TURBO-CHARGER QUIZ

Name: _____ Pilot #: _____
(Print)

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A turbocharged engine?

1. A turbocharged airplane, depending on *the type of missions you intend to fly*, a _____ is worth the additional investment of _____ and _____, and could easily be among the most important flying decisions you make -- both from a _____ and _____perspective.

Standard Day: How Aircraft Engines are Rated for Power

1. To understand the impact of a turbocharger, it is helpful to understand how _____ _____ aircraft power and performance.
2. Because the _____changes with altitude – and because these changes impact aircraft_____ – aircraft engines are almost always rated for power at universally agreed conditions known as '_____ _____.'
3. Standard day conditions are based on common atmospheric _____ such as air pressure and temperature.
4. Rating aircraft engine power in this manner provides a _____ to which all aircraft engines can be compared.
5. Standard day is defined to include barometric pressure of _____ inches of mercury (1013.2 millibars), density of _____ lbs./square inch (PSI) and air temperature of ___ degrees Celsius (59 degrees Fahrenheit) at sea level.
6. When an aircraft manufacturer specifies an aircraft engine's horsepower rating, this rating refers to *the engine* _____ *that can be achieved at these* _____ _____ _____.

How Altitude Affects Aircraft Performance

For those new to the world of flying a _____ _____, a common misconception is that manufacturer rated aircraft engine power is maintained throughout aircraft operation. In

other words, if an aircraft is rated for 300 horsepower, it is not always _____that *this does not mean* the aircraft engine will continue to perform at 300 horsepower as it climbs.

Because all aircraft engines are dependent on the _____ _____, and _____ of air for fuel combustion, the amount of _____ an aircraft engine can produce is directly _____upon air being pumped into the engine at consistent pressure and density. However, because atmospheric ___ _____ _____ as an aircraft gains altitude, air density is diminished, causing a relative _____ in engine horsepower.

A normally aspirated engine in fact typically loses about 3% of _____ for every _____ feet of altitude.

How Turbochargers Work

Turbocharging, also known as '_____ _____,' involves the use of a gas compressor to force more _____ into the engine's combustion chamber than would be _____ with a naturally aspirated engine, therefore allowing the engine to maintain _____-_____ _____ _____ as altitude increases. In other words, feeding more _____ to the engine allows the engine to burn more _____ and create more energy to power the aircraft – and-_____, _____rated power - despite increasing altitudes.

The turbocharger is typically housed in a circular casing that contains a small turbine connected by shaft to an impeller wheel. Aircraft _____ is sent directly into the_____, where the turbine converts it into rotating energy which in turn spins the impeller wheel and compresses _____ air. The turbine and impeller found in a turbocharger behave in a very similar manner to the _____ and _____ found in a turboprop (turbine) engine. Following compression, compressed air is discharged directly into the engine's _____ _____.

Turbochargers work in one of two ways: A 'ground boosted' turbocharger directly increases overall power output of the engine to achieve its sea-level rated power. A 'turbo-normalized' turbocharger works to assure that ____ _____ _____ performance is maintained as it reaches higher altitudes.

Turbocharger Cons:

Non-pressurized Aircraft Considerations

The FAA dictates that pilots flying above 12,500 feet for thirty minutes or longer _____ _____ supplemental oxygen -- and many find it necessary at or before 10,000 feet in order to avoid the _____ of hypoxia. Therefore, a *non-pressurized* turbocharged aircraft calls for oxygen on-board in order to take advantage of the higher altitudes turbocharging affords.

Therefore, when considering the use of a turbocharger, it is important to consider both the type of missions you intend to fly, as well as the type of passengers... For families with small children, oxygen masks can at times be challenging to deploy.

TLC for Turbo Charging

Turbocharged aircraft engines tend to be more prone to pilot abuse than _____ _____aircraft engines.

Ground-boosted turbo engines, in particular, call for more_____ _____ treatment. Because it is possible to push these aircraft beyond stated power, it's important to fly at a _____ power setting when flying at _____ altitudes so as not to _____-_____ the engine.

A turbo-normalized engine is a better candidate for engine longevity… especially for the less diligent pilot. (Though with proper training on_____ _____, any attentive pilot can properly operate a turbocharged aircraft.)

Turbocharger technology has also come a long way since early designs first appeared on the market. Even though, today's more modern turbochargers typically have _____ _____ that reduce the potential for pilots to over-boost the engine, however, attentive engine management is still _____.

a. The engine for this airplane is manufactured by: _____ _____.
b. The Engine Model Number for this airplane is: _____
c. The Engine Type for this airplane is: Turbocharged, ____ _____, ____ _____ horizontally opposed.
d. The Engine is: fuel injected, six-cylinder with _____cu. in. displacement.
e. The Engine has a Horsepower Rating and Engine Speed: _____rated BHP at ___ in. hg. and _____ RPM

The following Quiz is based on the SPORTY'S ADVANCED EQUIPMENT air Facts: Turbochargers & Flight Level Flying, DVD. Print your answers

1. Why do turbocharged airplanes seem to have higher accident rates than normal?

   _____

2. Why is it that turbo charged airplanes with the same fuel flow have slower airspeeds at lower altitudes? _____

3. Does the public record show an increased risk in mechanical failures and engine repair?

   Explain:

   _____

4. What is considered the real risk in flying a turbocharged airplane?

   _____

5. What two turbocharger components are mentioned and separated by a "hefty" element?

   _____

6. The color associated with the compressor in the video of the turbocharged airplane is _____?
7. How does manifold pressure (MP) relate to power output? _____
8. The higher you fly a turbocharged airplane, the higher the engine temperature. Explain

   _____

9. What is an Intercooler? _____
10. Is the Intercooler an SST? _____
11. Preferred Turbine Inlet temperature (TIT). Explain:

    _____

12. Turbo-normalized means? Explain:

    _____

13. What would be the advantage of speed brakes related to operation of the airplane and engine? _____
14. Fuel planning is much more demanding. Why? _____
15. Altitude chamber check out? What would be the reasoning? _____

16. What is a new consideration with flying weather with a turbocharged airplane? Explain:_____
17. What altitudes are usually encountered flying a turbocharged airplane? Why?
18. How should the answer to question #17 affect your flight planning when flying turbocharged airplanes?

    _____
19. How does the turbocharger work? In your own words, what would be an appropriate answer? _____
20. Duty cycle on starter. Often an issue for cold weather or hot starts. What is the duty cycle and why is there a concern? _____
21. What is “Shock Cooling”?_____
22. What is the most commonly used method a pilot can use to hopefully preclude shock cooling? _____
23. When descending from altitude, discuss the power management, necessary to maintain engine and turbo charger best performance, and minimization of shock-cooling potential

    _____
24. Explain, at what TIT, the engine power can be used as if the turbo charger did not exist.

    _____

25. Discuss the leaning (mixture control) for takeoff, climb, descent, and power setting when exiting the Runway._____