

**MYTH DEBUNKING: WHAT CAN AN ENGINE MONITOR REALLY TELL YOU?**

George W. Braly has been a pilot since he was 16. He worked as a flight instructor through college, where he graduated with a major in aerospace engineering from Brown University in 1970. He has more than 7000 hours of experience flying general aviation aircraft. He is currently the chief engineer for General Aviation Modifications, Inc., in Ada, Okla., which holds STCs for balanced fuel injectors on virtually all of the injected Continental and Lycoming normally aspirated and turbocharged engines.

We asked Braly about the claim that engine monitors can detect detonation in an aircraft engine. Here's what he told us:

"Short answer: Not likely. Most of the engine monitor manufacturers provide some kind of guidance in their manuals telling the pilot how to detect detonation. Much of that information is contradictory from one manual to the next. So far, I have not seen any of those manuals that get it right," he said.

Braly provided us with some charts to illustrate his point.

Says Braly, "Your engine monitor will not give you any indication that the cylinder is periodically experiencing the types of combustion events you see in Figure 2. You might, if you are anal retentive and have your engine monitor in a fully normalized mode, be able to detect some very small change in CHT and EGT (upwards and downwards, respectively) but that is unlikely."

The combustion event in Figure 3 is one that has been characterized as heavy detonation. Notice the magnitude of the initial spike runs from about 68 Bars up to about 85 Bars, or a spike in pressure due to detonation of about 17 Bars. In the automotive world, that initial pressure wave is referred to as the initial pressure wave. There is at least one group of people in the automotive world claiming that only when those initial pressure spikes increase into the range of 20 Bar and more does the detonating combustion event actually become "relevant" to damage to the automotive engine.

"None of us want our engines operating with combustion events that look like those in Figure 3," said Braly. "The problem is even those kinds of combustion events will not typically show up in any obvious way on your engine monitor."

"Detonation is a highly variable and random activity. On the test stand and in the engine in the experimental airplane used for testing, we see a series of combustion events for which there is a small and random percentage of the consecutive combustion events that exhibit light detonation and a still smaller percentage that exhibit medium detonation. Those events just will not move the needle on your engine monitor in any way that you can appreciate," he continued.

"In the test stand, we routinely and deliberately force the engines to operate at 115 percent to 120 percent of rated power at extreme temperatures in order to obtain heavy detonation," he said. "Even then, the percentage of those heavy combustion events is fairly low. Only when a medium fraction or more of the combustion events begin to occur at the level shown in Figure 3, or worse, will you see evidence of detonation in your engine monitor—and then only if you set your CHT alarm levels correctly and are watching carefully," he explained.

We asked Braly if there is any clear indication an engine monitor can give us regarding detonation.

"There is one condition you should be aware of," he said. "Anytime you see a rapidly rising CHT (rising 1 to 2 degrees F per second) and it is accompanied by a dropping EGT, then

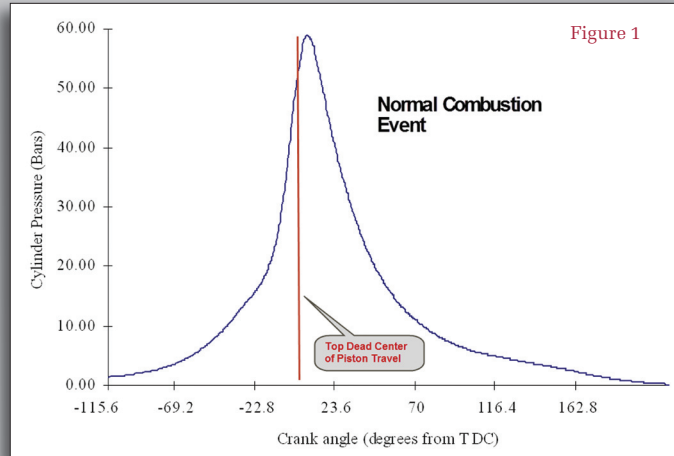


Figure 1 is a pressure trace of a normal combustion event in an aircraft cylinder. Each "Bar" is about 14.5 PSI, for those of us who still like English units of measurement.

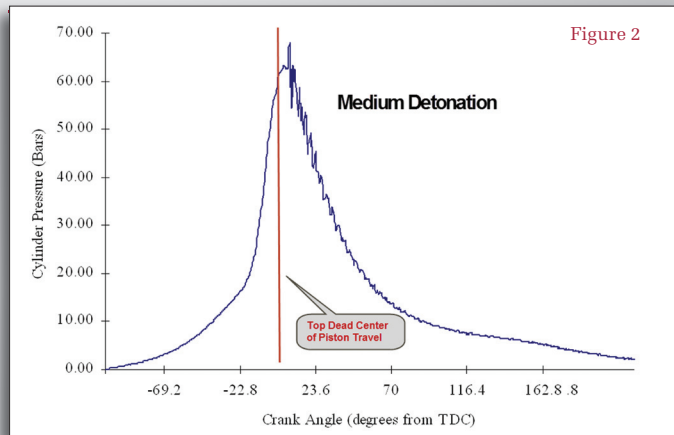
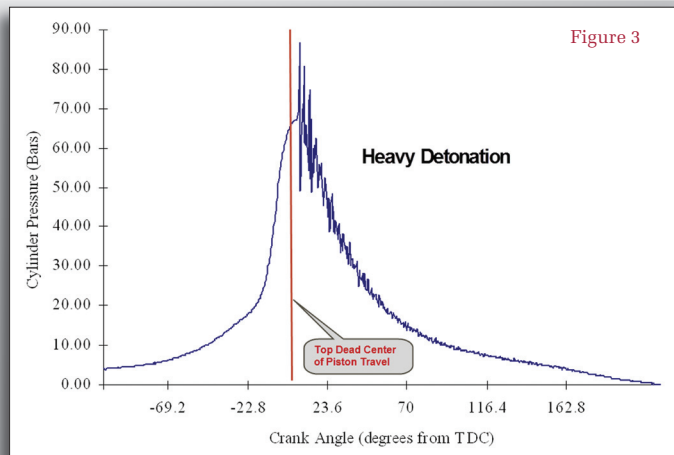


Figure 2 is a combustion event that has been characterized by the FAA as a "medium" intensity detonation event. The problem is —your engine can run for a long time with that type of combustion event—and you will never know the difference.



Houston, you do have a problem. That will be either a lot of very heavy detonation or more likely preignition. If you catch it before the CHT reaches redline, you will likely avoid changing a cylinder. Otherwise, you are going to have a bad day," he sighed.