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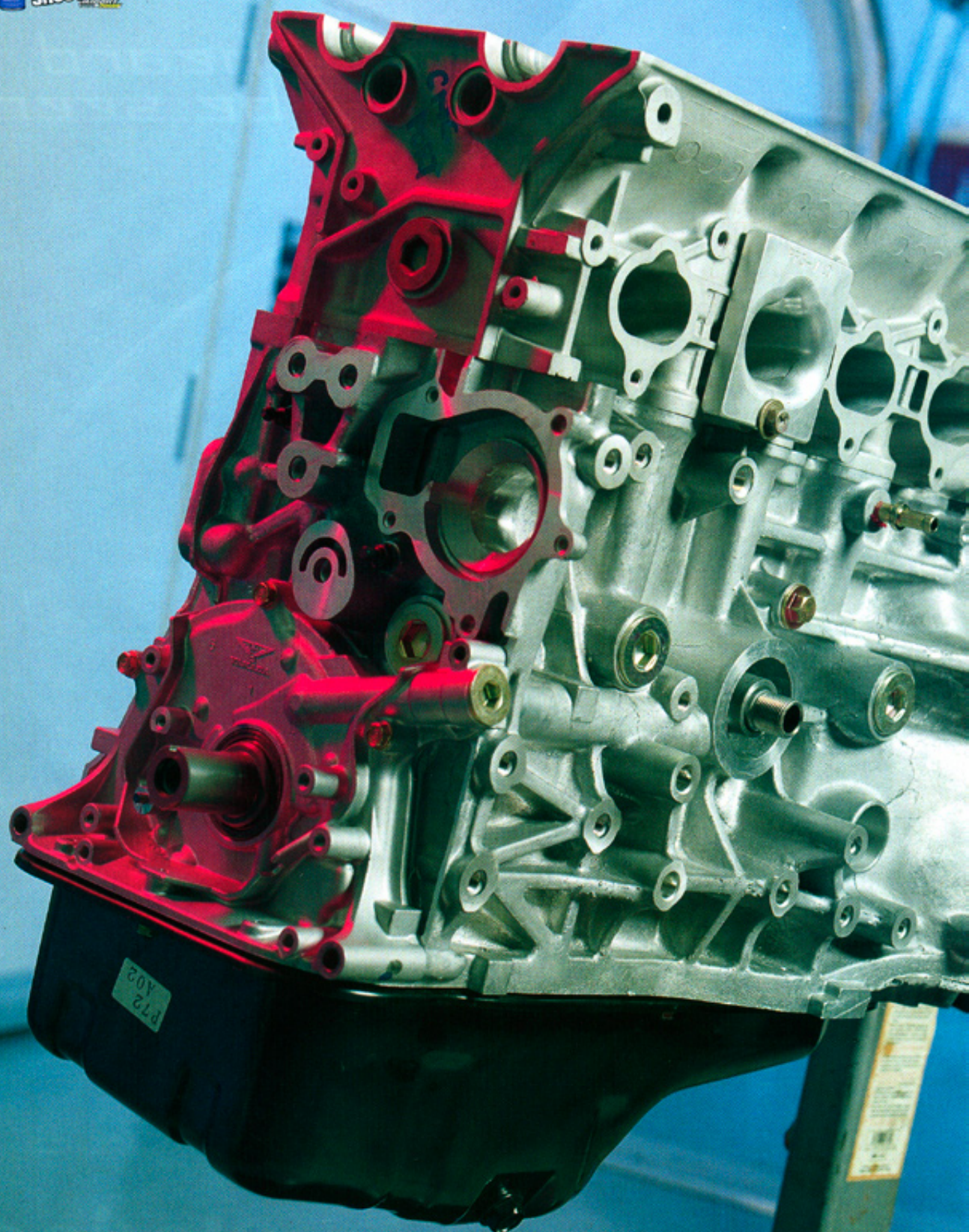
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PRIMEDIA





WD-40  
**B-SERIES  
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SHOOTOUT**





TEXT AND PHOTOS BY GARY CASTILLO

# BRAWLIN'

## THE SHORT BLOCKS COME TOGETHER



AT FIRST WE THOUGHT THIS STORY WAS GOING TO BE EASY BECAUSE THE ENGINE BUILDERS WILL BE DOING ALL THE WORK. THEN WE WOKE UP AND REALIZED THE TRUTH. THE ENGINE BUILDERS ARE DOING THEIR PART MAKING THIS STORY WORK WELL. WE STILL HAD WORK TO DO. FOR OUR SECOND PART OF THE B-SERIES SHOOTOUT WE DECIDED TO GO OVER THE DIFFERENT BUILDERS' APPROACHES. WHILE YOU MIGHT THINK EACH TEAM WOULD BLUEPRINT AND ASSEMBLE THE ENGINES IN AN IDENTICAL FASHION, WE CAN TELL YOU THAT EACH BUILDER IS ACTUALLY GOING ABOUT THE BUILD UP IN VERY DIFFERENT WAYS. WE WERE SHOCKED AS WELL. WORKING WITHIN OUR GUIDELINES IS THE KEY TO SUCCESS AND IS PART OF THEIR PROCESSES. FOR THE MOST PART EACH BUILDER IS EXCITED ABOUT THE PROJECT. WHEN WE DID THE Q&A FOR THIS SEGMENT WE WERE ABLE TO GET THE VIEWS OF EACH OF THE ENGINES AS WELL AS THE BUILDERS' OPINIONS ABOUT THEIR COMPETITORS.



## Q&A



**How do you think an 83mm bore with the same stroke (JG Engine setup) will run against your set-up?**

With all the bore and stroke numbers pretty close it all depends on how they are built and how they address making power for that particular test condition. Ultimately the motor with the bigger bore and bigger stroke will have more potential.

**What about an engine with an 87.2mm stroke (R&D Dyno setup)?**

From a reliability standpoint, the motor with the longer rod ratio will last longer; an 8500 to 9000 redline. Everything is going to be very similar. You won't see anything too drastic. If you wanted to get super technical, the shorter stroke motor will have more peak horsepower potential just because the short stroke will have the longer rod and will be closer to the center-line of the crank. In the horsepower department the 87.2mm will make more peak horsepower but the bigger bore and bigger stroke will make more mid range. It would be a trade off from top end to bottom end power. This is assuming all things will be equal, which they won't be.

**Skunk2 has almost the identical bottom end set up. The main difference is that you are running a billet crank. Why?**  
The crank is a Peak crank that Dynamic



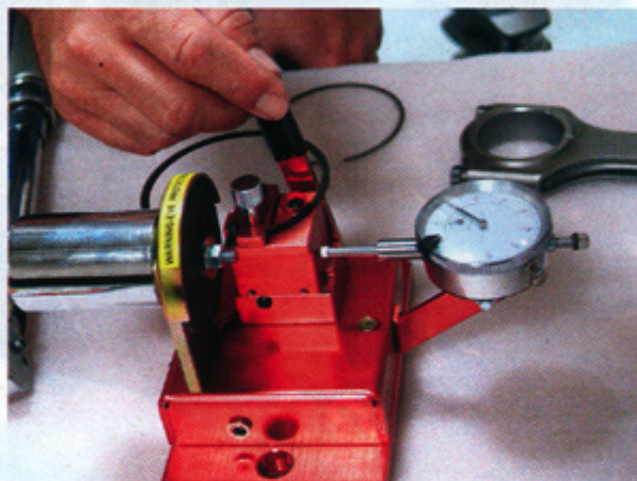
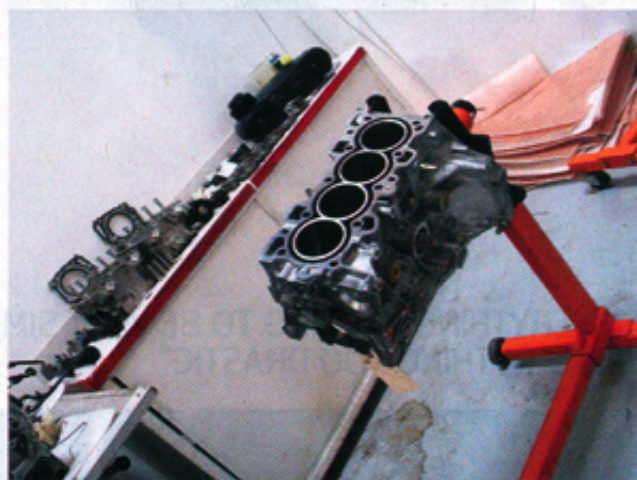
is trying to promote so my hands are kinda tied on it right now. However, this is the first time we will use it so we are gonna find out some of the oiling issues involved with it, but it is a couple pounds lighter than others. It will make the engine accelerate a little better and it could possibly carry the power a little better but that's kind of a gray area. Like I said, we are gonna test it and see what goes on with it.

**What's the most you have ever bored out stock sleeves?**

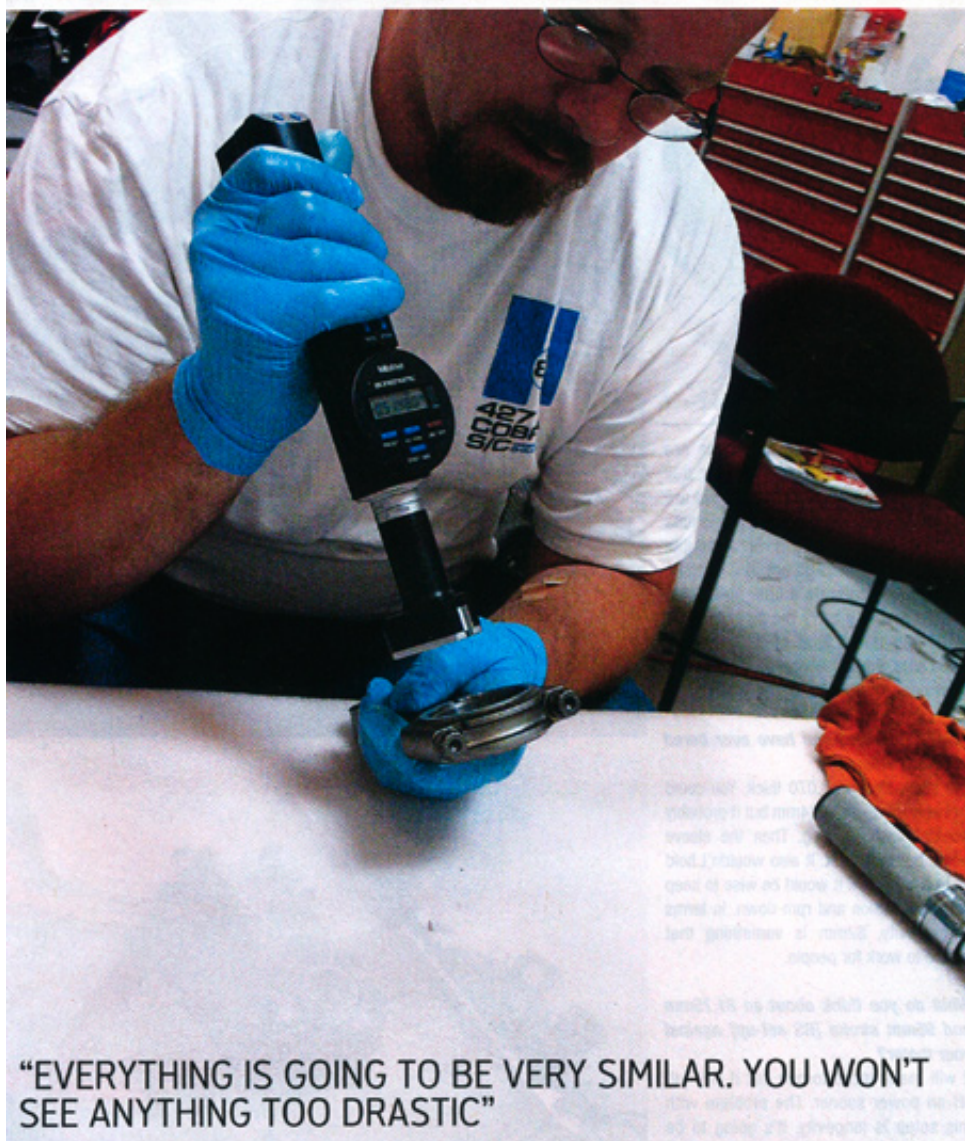
The stock sleeve is .070 thick. You could probably run them at 84mm but it probably wouldn't last too long. Then the sleeve would be .020 thick. It also wouldn't hold up to a high rpm. It would be wise to keep the compression and rpm down. In terms of longevity, 82mm is something that seems to work for people.

**What do you think about an 81.75mm and 95mm stroke (RS set-up) against your motor?**

It will make more torque but it will fall off on power sooner. The problem with this setup is longevity. It's going to be really hard on the cylinder walls. It will have a shorter life span. The piston has to travel much farther, so that equals out to more wear.







## DYNAMIC AUTOSPORTS SPEC BOX

Builder	Omniman
Pistons	CP
Wrist Pin	CP
Bore	Total Bore 84.5 (3.5mm over)
Compression	11.0:1
Rings	Peak
Sleeves	Peak
Rods	Peak Rod
Design	H beam 4130 Billet Steel
Crank	Scat
Stroke	Billet 89mm
Displacement	1996cc

Dynamic decided to stick to a larger bore and stroke. Not only does this change the rod ratio of the motor, it also changes the displacement of the engine. End result of their short block will be a total displacement of 1996cc.

The piston is an off-the-shelf CP unit with a compression ratio of 11:1, however, Dynamic did decide to go with a Peak ring set rather than the CP rings. Also in the Peak line up is a set of H beam rods. According to Omniman, "We tried to stretch the limit in obtaining the optimal displacement using off-the-shelf parts."



"EVERYTHING IS GOING TO BE VERY SIMILAR. YOU WON'T SEE ANYTHING TOO DRASTIC"







"WHEN IT CAME DOWN TO EATING OR PUTTING PARTS ON MY CAR, BACK IN THOSE DAYS I DIDN'T HAVE A LOT OF MONEY, SO I JUST DIDN'T EAT A LOT THEN"



Going into this project, Javier was first inclined to unload top-notch parts out of his arsenal. After the intro story and jumping into the short block build up, his mentality flipped 180 degrees. According to Javier, "I'm gonna take this engine the economical route now. For the most part this will be an engine that anyone could build in their backyard using my parts. Instead of using my Pro Series head which can cost some money, I decided to go with my Redline head. It won't make as much as the Pro but you will be surprised with the power. If I just wanted max power, I would use 92 crank 84 bore. For the economical route I'm keeping the bore at 83mm to cut the cost of sleeving and installing a JG block guard instead."



## JG ENGINE DYNAMICS SPEC BOX

Builder	Javier
Pistons	CP JG-spec
Wrist Pin	CP
Bore	Total Bore 83mm
Compression	12.0:1
Rings	CP
Sleeve	Stock
Rods	JG long rod
Design	H-beam
Crank	B188 LS Crank
Stroke	89mm
Displacement	1930cc





## Q&A

**If you weren't basing your build up on a budget what engine management would you have used other than the Honda?**

A Motec M 4, only because of familiarity. Stuff like AEM, DFI Gen VII and Haltech will all make around the same horsepower. For me it's just the familiarity with the Motec. On this particular build up, it's gonna be all the same, but if we were talking race engines the Motec will hold its value.

**Do you think a B series engine needs to be resleeved at an 84.5mm bore?**

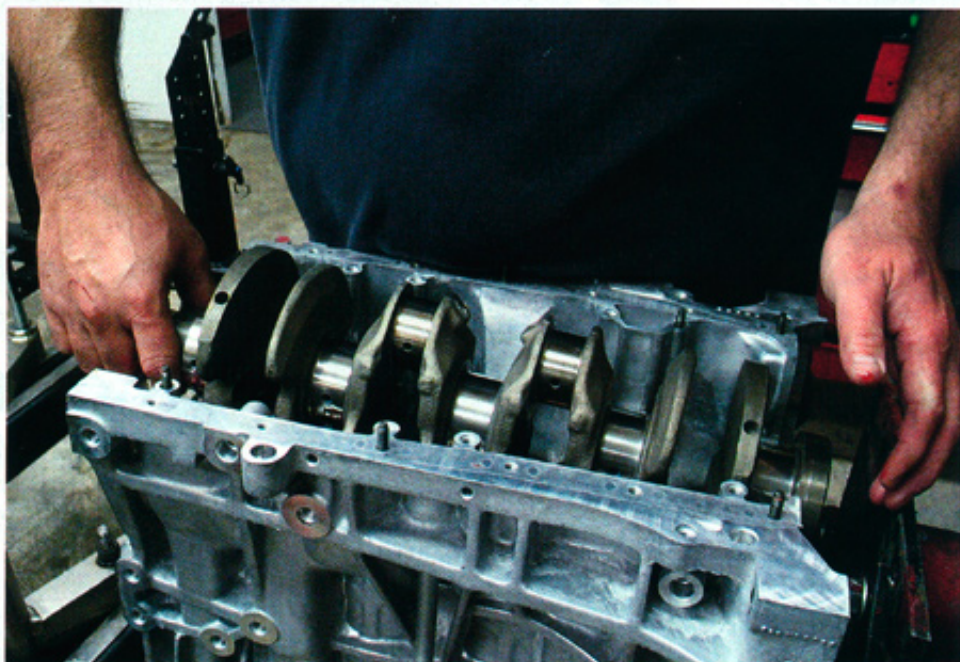
Yes, it absolutely does. We've run them at 83mm without any problem but at 84mm, it's too risky. I might want to take a chance at it with my own engine but not on a customer's engine. If I wasn't concerned about money I would resleeve the engine and go with an 84.5 bore. But I want to build an affordable engine.

**Since you have a DTS engine dymo, would you say that you have the upper hand being able to tune your engine before the final test?**

No, I don't think so because everyone in this build up is a professional so they all know what they're doing. The only advantage is knowing the engine dymo controls to make the process go by much quicker.

**Your setup is similar to the Skunk2 setup with the exception of a 1.5mm bore difference. What do you think the major difference will be with the two bottom ends?**

The main difference will be torque but their engine will cost over a thousand dollars more to build than mine because you have to sleeve it at that point, and it will only be 4 or 5 lb-ft difference in torque.



**What do you think about the reliability issues on a short rod 95mm stroke?**

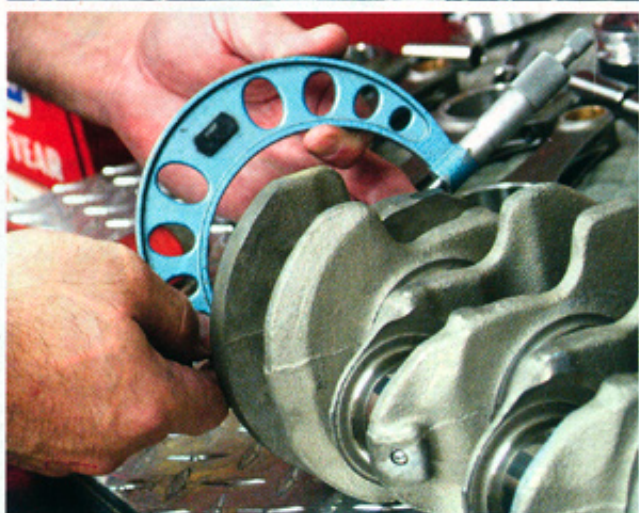
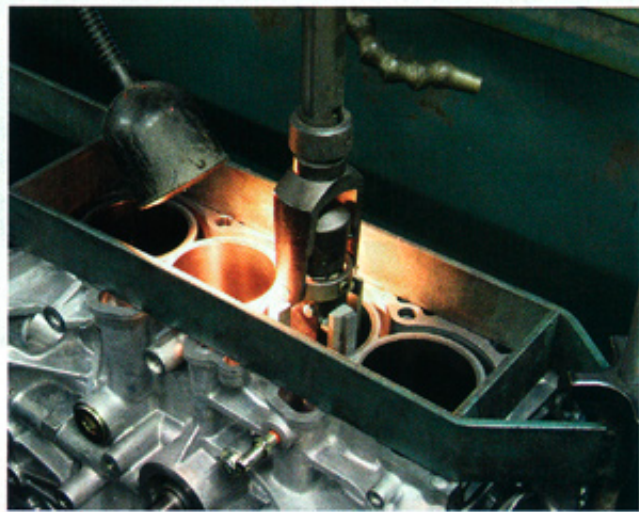
Reliability on the 95mm will be cut in half over the 89mm stroke because the wear and tear on the piston skirts, cylinder walls and rings are higher. This is because of the piston speed, especially when it gets over 7000 rpm, and most of these engines will turn 8500 to 9000, which causes more wear. The longer stroke will have an advantage in torque in the mid range but horsepower will be similar. The torque will be the major difference. Then again, you also have to easily spend \$2000 more for the added midrange torque.

**You are running one of the smaller displacement engines in the group. What are you proving with your setup?**

I'm just trying to make the most power with the least amount of money. Kinda goes back in the days when I was in high school. When it came down to eating or putting parts on my car, back in those days I didn't have a lot of money so I didn't eat a lot then. With this motor I'm not even gonna use our best cylinder head just because of the cost difference.

**What about an 87.2 stroke [R&D setup]?**

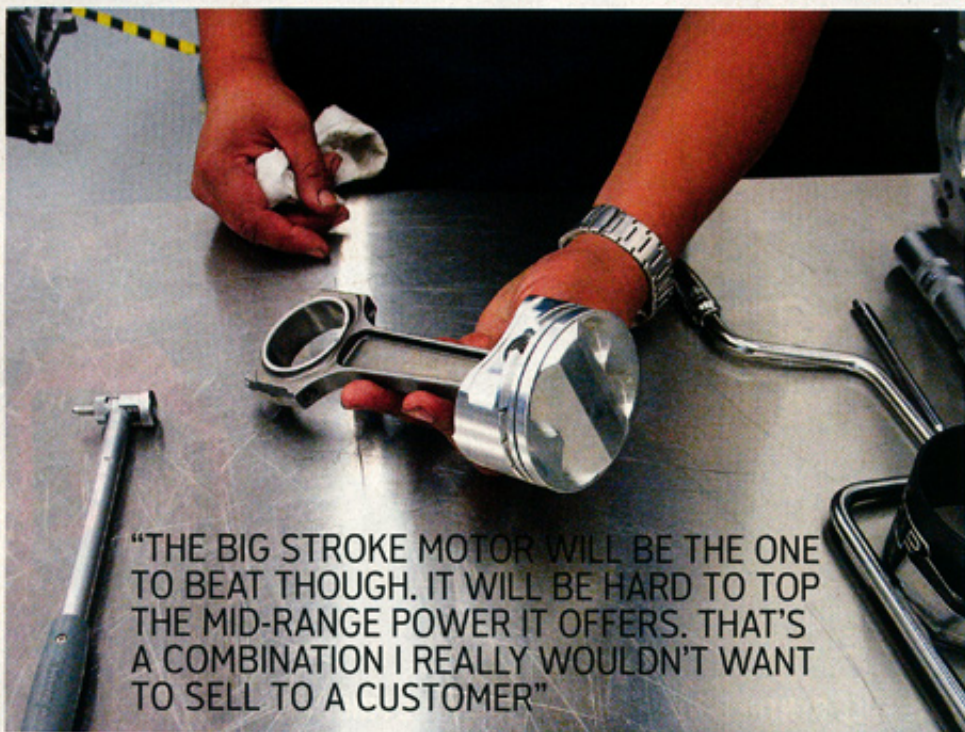
Torque will be down 4 or 5 lb-ft but this stroke will run more rpm—about 500 to 600 more. It could even make a little more power.







For the most part the bore and stroke are identical to the Dynamic motor. Keep in mind that assembly has a drastic effect on horsepower so while they may look the same; they could eventually end up making two different power levels and holding different spots in rpm. Skunk2's theory behind this engine is primarily based on cost and sticking to the 1999cc rule. Be on the look out for power differences between Dynamic and Skunk2 since they share similar specs.



"THE BIG STROKE MOTOR WILL BE THE ONE TO BEAT THOUGH. IT WILL BE HARD TO TOP THE MID-RANGE POWER IT OFFERS. THAT'S A COMBINATION I REALLY WOULDN'T WANT TO SELL TO A CUSTOMER"



#### SKUNK2 SPEC BOX

Builders	Manny Rodriguez
Pistons	CP
Wrist Pin	CP
Bore	84.5
Compression	11.0:1
Rings	CP
Sleeves	stock
Rods	Pauter
Design	I-beam
Crank	LS Stock
Stroke	89mm
Displacement	1996cc



# Q&A

**Do you think you can run an 84.5mm bore on stock B Series sleeves?**

Not on a B18C block. On the B20 block we can, since it's 84 to start with.

**You guys are running a 1996cc displacement. Compare that to a 1956cc engine [R&D Dyno set up].**

Well, with a 40cc difference it's probably going to be a difference of about six horsepower. Theoretically!

**What about a 95mm stroke [RS Machine set up]?**

That is going to have a bitch of a rod ratio! That setup might have durability issues. Don't quote me on the exact source for this but I know one of the auto manufacturers did testing on what rod ratio does and in horsepower it didn't really do much. Longevity is the problem and I think most people will agree with me. The big stroke motor will be the one to beat though. It will be hard to top the mid-range power it offers. That's a combination I really wouldn't want to sell to a customer.

**If you weren't after horsepower per dollar, would you run an 89mm billet crank or would you stick with the stock crank?**

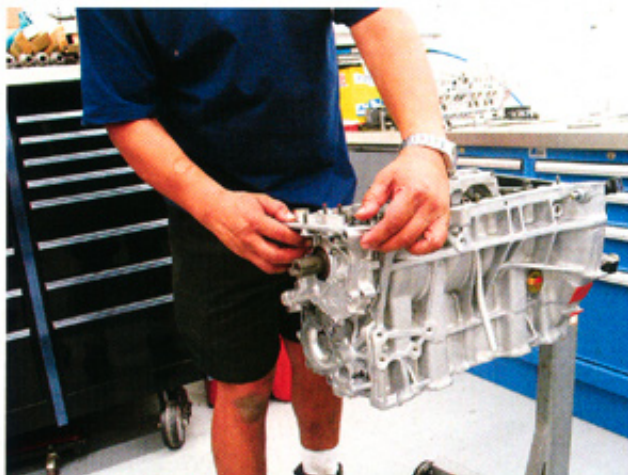
I would still stick with the stock crank. It offers forging processes that are better than what most aftermarket cranks can offer.

**You guys have a DTS, so will you tune your engine prior to the final test?**

Yeah, but it doesn't matter what dyno you tune it on, it could even be on a chassis dyno. It's just a matter of getting most of the tuning out of the way and then you

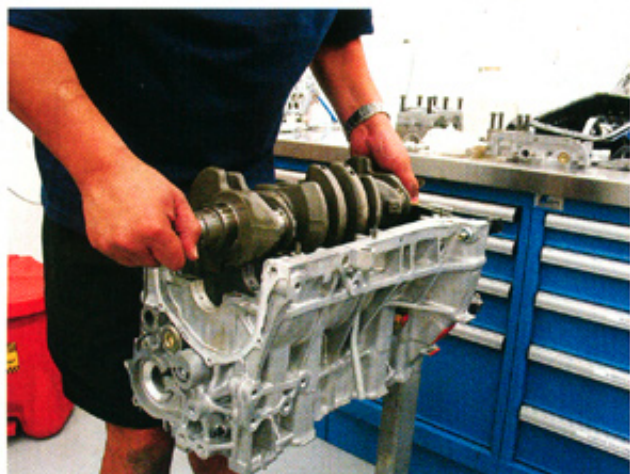


only have to tweak it a little bit for the final dyno run.



**Your bottom end is pretty much similar to the Dynamic one. What is the one thing that will set them apart?**

Head and cams play a major part. It's the top end package that will make the difference.





"BY RUNNING THE SHORTER STROKE I EXPECT TO HAVE MORE HORSEPOWER IN THE HIGH END OF THE RPM"



Just like most of the others in this shootout, Darren is going to sticking with the budget and cut cost down and still break deep into 200-plus horsepower. Out of all the engines this one has the shortest stroke in the field. Darren stated, "Since the 1999cc displacement is in effect I want to eliminate the use of a billet crank to keep the cost down. Now if we were able to break that rule, of course we would get more stroke out of the engine but keep in mind that horsepower goes up just as the cost goes up."



## R&D DYNO SPEC BOX

Pistons	CP
Wrist Pin	CP
Bore	84.5
Compression	11.0:1
Rings	CP
Sleeve	Darton
Rods	Probe
Design	H-beam
Crank	Factory
Stroke	87.2 mm
Displacement	1956



## Q&A

**What do you think about an 84.5mm bore and 89mm stroke against your setup?**

Well, should be relatively the same. The stroke just gives them a little bit more torque. But that might accelerate the piston speed so it can make a little bit more horsepower all the way across the top. A lot of this is assuming that the cylinder head, cams and intake manifold design is all the same.

**What about a bigger 95mm stroke [RS setup]?**

That would have a lot faster piston speed and that will pull a lot more air through the cylinder head assuming that the cylinder heads on the engines were the same. In the long term the rings are gonna wear out sooner because the piston speeds are a lot faster. If it's something that need to be good for 200,000 miles, this would actually be knocked down a lot lower. For a street engine, I would expect people would want it to last a lot longer.

**You seem to be the only one running an 87.2 mm stroke.**

By me running the shorter stroke I expect to have more horsepower in the high end of the rpm. From VTEC up.

**What's the most you have ever seen stock sleeve bore out to?**

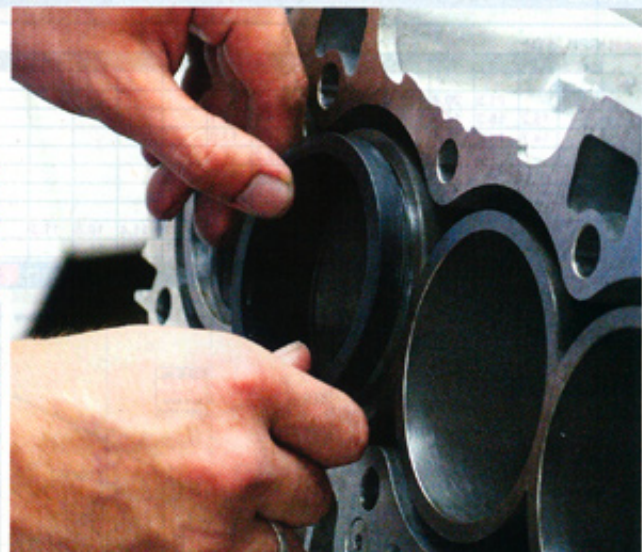
[I've seen one bored out to] 1/2 a millimeter. That's it.

**Do you think a B series engine can run 12.0:1 on 91 octane [JG Engine Dynamics setup]?**

When you use that phrase you mean something that should last past 60,000 miles. No. If you want to squeak it by, you might be able to. It all depends on how heavy the car is and if the guy cruises around with all his friends in the car. You might be able to get away with 11.8:1 to 12.2:1 but only with some really big primary lobe cams that would lower the cylinder pressure. So we can kinda get away with it, but it's still on the border. I mean both, detonation and reliability are an issue. The motor will detonate before you hear it. The last thing you want to do is detonate and unload the rings.

**Your engine package seems like it's the more reliable motor. Thoughts?**

We want it to last just as long as an OEM one, provided you were to keep up with the normal maintenance.







As I stated in the introduction part of the B series shootout, head machinist Mike Coughtrie can be one angry guy. What I didn't tell you was that he is a guy that loves to spread his knowledge. So on this visit, instead of yelling at me, Mike decided to tell me a few things about building engines. "Our concept behind this particular motor is to stick to your guidelines and build it as close to a two-liter as possible. Our motor can take a lot of punishment but the key to lasting long is a good tuner. We aren't tuners so we will use whoever can tune a good motor. Now since this is a street motor we are emphasizing torque. Torque is what you feel on the street. Also, we aren't gonna rely on any foo-foo stuff like coating. This is an engine you would get from us with your guidelines."

#### RS MOTORWORKS SPEC BOX

Builder	Buda
Pistons	Arias
Wrist Pin	Arias
Bore	Total Bore 81.75
Compression	11.0:1
Rings	Arias
Rods	Factory rods
Sleeve	Stock
Design	Cast Steel with the CP Wrist Pin Pressed
Crank	Eagle
Stroke	.95mm
Displacement	1995

"CAMs WILL BE THE DECIDING FACTOR AND ALSO HAVING A GOOD TUNER MAKES THE BIGGEST DIFFERENCE"

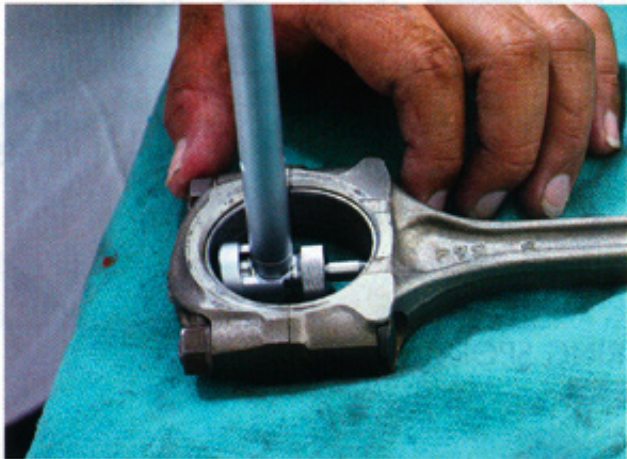


## Q&A

**What do you think about the longevity with your motor since it has a big stroke and short rod?**

Proprietary information. Haha! It's not much shorter than a regular Honda engine. <He punches numbers into a calculator.> Well, it's not the worst but it's not the greatest rod ratio. It comes down to the design of the motor and a lot of cam research. Cams will be the deciding factor and also having a good tuner makes the biggest difference. You know, the longer rod will make more torque blah blah blah. I mean it's gotten down to cylinder pressure sensor stuff in the real engineering world and they are finding that the rod lengths aren't that critical. But longevity wise, yeah that's an issue, but I'm looking at this motor at least lasting 100,000 miles.

*You guys are using a 95 mm stroke and a small bore, how do you think that*







# RS MOTORWORKS



**compares to a 89mm stroke and big bore? Almost the same displacements, but with a different bore and stroke?** More horsepower out of the shorter stroke. As we know, horsepower is never measured, it's a factor off of torque and rpm. Torque is what makes a heavy streetcar move. It comes down to the V8 stuff, you can feel 500 lbs-ft of torque at 6000 rpm compared to 500 horsepower at 8000 rpm. It comes down to building

the motor for the application.

**Do you think a B series on 91 can have a compression of 12:1 (JG setup)?**

It depends on the camshaft but I don't think so. I don't push that stuff. For our engine it will be at 11:1 but for a customer we'll go with 10.5:1. Honda runs them at 10.5 and we might do one at 11.5, but on a hot day it might detonate. Fuel quality is everything. You want to do a test! Test

some fuel sometime. Just go down to the pump and you would be amazed at the differences. Go to a couple different ones. I think you will find Chevron will be the most powerful gas.

**Since most of the competitors have a dyno to test their engines, do you think you have a handicap?**

Oh definitely!

**Your displacement is at 1995. Compare engine characteristics between 1995 and 1930.**

You must pick the application that you are intending to build the motor for. The arm is torque. That's what you feel on the street. If you need more than that then put a bottle on the damn car. A 95mm will spin just as hard as a 89mm. I've seen motors at 86mm bore by 89mm stroke make about 250 horsepower. They don't run very well on the street though.

**For the record, Mike likes to talk, a lot so here are just a few things that he said during the interview:**

"A man by the name of Gene Berg once said, 'For those who can only afford to do it once, quality isn't expensive; it's priceless.' I think that was off of 'The Old Ones' chat board. Gene is world renown for his Volkswagen transmissions. That was back in the '70s and '80s when Volkswagens were all the rage."

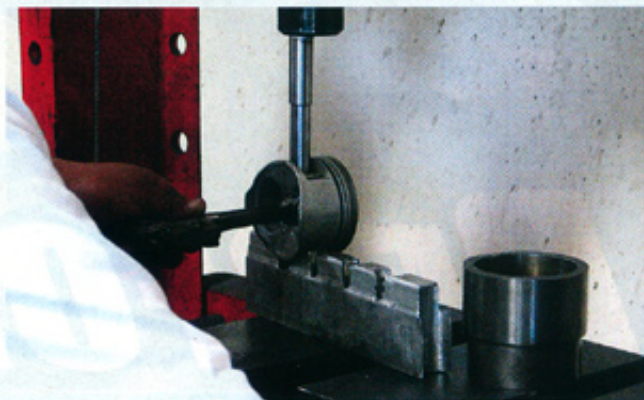
"Look what we did with Bisi motor! We did 10.7 on the small motor. He thinks it's detrimental. He will help if I want him to. SOHC is way under rated. Now if your talking SOHC stuff, then the guys at Exo Speed

can put together some good stuff."

"They just came out with the new Engine Master on the newsstands again. It's a good format and it's something you should look at."

"I really like the AEM system and I don't really want to put carburetors on this motor. If I wanted to go street racing, I might want to put some carbs on it. The Mustang guys rave about the AEM system."

"I just want to win the f@\$\$ing contest!"



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