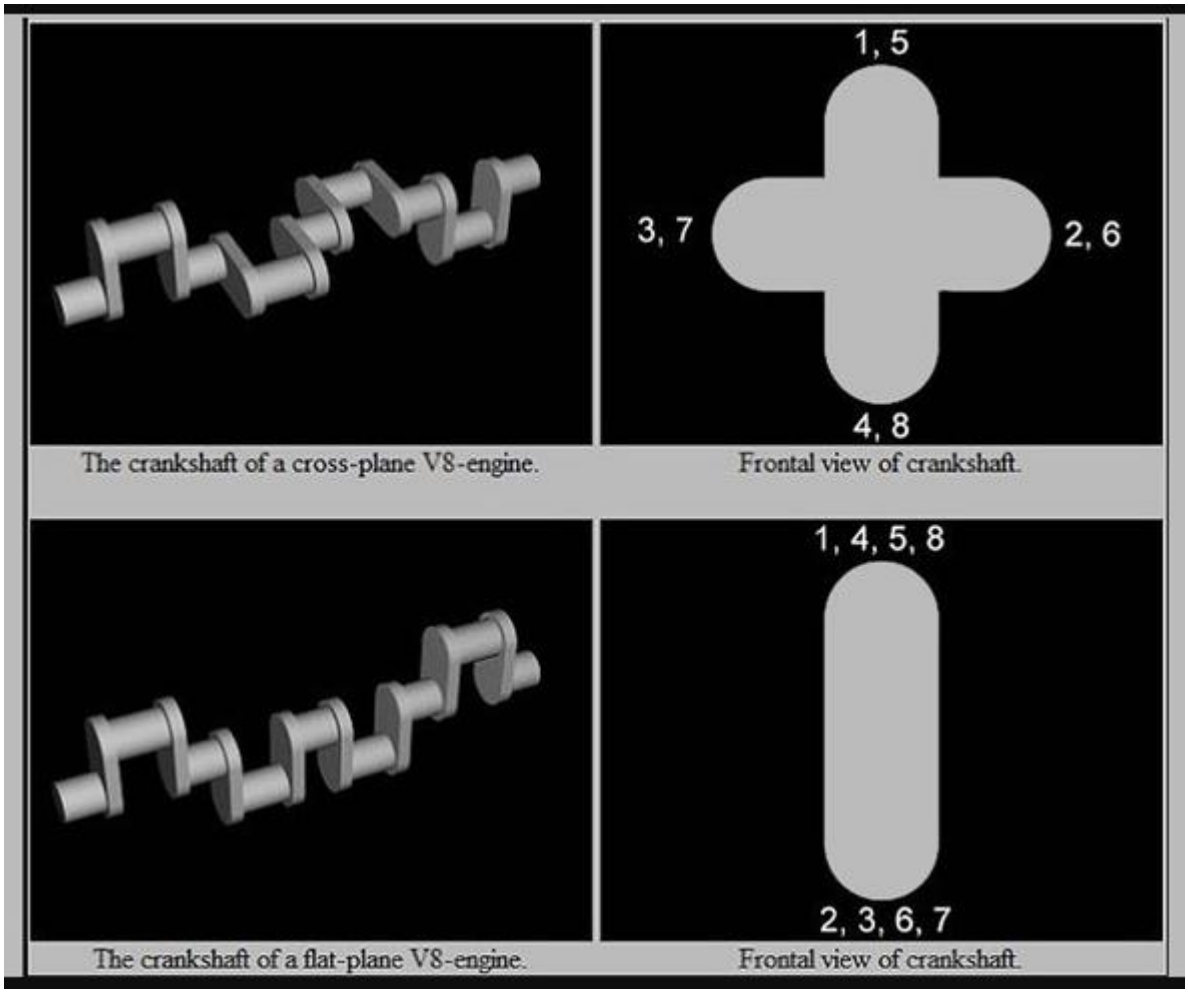
Under the Hood, January 2022

The upcoming Z06 will have a 5.5-liter double overhead camshaft (DOHC) engine with a flat plane crankshaft. When Chevy presented the C8R race car for IMSA, they used a 5.5-liter 4 cam flat plane crank engine. I understand that IMSA rules require that manufacturers offer a minimum of 300 similar vehicles for the street and Chevy decided to offer the C8 Z06 to comply. You should realize that flat plane cranks are not new. If you ever had a VW bug, or almost any four-cylinder engine, it had a flat plane crank. What is new, is that Chevy is offering a flat plane crank in a V8 engine. Note that Ford did offer a flat plane crank in the recent GT350, but that engine has now been discontinued. Basically, if you laid a flat plane crank on a table, you would find that it lies flat as all the piston rod journals are in the same line, or plane. The flat plane is also referred to as a 180-degree crank. Most V8 engines (and all previous Corvette engines including the exotic C4 ZR1) have a 90-degree crank. If you imagine a flat plane crank engine in operation, with every half turn of the crankshaft half of the pistons would be at the top of the cylinder while the other half are at the bottom of the cylinder. The 90-degree crank (also called an off-set crank) has the rod journals located 90 degrees from each other and therefore there are 4 different journal locations. With this 90-degree crank V8 engine, we would find for the same half rotation of the crank, two pistons might be at top dead center, two at the very bottom and 4 pistons mid location in the cylinder with two going up and two going down. The 90-degree crank has large counterweights which help with the engine balance giving us the typical V8 smoothness and the rather



unique V8 rumble. Smoothness is the main reason that almost all V8 manufacturers have used the 90-degree crankshaft. Certainly, GM wanted Cadillac to have an engine that you could barely feel. One manufacturer went so far as to stand a quarter on edge on the hood of their vehicle to demonstrate the smoothness of the running engine. Now that Cadillac V8 smoothness is probably a bit lower on the wish list of the typical Corvette buyer. You might remember that the original Chevy 265 ci V8 had a reputation for its ability to rev and rev up fast. This was partly the result of the lightweight valve train in that engine. Any time we have reciprocating or rotating mass in an engine less mass means the quicker the engine will rev, and in general that same engine will be able to rev higher. Since the flat plane crank does not have the heavy counterweights of the 90-degree crank, it stands to reason that the flat plane crank engine would rev more freely and be able to rev higher. That is exactly what happens and why Chevy is using this engine in the C8R race car. The standard C8 has 495 hp at 6,450 rpm, and 470 ft-lbs. of torque at 5,150 rpm. The C8 Z06 is expected to develop 670 hp at 8,400 rpm and 460 ft-lbs. torque at 6,300 rpm, all from a slightly smaller displacement engine. There is more to the Z06 engine than the flat plane crank, but undoubtably the crankshaft design does play a significant role in the new Z06 engine. Plus, won't it be neat to tell people you have a flat plane crank, knowing that most of them won't have any idea of what you are talking about. In addition to the flat plane crank the new engine will have double overhead cams. While this adds complexity with 4 camshafts (instead of one) and a complex chain drive, the head design allows for lightweight individual components and by eliminating pushrods adds to the ability for higher revs. As the engine revs increase, the engine designers are concerned with piston speed in the cylinders. After all, for every revolution of the engine, the piston must travel both up and down the cylinder, and that peak piston speed has some pitfalls. For the Z06 engine the engineers used a very oversquare cylinder design with a cylinder bore of 4.11 inches and piston stroke of 3.15 inches. That short stroke helps with the ability of the engine to have higher revs, but typically shorter stroke engines have lower torque. Other high-performance goodies for the Z06 engine include dual valve springs, forged pistons, and forged titanium piston rods, adding either light weight or durability. I have tried to explain the upside, but there are also downsides to the new Z06 engine. The 90-degree crank and the counterweights add smoothness. Some of the expected smoothness will be missing in the Z06 engine. While the horsepower numbers and rev limit of the C8 Z06 sound great, I am less impressed with the torque characteristics of the engine and where in the rev band that torque is developed. Did you note that the C8 Z06 max torque is actually slightly less than the standard C8, and that torque is developed about 1,200 rpm higher? Remember that horsepower is a calculated number HP=Torque X RPM/5250. If you review the torque numbers of the standard C8 and the Z06, it is obvious that up 5150 rpm the standard engine is actually putting out more horsepower than the Z06. The Z06 comes on at the higher revs, and of course revs higher. Worse, in this comparison, look at the C7 Z06 with the engine rated at 650 hp at 6,400 rpm, but with an extraordinary 650 ft-lbs. of torque at only 3,600 rpm. Yes, it took a bit more engine displacement and a supercharger to bolster the C7 Z06 numbers, but those are real driver numbers. I maintain that most of us drive with torque, rather than horsepower, unless you are driving near the top of the rev limit all the time. I expect that the C8 Z06 will be an absolute blast at Pacific Raceway and will thrill us with its shriek, rather than the more typical Corvette growl or roar. However, perhaps the C8 Z06 will be a little less satisfactory on the street as I anticipate the engine to be a bit "peaky". Chevy has tried to partly solve the peaky problem by installing a much lower (higher numerically) differential gears in an attempt to keep the engine closer to the power band. How well all of this works will be Corvette Forum fodder for a couple

years to come. Stay tuned and if you have a Z06 on order I sincerely hope that you will enjoy the experience.