms)	0.36	0.36	0.36	0.3	0.36	0.32	0.3	0.36	0.34	0.36
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	34.98217	34.99158	34.99794	35.05597	35.05949	35.05137	35.03088	35.02337	35.8429	35.03757
TSOI (K)	745.6744	748.7406	745.2608	749.0549	744.218	745.1031	736.6795	751.1607	767.6843	751.788
nC16 @ 15.1 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	7.802655	8.354052	7.825194	8.276504	7.829456	7.787334	7.847241	7.793561	7.799569	7.752882
IGDtime (ms)	0.2	0.12	0.14	0.12	0.24	0.14	0.24	0.24	0.12	0.2
SOI (deg ATC)	-6	-5	-6	-5	-6	-7	-7	-6	-6	-6
PSOI (bar)	37.90859	38.00745	37.92567	37.93688	37.90261	37.10638	37.23679	37.98109	37.9439	37.92389
TSOI (K)	777.5521	771.3794	776.5778	774.6931	779.3468	762.1448	764.8331	776.8927	781.7862	782.7178
nC16 @ 16.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	7.873055	7.795578	7.853066	7.819301	7.74904	7.865995	7.706202	8.272067	7.714759	8.319611
IGDtime (ms)	0.2	0.24	0.22	0.26	0.2	0.32	0.22	0.24	0.22	0.2
SOI (deg ATC)	-9	-9	-9	-9	-9	-9	-9	-8	-9	-8
PSOI (bar)	38.17342	38.15401	38.2068	38.23511	38.23063	38.18031	38.19238	38.20987	38.27327	38.20489
TSOI (K)	828.4638	823.0156	829.4995	835.72	824.1069	829.7414	835.4689	817.7191	833.1514	817.5336
nC16 @ 18.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	8.17749	8.076069	8.12259	7.860432	8.125358	8.115576	7.997284	8.095766	8.08371	8.086603
IGDtime (ms)	0.2	0.2	0.2	0.2	0.16	0.24	0.2	0.2	0.16	0.18
SOI (deg ATC)	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
PSOI (bar)	39.99601	40.03031	40.06991	39.96386	40.03164	39.95285	40.04499	40.04962	39.96657	39.95676
TSOI (K)	851.5311	852.4075	861.2871	857.2242	857.1134	849.0875	853.4911	849.5385	848.1484	851.2917

Appendix D: Raw Data for Normal Decane

nC10 @ 11.9 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-0.45606	10.34252	-0.18959	9.222716	-0.20931	-0.0989	9.061456	-0.22365	-0.04593	-0.02159
IGDtime (ms)	0	1.14	0	1.86	0	0	2.02	0	0	0
SOI (deg ATC)	4	3	4	4	4	5	5	4	4	5
PSOI (bar)	28.93102	32.26403	31.50754	32.97224	32.15278	32.52378	32.93821	31.73222	33.14405	32.8985
TSOI (K)	570.7222	640.8709	627.0205	657.0247	641.8865	656.11	667.4078	632.3634	663.9711	662.0783
nC10 @13.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-0.20453	9.538589	-0.17295	8.899065	-0.20137	0.008127	9.281092	-0.50421	-0.31003	9.283334
IGDtime (ms)	0	1.24	0	1.46	0	0	1.84	0	0	1.44
SOI (deg ATC)	3	2	3	3	4	4	4	2	3	4
PSOI (bar)	33.55534	35.80251	34.75651	36.23354	34.43658	36.28732	36.2398	34.62595	36.31313	36.51337
TSOI (K)	656.7268	699.0634	686.5859	718.5438	686.5343	726.6175	726.1161	686.3412	715.5595	728.7758
nC10 @ 14.4 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	8.888045	8.509786	-0.19519	8.709814	8.219384	8.219901	-0.22764	8.610763	8.361747	8.332447
IGDtime (ms)	2.14	1.26	0	0.88	3.36	2.08	0	0.82	1.28	1.44
SOI (deg ATC)	3	3	3	4	3	4	3	3	2	2
PSOI (bar)	35.05252	36.72459	37.08285	39.40715	37.44741	37.12513	37.357	39.61674	37.65952	37.682
TSOI (K)	682.339	724.3427	732.5212	785.7211	739.5492	740.0749	736.2081	786.3446	738.1074	736.0935
nC10 @ 16.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	8.053479	7.083233	7.491432	7.878923	8.007645	7.552858	7.276444	8.04065	8.203963	8.043664
IGDtime (ms)	2.72	2.84	3.1	1.84	2.52	2.78	1.14	1.22	1.38	1
SOI (deg ATC)	2	2	4	4	3	4	3	3	3	2
PSOI (bar)	38.08763	39.15529	40.3666	40.29966	40.37847	40.04935	40.28647	40.52715	40.44779	40.59378
TSOI (K)	741.4199	763.1056	805.8883	802.1723	803.0586	799.5203	798.0514	802.291	800.0783	805.0689
nC10 @ 18.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	8.308672	8.218112	8.2213	8.032393	8.006171	7.889175	7.793095	7.924772	7.977657	7.988436
IGDtime (ms)	1.1	0.96	0.78	0.84	0.66	0.74	0.5	0.58	0.58	0.7
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	42.43639	44.3619	45.41613	45.59234	45.45781	45.51977	45.42938	45.54162	45.55286	45.48692
TSOI (K)	825.0714	861.9101	884.8356	891.9193	889.2716	890.3601	888.2761	892.658	890.1525	893.0566

nC10 @ 11.9 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	9.423875	-0.2218	-0.05623	0.028226	-0.029	9.748459	-0.18857	-0.00674	0.020649	0.002955
IGDtime (ms)	1.38	0	0	0	0	1.08	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	3	4	4	4
PSOI (bar)	33.29767	31.72284	33.0692	33.44821	33.0708	33.51868	32.25931	33.33727	33.37818	33.35133
TSOI (K)	673.9793	636.7431	658.0032	665.4397	659.4953	672.2157	639.1226	668.5946	666.8853	664.5152
nC10 @13.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	-0.21412	9.240005	-0.20628	8.759291	-0.20176	-0.29157	9.452948	-0.50355	9.15559	-0.48352
IGDtime (ms)	0	2.18	0	2.44	0	0	1.32	0	2.06	0
SOI (deg ATC)	3	4	3	3	4	3	4	2	4	2
PSOI (bar)	34.81333	36.53742	34.85946	36.34122	34.49597	36.41721	36.55383	34.78336	36.78295	34.87132
TSOI (K)	688.145	729.712	696.5398	714.0481	692.798	716.6386	731.0851	681.5235	731.2631	687.056
nC10 @ 14.4 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	-0.24007	8.41269	8.567034	-0.22038	8.596867	8.310966	8.395022	-0.21341	8.731315	8.657472
IGDtime (ms)	0	0.86	1.68	0	1.02	1.06	1.86	0	0.94	2.76
SOI (deg ATC)	3	3	2	2	3	2	2	3	3	2
PSOI (bar)	37.29462	39.43319	37.58332	37.56105	39.63512	37.65061	37.63839	37.36	39.50147	37.71401
TSOI (K)	737.4673	782.1956	740.5708	743.3819	777.5551	736.0078	739.5363	733.2301	783.3622	744.0418
nC10 @ 16.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	7.857536	7.548253	8.017388	8.00544	7.962106	8.132809	7.939604	8.054211	7.796715	7.942468
IGDtime (ms)	1.04	1.2	0.84	1.1	1.08	1.26	0.82	1.04	1.14	0.8
SOI (deg ATC)	2	1	2	2	2	2	2	2	2	2
PSOI (bar)	40.62594	40.61287	40.68928	40.58398	40.57731	40.71117	40.75054	40.70432	40.80993	40.79882
TSOI (K)	801.6234	801.3938	800.0882	802.1124	806.2136	803.6446	802.1704	805.8212	800.8938	802.4805
nC10 @ 18.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	8.011589	8.159114	8.189092	8.058207	8.038535	8.037783	7.914098	8.111518	8.031086	8.245579
IGDtime (ms)	0.58	0.62	0.66	0.4	0.54	0.58	0.74	0.64	0.74	0.5
SOI (deg ATC)	1	0	0	1	1	1	1	1	1	0
PSOI (bar)	45.53866	45.51562	45.63668	45.68157	45.68753	45.791	45.67885	45.82258	45.77618	45.89189
TSOI (K)	886.4058	895.6519	899.3283	898.0724	899.3447	901.9276	899.8278	898.7224	897.2864	905.2723

nC10 @ 11.9 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	9.809406	-0.17901	-0.00168	8.911547	-0.18166	0.018862	0.031258	8.770361	-0.15602	9.24248
IGDtime (ms)	1.32	0	0	3.34	0	0	0	3.92	0	1.48
SOI (deg ATC)	4	3	4	4	3	4	4	4	4	4
PSOI (bar)	33.52119	32.24176	33.42235	33.48596	32.311	33.57581	33.42583	33.55773	32.20849	33.50368
TSOI (K)	673.6516	636.1615	665.0576	668.6664	646.5173	667.7643	667.9038	672.0525	641.7445	673.1818
nC10 @13.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	8.702337	-0.17668	9.252879	-0.18871	9.087689	-0.48631	9.193214	-0.47582	8.600875	-0.48691
IGDtime (ms)	2.88	0	2.48	0	1.16	0	2.36	0	1.04	0
SOI (deg ATC)	3	4	4	4	4	2	4	2	2	1
PSOI (bar)	36.75775	34.6223	36.59479	34.59651	36.66899	34.90178	36.80172	35.02019	36.94479	35.02502
TSOI (K)	726.1219	694.4575	734.5653	694.5715	731.2144	688.7026	739.4299	692.8323	726.3155	690.9536
nC10 @ 14.4 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	-0.18389	8.695215	8.119477	8.170314	8.468101	8.174297	-0.15947	8.597101	8.248575	8.57613
IGDtime (ms)	0	1.12	2.92	1.42	3.28	2.74	0	0.86	1.02	2.26
SOI (deg ATC)	3	3	1	3	2	3	3	3	2	2
PSOI (bar)	37.52174	39.69747	37.73222	37.68743	37.80917	37.50365	37.64105	39.55526	37.86545	37.76079
TSOI (K)	747.2101	785.8844	741.5924	749.1923	743.381	740.8359	745.4805	784.3883	745.3161	744.0892
nC10 @ 16.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.565712	7.95493	7.939323	7.870343	8.010307	7.984637	7.706872	8.058026	8.12637	7.977345
IGDtime (ms)	0.7	0.86	1.04	0.74	1.06	0.98	0.52	0.78	1.02	0.8
SOI (deg ATC)	1	2	2	2	2	2	0	2	2	2
PSOI (bar)	40.75451	40.86387	40.88093	40.77985	40.96927	40.92255	40.99763	40.96091	40.86151	40.97022
TSOI (K)	796.5054	807.1256	801.4603	804.6843	806.8399	804.0531	807.3173	812.2272	806.961	809.9389
nC10 @ 18.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.959283	8.183528	8.209767	7.706811	8.053587	8.282445	8.153009	8.160652	8.263809	8.257315
IGDtime (ms)	0.48	0.44	0.46	0.34	0.5	0.46	0.4	0.44	0.44	0.32
SOI (deg ATC)	0	0	0	-1	0	0	0	0	0	0
PSOI (bar)	45.85347	45.89864	45.87434	45.95312	45.92948	45.96457	46.05445	45.94032	45.99758	45.94493
TSOI (K)	897.7637	902.9736	902.0429	905.3443	897.4992	903.7695	904.5526	902.9101	902.5025	905.1397

nC10 @ 11.9 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	-0.16819	0.027574	9.298066	-0.17696	8.784854	-0.16601	7.979024	-0.14704	0.032595	9.291696
IGDtime (ms)	0	0	1.8	0	2.5	0	5.04	0	0	1.68
SOI (deg ATC)	4	4	4	4	3	4	4	4	4	4
PSOI (bar)	32.08208	33.49888	33.69605	32.05054	33.74071	32.12182	33.76321	32.30495	33.78231	34.06309
TSOI (K)	641.1386	670.1463	671.8366	641.5054	672.7929	645.8394	677.1682	647.121	678.8529	679.417
nC10 @13.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	9.25722	-0.17667	9.198228	-0.16955	9.163085	-0.19146	8.861501	-0.16537	9.124694	-0.16496
IGDtime (ms)	2.5	0	1.94	0	1.2	0	2.2	0	1.4	0
SOI (deg ATC)	3	3	3	3	3	3	2	3	3	2
PSOI (bar)	37.13867	34.97985	37.01166	35.04373	37.14025	34.88293	37.32452	35.09458	37.0496	35.29091
TSOI (K)	745.1317	694.518	742.0018	692.754	749.1185	692.5745	735.2179	694.9127	734.1148	701.2267
nC10 @ 14.4 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	8.308569	7.885192	8.15032	8.038839	8.301277	8.138416	8.272812	7.737221	8.015486	8.070934
IGDtime (ms)	2.22	3.56	2.96	1.46	2.36	2.12	2.52	3.36	1.22	1.36
SOI (deg ATC)	2	3	3	3	3	3	2	3	3	2
PSOI (bar)	37.75791	37.55247	37.74735	37.63344	37.63395	37.51603	37.88499	37.63765	37.97485	37.92096
TSOI (K)	747.1802	743.2708	751.1807	751.0104	748.0219	744.4959	751.1681	746.6235	754.3075	747.1247
nC10 @ 16.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	8.106568	8.090891	7.914383	8.089771	8.063269	7.656165	8.029511	8.044314	7.903199	8.147934
IGDtime (ms)	0.82	0.82	0.6	0.8	0.82	0.84	0.66	0.88	0.76	0.9
SOI (deg ATC)	1	1	2	1	1	0	1	1	1	1
PSOI (bar)	41.19744	41.05801	41.0187	41.21039	41.1668	41.21446	41.22223	41.23005	41.27818	41.32518
TSOI (K)	805.0012	802.8714	805.5949	805.933	804.1215	808.1074	803.9953	809.9996	807.2297	813.9656
nC10 @ 18.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	7.85903	8.316291	8.310357	8.285297	7.815008	8.211427	8.324749	8.209993	8.316669	8.236804
IGDtime (ms)	0.36	0.26	0.38	0.54	0.36	0.34	0.38	0.34	0.36	0.34
SOI (deg ATC)	-1	0	0	0	-1	0	0	0	0	0
PSOI (bar)	46.07093	46.12155	46.07143	46.03562	46.17331	46.19963	46.16357	46.11873	46.20747	46.28966
TSOI (K)	900.2903	903.3339	906.8625	903.9736	906.3825	905.5678	900.6518	905.6871	911.0476	910.6119

nC10 @ 11.9 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	-0.16819	8.593645	-0.1727	8.947745	-0.45177	0.02359	9.231048	-0.17058	8.804439	-0.17678
IGDtime (ms)	0	1.36	0	1.72	0	0	2.08	0	2.62	0
SOI (deg ATC)	3	3	3	4	3	4	4	3	4	4
PSOI (bar)	32.30344	33.85194	32.37969	33.8162	32.12869	33.70294	33.88247	32.40131	33.88374	32.16483
TSOI (K)	638.3292	674.3636	638.6873	679.9634	635.8285	675.3678	674.7862	644.3753	673.8298	644.144
nC10 @13.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	8.896669	-0.45929	9.154471	-0.16742	9.230223	-0.16025	8.655208	8.224097	8.417828	-0.1711
IGDtime (ms)	1.8	0	2.14	0	1.96	0	1.18	3.1	2.18	0
SOI (deg ATC)	2	2	3	3	4	3	2	1	3	3
PSOI (bar)	37.17355	35.15086	37.07184	35.0992	36.94674	35.17996	37.03782	35.33747	35.15312	35.09077
TSOI (K)	728.058	693.1538	734.8286	700.0517	735.4116	696.3741	733.3598	694.5021	697.2815	700.2392
nC10 @ 14.4 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	8.107083	8.290507	8.170649	8.161233	8.275581	7.923893	8.463174	8.058312	8.148067	8.154791
IGDtime (ms)	1.12	1.68	1.88	1.84	2.24	0.9	2.48	1.36	1.6	2
SOI (deg ATC)	2	2	2	2	2	2	2	3	2	2
PSOI (bar)	37.91605	37.91797	37.80654	37.87181	37.85789	37.94004	37.9885	37.66646	38.00844	37.94294
TSOI (K)	747.1488	743.3068	747.4162	744.6707	745.7496	747.472	747.1363	749.0541	753.9639	745.9002
nC10 @ 16.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	8.040483	8.101313	7.948188	8.126884	7.667083	7.579085	7.45416	7.437775	8.03019	7.444321
IGDtime (ms)	0.54	0.56	0.66	0.86	0.66	0.52	0.64	0.5	0.46	0.8
SOI (deg ATC)	1	1	1	1	0	0	0	0	1	1
PSOI (bar)	41.30036	41.36638	41.323	41.25924	41.30666	41.31859	41.31356	41.36998	41.37236	41.31146
TSOI (K)	807.9322	811.7128	809.7619	806.1431	808.7987	807.1945	805.9902	807.6359	812.1575	809.7876
nC10 @ 18.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	8.197878	8.243432	8.263533	8.148896	8.287155	8.404237	8.305866	8.340926	8.252011	8.446145
IGDtime (ms)	0.32	0.34	0.24	0.34	0.34	0.4	0.24	0.2	0.26	0.24
SOI (deg ATC)	0	0	0	0	0	0	0	0	0	0
PSOI (bar)	46.36826	46.28186	46.39391	46.37093	46.36834	46.37184	46.39302	46.31878	46.28976	46.42929
TSOI (K)	913.9271	902.6429	904.4918	907.8429	908.038	912.834	910.152	907.3643	906.5392	909.3234

nC10 @ 11.9 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.626401	-0.15885	8.542841	-0.15498	8.92395	-0.17311	8.64862	-0.18141	8.66261	-0.16248
IGDtime (ms)	4.18	0	3.76	0	1.74	0	1.56	0	3	0
SOI (deg ATC)	4	3	4	4	4	3	2	3	4	3
PSOI (bar)	33.94728	32.56227	33.88851	32.37515	33.81889	32.55159	34.0439	32.4318	33.91911	32.56916
TSOI (K)	683.1423	653.1848	677.8958	646.6719	674.3654	642.3301	669.8756	641.3678	681.9246	642.7562
nC10 @13.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.896083	8.641032	-0.16576	9.041357	8.512359	-0.1669	8.613675	8.065149	7.976611	-0.14128
IGDtime (ms)	1.02	2.76	0	1.58	3.3	0	1.96	2.88	3.16	0
SOI (deg ATC)	3	2	3	3	3	3	2	2	3	3
PSOI (bar)	37.26673	35.37345	35.13535	37.22642	35.30032	35.21613	37.01032	35.21166	35.24984	35.43738
TSOI (K)	750.3148	699.9627	695.9811	734.9365	702.3301	695.6506	727.3961	692.9895	697.095	703.9768
nC10 @ 14.4 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.413728	8.277618	7.914247	7.509598	8.264979	7.894976	8.019622	7.93334	8.033509	8.077641
IGDtime (ms)	2.26	2.2	1.02	0.98	1.38	0.98	1.1	1.14	1.14	1.16
SOI (deg ATC)	2	2	2	1	1	2	2	2	2	2
PSOI (bar)	37.88786	37.9209	38.14836	38.06114	38.18247	38.03722	37.9723	37.996	37.94557	37.97922
TSOI (K)	746.4888	745.9989	750.4127	747.2367	756.4471	750.5142	746.4796	749.6486	743.7188	749.728
nC10 @ 16.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.121787	8.104015	8.098535	8.033105	7.890653	7.8673	7.964192	8.044285	7.814007	8.129733
IGDtime (ms)	0.52	0.5	0.5	0.48	0.56	0.46	0.48	0.56	0.58	0.42
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	41.36619	41.50668	41.54057	41.44572	41.39224	41.53445	41.44815	41.47886	41.44627	41.51554
TSOI (K)	815.5234	811.0267	816.7673	812.2699	806.445	815.7129	812.9301	816.1397	815.8141	815.5577
nC10 @ 18.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.179504	8.39778	8.229026	7.439771	7.861073	8.372349	8.443841	8.315845	8.141061	8.294647
IGDtime (ms)	0.22	0.22	0.26	0.32	0.26	0.26	0.26	0.22	0.28	0.22
SOI (deg ATC)	0	0	0	-1	-1	0	-1	0	-1	0
PSOI (bar)	46.35107	46.45408	46.51808	46.46957	46.53545	46.50652	46.22858	46.46883	46.3052	46.53978
TSOI (K)	910.6716	908.5778	918.4959	915.5243	909.7888	912.2481	903.9612	910.2429	906.5512	914.9072

nC10 @ 11.9 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	8.971537	-0.18185	8.717226	-0.16351	8.943091	-0.1687	8.944557	-0.17225	8.919075	-0.18647
IGDtime (ms)	1.68	0	3.82	0	1.48	0	2.86	0	1.58	0
SOI (deg ATC)	4	3	3	3	3	3	3	4	3	3
PSOI (bar)	33.91466	32.55556	34.26299	32.62524	34.21007	32.49425	34.22944	32.29147	34.22721	32.47437
TSOI (K)	677.6493	646.5934	686.5854	645.8617	675.08	646.0281	680.8134	647.9611	685.1186	641.9887
nC10 @13.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	8.461951	8.391479	-0.14429	8.661222	8.580187	-0.16323	8.86335	8.494147	8.372911	7.866336
IGDtime (ms)	0.72	3.54	0	1.42	2.26	0	1.06	1.24	1.68	3.26
SOI (deg ATC)	2	2	3	2	2	3	3	2	2	1
PSOI (bar)	37.36028	35.37345	35.20692	37.27547	35.47146	35.15784	37.15403	35.54784	35.41383	35.45557
TSOI (K)	734.4911	699.8824	699.1863	737.4963	700.6456	695.7045	736.9276	699.7302	697.0286	699.2765
nC10 @ 14.4 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	8.260882	8.106179	8.1392	7.972469	8.14801	8.081662	7.976868	8.050726	8.064168	8.062258
IGDtime (ms)	1.54	1.04	1.28	1.04	1.56	1.2	0.82	1.04	1.38	1.24
SOI (deg ATC)	2	2	1	1	1	1	2	1	1	1
PSOI (bar)	37.94688	38.101	38.14835	38.2018	38.1102	38.17086	38.13657	38.16667	38.26165	38.28316
TSOI (K)	749.3233	751.3872	748.4062	747.0651	751.9257	752.5533	751.3425	751.1887	750.9346	752.0718
nC10 @ 16.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.926617	8.071231	7.965937	8.124017	7.50544	8.113404	7.777676	7.727944	7.909222	7.705922
IGDtime (ms)	0.56	0.58	0.46	0.54	0.36	0.64	0.54	0.54	0.38	0.44
SOI (deg ATC)	1	1	1	1	0	1	1	0	1	0
PSOI (bar)	41.52525	41.58697	41.56633	41.54957	41.57401	41.5993	41.58584	41.65571	41.60432	41.60386
TSOI (K)	815.5847	821.4848	815.6528	814.3243	814.9471	819.6	814.4197	817.4451	817.4045	816.9962
nC10 @ 18.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.687969	8.168953	8.495659	8.486925	7.912141	7.860232	7.96275	8.290768	8.289737	7.854634
IGDtime (ms)	0.22	0.24	0.24	0.24	0.24	0.24	0.22	0.24	0.28	0.18
SOI (deg ATC)	-1	0	0	-1	-2	-2	-2	-1	-1	-2
PSOI (bar)	46.59679	46.54482	46.51483	46.34885	46.39351	46.42673	46.34716	46.35443	46.43433	46.49491
TSOI (K)	913.8731	912.2925	919.5865	914.0967	904.8738	908.5443	906.4076	909.2087	911.4317	912.0946

nC10 @ 11.9 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.864838	-0.19068	8.962122	-0.1685	8.886082	-0.16732	8.93607	-0.17801	8.870489	-0.16896
IGDtime (ms)	1.54	0	2.76	0	1.52	0	1.6	0	2.66	0
SOI (deg ATC)	4	3	3	3	3	3	3	3	3	3
PSOI (bar)	34.05539	32.4777	34.3893	32.56127	34.2404	32.53622	34.40055	32.59104	34.41471	32.66031
TSOI (K)	680.9654	640.0409	679.8385	647.1558	680.4665	648.0617	678.4029	647.0694	680.2789	651.5662
nC10 @13.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	-0.12459	8.754325	8.699254	8.383436	8.322124	-0.14171	8.604225	8.686203	-0.14715	8.800707
IGDtime (ms)	0	1.22	2.72	2.14	2.92	0	0.9	2.78	0	1.06
SOI (deg ATC)	3	3	2	3	3	3	3	2	3	3
PSOI (bar)	35.34835	37.13899	35.42578	35.26046	35.16397	35.34077	37.17561	35.47568	35.23481	37.33811
TSOI (K)	700.0408	735.0821	696.3775	697.1865	698.1332	701.0522	734.7486	703.6659	697.4424	741.4076
nC10 @ 14.4 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.167825	8.131567	8.103075	8.111613	8.136391	7.931735	8.033423	7.948252	8.050042	8.035956
IGDtime (ms)	0.88	0.7	0.98	0.92	0.86	1.22	0.88	0.82	1.1	0.74
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	38.21177	38.24539	38.22382	38.23884	38.29952	38.36334	38.22718	38.34339	38.28852	38.39808
TSOI (K)	752.9914	749.8857	750.3927	749.9073	750.8514	749.8926	749.2293	753.0963	750.1773	757.1782
nC10 @ 16.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	7.426442	8.095426	7.621987	7.887712	7.904375	7.552894	7.472987	7.599644	8.02076	7.733332
IGDtime (ms)	0.44	0.46	0.56	0.38	0.36	0.34	0.36	0.42	0.52	0.4
SOI (deg ATC)	0	1	0	1	1	0	0	0	1	0
PSOI (bar)	41.62609	41.66151	41.72229	41.69637	41.60202	41.70191	41.74382	41.75103	41.76295	41.66717
TSOI (K)	813.7249	817.5677	817.7738	815.6017	815.3849	818.2476	817.0613	818.1621	818.2308	815.0961
nC10 @ 18.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.30492	8.418367	7.81733	8.384681	8.392294	8.421846	8.301005	8.342614	8.200639	7.810744
IGDtime (ms)	0.24	0.16	0.12	0.14	0.18	0.18	0.22	0.16	0.24	0.22
SOI (deg ATC)	-1	-1	-2	-1	-1	-1	-1	-1	0	-2
PSOI (bar)	46.60331	46.48905	46.52182	46.48246	46.53397	46.44404	46.50705	46.54522	46.74723	46.61631
TSOI (K)	907.4337	909.7479	916.0266	918.9604	908.3334	910.5691	916.5415	912.0495	910.2941	917.6028

nC10 @ 11.9 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	8.973025	-0.16739	8.856709	-0.18222	8.764283	-0.46402	8.811459	-0.17186	8.955389	-0.17327
IGDtime (ms)	2.5	0	1.42	0	1.2	0	2.46	0	2.34	0
SOI (deg ATC)	3	3	3	3	3	2	3	3	3	3
PSOI (bar)	34.38027	32.62437	34.33392	32.63912	34.39122	32.65573	34.37185	32.74876	34.51859	32.69997
TSOI (K)	679.575	647.7999	679.3381	646.5207	680.6824	645.7859	679.9513	647.2557	686.5524	647.8028
nC10 @13.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	8.668546	8.048168	8.234293	8.481946	8.194464	8.320107	8.179374	8.170655	8.173917	7.935034
IGDtime (ms)	2.34	3.02	1.64	2.22	1.72	2.18	1.3	1.46	1.36	1.66
SOI (deg ATC)	2	1	3	2	3	2	2	2	2	1
PSOI (bar)	35.54677	35.41903	35.4773	35.54861	35.26709	35.46639	35.43717	35.49261	35.52558	35.40234
TSOI (K)	701.2176	691.8349	704.2944	703.4901	697.7765	700.6767	694.7925	698.2387	695.9079	697.365
nC10 @ 14.4 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	8.079691	7.97121	8.050187	8.163001	8.036181	7.978601	8.142111	8.160412	8.058416	8.200415
IGDtime (ms)	1.04	0.7	0.7	1.08	0.7	0.9	0.92	0.8	0.58	0.7
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	38.295	38.36791	38.3369	38.39177	38.40202	38.42097	38.40161	38.3688	38.39176	38.38655
TSOI (K)	748.737	753.2546	750.1539	753.8676	754.4927	754.5695	755.8266	752.0631	752.034	752.4887
nC10 @ 16.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	7.933548	7.81241	7.833717	8.061447	7.50483	8.032821	8.034207	7.531398	7.643577	7.962482
IGDtime (ms)	0.48	0.34	0.5	0.38	0.34	0.42	0.26	0.26	0.36	0.32
SOI (deg ATC)	1	1	1	1	0	1	1	-1	-1	1
PSOI (bar)	41.83344	41.77904	41.76947	41.79437	41.81485	41.82972	41.79914	41.82264	41.80175	41.92686
TSOI (K)	821.2131	817.8004	820.6974	818.6851	815.7403	817.4855	818.5387	820.3097	822.3504	823.0256
nC10 @ 18.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	8.385639	8.406138	8.33443	8.399033	8.497619	8.37399	7.721711	8.26353	8.318379	8.32622
IGDtime (ms)	0.14	0.22	0.26	0.14	0.22	0.16	0.16	0.1	0.1	0.1
SOI (deg ATC)	-1	-1	-1	-1	-1	0	-1	0	-1	-1
PSOI (bar)	46.57725	46.50581	46.56291	46.61378	46.62235	46.90115	46.85237	46.94654	46.63941	46.69962
TSOI (K)	913.135	912.5379	913.5087	917.2816	920.1316	917.0768	921.1154	922.4082	911.5317	917.5036

nC10 @ 11.9 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.834166	-0.18077	8.755167	-0.18287	8.791083	-0.19214	8.726958	-0.19392	8.770153	-0.1957
IGDtime (ms)	1.58	0	1.38	0	1.42	0	1.06	0	1.46	0
SOI (deg ATC)	3	3	3	3	3	3	3	3	3	3
PSOI (bar)	34.48031	32.68652	34.47115	32.6504	34.51555	32.70383	34.5891	32.67267	34.4706	32.61677
TSOI (K)	680.0694	651.5659	688.0771	648.6894	682.9997	649.0647	686.3823	645.3392	683.94	648.7229
nC10 @13.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.29164	8.08706	8.079508	8.395482	8.352853	8.17406	8.049913	7.878726	8.346317	8.294846
IGDtime (ms)	1.66	2.28	1.44	2.18	2.72	2.28	1.54	1.14	1.52	1.9
SOI (deg ATC)	2	1	2	2	2	3	3	1	2	2
PSOI (bar)	35.45629	35.45018	35.63097	35.57176	35.52301	35.36239	35.39413	35.53134	35.56823	35.60077
TSOI (K)	698.0606	696.2503	700.1583	701.3608	697.0143	698.8603	701.1371	695.615	701.5099	701.4715
nC10 @ 14.4 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.039894	7.76185	8.158391	8.144265	8.095113	8.046614	8.145937	7.373073	8.084107	8.037287
IGDtime (ms)	0.72	0.7	0.74	0.9	0.96	0.7	0.7	0.72	0.68	0.8
SOI (deg ATC)	1	1	1	1	1	1	1	0	1	1
PSOI (bar)	38.48937	38.4094	38.43358	38.49685	38.48167	38.56967	38.50831	38.43921	38.49336	38.62076
TSOI (K)	751.9605	752.988	754.9358	753.3954	751.3903	756.6882	751.5474	755.5608	755.4973	757.1257
nC10 @ 16.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.01184	8.002406	7.425529	8.242327	8.035858	7.297104	7.926006	7.813135	7.722245	7.908993
IGDtime (ms)	0.38	0.42	0.36	0.4	0.4	0.36	0.28	0.32	0.38	0.28
SOI (deg ATC)	1	1	0	1	1	0	1	-1	0	1
PSOI (bar)	41.84182	41.85601	41.89228	42.00931	41.86838	41.8909	41.98174	41.85347	42.05806	42.00097
TSOI (K)	820.0057	821.0339	823.0131	824.1721	820.6637	823.5219	822.218	819.8578	822.0348	820.5146
nC10 @ 18.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	8.460869	8.519372	8.472347	8.387802	8.284825	8.268461	8.419718	8.348914	8.436631	7.807663
IGDtime (ms)	0.12	0.2	0.16	0.18	0.14	0.14	0.18	0.12	0.1	0.14
SOI (deg ATC)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2
PSOI (bar)	46.71681	46.77443	46.66079	46.66281	46.7049	46.70977	46.6963	46.66677	46.69097	46.66
TSOI (K)	916.4517	918.0394	909.3254	911.0368	916.2829	918.503	919.2354	916.6939	916.23	924.5827

nC10 @ 11.9 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	8.733675	-0.19577	8.511375	-0.20074	8.697496	-0.20872	8.697039	-0.19255	8.698733	-0.21529
IGDtime (ms)	1.78	0	0.8	0	1.02	0	1.24	0	1.18	0
SOI (deg ATC)	3	3	3	3	3	3	3	3	3	3
PSOI (bar)	34.45725	32.72297	34.36464	32.66361	34.46285	32.71464	34.50939	32.66758	34.47608	32.69809
TSOI (K)	682.8859	650.2871	692.1927	652.0934	678.4314	647.4395	681.329	647.0037	684.593	649.7714
nC10 @13.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	8.45771	8.281525	7.900504	8.190414	8.18669	7.827672	8.141565	8.113635	8.201548	8.230747
IGDtime (ms)	2.58	2.5	1.04	1.6	1.32	1.14	1.34	1.18	1.02	0.98
SOI (deg ATC)	2	2	3	2	2	1	1	2	1	2
PSOI (bar)	35.57371	35.53634	35.41085	35.67056	35.54645	35.56317	35.64914	35.58211	35.68986	35.61949
TSOI (K)	700.2648	698.1832	699.8013	701.8962	699.2106	700.9426	701.111	696.2847	701.5644	702.2709
nC10 @ 14.4 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.985599	8.224892	8.104855	8.230397	8.139681	8.083175	8.010474	8.081865	8.193304	8.199472
IGDtime (ms)	0.6	0.58	0.62	0.64	0.56	0.52	0.56	0.42	0.54	0.74
SOI (deg ATC)	1	1	1	1	1	0	1	1	1	1
PSOI (bar)	38.58337	38.56549	38.63753	38.61825	38.59275	38.58494	38.582	38.67228	38.68672	38.60481
TSOI (K)	759.4947	761.7187	758.0903	756.9798	754.1912	762.3146	757.4717	758.6686	758.8893	758.2766
nC10 @ 16.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	8.061857	7.729245	7.975259	8.201071	7.913673	7.638442	8.027229	8.232938	8.05311	7.959918
IGDtime (ms)	0.38	0.38	0.26	0.4	0.26	0.3	0.3	0.24	0.26	0.38
SOI (deg ATC)	1	0	0	1	0	-1	0	0	1	1
PSOI (bar)	42.05673	41.94467	42.07272	42.03069	42.03985	42.03323	41.93801	41.95132	42.08809	42.08288
TSOI (K)	820.9928	819.3924	824.8914	823.324	822.2593	821.1363	821.6491	821.6347	822.1928	827.3113
nC10 @ 18.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	8.353133	8.512932	8.504234	7.958466	7.841434	8.507081	7.798337	8.086614	8.254416	8.457207
IGDtime (ms)	0.16	0.2	0.14	0.16	0.18	0.14	0.14	0.16	0.18	0.14
SOI (deg ATC)	-1	-1	-1	-2	-2	-1	-2	-2	-1	-1
PSOI (bar)	46.77822	46.71935	46.74406	46.77554	46.79877	46.78167	46.82636	46.76852	46.82986	46.80775
TSOI (K)	917.3201	916.8275	913.0786	923.9185	922.1825	917.7652	922.489	926.6755	919.5414	915.1333

nC10 @ 11.9 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.759299	-0.19144	8.783477	-0.18245	8.775848	-0.19231	8.637694	-0.21066	8.748409	-0.20865
IGDtime (ms)	2.16	0	2.32	0	1.62	0	1.06	0	2.3	0
SOI (deg ATC)	3	3	3	3	3	3	3	3	3	3
PSOI (bar)	34.61087	32.70469	34.47299	32.75241	34.66695	32.71679	34.55258	32.75264	34.50411	32.67856
TSOI (K)	683.5548	646.6101	680.4532	646.8768	685.2725	647.0981	683.3282	647.3964	681.5736	646.709
nC10 @13.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.28566	8.105812	8.37514	8.255615	7.913286	8.158047	8.427773	8.291336	7.936937	8.350974
IGDtime (ms)	1.02	1.04	1.54	1.26	1.36	1.34	1.74	1.58	0.84	1.08
SOI (deg ATC)	1	1	1	2	0	2	1	1	2	1
PSOI (bar)	35.73615	35.6783	35.81808	35.65406	35.7018	35.63358	35.78022	35.76263	35.66724	35.83934
TSOI (K)	701.2374	697.5391	704.6049	698.1789	703.6106	698.362	700.5333	700.7889	700.7385	706.1262
nC10 @ 14.4 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.156103	8.055911	8.067223	8.048701	8.073254	8.102154	8.082954	8.117708	8.196635	8.074098
IGDtime (ms)	0.6	0.62	0.56	0.6	0.76	0.6	0.58	0.5	0.56	0.6
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	38.65437	38.679	38.59333	38.66266	38.58502	38.76204	38.71949	38.76497	38.70482	38.76554
TSOI (K)	752.2707	758.0423	753.6929	754.3563	757.9619	758.6293	759.9357	758.1516	760.6111	760.2345
nC10 @ 16.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.688805	8.039419	8.286163	7.614456	7.969955	7.695612	8.095954	8.00061	7.4962	8.133585
IGDtime (ms)	0.24	0.26	0.28	0.24	0.26	0.26	0.26	0.26	0.26	0.24
SOI (deg ATC)	0	0	0	-1	0	-1	0	0	0	0
PSOI (bar)	42.15955	42.06851	42.10239	42.04449	42.20401	42.10135	42.15248	42.06257	42.16299	42.19521
TSOI (K)	827.7741	826.1915	822.8385	825.8756	826.1964	825.1967	824.02	825.0714	824.1905	825.9023
nC10 @ 18.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	8.352335	8.420222	8.455287	8.450786	8.305825	8.515319	8.398963	8.482837	8.507624	8.289226
IGDtime (ms)	0.14	0.12	0.16	0.16	0.1	0.1	0.16	0.16	0.12	0.1
SOI (deg ATC)	-1	-1	-1	-1	0	-1	-1	-1	-1	-1
PSOI (bar)	46.90165	46.87104	46.83243	47.01257	47.11297	46.87392	46.82123	46.88388	46.88654	47.02864
TSOI (K)	919.25	918.304	914.5101	920.0542	921.3403	916.5981	917.6235	917.0806	916.2602	924.1585

nC10 @ 11.9 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	8.497426	-0.20272	8.741292	-0.19027	8.615676	-0.20191	8.689014	-0.20308	8.735208	8.16117
IGDtime (ms)	1.02	0	1.24	0	1.26	0	1.38	0	2.32	2.16
SOI (deg ATC)	3	3	3	2	3	3	3	3	3	3
PSOI (bar)	34.37237	32.64959	34.53122	32.93188	34.46582	32.65756	34.41488	32.71961	34.50821	32.70568
TSOI (K)	679.4521	647.4605	684.2102	648.6797	681.8782	648.6178	687.6901	647.7162	683.7219	649.8699
nC10 @13.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.815296	8.300516	7.734698	7.591835	8.283913	7.955509	8.384703	8.387409	8.166384	8.085047
IGDtime (ms)	1.36	1.54	0.84	0.84	1.02	0.88	1.78	1.4	1.18	0.98
SOI (deg ATC)	0	2	0	0	1	1	1	1	1	2
PSOI (bar)	35.78611	35.66866	35.77699	35.7551	35.79282	35.73458	35.75919	35.82512	35.93685	35.77114
TSOI (K)	701.0807	704.099	698.782	701.4648	705.5709	704.1581	701.6664	703.6941	709.7412	708.2854
nC10 @ 14.4 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	8.151948	7.970773	8.139219	8.049732	8.215608	8.184394	8.163027	8.071404	8.127839	8.112225
IGDtime (ms)	0.62	0.66	0.48	0.46	0.6	0.46	0.56	0.58	0.42	0.46
SOI (deg ATC)	1	1	0	1	0	0	1	1	1	1
PSOI (bar)	38.71332	38.76009	38.72284	38.76327	38.71589	38.82385	38.7465	38.8472	38.83896	38.88055
TSOI (K)	761.0188	757.5476	758.8722	757.1925	759.771	762.7562	755.9832	763.5951	765.5006	761.7901
nC10 @ 16.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.712024	8.112964	7.616394	7.743192	8.005866	7.565902	8.044384	8.031178	8.043643	7.599411
IGDtime (ms)	0.28	0.3	0.26	0.26	0.22	0.26	0.28	0.28	0.3	0.24
SOI (deg ATC)	-1	0	-1	-1	1	-1	1	0	0	-1
PSOI (bar)	42.20129	42.20176	42.2033	42.19936	42.21432	42.25198	42.3287	42.22282	42.19179	42.34841
TSOI (K)	826.0001	827.1548	828.6002	824.2389	828.596	829.5208	831.8362	828.147	826.4014	830.1718
nC10 @ 18.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.827903	8.332938	8.42057	8.396485	8.393906	8.456966	8.466022	8.63742	7.876328	8.544302
IGDtime (ms)	0.14	0.12	0.14	0.18	0.12	0.14	0.14	0.2	0.16	0.14
SOI (deg ATC)	-2	-1	-1	-1	-1	-1	-1	-1	-2	-1
PSOI (bar)	46.89591	46.98237	46.87184	46.83031	46.98306	46.99503	46.91988	47.08911	46.98147	46.94581
TSOI (K)	920.4992	923.5391	923.7037	921.8692	924.3345	925.2645	926.4722	924.7514	922.3423	918.3574

nC10 @ 11.9 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	-0.22118	8.515769	-0.20693	8.662624	-0.21284	8.732781	-0.48122	8.612473	8.077465	-0.20036
IGDtime (ms)	0	1.08	0	1.48	0	1.4	0	1.38	3.82	0
SOI (deg ATC)	3	3	3	3	3	3	2	3	3	3
PSOI (bar)	32.59668	34.50885	32.74224	34.50684	32.70036	34.6879	32.77169	34.49828	32.76196	32.66292
TSOI (K)	648.1602	687.4276	647.0376	684.7364	648.0476	688.3406	642.4247	684.95	650.2337	647.8874
nC10 @13.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.136097	8.230119	8.215879	8.198369	8.072968	8.256187	8.34915	8.143641	8.057606	8.037221
IGDtime (ms)	1.18	1.1	1.16	0.92	0.84	0.9	1.22	0.9	0.98	0.8
SOI (deg ATC)	2	1	1	1	1	1	1	1	1	2
PSOI (bar)	35.74231	35.90407	35.89255	35.87746	35.85121	35.95547	35.85727	35.8946	35.83639	35.76316
TSOI (K)	706.2555	707.2003	705.1955	705.7853	703.2573	700.1796	703.9159	705.4814	706.8398	706.4341
nC10 @ 14.4 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.227375	8.032816	8.049391	8.104204	8.041966	8.224054	8.02654	7.860702	7.691614	8.138228
IGDtime (ms)	0.5	0.4	0.44	0.62	0.44	0.48	0.46	0.54	0.46	0.48
SOI (deg ATC)	1	1	0	0	1	1	0	1	0	0
PSOI (bar)	38.72492	38.84943	38.75	38.82021	38.78241	38.83282	38.86138	38.91591	38.84939	38.96198
TSOI (K)	759.7335	760.3132	760.4727	761.3898	762.1699	764.029	761.3661	764.8112	759.5675	765.4557
nC10 @ 16.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.176457	7.670571	8.34458	8.002875	8.038349	8.097057	7.445427	7.650986	7.949135	8.301438
IGDtime (ms)	0.14	0.18	0.16	0.3	0.26	0.24	0.22	0.16	0.18	0.26
SOI (deg ATC)	0	-1	0	0	0	0	-1	-1	0	0
PSOI (bar)	42.19103	42.31408	42.29246	42.3299	42.26346	42.18824	42.27857	42.26952	42.29295	42.26827
TSOI (K)	825.6656	825.9437	834.5348	827.0021	830.7564	830.4288	831.3692	826.0438	832.5208	831.7146
nC10 @ 18.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.332269	8.382291	8.359709	8.331277	8.031602	8.60648	7.981591	8.423711	8.344495	8.450068
IGDtime (ms)	0.14	0.14	0.14	0.18	0.18	0.16	0.14	0.12	0.14	0.14
SOI (deg ATC)	-1	-1	-1	-1	-2	-1	-2	-1	-1	-1
PSOI (bar)	46.96017	47.02088	47.03699	47.03993	47.00013	47.00412	47.0079	47.0042	47.04958	47.02648
TSOI (K)	924.492	924.1952	922.3907	925.2196	927.3542	924.5552	920.1005	922.6411	922.2914	920.0778

nC10 @ 11.9 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.586298	7.936453	-0.47545	8.544349	-0.21951	8.599067	8.157103	-0.19804	8.473317	7.97991
IGDtime (ms)	1.26	3.74	0	1.44	0	1.04	3.22	0	0.86	3.24
SOI (deg ATC)	3	3	2	3	3	3	3	3	3	1
PSOI (bar)	34.406	32.75111	32.78023	34.44957	32.64731	34.48614	32.74323	32.69309	34.51787	32.91145
TSOI (K)	684.9398	650.7517	648.4989	684.3965	643.1699	683.8181	649.4836	647.0344	680.9781	645.1344
nC10 @13.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.06175	8.092535	7.615321	8.17545	8.027593	8.094642	7.983028	8.102041	7.995703	7.714867
IGDtime (ms)	0.84	1	0.8	0.9	0.7	0.9	0.72	0.82	0.82	0.74
SOI (deg ATC)	1	1	0	1	1	1	1	1	1	0
PSOI (bar)	35.94599	35.89858	35.86222	35.91969	35.83472	35.95177	35.96311	35.86385	35.92945	36.00627
TSOI (K)	710.4415	707.4056	704.4065	704.7185	704.3737	705.4755	704.1532	700.9891	705.4349	709.0013
nC10 @ 14.4 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.131698	8.065508	8.074565	8.051613	8.047327	7.995652	8.212402	8.047845	8.072879	8.078209
IGDtime (ms)	0.42	0.46	0.46	0.42	0.54	0.42	0.48	0.4	0.44	0.48
SOI (deg ATC)	0	1	0	1	1	1	1	1	1	1
PSOI (bar)	38.87745	38.91775	38.95453	38.91509	38.92966	38.95496	38.9624	39.0407	38.92146	38.96851
TSOI (K)	759.0885	763.5535	764.4187	762.3555	767.4368	764.1406	762.8588	763.1308	765.6332	767.4575
nC10 @ 16.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	7.69073	7.981808	7.920941	8.225356	8.043951	8.034408	8.428034	7.795994	7.508853	7.611294
IGDtime (ms)	0.22	0.24	0.16	0.26	0.2	0.18	0.14	0.16	0.18	0.22
SOI (deg ATC)	-1	0	0	0	1	0	0	-1	-1	-1
PSOI (bar)	42.34327	42.39383	42.43306	42.38336	42.45606	42.42206	42.40867	42.4236	42.32545	42.36772
TSOI (K)	829.7564	831.9986	831.8223	830.05	837.2464	829.1235	832.7586	830.8108	826.6608	831.7955
nC10 @ 18.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	8.451284	8.322488	8.41863	8.55238	8.322397	8.237814	8.469032	7.959244	7.811277	8.198086
IGDtime (ms)	0.16	0.12	0.12	0.18	0.18	0.18	0.16	0.12	0.12	0.12
SOI (deg ATC)	-1	-1	-1	-1	-1	-1	-1	-2	-2	-1
PSOI (bar)	47.11251	47.01559	46.89226	47.08536	47.04171	47.08675	47.06272	47.10289	47.17598	47.09161
TSOI (K)	923.968	920.049	919.6364	925.0125	919.8253	923.1562	921.6987	924.8118	927.237	928.7197

nC10 @ 11.9 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.130266	7.946672	-0.16538	8.660599	-0.17301	8.35411	-0.17214	8.706324	8.13296	-0.20936
IGDtime (ms)	3.72	3.14	0	2.14	0	1	0	1.64	3.04	0
SOI (deg ATC)	2	3	3	3	3	3	3	3	3	3
PSOI (bar)	32.75045	32.84456	32.79427	34.50402	32.83311	34.46429	32.76089	34.55237	32.72153	32.68875
TSOI (K)	645.3753	653.9188	648.004	690.242	651.7918	681.578	652.6283	685.6943	652.6384	647.4518
nC10 @13.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	8.067878	7.638558	7.747628	7.726942	7.98188	7.594927	8.227457	8.063257	8.018055	7.908562
IGDtime (ms)	0.72	0.84	1.04	0.92	0.86	0.86	0.9	0.88	0.88	0.64
SOI (deg ATC)	1	0	0	0	1	0	1	1	1	1
PSOI (bar)	35.97722	35.93155	35.94353	35.92345	35.97607	36.02298	36.02283	36.10817	35.96781	35.98713
TSOI (K)	706.096	709.052	702.2038	707.8654	707.0926	701.7873	703.7625	704.795	705.5486	707.6738
nC10 @ 14.4 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.501439	8.129251	8.164213	8.081977	8.085495	8.022354	8.024138	8.053738	7.94195	8.05561
IGDtime (ms)	0.46	0.36	0.46	0.42	0.42	0.4	0.38	0.46	0.4	0.38
SOI (deg ATC)	0	1	1	1	1	1	1	0	1	1
PSOI (bar)	38.93037	38.88031	38.93176	39.02156	39.03192	38.96782	39.00183	38.96008	39.03228	39.02236
TSOI (K)	764.35	759.7945	764.1	768.8768	766.3222	765.6585	765.5278	765.8407	767.968	761.6847
nC10 @ 16.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.801632	7.997076	8.239694	8.043689	8.240678	8.411525	8.093208	8.110913	7.922711	8.139866
IGDtime (ms)	0.2	0.12	0.14	0.18	0.14	0.2	0.18	0.18	0.22	0.16
SOI (deg ATC)	-1	0	0	0	0	0	0	0	0	0
PSOI (bar)	42.49472	42.38811	42.47043	42.4098	42.42878	42.46953	42.51214	42.54065	42.44375	42.47744
TSOI (K)	831.1411	828.4861	834.1843	831.3837	831.0967	830.3842	829.6393	836.1187	831.6415	832.944
nC10 @ 18.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	8.523808	7.920519	7.940166	7.983802	8.474172	8.469412	8.559097	8.461898	8.383096	8.45316
IGDtime (ms)	0.12	0.14	0.12	0.14	0.06	0.16	0.18	0.16	0.18	0.12
SOI (deg ATC)	-1	-2	-2	-2	-1	-1	-1	-1	-1	-1
PSOI (bar)	47.23519	47.11565	47.09502	47.15121	47.1096	47.16277	47.10879	47.06974	47.3081	47.14408
TSOI (K)	929.1436	924.4615	923.5305	923.7484	926.0761	929.0616	922.1331	921.9015	930.2437	928.0852

nC10 @ 11.9 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	8.577469	7.826305	-0.17259	8.438606	8.01048	-0.1677	8.652371	-0.16534	8.600757	8.118489
IGDtime (ms)	1.62	3.7	0	0.84	3.8	0	2.02	0	1.66	1.88
SOI (deg ATC)	3	3	3	3	3	3	3	3	3	3
PSOI (bar)	34.51438	32.71404	32.83895	34.62052	32.75491	32.78233	34.57851	32.72309	34.55611	32.73482
TSOI (K)	682.1892	648.4586	651.3123	689.1643	652.0791	650.1179	683.0268	649.2542	685.9491	649.5116
nC10 @13.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.714442	7.627601	7.633566	8.096451	8.206473	8.051509	8.191492	7.674166	7.611661	8.084411
IGDtime (ms)	0.92	0.7	0.76	0.68	0.84	0.64	0.88	0.56	0.72	0.7
SOI (deg ATC)	0	0	0	1	1	1	1	0	0	1
PSOI (bar)	36.05859	35.99557	36.08576	36.1245	36.09673	36.15173	36.07783	36.1305	36.04568	36.01107
TSOI (K)	708.3077	702.8477	707.2458	707.0526	703.9805	705.6096	709.4751	706.2144	703.7611	707.2451
nC10 @ 14.4 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.91419	8.146731	8.182332	7.879986	8.111684	8.096447	7.920953	7.928951	8.078267	7.94633
IGDtime (ms)	0.44	0.4	0.38	0.42	0.36	0.5	0.4	0.26	0.3	0.4
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	39.05694	39.00904	39.02933	39.05086	39.05608	39.08214	39.06016	39.10488	39.00884	39.09232
TSOI (K)	764.1774	769.2804	764.9533	769.4673	764.3791	766.4976	769.3828	770.2186	766.3043	763.5777
nC10 @ 16.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	8.246409	7.694106	8.210656	7.72359	8.09489	8.162053	8.346397	7.991438	8.304251	8.323287
IGDtime (ms)	0.12	0.18	0.16	0.26	0.16	0.3	0.2	0.2	0.2	0.3
SOI (deg ATC)	0	-1	0	-1	0	0	0	0	0	0
PSOI (bar)	42.46357	42.4447	42.40507	42.37274	42.52067	42.50716	42.46271	42.6008	42.5145	42.55226
TSOI (K)	835.0745	829.5124	831.0195	827.9324	832.6059	830.1882	832.552	833.4033	832.4174	829.5473
nC10 @ 18.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	8.502953	8.324231	8.52303	8.423067	7.982354	8.364735	8.333024	8.09156	8.634714	8.08338
IGDtime (ms)	0.1	0.16	0.08	0.16	0.14	0.14	0.18	0.18	0.2	0.14
SOI (deg ATC)	-1	-1	-1	-1	-2	-1	-1	-2	-1	-2
PSOI (bar)	47.23167	47.34922	47.28069	47.0983	47.28533	47.18514	47.18631	47.23455	47.26263	47.21856
TSOI (K)	924.9625	931.2019	927.1812	920.1394	930.7281	928.1588	922.8288	928.3844	928.9494	929.0882

nC10 @ 11.9 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.207755	-0.15127	8.377061	8.096701	-0.18717	8.311471	7.788076	-0.15158	8.557319	7.939188
IGDtime (ms)	5.44	0	1.2	3.26	0	0.86	5.18	0	1.26	3.48
SOI (deg ATC)	3	3	3	2	3	3	2	3	3	3
PSOI (bar)	32.62726	32.95566	34.52478	32.94418	32.81922	34.51868	32.96767	32.80096	34.55655	32.76789
TSOI (K)	642.8527	653.5237	683.5599	656.4923	646.758	685.3968	651.6321	649.9815	681.8312	645.8148
nC10 @13.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.064102	7.981725	7.642761	7.961925	8.173669	8.042279	7.678483	8.109177	8.120317	8.050724
IGDtime (ms)	0.74	0.72	0.7	0.54	0.62	0.7	0.58	0.56	0.7	0.58
SOI (deg ATC)	1	1	0	1	1	1	0	1	1	1
PSOI (bar)	36.14188	36.10546	36.17787	36.07195	36.12196	36.22961	36.14495	36.15482	36.21561	36.1497
TSOI (K)	712.4495	707.1634	710.7271	705.3923	705.4881	708.5902	705.0861	712.2008	711.0619	708.6341
nC10 @ 14.4 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.02312	8.020955	7.900254	8.105411	8.107064	8.127998	7.982311	7.923077	8.003537	8.067175
IGDtime (ms)	0.38	0.38	0.36	0.38	0.42	0.32	0.38	0.42	0.4	0.34
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	39.14838	39.12169	39.05922	39.03255	39.05605	39.13886	39.10143	39.13383	39.10194	39.17756
TSOI (K)	767.2164	765.8301	762.9931	763.0244	766.2897	766.8816	765.5938	764.487	769.1498	769.2264
nC10 @ 16.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.033403	7.773125	8.207583	8.187426	8.161013	7.835943	8.276287	7.673095	8.059664	8.174842
IGDtime (ms)	0.12	0.18	0.16	0.16	0.2	0.2	0.16	0.2	0.16	0.16
SOI (deg ATC)	0	-1	0	0	0	-1	0	-1	0	0
PSOI (bar)	42.47842	42.46276	42.54167	42.45106	42.54037	42.60482	42.53548	42.56447	42.65794	42.57401
TSOI (K)	830.4292	831.0511	833.2699	832.0997	830.9447	833.6035	837.738	832.449	834.432	833.7172
nC10 @ 18.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.968334	8.314084	8.440593	8.514569	8.416632	8.429187	8.559161	8.52043	8.331264	8.478947
IGDtime (ms)	0.12	0.16	0.2	0.12	0.16	0.12	0.16	0.18	0.14	0.18
SOI (deg ATC)	-2	-1	-1	-1	-1	-1	-1	-1	-1	-1
PSOI (bar)	47.22714	47.17952	47.40554	47.27474	47.29341	47.35263	47.28159	47.25674	47.43205	47.21624
TSOI (K)	932.5594	924.9572	929.5722	929.7881	924.2179	924.1475	923.4115	930.8444	928.7484	926.1997

nC10 @ 11.9 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	7.811638	7.832702	7.916004	7.617425	7.831809	7.863174	-0.449	8.403039	-0.17217	8.466989
IGDtime (ms)	3.16	2.92	2.36	4.06	3.14	2.86	0	1.04	0	1.1
SOI (deg ATC)	3	3	3	3	3	3	2	3	2	3
PSOI (bar)	32.81131	32.84283	32.83775	32.81852	32.84022	32.8835	32.80145	34.53051	33.09541	34.59002
TSOI (K)	647.5576	650.7301	652.5411	650.4624	649.8326	655.9457	648.4746	685.8264	657.0545	683.5653
nC10 @13.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.037565	7.680086	8.167265	8.04519	7.910707	8.06902	8.169317	8.03171	8.067872	7.982248
IGDtime (ms)	0.82	0.5	0.54	0.5	0.7	0.7	0.88	0.44	0.7	0.64
SOI (deg ATC)	1	0	1	1	1	1	1	1	1	1
PSOI (bar)	36.13557	36.27608	36.27634	36.25265	36.20864	36.25993	36.229	36.30051	36.25284	36.29578
TSOI (K)	710.9892	711.4555	714.1775	714.29	711.5409	710.2867	708.3658	714.4969	713.5689	716.7782
nC10 @ 14.4 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.031893	7.651532	7.605653	8.155756	8.021965	8.188542	8.061047	8.091287	8.117653	8.093466
IGDtime (ms)	0.36	0.4	0.38	0.38	0.24	0.42	0.24	0.32	0.38	0.4
SOI (deg ATC)	1	0	0	1	1	1	1	1	1	0
PSOI (bar)	39.15734	39.15532	39.22804	39.11735	39.17717	39.17259	39.20574	39.25245	39.24726	39.07728
TSOI (K)	766.6105	768.1026	767.9566	765.3087	767.0791	772.8623	772.2025	763.7158	767.7381	767.8683
nC10 @ 16.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	7.671051	8.116024	8.016168	7.675583	8.118814	8.088629	8.030116	7.691798	7.683099	8.315174
IGDtime (ms)	0.16	0.16	0.16	0.18	0.16	0.2	0.18	0.18	0.18	0.18
SOI (deg ATC)	-1	0	0	-1	0	0	0	-1	-1	0
PSOI (bar)	42.5608	42.58726	42.57471	42.55557	42.60158	42.64213	42.57823	42.67923	42.69682	42.62162
TSOI (K)	837.3711	832.9802	828.5186	832.7634	832.9007	833.3649	837.8072	834.1377	836.948	832.0545
nC10 @ 18.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.431148	8.447251	7.90308	8.424598	8.339837	8.279497	8.417283	8.376205	8.54275	8.297047
IGDtime (ms)	0.12	0.14	0.16	0.12	0.12	0.12	0.18	0.12	0.18	0.16
SOI (deg ATC)	-1	-1	-2	-1	-1	-1	-1	-1	-1	-1
PSOI (bar)	47.44888	47.26685	47.23955	47.33888	47.23575	47.37138	47.35592	47.39539	47.32871	47.34566
TSOI (K)	929.8666	929.6797	932.1585	932.1419	918.8804	930.27	931.2057	929.418	928.2627	926.9531

nC10 @ 11.9 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	8.182714	7.122273	7.942757	7.863165	7.675206	7.452487	-0.15148	8.339591	8.13441	6.904107
IGDtime (ms)	3.5	5.42	2.16	1.88	3.76	5.26	0	0.88	2.68	5.8
SOI (deg ATC)	2	3	3	3	3	3	3	3	2	3
PSOI (bar)	33.00169	32.7614	32.99673	32.71452	32.73873	32.84442	32.83127	34.49047	33.05402	32.76518
TSOI (K)	649.6819	648.0405	650.449	651.764	649.4166	651.671	652.0644	683.2118	656.6471	646.7324
nC10 @13.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	8.005763	8.037871	8.022156	7.673289	8.047191	7.722615	8.044649	7.990627	7.973771	7.96153
IGDtime (ms)	0.62	0.6	0.68	0.56	0.5	0.58	0.48	0.66	0.7	0.48
SOI (deg ATC)	1	1	1	0	1	0	1	1	1	1
PSOI (bar)	36.34413	36.35724	36.36121	36.38279	36.37069	36.28604	36.32636	36.32505	36.36907	36.39666
TSOI (K)	714.5291	713.6701	715.2705	713.7714	712.1438	711.2402	709.8971	712.7527	711.911	714.5121
nC10 @ 14.4 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	7.950313	8.051678	7.948922	7.873642	8.087463	7.927785	8.087827	8.060416	8.028509	8.027112
IGDtime (ms)	0.28	0.28	0.34	0.36	0.46	0.26	0.34	0.32	0.28	0.38
SOI (deg ATC)	1	1	1	1	1	1	1	1	1	1
PSOI (bar)	39.23368	39.2103	39.15815	39.26295	39.27623	39.18759	39.19711	39.2723	39.22014	39.23599
TSOI (K)	768.0612	764.8555	764.899	769.8615	766.2832	772.1602	769.0735	767.3554	768.8201	771.995
nC10 @ 16.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	8.228466	8.238183	8.196259	8.015727	8.07387	8.038127	8.149326	8.235462	8.130238	7.736994
IGDtime (ms)	0.14	0.18	0.18	0.22	0.16	0.16	0.18	0.2	0.14	0.18
SOI (deg ATC)	0	0	0	0	0	0	0	0	0	-1
PSOI (bar)	42.64556	42.6902	42.70153	42.73206	42.7044	42.76296	42.62837	42.68514	42.81819	42.77661
TSOI (K)	835.6082	833.5304	836.605	837.7102	834.4839	838.4563	834.8574	834.8367	837.6873	842.1884
nC10 @ 18.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	8.350343	8.379233	8.359333	7.780328	8.54976	8.401899	8.331559	8.340088	8.45582	7.859806
IGDtime (ms)	0.1	0.14	0.12	0.1	0.12	0.16	0.18	0.2	0.18	0.12
SOI (deg ATC)	-1	-1	-1	-2	-1	-1	-1	-1	-1	-2
PSOI (bar)	47.30952	47.35011	47.37312	47.44075	47.39198	47.36423	47.45085	47.31927	47.42579	47.36338
TSOI (K)	930.4427	927.2583	929.0067	929.8229	926.6642	931.0878	932.1452	931.7561	933.4546	929.9782

Appendix E: Raw Data for Normal Heptane

nC7 @ 13.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-0.39634	9.244726	-0.21166	0.046599	-0.26434	0.057496	0.05855	0.076128	0.076837	0.086512
IGDtime (ms)	0	2.64	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	5	6	5	5	5	5	5	6
PSOI (bar)	29.11432	34.72908	33.54328	35.67334	35.90473	36.49954	36.5918	36.69261	36.49973	35.99089
TSOI (K)	572.2503	683.1903	678.9671	726.9576	721.8376	745.8871	736.7891	733.3296	734.1934	738.2348
nC7 @ 14.4 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-0.17594	-0.42366	-0.32357	-0.00055	-0.27477	-0.28696	-0.19771	-0.19803	-0.23742	-0.18559
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	2	2	2	2	1	1	1	1	1	1
PSOI (bar)	36.88959	36.66806	38.5041	38.38609	38.05253	38.13528	38.22569	37.81473	38.02702	37.85617
TSOI (K)	719.1381	716.0886	754.2865	761.8735	750.2565	752.9366	755.5547	742.5834	743.0631	742.5535
nC7 @ 16.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	8.233571	-0.80525	-0.27803	-0.58875	-0.2259	-0.52112	-0.50663	8.313455	-0.72716	-0.49105
IGDtime (ms)	4.36	0	0	0	0	0	0	1.76	0	0
SOI (deg ATC)	4	3	4	3	4	3	3	3	3	3
PSOI (bar)	38.28138	36.90355	40.03432	40.31055	40.36929	40.288	40.29992	40.43231	38.77369	41.33972
TSOI (K)	754.4815	725.9173	800.4978	799.8872	809.85	793.2582	796.1755	801.6823	769.8906	816.6549
nC7 @ 18.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-0.47666	7.133596	6.380521	6.76531	7.065611	7.118704	7.610558	6.885493	-0.71822	7.443946
IGDtime (ms)	0	0.86	4.22	3.22	2.38	1.88	1.72	3.12	0	0.98
SOI (deg ATC)	1	2	1	1	1	1	2	0	1	0
PSOI (bar)	41.36716	45.37877	44.27895	44.33284	44.17272	44.21877	44.12794	44.31665	44.09636	47.21181
TSOI (K)	802.8395	889.9039	860.8099	865.7782	865.6129	857.3614	860.5665	868.0608	858.7357	919.6414

nC7 @ 13.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	-0.21617	0.075496	0.117581	0.113336	0.100027	0.108291	-0.22798	0.087557	-0.22038	0.080245
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	5	5	5	5	5	4	5	4	5
PSOI (bar)	36.54767	36.4775	36.71105	36.70232	36.46725	36.53036	36.415	36.50676	36.42389	36.40444
TSOI (K)	730.8985	735.9152	741.1669	747.7031	741.8267	737.3183	728.8638	735.2897	725.2212	733.6508
nC7 @ 14.4 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	-0.126	12.17765	-0.56334	-0.17618	-0.09111	-0.13656	-0.13516	-0.14717	-0.0354	-0.0423
IGDtime (ms)	0	1.8	0	0	0	0	0	0	0	0
SOI (deg ATC)	1	1	-1	1	1	1	1	1	1	1
PSOI (bar)	38.03048	38.10119	36.76637	38.79293	38.59609	38.2717	38.25073	38.16366	38.31557	38.27445
TSOI (K)	745.3884	747.5806	717.0668	763.1186	757.2857	751.2141	755.1107	743.3376	753.281	754.0435
nC7 @ 16.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	-0.49662	-0.49767	-0.14111	-0.49216	-0.48667	-0.13649	8.378894	-0.72002	-0.15791	-0.45593
IGDtime (ms)	0	0	0	0	0	0	4.02	0	0	0
SOI (deg ATC)	3	3	4	2	2	3	3	2	3	2
PSOI (bar)	41.3622	41.15989	41.41825	41.80831	41.63493	41.90887	41.94745	39.33236	41.66551	41.84453
TSOI (K)	819.4033	813.3444	826.3355	831.3879	818.1946	834.3086	826.6326	771.7248	831.3459	822.5124
nC7 @ 18.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	7.789985	7.181499	7.080489	7.195764	7.763667	7.313634	7.257891	7.36945	7.349621	7.311433
IGDtime (ms)	1.7	2.4	2.04	1.4	1.8	2.34	1.44	1.84	1.72	2.1
SOI (deg ATC)	1	0	0	-1	0	-1	-1	-1	0	-1
PSOI (bar)	44.30995	44.35085	44.44591	44.42119	44.58902	44.4167	44.57391	44.51012	44.62189	44.57621
TSOI (K)	875.2226	868.782	868.8633	860.3983	880.7684	872.2025	876.3209	873.5827	876.2123	868.5854

nC7 @ 13.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	0.122501	0.109011	0.099179	0.097358	0.098785	0.116888	0.094475	0.10521	0.077438	-0.20306
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	5	5	5	5	5	5	5	5	5	4
PSOI (bar)	36.6696	36.58548	36.58498	36.54109	36.56414	36.66409	36.54756	36.62508	36.32409	36.58671
TSOI (K)	740.0813	740.6945	733.1523	739.2497	741.1375	738.5238	739.6062	738.5113	733.3254	730.1412
nC7 @ 14.4 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	0.210266	-0.03925	-0.15662	-0.01301	0.228728	-0.09442	12.26674	-0.28819	-0.23196	-0.1144
IGDtime (ms)	0	0	0	0	0	0	1.42	0	0	0
SOI (deg ATC)	2	1	1	1	2	1	1	-1	1	1
PSOI (bar)	38.07363	38.60389	38.03799	38.43829	37.99698	38.31067	38.22331	36.80105	38.91491	39.15037
TSOI (K)	750.1741	758.2114	739.6553	755.3208	749.3508	748.9009	749.6905	721.9622	760.9607	770.7333
nC7 @ 16.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	-0.44583	8.969779	-0.41345	-0.14063	8.66373	-0.70582	8.281651	-0.37772	8.381334	-0.38332
IGDtime (ms)	0	1.84	0	0	3.1	0	1.82	0	2.98	0
SOI (deg ATC)	2	3	3	3	3	2	2	3	2	3
PSOI (bar)	41.94411	41.7818	39.22692	41.66728	41.81825	39.38923	41.92389	39.50641	41.84818	39.43798
TSOI (K)	824.8953	823.3921	780.4034	825.9466	829.3009	776.9394	824.2206	786.3117	823.3443	783.4054
nC7 @ 18.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.185401	7.692603	7.379351	7.337458	7.311136	7.232068	7.790729	7.743934	7.543271	7.726441
IGDtime (ms)	1.5	1.6	1.58	1.48	1.3	1.16	1.12	1.34	1.68	1.32
SOI (deg ATC)	0	0	-1	-1	-1	-1	0	0	-1	0
PSOI (bar)	44.65749	44.8437	44.72375	44.68475	44.69517	44.83816	44.88955	44.74982	44.74555	44.90141
TSOI (K)	876.9274	880.3528	876.0705	872.9833	873.5724	882.2438	877.988	883.6764	874.0894	890.6901

nC7 @ 13.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	0.112759	0.107393	0.093857	0.093727	0.097596	0.102414	0.088416	0.073178	0.091422	0.077833
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	5	4	5	5	4	5	5	5	5	5
PSOI (bar)	36.58438	36.99301	36.48283	36.48859	36.95607	36.50615	36.48171	36.34868	36.48236	36.48916
TSOI (K)	741.7247	748.2479	738.6793	738.2156	746.573	737.6616	737.7657	735.5692	739.7015	739.5943
nC7 @ 14.4 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	-0.1282	-0.11914	-0.1192	-0.06945	11.78316	-0.21336	-0.0886	0.266996	12.13028	-0.22837
IGDtime (ms)	0	0	0	0	2.2	0	0	0	2.18	0
SOI (deg ATC)	1	1	1	1	1	1	1	2	2	1
PSOI (bar)	38.76309	38.82299	38.52182	38.61777	38.96023	37.14664	39.6926	39.26331	39.24183	37.24553
TSOI (K)	758.1325	761.0291	755.7141	758.4941	768.5164	730.7587	781.3279	771.9086	770.1675	727.8924
nC7 @ 16.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	8.203901	-0.36554	7.723342	-0.68382	8.278058	-0.68643	8.245261	-0.69221	-0.43516	8.9956
IGDtime (ms)	2.02	0	4.7	0	3.14	0	3.34	0	0	2.82
SOI (deg ATC)	2	2	2	2	2	2	2	2	2	3
PSOI (bar)	41.85208	39.78578	41.8098	39.5902	42.01351	39.6123	41.82323	39.50874	41.95994	42.07574
TSOI (K)	822.5873	789.9188	821.9292	780.3875	823.1503	780.1874	821.1433	778.2578	822.6447	833.3974
nC7 @ 18.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	7.332293	7.333704	7.263706	7.260273	7.535096	7.430436	7.777053	7.566549	8.006698	7.094489
IGDtime (ms)	1.16	1	0.98	1.02	1.36	0.98	1	1.38	1.06	0.96
SOI (deg ATC)	-1	-1	-1	-1	-1	-1	0	-1	-1	-2
PSOI (bar)	44.88929	44.94397	44.88979	44.99695	45.08927	44.9289	44.99627	45.038	44.87491	44.98244
TSOI (K)	877.4964	882.5259	888.1595	877.4277	877.2468	875.1502	880.9507	876.2061	880.5329	885.1424

nC7 @ 13.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	0.075797	0.092307	0.094401	0.075696	0.121505	0.086249	0.09662	0.084679	0.082892	0.111692
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	5	4	4	4	5	5	4	5	4	4
PSOI (bar)	36.41047	36.92241	36.9057	36.84848	36.76215	36.46196	36.94014	36.47563	36.8609	37.04657
TSOI (K)	735.512	747.0785	749.475	735.1071	741.0012	735.6111	740.6451	739.0838	738.105	741.1106
nC7 @ 14.4 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	-0.13021	0.195256	-0.07315	-0.04985	-0.09378	-0.00437	0.208707	12.07501	-0.5618	10.87725
IGDtime (ms)	0	0	0	0	0	0	0	1.42	0	2.18
SOI (deg ATC)	1	2	1	1	1	1	2	1	-1	1
PSOI (bar)	39.53566	39.36065	39.55194	39.39551	39.20071	39.621	39.14681	39.5795	37.23579	39.78203
TSOI (K)	774.7108	776.1058	777.0468	772.9564	767.5548	777.5633	771.6693	773.7366	732.8126	783.1349
nC7 @ 16.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	-0.68391	8.748368	-0.35073	8.47079	-0.68981	8.144464	-0.69201	8.83259	7.644486	-0.33221
IGDtime (ms)	0	2.08	0	3.24	0	1.54	0	2.14	3.96	0
SOI (deg ATC)	2	3	2	3	2	1	1	2	1	2
PSOI (bar)	39.58559	41.95942	39.91964	41.98469	39.51488	42.31205	39.89573	42.39458	39.99963	40.10894
TSOI (K)	776.8402	826.0537	788.799	835.3962	779.5002	835.1595	778.5399	840.1457	783.7695	797.3486
nC7 @ 18.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	7.380919	7.707229	7.39643	7.340401	7.40535	7.355919	7.394202	7.41805	7.467048	7.274708
IGDtime (ms)	1.06	1.04	0.98	1.2	1.08	0.8	0.86	1.22	1.04	1
SOI (deg ATC)	-2	-1	-2	-2	-2	-2	-2	-2	-2	-2
PSOI (bar)	44.98709	45.08545	44.96	44.88631	44.87857	45.0507	45.13358	45.09615	45.04732	45.07808
TSOI (K)	883.9926	880.209	878.3622	883.6669	886.1378	886.5755	885.1124	881.6996	887.4599	889.6278

nC7 @ 13.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	0.07159	-0.22842	0.075151	0.084572	0.071391	0.058685	0.081887	0.086759	0.06221	0.065954
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	3	4	4	5	5	4	5	5	4
PSOI (bar)	36.81151	36.93195	36.85069	36.91577	36.48658	36.34	36.91723	36.63193	36.44809	36.87034
TSOI (K)	737.6576	735.6888	745.7255	743.5931	737.3355	739.2331	744.7946	745.1102	733.0784	744.2675
nC7 @ 14.4 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	-0.55419	-0.11622	11.74406	-0.52023	-0.13576	11.38583	-0.17872	11.07108	-0.53784	-0.13311
IGDtime (ms)	0	0	2.04	0	0	2.5	0	1.72	0	0
SOI (deg ATC)	0	1	2	0	1	1	1	1	0	1
PSOI (bar)	37.5453	40.20865	39.85724	37.54369	40.15466	39.83553	37.87831	40.49319	37.72301	40.33667
TSOI (K)	731.2748	789.0595	786.3002	738.9225	788.3639	783.1431	746.5948	797.6688	740.6891	793.9209
nC7 @ 16.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	8.328541	-0.65693	8.319394	-0.33187	8.236865	-0.65854	8.233804	-0.65246	8.590697	-0.31828
IGDtime (ms)	2.1	0	1.7	0	2.14	0	1.6	0	1.74	0
SOI (deg ATC)	2	1	2	2	1	1	2	1	2	2
PSOI (bar)	42.07872	40.07338	42.19543	40.17103	42.43649	40.08372	42.04906	40.15596	42.47211	40.14536
TSOI (K)	828.4811	786.8263	827.5653	788.5373	830.1478	790.2733	825.7533	784.878	846.2759	783.7205
nC7 @ 18.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	7.836808	7.251987	7.232493	7.762193	6.265384	6.561283	6.880822	7.638855	7.25046	7.240537
IGDtime (ms)	1.16	0.8	0.8	0.98	1.18	1.08	1	0.92	1.2	0.98
SOI (deg ATC)	-1	-1	-2	-1	4	2	-1	0	-2	-2
PSOI (bar)	45.00266	45.3749	45.19	45.10426	44.0656	45.09992	45.64656	45.40682	45.1859	45.30614
TSOI (K)	883.0365	890.6516	886.5227	890.2656	878.5813	880.6979	885.823	891.4819	883.3927	889.9432

nC7 @ 13.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	0.079808	0.087809	0.08928	0.054433	0.08355	0.07324	0.063831	0.067166	0.047552	0.054081
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	36.95723	37.09169	36.95528	36.78867	37.1027	36.91802	36.81804	36.90643	36.73389	36.78824
TSOI (K)	736.6891	752.6097	753.1559	744.7866	751.562	735.2513	746.9788	736.4563	735.0538	738.2573
nC7 @ 14.4 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	-0.10864	11.32088	-0.51927	11.40782	-0.21544	-0.15562	11.38462	-0.55861	-0.12588	0.285884
IGDtime (ms)	0	2.24	0	1.4	0	0	1.66	0	0	0
SOI (deg ATC)	1	1	0	1	0	1	2	0	1	2
PSOI (bar)	40.392	40.35002	37.83116	40.52721	37.7003	40.46135	40.50784	37.7766	40.8318	40.66991
TSOI (K)	794.0191	792.891	743.8601	794.4191	737.175	793.7543	796.1215	742.202	803.5688	797.596
nC7 @ 16.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	8.698541	-0.6709	8.765852	8.159893	-0.33614	8.52586	-0.65847	8.581461	7.411385	-0.63622
IGDtime (ms)	2.4	0	2.5	3.42	0	1.4	0	1.18	6.18	0
SOI (deg ATC)	2	1	3	2	3	3	1	2	1	2
PSOI (bar)	42.32147	40.13313	42.17801	40.18437	39.83517	42.12031	40.15726	42.50181	40.27897	40.09397
TSOI (K)	837.1933	786.3333	832.8409	787.22	790.4655	835.7666	786.3802	839.7583	790.8194	788.9053
nC7 @ 18.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.425075	7.425038	7.300649	7.2711	7.33116	7.291449	7.289835	7.372352	7.867944	7.281595
IGDtime (ms)	0.88	0.86	0.96	0.9	0.72	1	1.06	0.82	0.82	0.84
SOI (deg ATC)	-2	-2	-2	-2	-2	-2	-2	-2	-1	-2
PSOI (bar)	45.31834	45.21192	45.30874	45.29849	45.36861	45.27196	45.38368	45.49811	45.38407	45.38905
TSOI (K)	888.8612	892.0934	888.2156	891.0814	892.5774	887.7578	897.7514	894.8334	887.232	893.8721

nC7 @ 13.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	0.0883	0.065547	0.094762	0.057976	0.066471	0.05535	0.067076	0.052332	0.047192	0.060115
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	37.0692	36.86966	37.14228	36.86974	36.92894	36.91712	36.88574	36.87558	36.8646	36.90594
TSOI (K)	745.6887	747.0755	745.7386	735.0092	749.8315	737.0207	739.6679	735.6413	730.7568	736.5861
nC7 @ 14.4 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	-0.09222	11.37614	-0.21456	10.92541	-0.52825	11.29711	-0.53228	-0.13969	11.18166	-0.5464
IGDtime (ms)	0	1.82	0	1.76	0	1.8	0	0	1.26	0
SOI (deg ATC)	1	1	1	1	0	2	0	1	1	0
PSOI (bar)	40.64007	40.61225	37.89194	40.88048	38.03207	40.8137	38.05862	40.587	40.82227	38.00225
TSOI (K)	797.1693	795.7048	740.4575	801.7351	744.4052	798.8192	743.1873	797.2106	803.9446	741.4828
nC7 @ 16.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	8.520999	-0.64987	8.232314	-0.65276	8.142523	8.210391	-0.63737	8.522434	8.229764	7.583878
IGDtime (ms)	1.94	0	1.5	0	1.9	3.74	0	1.7	3.06	3.44
SOI (deg ATC)	3	1	2	1	2	2	1	2	2	1
PSOI (bar)	42.19517	40.25856	42.25939	40.33606	42.15878	40.34885	40.39859	42.39212	40.35957	40.43816
TSOI (K)	835.762	786.715	833.3434	789.5147	830.4764	793.3071	790.0832	837.5635	799.1225	798.3816
nC7 @ 18.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	7.782626	7.240153	7.746951	7.829144	7.081051	7.229772	7.28718	7.211154	7.235076	7.757086
IGDtime (ms)	0.82	0.82	0.82	0.88	0.76	0.76	0.62	0.7	0.78	0.68
SOI (deg ATC)	-1	-2	-1	-1	-2	-2	-2	-2	-1	-1
PSOI (bar)	45.25842	45.43364	45.57245	45.40488	45.521	45.41037	45.54947	45.49309	45.72417	45.57389
TSOI (K)	883.5454	888.4133	898.2349	894.6052	895.1578	886.7247	895.0532	892.252	897.2044	894.0238

nC7 @ 13.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	0.06289	0.074935	0.083828	0.059363	0.059336	0.057489	0.076507	0.064424	0.04452	0.051224
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	37.01929	37.12694	37.068	36.9509	36.87199	36.86312	37.01309	36.97263	36.83802	36.95768
TSOI (K)	744.1028	742.7416	751.1972	738.7758	738.799	739.7574	741.2458	740.1689	739.8909	738.1212
nC7 @ 14.4 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	9.919206	-0.44517	-0.04364	11.52743	-0.4791	10.81978	-0.52285	9.664057	-0.44125	10.82985
IGDtime (ms)	3.48	0	0	2.36	0	1.62	0	4.2	0	1.26
SOI (deg ATC)	1	1	1	2	0	1	0	1	1	1
PSOI (bar)	40.73481	38.5757	41.03557	40.85522	38.30176	40.8344	38.18758	41.16081	38.66645	41.00116
TSOI (K)	800.386	756.98	809.6402	801.7449	751.9788	798.6493	751.1405	809.4273	761.361	801.189
nC7 @ 16.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	-0.30284	8.372476	7.759881	-0.27201	8.452119	-0.29014	8.004434	7.798337	7.771792	7.472172
IGDtime (ms)	0	1.54	3.5	0	1.36	0	1	2.58	3.08	3.52
SOI (deg ATC)	2	3	1	2	3	2	1	1	1	1
PSOI (bar)	40.45488	42.13983	40.3	40.40917	42.27628	40.39581	42.58905	40.49668	40.4357	40.53001
TSOI (K)	798.7979	835.2626	794.4875	803.1238	836.8799	796.7054	834.0241	794.963	791.6286	799.144
nC7 @ 18.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	7.184606	7.441707	7.446224	7.13897	7.38928	7.273532	7.294437	7.289591	7.195926	7.056352
IGDtime (ms)	0.8	0.66	0.72	0.68	0.7	0.66	0.68	0.58	0.64	0.78
SOI (deg ATC)	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
PSOI (bar)	45.56211	45.57527	45.58699	45.61566	45.62719	45.60894	45.59587	45.77389	45.69921	45.55695
TSOI (K)	899.4854	901.0979	890.2938	901.0398	900.9568	898.3826	897.0153	906.0351	893.6535	897.8373

nC7 @ 13.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	0.03973	0.045242	-0.25629	0.068131	0.065664	0.032572	0.047501	0.039607	0.052382	0.036322
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	3	4	4	4	4	4	4	4
PSOI (bar)	36.81001	36.88457	36.98005	37.0532	37.05942	36.80426	36.91573	36.79494	36.91784	36.92076
TSOI (K)	740.9367	733.9726	731.5572	738.1603	755.1306	735.5565	740.3841	741.01	736.6385	738.7134
nC7 @ 14.4 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	-0.52207	10.34648	-0.20681	10.75607	-0.18469	10.51668	-0.53309	9.461529	-0.0392	10.91378
IGDtime (ms)	0	1.44	0	2.72	0	1.48	0	3.8	0	1.4
SOI (deg ATC)	0	1	1	1	1	1	0	1	2	2
PSOI (bar)	38.16305	40.82789	38.27184	40.98085	38.4806	41.01012	38.33744	40.93549	39.18337	41.27745
TSOI (K)	751.5624	799.9019	747.086	807.3814	760.4332	810.0659	754.1325	800.4916	773.3922	808.5013
nC7 @ 16.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	7.818288	7.765946	7.715261	7.558261	7.430615	8.162536	8.027078	7.702103	7.750084	-0.56923
IGDtime (ms)	3.68	2.88	3.4	4.06	3.78	2.5	3.64	3.22	4.06	0
SOI (deg ATC)	2	1	1	1	1	2	2	1	2	1
PSOI (bar)	40.5898	40.61837	40.69298	40.61047	40.76015	40.69568	40.59405	40.78924	40.79242	40.65668
TSOI (K)	798.9595	795.3047	797.4313	797.4283	801.4977	803.0534	797.7615	804.1892	802.0585	794.0243
nC7 @ 18.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	7.691608	7.531537	7.667096	7.28174	7.386498	7.410366	7.322135	7.208762	7.236666	7.292424
IGDtime (ms)	0.68	0.58	0.56	0.68	0.66	0.54	0.7	0.7	0.68	0.66
SOI (deg ATC)	-1	-2	-1	-2	-2	-2	-2	-2	-1	-2
PSOI (bar)	45.68835	45.76079	45.80957	45.67788	45.87268	45.68836	45.77575	45.73928	45.991	45.81492
TSOI (K)	895.9001	897.1552	900.3406	900.6442	901.1468	901.4909	903.0336	908.0156	901.1046	903.1951

nC7 @ 13.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	0.048491	0.048635	0.053143	0.044745	0.060324	0.029946	0.033877	0.039547	0.021256	0.032387
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	36.88695	36.89198	36.96857	36.84084	37.07217	36.89304	36.97675	36.96927	36.83497	36.91837
TSOI (K)	740.041	734.1862	738.4272	736.0027	739.0602	739.2912	748.6015	739.7681	736.6616	738.8315
nC7 @ 14.4 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	-0.51688	-0.1004	11.5535	-0.52888	10.63466	-0.50222	10.42998	-0.49548	9.977912	-0.4815
IGDtime (ms)	0	0	1.3	0	1.96	0	1.62	0	3.3	0
SOI (deg ATC)	0	1	2	-1	1	0	1	0	1	1
PSOI (bar)	38.40657	41.015	41.43011	38.19472	41.10898	38.44579	41.04367	38.58054	40.91494	38.68924
TSOI (K)	747.9434	803.0833	816.0884	751.8476	805.5794	755.1476	806.3895	756.8084	805.6642	760.9398
nC7 @ 16.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.767145	8.108675	8.176332	7.806535	8.100125	8.313103	6.216154	8.121716	7.738971	8.20005
IGDtime (ms)	0.82	2.3	3	2.38	2.38	2.22	7.86	2.06	2.82	2.74
SOI (deg ATC)	1	0	2	1	2	2	2	2	1	2
PSOI (bar)	42.61305	40.78598	40.72766	40.88346	40.71887	40.81372	40.82792	40.97812	40.80192	40.7717
TSOI (K)	830.5579	791.195	799.4826	799.678	799.816	801.7878	805.9747	806.7508	796.8398	802.2224
nC7 @ 18.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.048052	7.315237	7.199244	7.780477	7.317532	7.302199	7.542266	7.39661	7.480694	7.513738
IGDtime (ms)	0.56	0.58	0.5	0.66	0.64	0.58	0.54	0.54	0.58	0.56
SOI (deg ATC)	-1	-1	-2	-1	-2	-2	-2	-2	-2	-2
PSOI (bar)	46.10374	46.09681	45.91553	45.92744	45.88647	45.90682	45.86957	45.87858	45.88022	45.91789
TSOI (K)	908.3912	911.6039	892.7608	904.504	904.1309	904.7208	905.582	903.1676	898.4658	908.4114

nC7 @ 13.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	-0.27429	0.031802	0.027477	0.020825	0.03651	0.043251	0.038376	0.042543	0.048778	0.031322
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	3	4	4	4	4	4	4	4	4	4
PSOI (bar)	36.89246	36.83271	36.81386	36.73679	36.87401	36.97442	36.88902	36.93748	37.08006	36.93914
TSOI (K)	729.3576	739.7752	739.0617	735.0677	738.6387	740.2608	737.6845	740.3074	741.2718	738.5144
nC7 @ 14.4 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	11.11313	-0.14749	10.20346	-0.52065	10.41856	-0.18549	10.77524	-0.21039	10.30953	-0.20229
IGDtime (ms)	2.56	0	2.22	0	1.62	0	1.06	0	1.18	0
SOI (deg ATC)	2	1	1	0	1	1	2	1	1	1
PSOI (bar)	41.25866	38.79425	41.01982	38.55625	40.95383	38.66292	41.0706	38.47361	41.11041	38.56647
TSOI (K)	812.044	759.6823	808.9188	761.5828	801.1297	754.0431	809.5072	753.2675	806.3627	753.1095
nC7 @ 16.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.838615	7.998365	7.958127	7.801829	8.076114	8.210146	8.150976	8.210659	7.955225	8.095136
IGDtime (ms)	2.04	1.52	1.88	2.06	1.54	1.58	1.74	2.36	1.64	1.36
SOI (deg ATC)	1	2	2	1	2	2	2	1	2	2
PSOI (bar)	40.91411	40.95019	40.88595	40.89171	40.91812	40.96214	40.93453	40.95144	41.00758	41.01819
TSOI (K)	804.4311	806.4881	803.2312	804.1997	805.4884	805.7151	802.0532	804.6258	805.2338	804.0329
nC7 @ 18.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.557974	7.398102	7.52873	7.287404	7.428774	7.44787	7.417232	7.340834	7.414067	7.330024
IGDtime (ms)	0.5	0.5	0.52	0.5	0.5	0.54	0.52	0.56	0.52	0.42
SOI (deg ATC)	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
PSOI (bar)	45.94082	46.05572	45.91648	45.91275	45.97417	45.80475	45.90616	45.85136	45.87631	46.03158
TSOI (K)	903.1825	906.7747	896.7391	898.0934	910.2032	903.0383	903.5215	902.5894	898.5971	905.796

nC7 @ 13.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	0.04844	0.042558	0.036596	0.036027	0.03189	0.041734	0.031297	0.033199	0.023438	0.053679
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	37.02825	36.94467	36.91852	36.956	36.9032	36.95402	36.91972	36.81804	36.88039	36.98945
TSOI (K)	741.0301	740.8049	738.2152	741.85	738.4558	740.5589	737.4841	733.2822	741.1181	743.7235
nC7 @ 14.4 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	10.43769	-0.50497	10.32141	-0.17677	10.39458	-0.51933	9.931999	9.338655	-0.50658	10.39318
IGDtime (ms)	1.58	0	1.24	0	2.18	0	1.76	1.98	0	1.82
SOI (deg ATC)	1	0	1	1	2	0	1	0	0	2
PSOI (bar)	41.02793	38.55809	40.93387	38.65256	41.00632	38.61479	40.96924	38.5762	38.65934	40.85804
TSOI (K)	807.3845	759.6556	803.481	761.878	803.8162	760.1833	806.9167	756.9549	752.6488	805.1753
nC7 @ 16.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	8.127141	7.51063	7.73465	7.664473	7.742621	8.059198	8.098645	7.638052	7.525616	8.04636
IGDtime (ms)	1.52	1.34	1.28	1.18	1.72	1.36	1.36	1.18	1.32	1.5
SOI (deg ATC)	2	1	1	1	1	2	2	0	1	2
PSOI (bar)	41.04346	41.09275	41.05195	41.04934	41.00519	41.13931	41.09307	41.1529	41.07363	41.09783
TSOI (K)	805.9855	801.7797	801.9436	804.7537	804.9339	805.9317	807.1522	809.7394	804.0905	805.0707
nC7 @ 18.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.904638	7.501631	7.329239	7.412847	7.270737	7.345388	7.466688	7.931576	7.243959	7.509236
IGDtime (ms)	0.56	0.46	0.54	0.48	0.52	0.42	0.44	0.38	0.58	0.4
SOI (deg ATC)	-1	-2	-2	-2	-2	-2	-2	-1	-2	-2
PSOI (bar)	45.90692	46.0733	46.02397	46.05596	46.02967	46.00749	46.07376	46.01303	46.03002	46.03249
TSOI (K)	897.3451	912.6978	902.0963	905.3248	910.0883	906.8751	908.6327	896.2381	909.2711	898.091

nC7 @ 13.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	0.03556	0.045546	0.036254	0.039652	0.031305	0.025536	0.043816	0.031728	0.044126	0.041008
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	36.89368	36.96108	37.01025	36.92004	36.94874	36.86243	36.95423	36.99268	37.03781	36.90636
TSOI (K)	738.319	739.9087	740.9458	738.4535	741.6162	738.9166	740.0667	739.356	739.8908	736.3357
nC7 @ 14.4 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	-0.51316	9.653639	-0.50296	9.779596	-0.17272	9.835131	9.07435	-0.17343	10.12603	-0.16094
IGDtime (ms)	0	1.06	0	1.02	0	1.64	3.16	0	0.98	0
SOI (deg ATC)	0	1	0	1	1	1	0	2	2	1
PSOI (bar)	38.65181	41.10742	38.60707	41.06803	38.60495	41.12496	38.73401	38.78615	40.88514	38.6871
TSOI (K)	755.6824	803.7707	760.1379	805.1782	756.3705	811.4665	763.6048	761.5929	806.3103	764.0621
nC7 @ 16.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	7.996501	7.508725	7.926657	8.086848	7.989294	8.108482	7.981198	7.692902	7.537628	7.470701
IGDtime (ms)	1.72	1.14	1.54	1.44	1.36	1.44	1.22	1.2	1.16	1.06
SOI (deg ATC)	2	1	2	2	2	1	1	0	0	0
PSOI (bar)	41.06773	41.1194	41.09909	41.16168	41.14371	41.34831	41.3806	41.40456	41.3804	41.29039
TSOI (K)	805.505	805.6505	810.283	807.1076	813.9768	812.4881	814.2123	809.0757	810.6818	807.4687
nC7 @ 18.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	7.388907	7.365104	7.375613	7.398162	7.320729	7.206453	7.550434	7.477682	7.362087	7.29674
IGDtime (ms)	0.5	0.36	0.34	0.4	0.56	0.44	0.4	0.42	0.48	0.48
SOI (deg ATC)	-2	-2	-2	-2	-2	-2	-2	-2	-2	-1
PSOI (bar)	46.12703	46.10744	46.13606	46.21362	46.15826	46.16719	46.08085	46.2031	46.12691	46.3847
TSOI (K)	911.8293	904.2327	902.0692	905.4178	903.1189	912.6081	903.2715	910.5606	903.3282	902.6084

nC7 @ 13.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	0.027717	0.033897	0.05033	0.032131	0.030405	0.061612	0.021209	0.017194	0.028528	0.051286
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	36.93122	36.96723	37.03879	36.91805	36.9055	37.07977	36.91302	36.8419	36.8863	37.11276
TSOI (K)	739.0766	740.5362	741.3904	737.5629	736.4029	742.7501	737.8929	735.656	740.7621	745.9128
nC7 @ 14.4 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	10.05073	-0.48035	9.513163	9.489445	-0.45359	10.1597	8.754624	-0.41585	10.22289	8.905225
IGDtime (ms)	1.08	0	1.06	2.06	0	1.48	3.9	0	1.24	3.56
SOI (deg ATC)	2	0	1	0	0	2	0	1	2	0
PSOI (bar)	40.9264	38.62717	40.9508	38.77352	38.84817	40.83754	38.79959	38.94243	41.04611	38.76077
TSOI (K)	808.1157	754.3735	802.1087	757.4145	757.7384	806.2517	758.6959	765.0588	807.4631	762.0661
nC7 @ 16.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	7.541775	8.008208	7.469499	8.119263	8.180755	7.620749	8.119057	8.142376	8.158689	7.952461
IGDtime (ms)	1	1.22	0.88	1.24	1.1	0.92	0.84	0.86	1.08	1.06
SOI (deg ATC)	0	1	0	1	1	0	1	1	1	1
PSOI (bar)	41.43562	41.32495	41.35641	41.49729	41.42951	41.45686	41.46695	41.47287	41.57136	41.47006
TSOI (K)	811.6667	803.4824	808.8031	808.1346	815.0732	812.5671	811.7907	810.8592	812.6802	810.6589
nC7 @ 18.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	7.328032	7.087514	7.481895	6.85212	7.131889	7.219835	7.324673	7.326143	7.496786	7.342343
IGDtime (ms)	0.38	0.48	0.5	0.42	0.48	0.32	0.52	0.38	0.38	0.36
SOI (deg ATC)	-2	-2	-2	0	-1	-2	-2	-2	-2	-2
PSOI (bar)	46.16819	46.14764	46.11759	46.54714	46.46298	46.14617	46.19854	46.2328	46.20108	46.27418
TSOI (K)	909.5575	906.8926	908.6719	910.1878	915.7441	913.8326	901.3487	907.921	906.4259	907.9501

nC7 @ 13.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	0.05805	0.035605	0.033072	0.047924	0.02867	0.036317	0.037247	0.016537	0.017676	-0.28211
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	5	4	3
PSOI (bar)	37.13033	36.98251	36.94785	37.03846	36.95623	36.95832	37.00384	36.44478	36.84907	36.96354
TSOI (K)	743.8366	742.1498	742.1353	738.5265	740.7911	741.5242	740.448	735.7849	750.9286	725.5569
nC7 @ 14.4 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	9.023061	-0.39191	9.413404	8.93793	8.647772	8.749177	8.862499	9.1983	8.933637	-0.36538
IGDtime (ms)	1.48	0	1.02	3.62	4.5	2.56	1.84	1.18	3.1	0
SOI (deg ATC)	1	0	1	1	2	1	1	1	0	1
PSOI (bar)	38.96864	39.01377	40.96539	38.80089	39.31607	39.30584	39.15253	39.04174	38.96109	39.0883
TSOI (K)	766.314	766.356	801.9601	761.0739	775.62	767.339	766.6094	772.8488	765.6635	769.9458
nC7 @ 16.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	8.062338	8.06334	8.145462	8.125221	8.097894	7.619758	7.559729	8.048714	8.117172	7.529941
IGDtime (ms)	0.76	1.1	0.72	0.92	1.1	1.1	0.92	1.08	0.9	1.06
SOI (deg ATC)	1	1	1	1	1	0	0	1	1	0
PSOI (bar)	41.55089	41.54826	41.64316	41.50512	41.56575	41.5281	41.66238	41.60138	41.57955	41.59247
TSOI (K)	815.2703	815.1905	816.7424	813.4736	814.323	809.6207	819.1071	813.4906	818.0106	814.1367
nC7 @ 18.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.245043	7.317494	7.296647	7.609412	7.56891	7.050181	7.173884	7.350769	7.316432	7.119683
IGDtime (ms)	0.5	0.36	0.38	0.4	0.42	0.3	0.36	0.38	0.42	0.4
SOI (deg ATC)	-2	-2	-2	-2	-2	-1	-1	-2	-2	-2
PSOI (bar)	46.21137	46.25288	46.33298	46.27217	46.3199	46.50749	46.60232	46.21863	46.30929	46.41653
TSOI (K)	910.4071	904.6402	913.9525	911.4071	908.9232	914.1134	917.1145	913.8524	912.3365	910.9011

nC7 @ 13.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	0.036914	0.020153	0.046646	0.040001	0.014441	0.021188	0.004961	0.00957	0.020573	0.019815
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	5	4	4	4	4	4	4	4	4	4
PSOI (bar)	36.60267	36.85528	37.0926	37.05364	36.82334	36.87779	36.82059	36.84468	37.00772	36.79697
TSOI (K)	741.9817	746.019	741.7511	736.8114	731.2973	734.9488	735.1471	734.663	740.5425	736.8002
nC7 @ 14.4 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	9.096197	9.335522	-0.35298	9.800938	9.058873	8.977464	9.146442	9.121114	8.677183	8.840401
IGDtime (ms)	0.86	2.38	0	0.86	3.56	2.3	1.34	2.76	1.32	2.86
SOI (deg ATC)	1	0	0	2	1	2	2	0	1	0
PSOI (bar)	41.14327	39.00474	39.13482	40.85764	38.99511	39.20369	39.18821	39.23331	39.15659	39.19719
TSOI (K)	809.1374	767.2613	767.2348	803.3227	763.5658	775.6257	770.1163	764.197	771.9366	771.2048
nC7 @ 16.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.985735	7.632393	7.688327	8.074112	8.175576	8.043018	8.112564	7.96866	7.888851	8.113334
IGDtime (ms)	0.9	0.96	0.72	0.88	0.88	0.92	0.54	0.88	0.88	0.72
SOI (deg ATC)	1	0	0	1	1	1	1	1	1	1
PSOI (bar)	41.55797	41.65449	41.59676	41.7533	41.68564	41.70758	41.66787	41.73985	41.70689	41.79002
TSOI (K)	813.535	814.0465	815.9413	821.8584	817.3666	815.6889	814.9781	820.1742	821.2114	818.5813
nC7 @ 18.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.455732	7.514943	7.386128	8.018324	7.419137	7.51876	7.418033	7.450745	7.406292	7.658329
IGDtime (ms)	0.36	0.32	0.36	0.34	0.36	0.36	0.3	0.32	0.3	0.38
SOI (deg ATC)	-2	-2	-2	-1	-2	-2	-2	-2	-2	0
PSOI (bar)	46.29085	46.35351	46.44619	46.40867	46.41341	46.47311	46.41545	46.49352	46.37272	46.70992
TSOI (K)	915.4791	910.337	912.7456	910.3815	916.0255	909.1106	907.9377	909.3913	916.0975	917.099

nC7 @ 13.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	0.009707	0.010093	0.020082	0.00862	0.017375	-0.00165	0.008717	0.048698	0.010213	0.000716
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	4	4	4	4
PSOI (bar)	36.88981	36.93556	36.87111	36.90886	36.82448	36.86356	36.868	37.13979	36.82707	36.82146
TSOI (K)	738.4089	742.7241	738.4252	740.6925	739.4028	739.2562	736.5146	745.4824	736.3795	734.0339
nC7 @ 14.4 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	8.747801	8.997936	8.870684	9.130269	8.7395	9.389896	8.866532	8.685207	8.708059	9.279269
IGDtime (ms)	2.68	2.48	1.9	1.52	1.3	2.2	2.48	1.9	1.54	1.52
SOI (deg ATC)	1	2	1	2	0	1	0	1	1	1
PSOI (bar)	39.26781	39.19707	39.19194	39.2676	39.33743	39.35557	39.43911	39.29423	39.28366	39.4405
TSOI (K)	770.2779	772.0741	767.9712	774.6765	766.78	776.7247	775.8465	769.6935	767.8991	776.582
nC7 @ 16.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.938499	7.561241	7.686536	7.979246	8.083287	8.056987	8.008162	7.969218	8.135829	8.086394
IGDtime (ms)	0.64	0.72	0.64	0.86	0.7	0.7	0.68	0.88	0.76	0.92
SOI (deg ATC)	1	0	0	1	1	1	1	1	1	1
PSOI (bar)	41.78606	41.83813	41.85834	41.86462	41.76364	41.76128	41.86178	41.86223	41.82726	41.88713
TSOI (K)	821.0312	815.6551	816.2653	821.4819	816.1979	820.5411	817.3741	824.499	820.427	817.4362
nC7 @ 18.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.265495	7.393437	7.376246	7.255419	7.45245	7.389091	7.501269	7.093983	7.588101	7.63958
IGDtime (ms)	0.38	0.36	0.34	0.44	0.24	0.36	0.36	0.38	0.34	0.32
SOI (deg ATC)	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
PSOI (bar)	46.35069	46.41299	46.44307	46.36792	46.44506	46.36361	46.45917	46.38835	46.4695	46.48547
TSOI (K)	912.0144	914.122	913.8868	912.9354	914.2494	916.9954	907.3225	908.6137	913.9672	910.2571

nC7 @ 13.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	0.007306	-0.00161	0.004619	9.819961	-0.23111	0.044285	-0.28274	0.028327	0.04213	0.014747
IGDtime (ms)	0	0	0	2.34	0	0	0	0	0	0
SOI (deg ATC)	4	4	4	4	4	4	3	4	4	4
PSOI (bar)	36.80031	36.78795	36.77495	36.90158	34.63056	37.1073	37.02011	36.96576	37.00403	36.95044
TSOI (K)	747.0521	736.0154	735.0067	737.6515	692.3495	742.5258	730.3762	741.8487	743.0341	742.3245
nC7 @ 14.4 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	8.807081	9.228922	9.215385	9.252024	8.862642	8.991171	8.542879	9.186265	8.537972	8.946915
IGDtime (ms)	1.96	1.44	1.22	1.64	1.42	1.08	1.08	1.46	1.02	1.48
SOI (deg ATC)	0	1	1	1	1	1	0	1	0	1
PSOI (bar)	39.41251	39.47331	39.40032	39.48943	39.39069	39.46901	39.4417	39.49613	39.57411	39.65187
TSOI (K)	768.6061	778.8026	771.2847	776.6249	770.8825	774.276	773.54	777.5436	776.7258	775.5657
nC7 @ 16.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	7.552374	7.652032	8.045281	8.07694	7.499135	7.988477	8.080483	7.974069	7.999058	8.134963
IGDtime (ms)	0.84	0.54	0.88	0.74	0.72	0.68	0.88	0.7	0.7	0.84
SOI (deg ATC)	0	0	1	1	0	1	1	1	1	1
PSOI (bar)	41.86796	41.91021	41.87912	41.91189	41.94139	41.92292	41.98849	42.06322	41.94971	41.97049
TSOI (K)	819.1675	818.178	823.1	824.0055	817.0849	822.0605	825.767	827.176	818.3213	826.1988
nC7 @ 18.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	7.478419	7.792337	7.393245	7.449023	7.496696	7.404998	7.415459	7.515687	7.521022	7.471809
IGDtime (ms)	0.3	0.32	0.24	0.34	0.34	0.32	0.26	0.34	0.26	0.28
SOI (deg ATC)	-2	-1	-2	-2	-2	-2	-2	-2	-2	-3
PSOI (bar)	46.48903	46.45654	46.49232	46.46005	46.48992	46.465	46.5503	46.52025	46.57822	46.23818
TSOI (K)	903.8039	908.1354	904.263	910.0878	910.8704	916.8428	918.392	915.8806	924.8337	910.0268

nC7 @ 13.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	0.025143	0.01642	0.026242	0.017921	0.01334	0.02454	0.020875	0.039303	0.011885	0.038894
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	4	4	5	4	4	4	4	4	4	4
PSOI (bar)	37.02246	36.93167	36.56039	36.85224	36.92884	37.00595	36.88027	36.98952	36.92058	37.03316
TSOI (K)	739.8632	740.1648	738.6327	737.856	752.6433	738.4642	747.4258	740.57	740.4504	739.0145
nC7 @ 14.4 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	9.176935	9.06548	8.553517	8.97923	8.523892	8.410846	8.843355	8.500034	8.405436	8.92082
IGDtime (ms)	1.6	1.08	1.1	0.92	1.44	1.04	1.06	1.22	1.46	1.26
SOI (deg ATC)	1	1	0	1	0	0	1	0	0	1
PSOI (bar)	39.58608	39.64218	39.62486	39.64206	39.66125	39.71726	39.60105	39.59307	39.65965	39.59824
TSOI (K)	778.5209	774.7201	776.7648	780.9385	774.4689	781.1029	775.4106	774.5511	775.0129	773.5645
nC7 @ 16.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	8.04665	8.1478	7.961296	7.497994	7.962766	8.154519	8.03545	7.688253	7.536417	7.855295
IGDtime (ms)	0.66	0.7	0.7	0.9	0.76	0.56	0.68	0.58	0.84	0.5
SOI (deg ATC)	1	1	1	0	1	1	1	0	0	1
PSOI (bar)	41.95249	42.00018	42.06472	41.9947	42.08716	42.05776	41.98474	42.08905	42.09176	42.0875
TSOI (K)	820.1519	818.7851	821.8495	818.1342	823.4537	827.061	822.61	828.2297	821.3808	824.715
nC7 @ 18.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	7.477317	7.581297	7.914682	7.486681	7.319634	6.713617	6.896597	7.30217	7.386524	
IGDtime (ms)	0.28	0.3	0.34	0.28	0.3	0.22	0.3	0.28	0.36	
SOI (deg ATC)	-2	-2	-1	-2	-2	1	0	-1	-2	
PSOI (bar)	46.50807	46.43461	46.53853	46.66574	46.63132	46.94276	46.90081	46.85612	46.60719	
TSOI (K)	909.0965	915.9123	904.8777	916.6624	911.5782	919.5625	914.8544	915.5287	917.4168	

Appendix F: Raw Data for Conventional Naval Aviation Fuel

JP-5 @ 18.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-1.04759	8.139351	7.106138	-1.02074	8.460149	7.976374	7.299885	-0.62727	7.959008	7.549256
IGDtime (ms)	0	2.88	4.14	0	1.48	3.32	3.8	0	1.64	2.06
SOI (deg ATC)	-4	-2	-4	-3	-2	-5	-4	-3	-4	-5
PSOI (bar)	36.01474	40.96652	42.75469	43.61088	45.72359	43.1198	43.65962	43.86984	45.16622	43.19927
TSOI (K)	710.8035	798.8023	848.1812	855.9795	898.8282	873.8521	872.4883	863.5035	893.5733	872.0311
JP-5 @ 16.0 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-0.99765	-0.98313	8.037076	-0.87868	9.319932	-0.8498	8.645311	7.367941	6.944083	-0.82955
IGDtime (ms)	0	0	3.58	0	2.08	0	2.96	3.98	3.86	0
SOI (deg ATC)	-3	-2	-3	-4	-5	-5	-5	-4	-5	-5
PSOI (bar)	33.24845	37.08534	40.27581	39.08737	40.41477	39.40625	40.45296	39.29052	39.45781	39.55158
TSOI (K)	645.8301	716.1802	789.7274	776.5775	819.236	796.4074	819.5931	780.5509	797.2889	798.7156
JP-5 @ 14.4 CR										
Engine Cycles	1	2	3	4	5	6	7	8	9	10
GMEP	-1.16734	-0.7395	-0.43808	-0.71571	-0.63832	-0.68034	-0.32537	-0.66025	-0.61884	-0.64651
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	-4	-1	-2	-4	-4	-4	-3	-4	-4	-4
PSOI (bar)	29.99649	33.02259	35.77844	35.0273	36.35432	36.16555	36.27029	36.21177	36.26741	36.26942
TSOI (K)	594.5561	640.075	694.1855	689.153	721.5969	724.0798	713.8189	724.6154	721.4685	720.2763

JP-5 @ 18.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	7.386784	7.343859	7.387704	7.416204	7.303634	7.259918	7.281933	7.480771	7.309768	7.41071
IGDtime (ms)	1.94	2.04	2.12	2.46	2.2	1.86	2.5	2.54	2.14	2.62
SOI (deg ATC)	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
PSOI (bar)	43.20288	43.38954	43.42014	43.42955	43.52757	43.51241	43.59267	43.65139	43.55099	43.6627
TSOI (K)	872.5194	867.4406	875.0217	876.6999	879.923	869.397	878.7165	878.1853	869.7909	882.8765
JP-5 @ 16.0 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	8.457431	7.061098	5.87832	6.985171	-0.73003	8.550219	7.693148	-0.82755	8.298039	6.983016
IGDtime (ms)	3.2	3.72	4.24	4.02	0	2.88	3.4	0	2.88	4
SOI (deg ATC)	-4	-5	-5	-5	-5	-5	-5	-5	-5	-5
PSOI (bar)	41.18368	39.41025	39.4507	39.85403	39.65602	40.86285	39.43284	39.53358	40.88296	39.47143
TSOI (K)	826.2301	789.7674	798.3557	798.6954	805.2213	818.4189	794.3142	801.9199	831.2854	798.5876
JP-5 @ 14.4 CR										
Engine Cycles	11	12	13	14	15	16	17	18	19	20
GMEP	-0.62077	-0.66562	-0.32889	-0.60534	-0.63568	-0.57888	-0.26946	-0.65561	-0.59833	-0.61418
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	-4	-4	-3	-4	-4	-4	-3	-4	-4	-4
PSOI (bar)	36.30591	36.18602	36.33691	36.2705	36.22174	36.40303	36.29048	36.24632	36.22745	36.13371
TSOI (K)	716.6362	721.3932	714.1053	719.0169	721.4789	728.2828	720.6572	717.3552	723.0954	716.7809

JP-5 @ 18.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.320575	7.179313	7.613994	7.805007	7.281602	7.348045	7.310633	7.363786	7.330943	7.234447
IGDtime (ms)	2.3	1.82	2.26	2.28	1.7	1.86	1.96	1.94	1.6	1.76
SOI (deg ATC)	-5	-5	-4	-4	-5	-5	-6	-6	-6	-6
PSOI (bar)	43.58469	43.73936	43.59103	43.83098	43.84094	43.81098	43.22999	43.26591	43.21395	43.2352
TSOI (K)	881.5096	882.9985	878.0494	873.2492	882.568	887.0343	885.8644	882.2146	888.3489	877.0414
JP-5 @ 16.0 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	7.487282	-0.45309	8.853905	7.051051	7.754718	7.497024	-0.79157	8.476602	7.582488	7.213846
IGDtime (ms)	3.76	0	1.9	4.14	2.24	4.02	0	2.16	3.68	3.62
SOI (deg ATC)	-5	-4	-5	-6	-5	-5	-5	-5	-6	-5
PSOI (bar)	39.73408	39.75816	40.98626	38.9905	39.80133	39.26158	39.76745	41.14391	39.28585	39.84117
TSOI (K)	799.1459	796.7793	827.5662	794.5178	802.2554	779.735	804.4868	832.132	804.2139	802.9328
JP-5 @ 14.4 CR										
Engine Cycles	21	22	23	24	25	26	27	28	29	30
GMEP	-0.57674	-0.63063	-0.63884	-0.60679	-0.64182	-0.60373	-0.59005	-0.58816	-0.34616	-0.25125
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	-4	-4	-4	-4	-4	-4	-5	-4	-3	-3
PSOI (bar)	36.27281	36.1826	36.18532	36.38853	36.25169	36.42599	35.78068	36.37664	36.30443	36.17033
TSOI (K)	723.1012	720.0466	716.9398	725.2196	722.6742	727.2517	711.4332	730.3288	716.6571	712.4553

JP-5 @ 18.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	7.243461	7.765935	7.324266	7.341562	7.248653	7.131296	7.345268	7.842325	7.287382	7.73984
IGDtime (ms)	1.64	1.76	1.68	1.8	1.72	1.6	1.54	1.74	1.68	1.62
SOI (deg ATC)	-6	-5	-6	-6	-6	-6	-6	-5	-6	-5
PSOI (bar)	43.17922	43.2494	43.27021	43.38041	43.31521	43.32255	43.33359	43.34195	43.38302	43.48216
TSOI (K)	870.1209	866.3455	874.3656	886.868	892.0354	885.9722	889.0595	873.0544	887.2126	874.7071
JP-5 @ 16.0 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	6.33117	7.323004	7.44867	7.763697	7.357725	6.874319	7.343143	7.116052	7.405698	7.423353
IGDtime (ms)	4.48	3.34	3.2	3.56	3.52	4.12	2.96	3.6	2.96	3.42
SOI (deg ATC)	-5	-5	-5	-4	-5	-5	-5	-5	-5	-5
PSOI (bar)	39.96054	40.17166	39.99762	40.01506	39.93721	40.0286	40.12565	39.95652	40.12472	40.08594
TSOI (K)	812.2286	809.3507	806.4795	799.7224	805.2105	808.852	809.7011	801.2822	812.1722	813.6572
JP-5 @ 14.4 CR										
Engine Cycles	31	32	33	34	35	36	37	38	39	40
GMEP	-0.61904	-0.60145	-0.67779	-0.62426	-0.60695	-0.60659	-0.59808	-0.60272	-0.60065	-0.32842
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	-4	-4	-5	-4	-5	-5	-4	-4	-4	-3
PSOI (bar)	36.31356	36.41725	35.71627	36.39055	35.78979	35.80315	36.31392	36.48002	36.40341	36.37608
TSOI (K)	723.6499	719.076	712.0383	727.3917	716.0107	714.1959	720.9729	727.5468	726.5039	714.4548

JP-5 @ 18.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	7.290091	7.144588	7.743842	7.315655	7.386658	7.210759	7.837339	7.392144	7.255914	7.271239
IGDtime (ms)	1.8	1.6	1.66	1.62	1.48	1.46	1.54	1.64	1.62	1.5
SOI (deg ATC)	-6	-6	-5	-6	-6	-6	-5	-6	-6	-6
PSOI (bar)	43.39163	43.5591	43.46431	43.55585	43.49353	43.52299	43.54053	43.55096	43.58577	43.58875
TSOI (K)	896.2097	888.2593	877.8975	885.6112	888.5213	893.0632	879.8405	893.6703	889.0091	891.7346
JP-5 @ 16.0 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	6.938976	7.469177	7.374968	7.300357	6.411928	7.498616	7.27176	7.85	7.325087	7.232499
IGDtime (ms)	3.58	3.2	2.48	3.46	4.9	2.78	3.08	3.02	3.68	3.38
SOI (deg ATC)	-5	-5	-5	-6	-5	-5	-5	-4	-6	-5
PSOI (bar)	40.12233	40.22467	40.13932	39.57603	40.20399	40.35684	40.09772	40.24014	39.52178	40.29503
TSOI (K)	806.8094	813.3048	815.3535	796.3489	807.9507	808.435	806.8598	805.4141	794.8487	813.4162
JP-5 @ 14.4 CR										
Engine Cycles	41	42	43	44	45	46	47	48	49	50
GMEP	-0.63934	-0.60954	-0.60631	-0.66043	-0.5906	-0.64829	-0.62286	-0.57177	-0.59076	-0.58974
IGDtime (ms)	0	0	0	0	0	0	0	0	0	0
SOI (deg ATC)	-4	-5	-5	-5	-4	-4	-4	-4	-4	-4
PSOI (bar)	36.26941	35.87289	35.87458	35.90868	36.4035	36.39238	36.34321	36.47979	36.40618	36.5219
TSOI (K)	722.7735	716.2278	716.8685	720.3065	727.4861	724.4424	724.2125	726.9909	727.4087	728.0182

JP-5 @ 18.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	7.361425	7.225394	7.364431	7.687446	7.302822	7.252198	7.222108	7.266515	7.218181	7.346855
IGDtime (ms)	1.5	1.28	1.7	1.5	1.48	1.34	1.46	1.38	1.5	1.44
SOI (deg ATC)	-6	-6	-6	-5	-6	-6	-6	-6	-6	-6
PSOI (bar)	43.59342	43.67395	43.65146	43.67041	43.67403	43.76513	43.68572	43.65024	43.68946	43.76182
TSOI (K)	891.7678	887.0452	890.0768	884.1281	891.9588	895.912	898.7754	899.2609	894.2651	884.4462
JP-5 @ 16.0 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	7.523214	7.417941	7.433463	7.35596	7.502498	7.439232	7.431165	7.379823	7.476382	7.172116
IGDtime (ms)	3.28	2.66	2.58	2.34	2.64	2.58	2.76	2.38	3.5	2.56
SOI (deg ATC)	-4	-5	-6	-6	-6	-6	-6	-6	-6	-5
PSOI (bar)	40.19843	40.39855	39.76577	39.73892	39.70444	39.73652	39.78885	39.87929	39.8235	40.45074
TSOI (K)	807.3257	814.1297	802.1879	813.368	820.2788	815.0158	817.6665	823.0259	810.3285	816.7679
JP-5 @ 14.4 CR										
Engine Cycles	51	52	53	54	55	56	57	58	59	60
GMEP	-0.5848	-0.34446	-0.28107	-0.61501	-0.65672	-0.6274	10.60986	-0.8021	-0.6388	-0.62534
IGDtime (ms)	0	0	0	0	0	0	4.22	0	0	0
SOI (deg ATC)	-5	-4	-4	-5	-5	-4	-4	-5	-5	-4
PSOI (bar)	35.84166	35.8824	35.99587	35.92764	36.02052	36.53752	36.45597	35.28469	36.16377	36.67164
TSOI (K)	713.988	706.9718	710.258	724.9548	716.9375	733.6201	725.5496	714.4856	723.4471	735.0961

JP-5 @ 18.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.219117	7.258425	7.180909	7.273349	7.161584	7.204324	7.295947	7.18157	7.094298	7.23171
IGDtime (ms)	1.3	1.34	1.38	1.36	1.28	1.28	1.4	1.34	1.32	1.18
SOI (deg ATC)	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
PSOI (bar)	43.66804	43.70202	43.87842	43.76097	43.82557	43.83106	43.80457	43.92958	43.83283	43.82412
TSOI (K)	898.4619	899.7346	893.4504	889.4961	893.7476	893.2537	899.385	903.7889	892.8127	895.6524
JP-5 @ 16.0 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	7.169816	7.315841	7.262016	7.783603	7.237686	7.349549	7.368558	7.346421	7.248225	7.161414
IGDtime (ms)	2.34	2	2.22	2.22	2.4	2.08	2.46	2.12	2.1	2.1
SOI (deg ATC)	-6	-6	-6	-5	-6	-6	-6	-6	-6	-6
PSOI (bar)	39.83109	39.82925	39.89999	39.79998	39.76536	39.83192	39.85606	39.85116	39.80476	39.78839
TSOI (K)	817.731	822.6357	817.6692	797.8881	820.4486	819.0956	816.7366	817.6546	814.6756	807.8599
JP-5 @ 14.4 CR										
Engine Cycles	61	62	63	64	65	66	67	68	69	70
GMEP	-0.60839	10.28065	-0.79935	-0.68316	-0.36605	-0.59268	-0.64938	9.872244	-0.78492	-0.65123
IGDtime (ms)	0	4.42	0	0	0	0	0	4.58	0	0
SOI (deg ATC)	-5	-5	-5	-5	-4	-5	-5	-5	-5	-5
PSOI (bar)	35.99883	36.20554	35.42265	36.17833	36.18237	36.23563	36.02287	36.11617	35.54503	36.40801
TSOI (K)	725.0486	730.075	713.5985	723.8021	711.4014	727.6598	720.534	726.216	716.5937	735.7139

JP-5 @ 18.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	7.244905	7.792319	7.739543	7.34576	7.326831	7.126687	7.233626	7.819372	7.238583	7.305123
IGDtime (ms)	1.34	1.48	1.36	1.16	1.16	1.26	1.2	1.36	1.16	1.2
SOI (deg ATC)	-6	-5	-5	-6	-6	-6	-6	-5	-6	-6
PSOI (bar)	43.8112	43.92399	43.83135	43.91892	44.04541	43.95789	44.00934	43.89383	44.0015	44.01835
TSOI (K)	888.7964	880.7496	884.3738	897.2911	900.7052	899.1293	901.0051	885.7239	904.7487	902.7051
JP-5 @ 16.0 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	7.366983	7.346619	7.133675	7.781369	7.157206	7.215927	7.332299	7.168789	7.300769	7.124769
IGDtime (ms)	2.28	2.5	1.68	2.48	1.86	1.9	2.24	1.94	2.28	1.9
SOI (deg ATC)	-6	-6	-6	-5	-6	-6	-6	-6	-6	-6
PSOI (bar)	39.74922	39.88701	39.9316	39.88308	39.96797	39.93457	39.91488	40.00135	39.94746	40.02439
TSOI (K)	813.2159	817.9185	816.1035	802.0742	811.4466	818.7907	814.6419	820.2421	819.3629	814.4633
JP-5 @ 14.4 CR										
Engine Cycles	71	72	73	74	75	76	77	78	79	80
GMEP	-0.61666	-0.62215	-0.28345	10.26942	-0.77386	-0.33887	-0.64705	-0.30098	-0.25185	-0.64067
IGDtime (ms)	0	0	0	4.44	0	0	0	0	0	0
SOI (deg ATC)	-5	-5	-4	-4	-5	-4	-5	-4	-4	-5
PSOI (bar)	36.39931	36.34506	36.23697	36.27262	35.58881	36.44295	36.48433	36.2501	36.31557	36.31013
TSOI (K)	733.6228	736.696	720.2997	722.1569	714.2947	731.8963	731.4607	724.8598	722.8152	736.9275

JP-5 @ 18.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	7.252698	7.291674	7.356604	7.288953	7.27273	7.330422	7.189976	7.213354	7.283355	7.282027
IGDtime (ms)	1.16	1.18	1.28	1.2	1.22	1.12	1.24	1.2	1.18	1.3
SOI (deg ATC)	-6	-6	-6	-6	-6	-6	-6	-6	-6	-7
PSOI (bar)	43.98335	44.01763	44.08464	44.09721	44.0856	44.07115	44.00959	44.0576	44.11497	43.28724
TSOI (K)	897.7431	910.4894	904.6597	900.6863	902.4254	902.0651	899.3159	900.9861	902.944	883.4477
JP-5 @ 16.0 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	7.317106	7.10752	7.259791	7.063683	7.232347	7.083758	7.641497	7.091199	7.688233	7.563658
IGDtime (ms)	2.1	1.92	2.14	1.74	1.9	1.76	1.92	1.94	1.92	1.7
SOI (deg ATC)	-6	-6	-6	-6	-7	-7	-6	-7	-5	-6
PSOI (bar)	39.93709	39.9715	39.94386	39.96642	39.29662	39.39385	39.32779	39.33278	40.05696	39.37519
TSOI (K)	819.4553	819.3987	814.8077	813.2494	802.3746	818.2601	803.5745	805.9786	810.522	791.7449
JP-5 @ 14.4 CR										
Engine Cycles	81	82	83	84	85	86	87	88	89	90
GMEP	-0.58063	9.741252	-0.78799	-0.65381	8.808137	-0.45338	9.62402	-0.49292	-0.68827	-0.32996
IGDtime (ms)	0	4.26	0	0	4.8	0	3.64	0	0	0
SOI (deg ATC)	-5	-5	-5	-5	-5	-4	-5	-4	-5	-4
PSOI (bar)	36.32437	36.38723	35.67276	36.57817	36.48023	35.68475	36.6638	35.72661	36.56337	36.54928
TSOI (K)	734.5599	731.1131	715.9285	739.6625	741.0158	711.2058	737.8325	709.4878	734.5924	732.6919

JP-5 @ 18.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	7.183635	7.282768	7.212915	7.189465	7.309394	7.296815	7.353527	7.126609	7.254717	7.325634
IGDtime (ms)	1.16	1.04	1.02	1.2	1.18	1.04	1.02	1.18	1.2	0.88
SOI (deg ATC)	-6	-7	-6	-6	-7	-6	-7	-6	-7	-6
PSOI (bar)	44.10792	43.29235	44.10047	44.12581	43.35043	44.23825	43.41975	44.19799	43.37188	44.17218
TSOI (K)	901.9138	885.7932	905.5189	898.0369	879.6117	905.9442	901.0736	893.5695	892.7667	907.0384
JP-5 @ 16.0 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	7.640375	7.617796	7.253646	7.200038	7.181137	7.137997	7.226949	7.108445	7.104987	7.166964
IGDtime (ms)	1.82	1.94	1.94	1.7	1.96	1.92	1.78	1.78	1.64	1.46
SOI (deg ATC)	-6	-6	-7	-7	-7	-7	-7	-7	-7	-7
PSOI (bar)	39.35027	39.3152	39.38987	39.44984	39.41088	39.40454	39.41237	39.41065	39.48706	39.38702
TSOI (K)	807.6754	796.0255	820.6539	806.8556	823.5872	805.077	826.5794	806.6857	822.7318	822.1273
JP-5 @ 14.4 CR										
Engine Cycles	91	92	93	94	95	96	97	98	99	100
GMEP	-0.57899	9.735609	-0.49891	-0.37814	8.858303	-0.7967	9.161952	-0.79932	-0.65819	-0.64209
IGDtime (ms)	0	3.74	0	0	4.18	0	3.7	0	0	0
SOI (deg ATC)	-5	-5	-4	-4	-5	-5	-5	-5	-5	-5
PSOI (bar)	36.63643	36.63051	35.62941	36.60361	36.75752	35.66055	36.64335	35.71613	36.78962	36.69538
TSOI (K)	738.096	737.4284	712.3148	729.9409	737.4894	722.6692	741.6702	719.9559	741.3623	742.0058

JP-5 @ 18.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.35797	7.294315	7.107957	7.205649	7.389236	7.268555	7.331366	7.218811	7.380045	7.305186
IGDtime (ms)	1.04	1.04	1.08	1.08	1.08	1.04	1.04	1.04	1.04	1.04
SOI (deg ATC)	-6	-7	-6	-6	-7	-7	-7	-7	-7	-7
PSOI (bar)	44.11284	43.42757	44.28791	44.21221	43.39848	43.50036	43.54282	43.44259	43.50288	43.51742
TSOI (K)	895.1443	886.911	913.6228	905.5619	887.7338	884.9967	906.21	889.6305	888.0155	894.4692
JP-5 @ 16.0 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	7.150042	7.240018	7.145908	7.158791	7.059673	7.203778	7.079689	7.136979	7.195646	7.255398
IGDtime (ms)	1.62	1.68	1.64	1.58	1.62	1.8	1.6	1.62	1.82	1.92
SOI (deg ATC)	-7	-7	-7	-7	-7	-7	-7	-7	-7	-7
PSOI (bar)	39.44611	39.49708	39.38142	39.49517	39.48466	39.46274	39.41973	39.46956	39.48283	39.40032
TSOI (K)	820.9175	824.2925	817.4875	821.8237	818.9562	821.2642	824.5371	820.9159	818.0951	820.2876
JP-5 @ 14.4 CR										
Engine Cycles	101	102	103	104	105	106	107	108	109	110
GMEP	-0.61397	9.843239	-0.78383	8.744395	-0.47587	8.28658	-0.43593	9.144972	-0.45931	8.266394
IGDtime (ms)	0	3.5	0	4.06	0	4.1	0	3.36	0	4.08
SOI (deg ATC)	-5	-5	-5	-5	-4	-5	-4	-5	-4	-5
PSOI (bar)	36.75513	36.75052	35.93361	36.7498	35.94916	36.7891	36.06133	36.8587	35.92674	36.91762
TSOI (K)	739.2296	738.6752	718.6776	736.2408	717.8039	740.5387	711.5957	741.4166	715.7889	741.6336

JP-5 @ 18.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.341727	7.300797	7.244255	7.429788	7.345907	7.259578	7.29228	7.19404	7.380625	7.336671
IGDtime (ms)	1.06	1.06	1.12	1.06	1.14	0.98	1.02	1.06	1	1.06
SOI (deg ATC)	-6	-6	-7	-7	-6	-6	-7	-6	-6	-7
PSOI (bar)	44.28209	44.31636	43.41017	43.46198	44.37	44.37058	43.58202	44.35487	44.40443	43.66045
TSOI (K)	900.2833	906.737	884.0348	899.6427	910.5748	908.451	889.0795	908.626	910.2872	891.3882
JP-5 @ 16.0 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.279825	7.178557	7.24509	7.039476	7.006982	7.202234	7.47897	7.175074	7.014636	6.996988
IGDtime (ms)	1.8	1.78	1.64	1.58	1.62	1.74	1.82	1.62	1.58	1.58
SOI (deg ATC)	-7	-7	-7	-7	-7	-7	-6	-7	-7	-7
PSOI (bar)	39.40046	39.49797	39.60243	39.55549	39.55042	39.62135	39.53954	39.62741	39.60961	39.68977
TSOI (K)	819.2757	820.9795	823.6726	823.5108	823.5274	824.9683	810.8901	822.3706	815.2653	823.6488
JP-5 @ 14.4 CR										
Engine Cycles	111	112	113	114	115	116	117	118	119	120
GMEP	7.86481	-0.75891	7.506594	-0.75998	8.643973	7.835458	-0.79854	8.535127	-0.49273	8.049114
IGDtime (ms)	3.58	0	5.36	0	3.48	3.7	0	3.34	0	4.82
SOI (deg ATC)	-5	-5	-5	-5	-5	-5	-5	-5	-4	-5
PSOI (bar)	36.05129	36.02797	37.1248	36.15716	37.10587	36.02402	36.08406	37.16152	36.05537	37.07779
TSOI (K)	729.1785	728.8557	750.6897	726.7441	743.478	733.4954	725.6083	751.3161	713.5084	752.8268

JP-5 @ 18.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.271364	7.209336	7.431765	7.181309	7.255878	7.273505	7.357032	7.246842	7.152815	7.269798
IGDtime (ms)	1	1.06	1.06	0.96	1.02	1.04	1.04	1.08	1	0.98
SOI (deg ATC)	-7	-6	-7	-6	-7	-7	-7	-7	-7	-7
PSOI (bar)	43.5318	44.36169	43.57875	44.4734	43.57525	43.64212	43.58457	43.61132	43.66842	43.6995
TSOI (K)	892.0431	912.2046	903.4364	915.4061	895.103	890.3959	887.5301	894.5269	898.4744	894.6049
JP-5 @ 16.0 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	7.040835	7.164086	7.038829	7.160939	7.064554	7.128828	7.144857	7.13225	7.125139	7.190773
IGDtime (ms)	1.64	1.5	1.56	1.48	1.46	1.46	1.42	1.6	1.44	1.44
SOI (deg ATC)	-7	-7	-7	-7	-7	-7	-7	-7	-7	-7
PSOI (bar)	39.59935	39.65678	39.50453	39.66732	39.6204	39.53405	39.7242	39.65483	39.61124	39.62938
TSOI (K)	823.5399	826.8972	822.2925	832.3766	827.4111	818.1872	817.1854	826.9564	822.939	823.8751
JP-5 @ 14.4 CR										
Engine Cycles	121	122	123	124	125	126	127	128	129	130
GMEP	-0.74767	8.115778	6.938826	-0.75186	8.490148	7.762044	7.654907	7.418587	7.310269	-0.4307
IGDtime (ms)	0	4.18	4.86	0	2.58	3.34	4.12	3.92	3.88	0
SOI (deg ATC)	-5	-5	-5	-5	-5	-5	-4	-5	-5	-4
PSOI (bar)	36.17364	37.16188	36.1664	36.28323	37.3075	36.12675	36.30724	36.28906	36.27971	36.29587
TSOI (K)	732.357	742.9495	727.9493	732.686	743.6386	729.3902	724.889	726.4188	734.3529	726.5361

JP-5 @ 18.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	7.35507	7.32093	7.281911	7.367918	7.196996	7.115778	7.178178	7.328443	7.21282	7.374665
IGDtime (ms)	1	0.86	1.02	0.98	1.04	1	0.82	1.02	0.96	0.9
SOI (deg ATC)	-7	-6	-7	-7	-7	-7	-6	-7	-6	-7
PSOI (bar)	43.63568	44.52813	43.7445	43.71076	43.63929	43.63386	44.62492	43.69974	44.63741	43.73956
TSOI (K)	894.2376	911.4181	891.3159	913.4935	893.3585	893.0094	912.1821	898.388	911.6438	910.1651
JP-5 @ 16.0 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	7.198324	7.116536	7.250442	7.685986	7.075524	7.059819	7.174072	7.034289	7.121704	7.113449
IGDtime (ms)	1.48	1.44	1.64	1.46	1.28	1.4	1.62	1.38	1.5	1.58
SOI (deg ATC)	-7	-7	-7	-6	-7	-7	-7	-7	-7	-7
PSOI (bar)	39.6024	39.58776	39.51598	39.73212	39.66949	39.68126	39.58606	39.60489	39.70299	39.6978
TSOI (K)	825.9341	825.9157	828.0705	810.1686	824.6902	825.2704	826.3804	828.221	825.2761	826.6206
JP-5 @ 14.4 CR										
Engine Cycles	131	132	133	134	135	136	137	138	139	140
GMEP	8.351902	-0.39223	8.249644	7.296795	-0.36955	8.272427	7.79772	7.282477	-0.73227	8.318694
IGDtime (ms)	2.56	0	4.52	4.26	0	2.86	4.36	4.68	0	2.44
SOI (deg ATC)	-5	-5	-4	-5	-4	-5	-4	-4	-5	-5
PSOI (bar)	37.35493	35.80452	37.23131	36.33475	36.41298	37.35522	36.20427	36.34733	36.58321	37.518
TSOI (K)	752.5435	726.0929	740.7823	728.0337	722.7826	748.5078	718.3806	726.0084	742.0977	755.9932

JP-5 @ 18.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	7.357354	7.356795	7.34448	7.340471	7.336071	7.231575	7.151936	7.352473	7.842499	7.179706
IGDtime (ms)	0.9	1.02	1.02	0.86	1	0.96	0.94	0.86	0.82	0.84
SOI (deg ATC)	-7	-7	-7	-6	-7	-6	-7	-7	-6	-7
PSOI (bar)	43.64883	43.70166	43.74395	44.61885	43.76345	44.54784	43.84371	43.7927	43.77227	43.88878
TSOI (K)	909.4921	907.4194	893.7743	912.5696	895.8352	908.5241	909.2892	907.2598	895.5586	920.7447
JP-5 @ 16.0 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	7.030307	7.050189	7.191829	7.56559	7.249613	7.081214	7.09351	7.115381	7.522076	7.172667
IGDtime (ms)	1.56	1.34	1.48	1.46	1.44	1.36	1.4	1.36	1.44	1.28
SOI (deg ATC)	-7	-7	-7	-6	-7	-7	-7	-7	-6	-7
PSOI (bar)	39.66788	39.71879	39.74344	39.69003	39.76295	39.73139	39.74244	39.70739	39.84489	39.82165
TSOI (K)	827.2314	828.7705	827.4716	812.4691	825.8724	825.758	824.2942	824.8298	809.1905	818.4034
JP-5 @ 14.4 CR										
Engine Cycles	141	142	143	144	145	146	147	148	149	150
GMEP	-0.39808	8.248056	-0.74578	8.19229	7.96973	-0.71368	8.201212	7.330525	7.386037	6.960897
IGDtime (ms)	0	3.72	0	2.96	3.84	0	3.3	4.22	3.76	4.46
SOI (deg ATC)	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
PSOI (bar)	35.83386	37.28418	36.27623	37.38046	35.89798	36.36488	37.37818	36.31792	36.51174	36.41302
TSOI (K)	723.6054	752.6179	731.314	757.6134	718.615	735.4564	750.3044	735.3292	734.3943	738.32

JP-5 @ 18.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.307864	7.264785	7.233474	7.29326	7.129009	7.301139	7.35345	7.421757	7.33549	7.207218
IGDtime (ms)	0.86	1.02	0.9	0.94	0.8	0.86	0.94	1	0.88	0.92
SOI (deg ATC)	-7	-6	-7	-7	-6	-7	-7	-7	-7	-7
PSOI (bar)	43.83298	44.7747	43.97147	43.82434	44.71416	43.78365	43.83444	43.81745	44.00691	43.79511
TSOI (K)	911.2401	907.7536	895.0546	898.3111	919.1157	910.6723	908.2982	896.5659	911.2971	911.3466
JP-5 @ 16.0 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.055044	7.174866	7.206369	7.109284	7.134717	7.634513	7.132627	7.080431	7.128782	7.130481
IGDtime (ms)	1.42	1.34	1.3	1.36	1.3	1.44	1.3	1.3	1.3	1.28
SOI (deg ATC)	-7	-7	-7	-7	-7	-6	-7	-7	-7	-7
PSOI (bar)	39.7832	39.73489	39.74594	39.79042	39.8038	39.80658	39.82082	39.82007	39.81458	39.8634
TSOI (K)	827.065	824.1761	828.6017	833.6221	833.1322	812.3791	834.9976	830.0824	830.8102	831.5316
JP-5 @ 14.4 CR										
Engine Cycles	151	152	153	154	155	156	157	158	159	160
GMEP	7.520332	7.448525	-0.39771	7.886311	7.528437	-0.6979	7.93109	-0.69527	8.070572	7.579076
IGDtime (ms)	2.96	3.22	0	3.68	3.76	0	2.56	0	2.02	3.76
SOI (deg ATC)	-5	-5	-4	-5	-5	-5	-5	-6	-5	-6
PSOI (bar)	36.57679	36.46286	36.50868	37.50841	36.43907	36.46028	37.47202	35.90493	37.59836	35.97545
TSOI (K)	741.4963	735.1138	731.7529	756.0172	735.8969	739.9968	761.0434	734.8626	761.8417	735.8293

JP-5 @ 18.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.446174	7.11061	7.2954	7.295404	7.809669	7.266596	7.373999	7.288491	7.229489	7.358387
IGDtime (ms)	1.02	0.92	0.88	0.82	0.88	0.82	0.86	0.88	0.84	0.88
SOI (deg ATC)	-7	-7	-7	-7	-6	-7	-7	-7	-7	-7
PSOI (bar)	43.91506	43.99248	43.88636	43.97048	43.91754	43.86955	43.96097	43.92544	43.9452	43.91014
TSOI (K)	914.8922	895.8422	906.5051	921.0243	896.3083	910.2672	910.8487	914.8659	905.0899	916.4688
JP-5 @ 16.0 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.15079	7.156701	7.168322	7.184423	7.185556	6.976846	7.15131	7.060504	7.140941	7.166309
IGDtime (ms)	1.34	1.34	1.18	1.28	1.3	1.26	1.24	1.28	1.32	1.28
SOI (deg ATC)	-7	-7	-7	-7	-7	-7	-7	-7	-7	-7
PSOI (bar)	39.75328	39.81593	39.88196	39.8969	39.80822	39.86658	39.83981	39.8288	39.84456	39.93806
TSOI (K)	825.9558	825.8097	833.5177	827.2877	831.7387	829.5758	828.5016	828.8616	834.1656	833.6843
JP-5 @ 14.4 CR										
Engine Cycles	161	162	163	164	165	166	167	168	169	170
GMEP	7.611068	6.830937	7.552488	7.333206	7.499376	7.377541	7.52425	7.281379	6.946366	7.366991
IGDtime (ms)	3.46	3.04	3.58	3.96	4.12	2.84	3.66	3.74	4.4	3.14
SOI (deg ATC)	-5	-5	-5	-5	-4	-5	-6	-5	-5	-5
PSOI (bar)	36.48186	36.54599	36.62574	36.52283	36.58542	36.66095	36.06322	36.65228	36.53157	36.69208
TSOI (K)	734.8696	732.2984	738.8659	740.3304	728.8631	736.7053	742.067	736.1189	734.9041	739.6162

JP-5 @ 18.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.928209	7.277268	7.260528	7.45489	7.359823	7.492735	7.229118	7.192027	7.274636	7.240713
IGDtime (ms)	0.86	0.92	0.96	0.86	0.84	0.86	0.82	0.8	0.78	0.82
SOI (deg ATC)	-6	-7	-7	-7	-7	-7	-7	-7	-6	-360
PSOI (bar)	43.98596	43.99692	43.99511	43.94642	43.98218	43.96806	44.0234	44.01229	44.85874	
TSOI (K)	906.1326	902.413	902.865	914.1785	911.6318	897.1059	900.7732	893.3997	919.6317	918.5493
JP-5 @ 16.0 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.226201	7.18067	7.086833	7.190974	7.167673	7.105337	7.153748	7.241269	7.230809	7.14666
IGDtime (ms)	1.24	1.12	1.24	1.32	1.32	1.32	1.26	1.34	1.28	1.32
SOI (deg ATC)	-7	-7	-7	-7	-7	-7	-7	-7	-7	-360
PSOI (bar)	39.89977	39.9707	39.89212	39.96589	39.94953	39.90429	39.95922	39.89693	39.91872	
TSOI (K)	830.7033	832.2396	833.4175	832.1508	827.141	828.1816	831.3556	827.8668	829.2281	
JP-5 @ 14.4 CR										
Engine Cycles	171	172	173	174	175	176	177	178	179	180
GMEP	7.29642	7.248172	7.362493	7.285844	7.379627					
IGDtime (ms)	3.54	3.38	3.78	2.86	3.06					
SOI (deg ATC)	-5	-5	-5	-5	-5					
PSOI (bar)	36.60217	36.66183	36.60914	36.6884	36.63316					

JP-5 @ 18.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	7.329278	7.241158	7.363047	7.36684	7.405688	7.237343	7.368894	7.272762	7.41421	7.326093
IGDtime (ms)	0.8	0.82	0.86	0.82	0.82	0.84	0.82	0.78	0.8	0.72
SOI (deg ATC)	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360
PSOI (bar)										
TSOI (K)	913.0329	893.8983	914.8294	915.3048	920.0623	915.3264	900.206	897.4791	917.5164	919.2482
JP-5 @ 16.0 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP	7.246188	7.176349	7.161426	7.227714	7.16191	7.179049	7.133634	7.199267	7.17618	7.143401
IGDtime (ms)	1.32	1.28	1.26	1.14	1.26	1.28	1.2	1.14	1.14	1.1
SOI (deg ATC)	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360
PSOI (bar)										
TSOI (K)										
JP-5 @ 14.4 CR										
Engine Cycles	181	182	183	184	185	186	187	188	189	190
GMEP										
IGDtime (ms)										
SOI (deg ATC)										
PSOI (bar)										
TSOI (K)										

JP-5 @ 18.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	7.407369	7.317139	7.423889	7.377541	7.339409	7.310608	7.298497	7.315503	7.256459	7.412692
IGDtime (ms)	0.84	0.84	0.78	0.74	0.84	0.84	0.8	0.78	0.84	0.8
SOI (deg ATC)	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360
PSOI (bar)										
TSOI (K)	915.9758	918.4377	920.8912	917.8145	914.3021	913.2781	907.9553	915.9105	896.7244	923.9902
JP-5 @ 16.0 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP	7.220326	7.157203	7.157121	7.206764	7.263162	7.143002	7.182862	7.234458	7.200187	7.223722
IGDtime (ms)	1.32	1.24	1.32	1.08	1.24	1.2	1.12	1.16	1.24	1.1
SOI (deg ATC)	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360
PSOI (bar)										
TSOI (K)										
JP-5 @ 14.4 CR										
Engine Cycles	191	192	193	194	195	196	197	198	199	200
GMEP										
IGDtime (ms)										
SOI (deg ATC)										
PSOI (bar)										
TSOI (K)										

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