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BULLETPROOF

ATO BUILDS A HIGH-TORQUE, LOW-DRAG FORD C-4 AUTOMATIC FOR RACING.

By Dave Wallace

PHOTOS: DAVE WALLACE



PHOTO: TIM MARSHALL

Anyone who has ever muscled a 3-speed C-6 gearbox into his Ford car or truck can be forgiven for cussing this big brute of a transmission. Tipping the scales at more than 140 pounds (plus converter), a typical C-6 outweighs other popular automatics by as much as 50 pounds. But it gets the job done, right?

The C-6 has long been considered standard equipment behind big-block Ford powerplants, and highly recommended for healthy small-blocks and/or heavy vehicles. Is there any viable alternative? Certainly not the compact, lightweight, much-maligned C-4 Ford automatic.

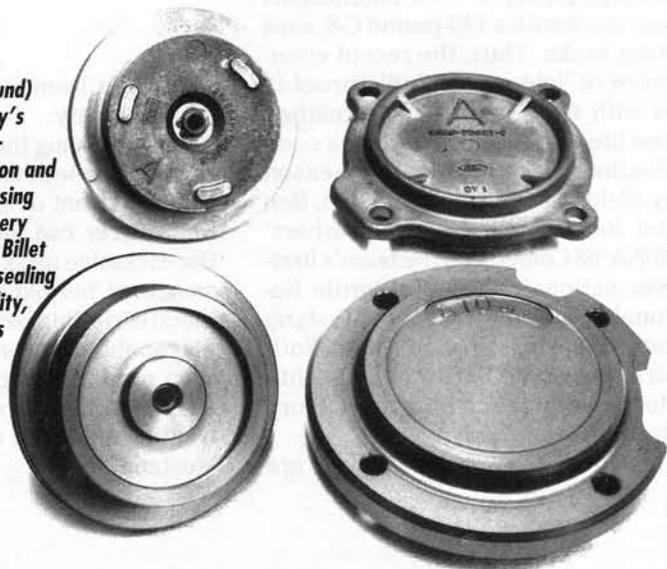
"Ten years ago, I would've said you were crazy to put a C-4 behind a big-block, or in any heavy car," says Jim Galatioto of ATO Racing Transmissions in Rancho Cordova, Calif.

"Even five years ago, nobody thought that little transmission had a chance. Now we're putting C-4s into big trucks and 428 Mustangs! I'm shocked at how well these things live in the heavier Super Stockers. And some of these 3000-pound drag cars have picked up two-tenths of a second



This competition C4 weighs in at just 81 pounds, ready to race! Numerous billet parts include ATO's High-Energy Servo (lower right), made from 6061-T6 aluminum. The pan and filter are late-model Ford C-5 items.

High-Energy Servo assembly (foreground) replaces the factory's failure-prone intermediate servo piston and cast-aluminum housing (background) in every ATO transmission. Billet housing improves sealing and increases rigidity, preventing gaskets from blowing out.



[ET] by switching from a C-6," says Galatioto.

No, this is no ordinary junkyard transmission that lifted California's Hultsman brothers to two prestigious NHRA Super Stock Eliminator titles last summer. It's a highly modified, extensively lightened C-4 that proud papa Galatioto refers to as "Mighty Mouse." The competition model weighs just 81 pounds, complete with ATO's exclusive trans-brake valvebody. Furthermore, a slightly heavier street version is rapidly finding favor with late-model Mustang owners and Ford bracket racers.

"The C-6 was a good transmission yesterday," explains Galatioto, who has specialized in heavy-duty Ford drive-trains for more than two decades. "But there really hasn't been that much new technology developed over the years. It's easy for people to put a manual valvebody in, buy some Cobra Jet parts, and have a halfway decent trans to handle respectable horsepower and torque—to a degree. A Wednesday-night racer might be pulling his C-6 apart every 30 or 40 passes and replacing clutches, but at least he's got something that isn't going to break easily.

Meanwhile, both the performance and durability of the long-overlooked C-4 have improved significantly. While much of the development credit is due to unsung bracket racers, the most visible proving ground has been NHRA's Super Stock Eliminator, in which automatic contestants are still required to retain genuine factory running gear.

New life for small-blocks

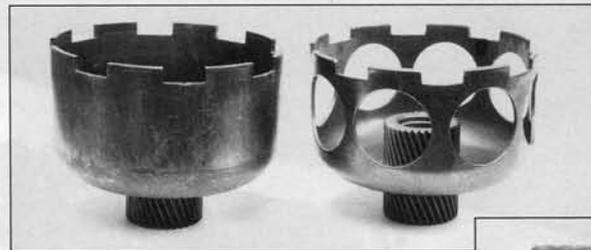
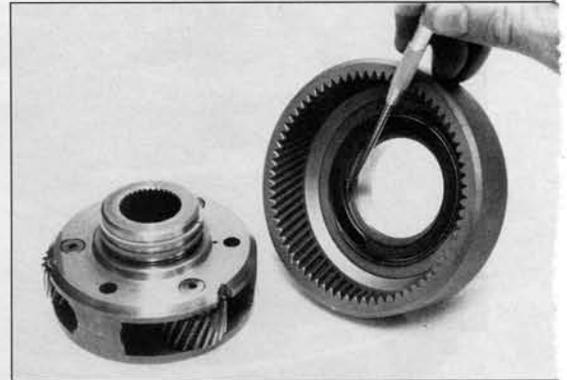
In the past, whereas a Chevy class racer enjoyed the option of a light-weight Powerglide with a killer brake, his high-powered Ford counterpart was stuck with a 140-pound C-6, sans trans brake. Thus, the recent emergence of lightweight, bulletproof C-4s with trans brakes has breathed new life into these small-block combinations—as evidenced last season by lifelong FoMoCo racers Ken, Ben and John Hultsman. The brothers' SS/NA '68 Comet won the team's first-ever national event (California Nationals), and their GT/MA Mustang took a big Winston points meet. Both cars carried ATO's 81-pound Mighty Mouse automatics into the victory circle.

Even big-block Super Stockers are



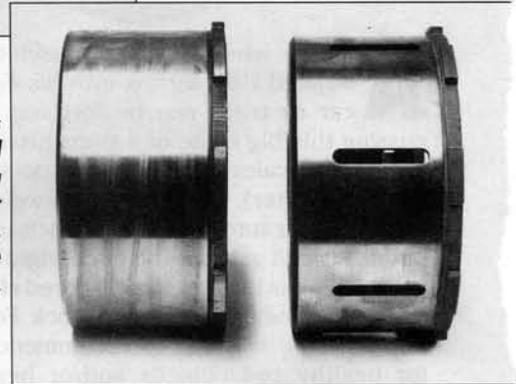
Hand-cut Teflon rings replace the four metal sealing rings in ATO's modified reaction shaft (left). Two more Teflon rings are used to reduce friction in the front planetary (right). Shiny cup plug in the stator seals off the cavity that originally contained a drain-back check valve. The ball-and-spring assembly was removed to ensure maximum flow between the torque converter and cooler.

Teflon rings in the planetary journal permit ATO to remove the brass bushing from the ring gear, which is then polished to provide a smooth surface for the Teflon. Pointer indicates roller bearing that replaces stock thrust washer.



In competition transmissions, the greatest single reduction in reciprocating weight is realized by extensive lightening of the drive shell. Stock shell (left) is retained in street applications.

Ford's direct clutch drum (left) is machined to reduce weight and speed evacuation of oil in drag racing units. The result is equal or better lubrication, according to ATO, with reduced friction between the clutches and steel plates.



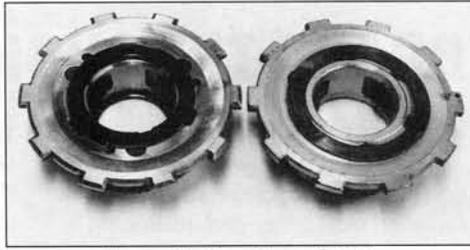
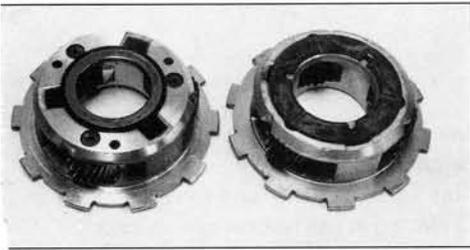
benefiting from the C-4's newfound respectability.

By modifying the bellhousing from an old, cast-iron FMX Cruise-O-Matic to fit the front of the C-4, a Ford big-block racer can finally, legally, shed the excessive mass and reciprocating weight of his old C-6. (Exactly how much of this big-block abuse a little C-4 is capable of absorbing remains to be seen, cautions Galatioto. However, one ATO customer is reportedly running trouble-free 10.30s with a 3200-pound Mustang.)

Money isn't power

Mighty Mouse's weight advantage results from a combination of the C-4's inherently compact size and additional component-lightening, as illustrated above. Replacing all factory thrust washers with needle bearings is another key ATO modification. The primary goal is maximum efficiency, according to Galatioto.

"A guy could have \$100,000 tied up in his race car," Jim says, "but it won't be competitive simply because it's not efficient. If the power has to pass

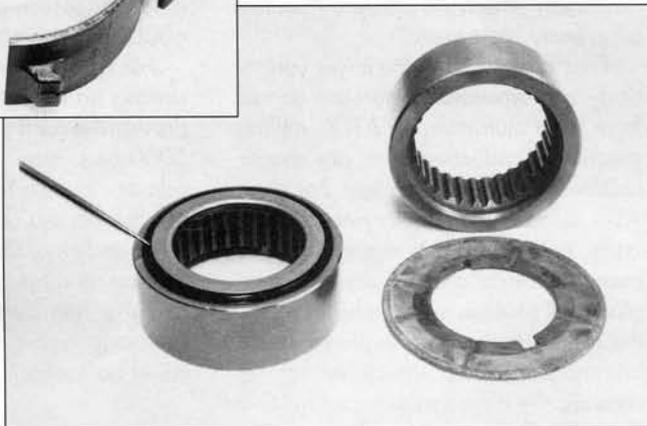


Top and bottom views of ATO's rear planetary (left) reveal low-drag thrust bearings on both ends. Stock planetary (right) comes with a set of metal thrust washers.

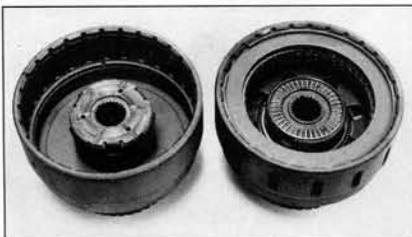


ATO street transmissions retain the factory's solid-steel band (foreground); trans brake applications get the flexible wrap band, TIG-welded for extra strength and relined with special material.

Pointer indicates roller thrust bearing in ATO's rear-sprag race, compared to common thrust washer used by the factory (right).

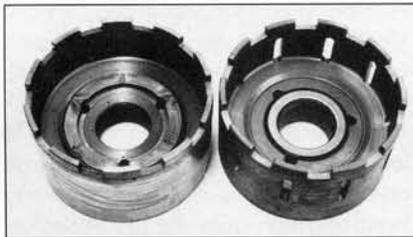


Ford's forward clutch drum (left) is rebuilt by ATO with Raybestos-lined clutches and a roller thrust bearing. Competition models also get machined slots for lighter rotating weight and rapid fluid evacuation.



through an inefficient transmission before it gets to the rear wheels, you're robbing horsepower. Weight in a transmission is horsepower. You shouldn't have a lot of heavy internal parts that you have to get rotating on the car's launch, going from standstill to motion. Factory thrust washers make that engine work even harder. With lighter internal parts and roller thrust bearings replacing the washers, the reciprocating parts will turn freer and easier. It all adds up. The end result is power in, power out;

Reverse drums are shown before (left) and after receiving ATO's roller bearing and lightening holes.



it can either be a loss or a gain."

The other advantage of a complete bearing system is keeping metal out of the transmission fluid. According to ATO, the only way to eliminate the metal is to eliminate the factory thrust washers that create it. As these bronze-coated washers get hot, they start to scuff; there is no wear surface. This metal residue shows up in the form of black ash that collects in the bottom of a transmission pan. If the fluid isn't changed regularly—as often as every 25 runs in a drag car—it ultimately

contaminates the valvebody, causing malfunctions. With needle bearings replacing all thrust washers, a C-4 racer can expect to run the same fluid all season.

ATO's street version gets the same roller-bearing treatment as the competition C-4, and also shares its handcut Teflon rings. Galatioto has been Teflon's biggest fan since 1974. Originally, he used the material in buffer rings, increasing support between reciprocating parts and metal parts. When he saw how well they wore, he started using them for sealing, too. Four .060-inch Teflon rings replace the factory's metal sealing rings in the stator. Two more Teflon rings in the front planetary replace the brass bushing that supports the stock ring gear, reducing friction and preventing fluid contamination.

"I hand-cut and shape my rings to fit my components," Galatioto notes. "A standard, automotive-type Teflon ring doesn't always work well, because the metal parts are not machined correctly to let the ring do what it's supposed to do. The factory ring lands leave too much room for oil to leak through.

"Installed correctly, these rings literally will not wear out. If you raced every weekend, twice a week, and freshened up the transmission once a season, you could put the same set of rings back in it forever."

Long-lasting rings

Jim offered the example of customer Randy Werth, who campaigns a 1 0.70-second Pinto in ET brackets and NHRA Super Street Eliminator. We looked him up at Sacramento Raceway, and Werth cheerfully confirmed that the same Teflon rings have lived inside his C-4 for more than 10 years.

Teflon doesn't wear out because it doesn't throw off the friction of a metal ring, explains Galatioto. Even if it's a hardened chrome ring, a metal ring still wears against its metal ring land, creating friction. Sealing rings fit inside a transmission drum like a piston ring inside a cylinder. They have to fit tight to seal the stator to the drum. If those rings wear, that pressure is lost. The more pressure that's lost, the faster you lose clutch plates. With Teflon sealing against metal, once the pressure hits, the ring conforms tightly to the inside diameter of the drum, making a better seal. There is no friction, and far less heat.

"Metal rings don't like heat," notes

Galatioto. "Normally, metal rings will go 75 to 100 passes in a drag car. Teflon rings will last longer than any part in that car." Jim acknowledges Teflon's poor reputation among some rival transmission builders, blaming their lack of understanding. "When you build a tranny, normally you air-check the components before you put the valvebody on, looking for internal leaks," he explains. "A metal ring is going to airseal great, because it's got all that friction. A Teflon seal will leak air like crazy, but it's not made to seal with air; it's made to conform and seal with fluid pressure. Some people don't understand that."

Converters and trannies

Excluding the drum-lightening inside competition C-4s, ATO's street and race assemblies differ only in valvebodies and torque converters. For quarter-mile customers, ATO highly recommends its own 8-inch Pro Competition torque converter, designed specifically for Mighty Mouse. The company offers a variety of converter styles and diameters for highway operation, depending on individual factors such as vehicle weight, horsepower, rear end gearing and intended use.

Competition transmissions are shipped with either a full-manual, reverse-pattern valvebody or the optional trans-brake setup (see story at right). Standard equipment in the street version includes a vacuum-assisted automatic valvebody. For faster Fords running low on vacuum, ATO has engineered a full-manual Pro Street valvebody. Complete C-4 assemblies are priced from around \$700 to \$935 (depending on valvebody), plus torque converter. Or, do-it-yourselfers can purchase ATO's low-drag, all-needle-bearing planetary kit (\$253) and other trick components separately.

Now that Ford fanatics have gotten the word about Mighty Mouse, Jim Galatioto envisions a market far beyond the Blue Oval. "I feel strongly that down the road, the C-4 will become a popular transmission behind Chevrolet engines," he predicts boldly. ■

SOURCE

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BRAKE-THROUGH

When ATO's Jim Galatioto set out to build a reliable C-4 transmission brake, he avoided the conventional route of modifying and reshaping a passenger-car valvebody. Instead, he started with a master machinist's equivalent of a fresh sheet of paper: aluminum billet.

"A cast factory body has all the circuits of an automatic valvebody," he explains. "Because it has to be cut, plugged and changed dramatically to recurve these circuits, you're limited. You wind up with something you don't want. We were able to make the circuitry go exactly where we wanted. Plus, this billet body is stronger."

Four prototypes of the lower control body and separator plate were carved from billet aluminum on ATO's milling machine. Production units are manufactured on CNC equipment. For now, ATO is using the factory-cast upper body, but uses only its regulator valve, manual valve and brake-control valve, plus ATO's submersible brake solenoid; the rest of the body is empty space. A late-model C-5 filter was chosen for two reasons: 1) it fits better than the C-4 filter; 2) it delivers superior filtering. The deeper stamped-steel pan also comes from a C-5.

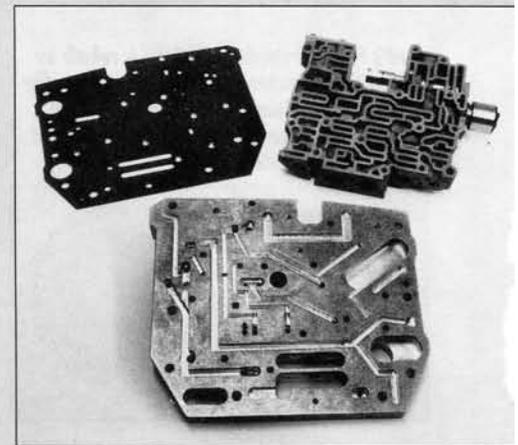
The brains of any trans brake is a special valvebody that locks up a transmission in low gear by telling the transmission to go backward and forward simultaneously. Most manufacturers accomplish this in a 3-speed automatic by applying both the high-gear clutch and reverse band. When it's time to launch, the driver uses a button to release an electric solenoid, releasing the reverse band and high-gear clutches. An unfor-

unate side effect can be accelerated wear on the clutches.

This wear factor is one reason that ATO elected to use reverse and second, instead of high. "Second gear releases cleaner and quicker when the band lets go of that drum," says Galatioto. "Our C-4 customers report better reaction times, with no trace of burning or dragging the band."

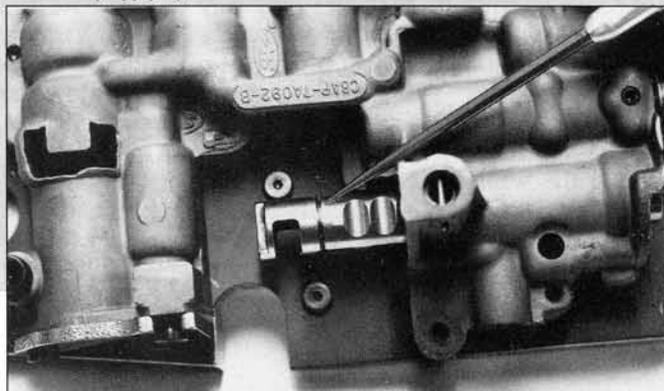
The only down side of this arrangement is that second gear doesn't have the holding power of high. Consequently, ATO's trans brake is currently limited to 5300-rpm launches, although Galatioto is hopeful of increasing holding power to 6000 rpm in future versions.

For right now, ATO recommends installing an MSD two-step rev limiter to prevent the car from creeping forward at 5000-plus rpm. "It's a trade-off," he admits, "but we feel that a guy is better off having quick, consistent reaction times and extending the life of his transmission. A third-gear brake might hold at higher rpm, but he'll be back in the pits replacing high-gear clutches when he could be racing."



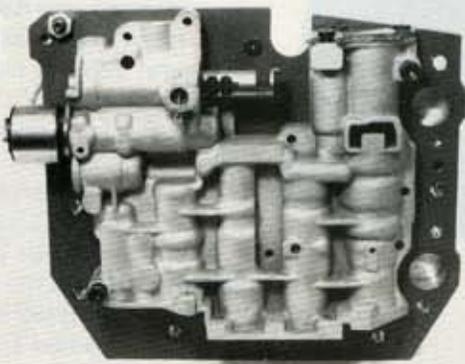
Rare exploded view shows complex circuitry inside the billet aluminum control body.

ATO machines the stock shift-control valve to accept this safety ring (pointer). Even if the shift linkage is overadjusted, the snap ring prevents the valve from moving beyond the high-gear indent and accidentally applying the transmission's reverse band.





The brains behind ATO's new trans brake is this billet-aluminum valvebody. Bottom view reveals C-5 filter and submersible solenoid. Electrical wire connects solenoid to a safety switch (top, front) that prevents accidental activation of trans brake.



Modified Ford upper body bolts to ATO's billet separator plate. Only internal parts are regulator valve, manual valve and brake-control valve.

ATO's valvebody is a full-manual, reverse-pattern (PRN123) design. To prevent the possibility of a driver selecting low gear (instead of neutral) after the finish line and locking up his rear wheels, low gear "freewheels" at all speeds. There's also a built-in pressure switch that lets the brake apply in low gear only. This way, there's no chance of locking up the rear wheels if the driver bumps the trans brake button after shifting out of low.

This trans brake is engineered to fit all 1965-80 C-4 cases. Installation in pre-'70 transmissions requires minor grinding of the case to clear the solenoid wires. Detailed directions and diagrams are included in the \$495 package.

—D.W.

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