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The results he achieved are as impressive as the term “Y-block” means the lower regions of the block structure don’t end at the crankshaft centerline, but instead extend further downward, much the connecting rods would impinge upon the camshaft. "To the best of my knowledge,” said Jon Kaase, “prior to last year’s Engine Masters Challenge, the most powerful naturally aspirated Ford Y-block engine produced around 600 hp.” This enduring feat, however, was substantially exceeded on January 17, 2016, when Kaase’s efforts raised the peak power record to 709 hp @ 6,300 RPM and 748-lb.ft. of torque at 5,400 RPM. That actually occurred after the EMC competition was over, when Kaase removed the Vintage class-compliant camshaft from his 400-cu.in. Y-block and substituted a drag racing alternative to see what more the engine could produce without the restrictions imposed by the competition rules. The specifications of the replacement camshaft are 269 degrees duration (intake) and 279 (exhaust). The lobe center separation angle is 106 degrees with 0.705-inch valve lift.

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Words and photography by Vic Moore

Ford's earliest overhead is massaged to make mega-power

Y-BLOCK REVISITED

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KAASE’S EMC-WINNING Y-BLOCK
Apart from some cylinder head work performed earlier, Kaase spent three weeks last September preparing what turned out to be the winning Vintage class entry of the 2015 EMC competition.

Protecting the expensive crankshaft and connecting rods. “I probably could have succeeded without introducing a mains girdle and new caps, but I had purchased a very expensive crank and rods ($4,000 to $5,000), and I wanted to ensure their safety as much as I could, particularly against the severe downward forces that could strain the caps. By extending the caps flush with the lower crankcase mounting flange, I could fully integrate them with the crankcase.”

To obtain the longest possible stroke length—in an effort to gain maximum torque in the lower RPM range—Bryant Racing Crankshafts made a custom billet crank with the same properties and finish as the Chrysler hemi Funny Car oil pan. The Chrysler oil pan uses a rear pick-up, so all that was necessary to connect the stock replacement external Y-block oil pump (from Melling) was to link the pickup in the sump to the pump with a pickup tube.

The reason for creating a main cap girdle and longer main bearing caps was to increase the strength of the lower regions of the crankcase to raise the entry of the intake ports and introduce adequate substance to accommodate machining of the port roofs.

Combustion chamber alterations at earlier stage: “The original intake valves were operating too close to the cylinder walls in two places. First, they were close to the cylinder walls as they traveled up and down. Second, because of the valve’s angle, the further it opened, the closer it moved toward the outer wall of the cylinder.” Consequently, the valves and spark plug and many combustion chamber “landmarks” were relocated toward the intake manifold. The purpose of the half holes (for valve seats) is to signal to stop welding. Next, a blueprint was made, which would ensure the remaining valves would be situated similarly.

The other set of heads was purchased from Y-block specialist John Mummert (www.ford-Y-block.com). These were raw unmachined castings. Because Y-block heads feature more turns and, therefore, are more difficult to port, Kaase decided to convert the Mummert head castings to conventional intake ports. “A shining flashlight at the part entry barely penetrates the other end of the Y-block heads,” he notes.

The EMC competition is held each October at the University of Northwestern Ohio in Lima to determine the highest average power output of an engine.

Still, Kaase was limited to 0.345-inch lobe lift. To do otherwise would be the winning Vintage class entry of the 2015 EMC competition. Measured over a specified rev range—in this case 3,000 to 6,000 RPM—the output is calculated by adding the highest horsepower and torque values.
To gain optimum induction flow, a high-rise manifold was acquired. The Edelbrock 7110 Street Tunnel Ram for a small-block Chevrolet (SBC) was selected. But because the deck height (that is the dimension from the crankshaft center line to the upper deck surface) of the Chevrolet differed by approximately 0.780-inch and, in addition, the induction port roofs in the cylinder heads were raised, substantial aluminum spacers were required. Phenolic spacers were also made and placed between the intake manifold and the aluminum spacers to shield the intake from heat. “It’s an insulator—if the manifold is exposed to heat, the engine will lose around 10 hp.”

The carburetor company CFM is owned by Dale Cubic, whose main carburetor bodies are constructed of billet aluminum. Cubic supplied Kaase’s carburetors, whose chief concern was that they draw sufficient fuel at low engine speeds. “I didn’t want it to go lean at 3,000 RPM.” At low RPM, air speed through the carburetor is minimal and as a result, fuel is also limited. This condition is further exacerbated when there are two carburetors. But Cubic rose to the challenge by concentrating on the metering blocks. He also developed king-size annual boosters that were sensitive to the most diminutive vacuum signal. Though Kaase had them prepared initially, to supply oil to the tappets, the main oil gallery that routes upward was plugged at the deck surface by drilling, tapping and inserting a set screw. Then, in the valley, a hole was drilled to intersect the oil gallery. Down the middle of the valley, a piece of hexagonal aluminum bar stock was mounted. Its flat sides made for easy mounting; they were also ideal for attaching the fittings complete with their oil transfer tubes. For competition purposes, the oil couldn’t drain efficiently from the front end of the camshaft. Both camshafts used tool steel tappets with DLC (“diamond-like carbon”) coating being applied to those operating with the steel cam.

Compared to the original Y-block tappets, Kaase’s variants are longer and thicker, and possess an oiling circuit within. Furthermore, the original Y-block tappets had no direct supply of oil. So Kaase introduced an oiling hole about half-way up the middle of the tappet shank. When the cam is on base circle and the tappet is all the way to the bottom of its travel, the groove within the tappet bore aligns with the tappet oiling hole.

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For the Engine Masters Challenge, a steel camshaft (left) was employed. After the contest, a cast-iron camshaft was substituted to test the engine for peak power. Both camshafts used tool steel tappets with DLC (“diamond-like carbon”) coating being applied to those operating with the steel cam. For the Engine Masters Challenge, a steel camshaft (left) was employed. After the contest, a cast-iron camshaft was substituted to test the engine for peak power. Both camshafts used tool steel tappets with DLC (“diamond-like carbon”) coating being applied to those operating with the steel cam. For the Engine Masters Challenge, a steel camshaft (left) was employed. After the contest, a cast-iron camshaft was substituted to test the engine for peak power. Both camshafts used tool steel tappets with DLC (“diamond-like carbon”) coating being applied to those operating with the steel cam.

Originally, the Y-block lubricated the rockers by transferring oil up to the cylinder head and through the piece-piece rockershaft. But the system used on this EMC engine was altered. Oil was diverted to the tappets, which were equipped with an internal oiling system that moved the lubricating oil northward to the rockers via the tubular core of each pushrod.

But at lower rpm, oil splash from the rods was insufficient. So a series of small-bore holes was inserted. Above them, in the valley, a dam was created from 1018, a mild to low carbon steel. Among its requirements are correct positioning, particularly the height of the rockers. It’s critical that the rocker’s nose wheel operates near the center of the valve stem during its arc of travel.

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