

New Model A Engine



- The exterior is original
- The interior is modern
- New alloys & heat treat
- 5 main bearings
- 17 pressure fed bearings
- 8 counterweights
- Radial lip crankshaft seals
- 2-inch bearing journals

Topics for this Presentation

- **Introduce the team**
- **Engineering Evaluation Engine** (pre-production)
 - 6 Hour endurance test, Hill Climb, Teardown Results
- **Details of the new parts**
 - Cylinder Block, Crankshaft, Connecting Rod, Camshaft, Flywheel, and Head

The Team and Responsibilities

- **Terry Burtz (model.a.engine@hotmail.com)**
 - Design, Engineering, Anything technical
- **John Lampl (jrlampl@jrlasia.com)**
 - Manufacturing, QA, Importation, and Distribution
- **William Percival (wrpercival@gmail.com)**
 - Business management and bookkeeping

Constraints and Goals for the New Engine Parts

- **Appearance**
 - The exterior of all visible parts must look **exactly** like the exterior of stock Model A parts used during production and be able to pass fine point judging
- **Interfaces**
 - All interfaces for mating parts must be **identical** to a stock Model A engine
- **Basic Dimensions**
 - Bore, stroke, length of connecting rod, etc. must be **identical** to a stock Model A engine
- **Design Loading (for stress analysis)**
 - 5000 RPM
 - Unlimited fatigue life
- **Update to Current Technology**
 - Incorporate better materials, heat treating, seals, lubrication system, and insert bearings
 - Enlarge and streamline intake valve port
 - Document the new design with SolidWorks
 - Drawings are only used for QA
- **Lubrication system**
 - New design provides oil pressure to 16 bearings (17 with our new camshaft)
- **Cost**
 - Equivalent to a rebuild
- **Quality**
 - Equivalent or better than a rebuild

Engineering Evaluation Engine

- Bert's (Steve Becker) was hesitant but agreed to be the 3rd party evaluator
- Parts shipped directly from China to Bert's in Englewood, CO
- We were asked to arrive a few days later
- Engine assembled and running in 2 ½ days (no Builders Guide)
- Tested with stock oil pump and had no oil pressure
- Modified oil pump installed and had low oil pressure
- Ran at 3100 RPM (75 MPH) for 6 hours
 - Oil pressure > 4 PSI, oil temp 260 degrees F
- Ran at 2000 RPM for 5 hours
 - Head temperature 260 degrees F (operator error)
- Installed in Steve's coupe for a hill climb at Lookout Mountain
 - 5 miles @ 6 ½ percent grade
 - Steve wanted to keep the New Engine

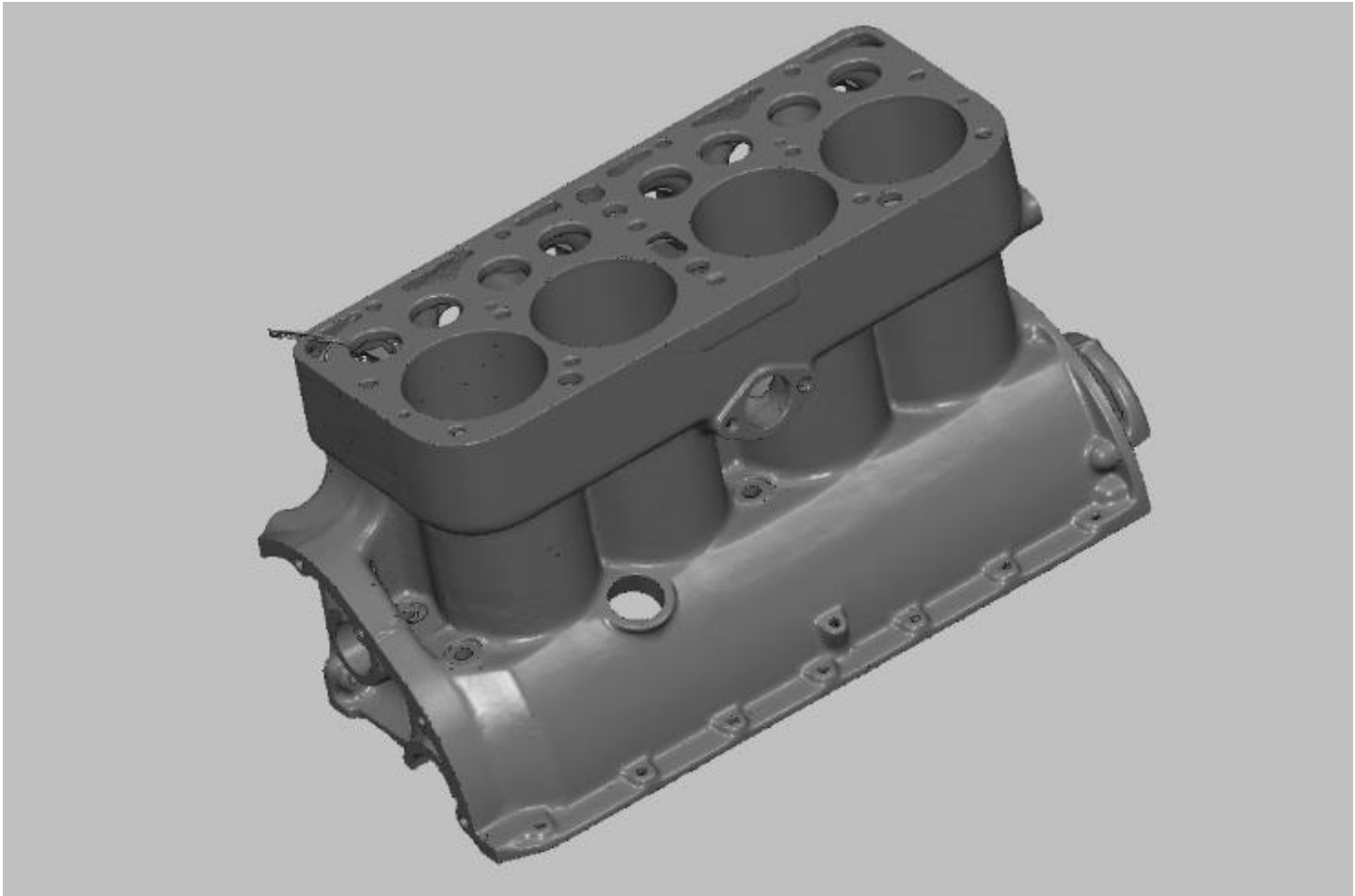
Assembling the Engineering Evaluation Engine at Bert's



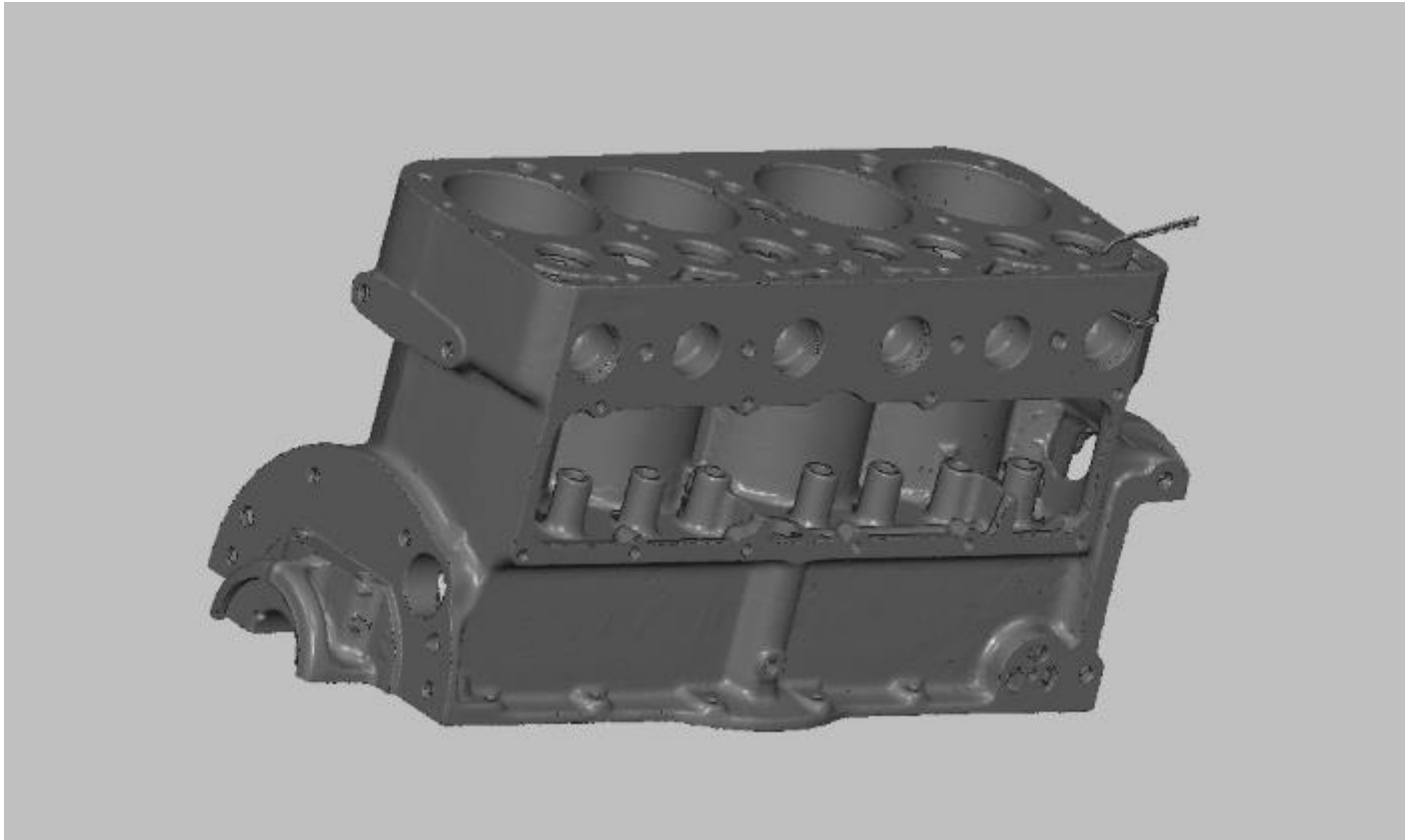
Cylinder Block Interior Redesign

- **Interfaces are from Ford drawing A-6015**
- **Improvements that have been incorporated**
 - 5 Main Bearings instead of 3
 - Large diameter (2") bearings, rear main shortened
 - Commonly available Insert Bearings (used from 1955 to 2003)
 - Pressure Lubrication to 16 bearings (5 main, 5 cam, 4 rod, and 2 thrust bearings)
 - All lubrication passages are in casting bosses (no tubes or fittings)
 - Radial Lip Rear Main Seal(s)
 - 5 replaceable cam bushings
 - Larger "B" size intake ports
 - Streamlined 135-degree intake ports (Stock are closer to 180 degrees)
 - Oil pump retention clamp
 - Thicker main webs
 - Thicker water jacket walls in areas prone to cracking
 - Thicker upper deck between exhaust ports and cylinders
 - Main caps located with dowel pins
 - Cylinder block is a modern grey iron alloy, main caps are a modern nodular iron alloy

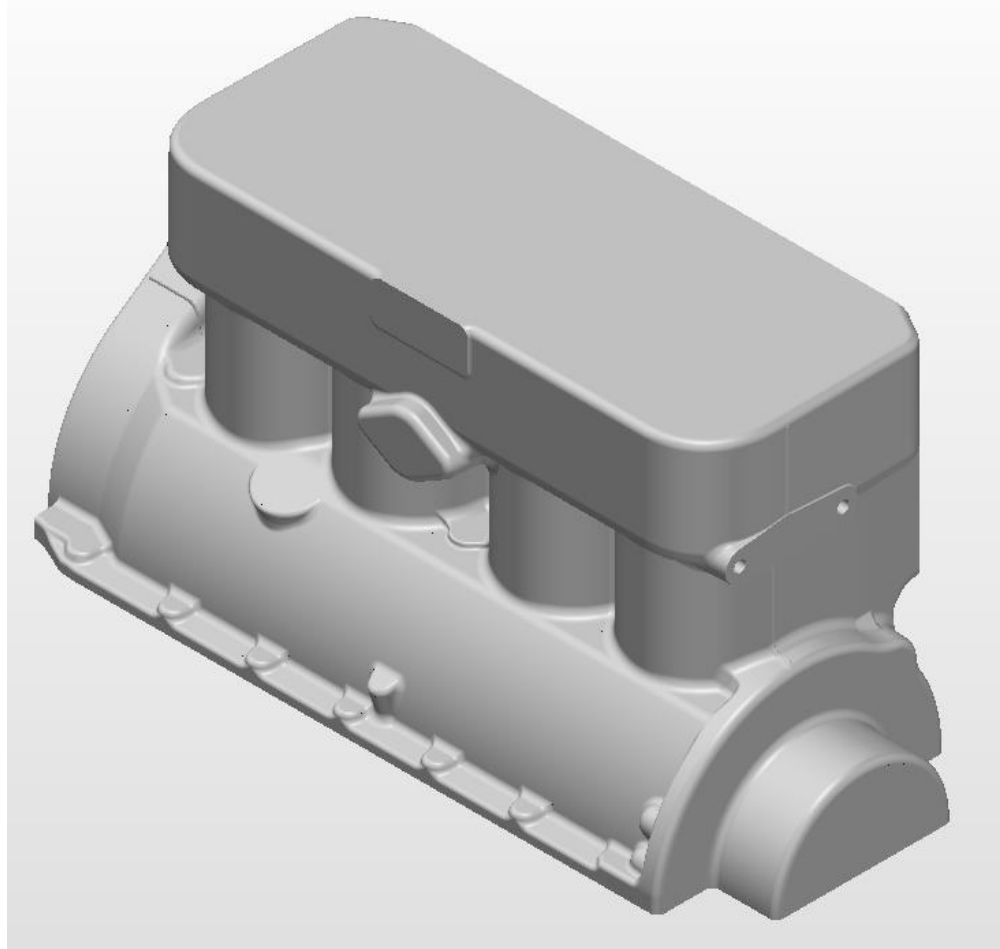
Laser Scan of Original Cylinder Block



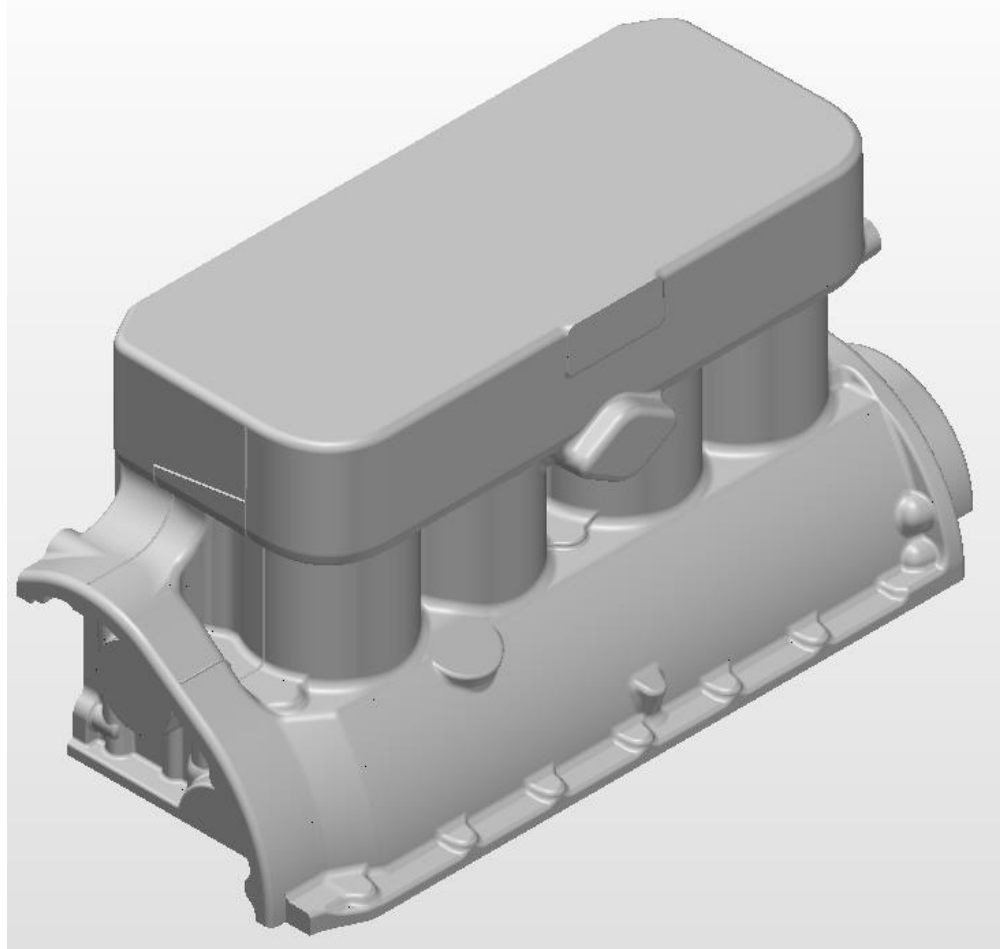
Laser Scan of Original Cylinder Block



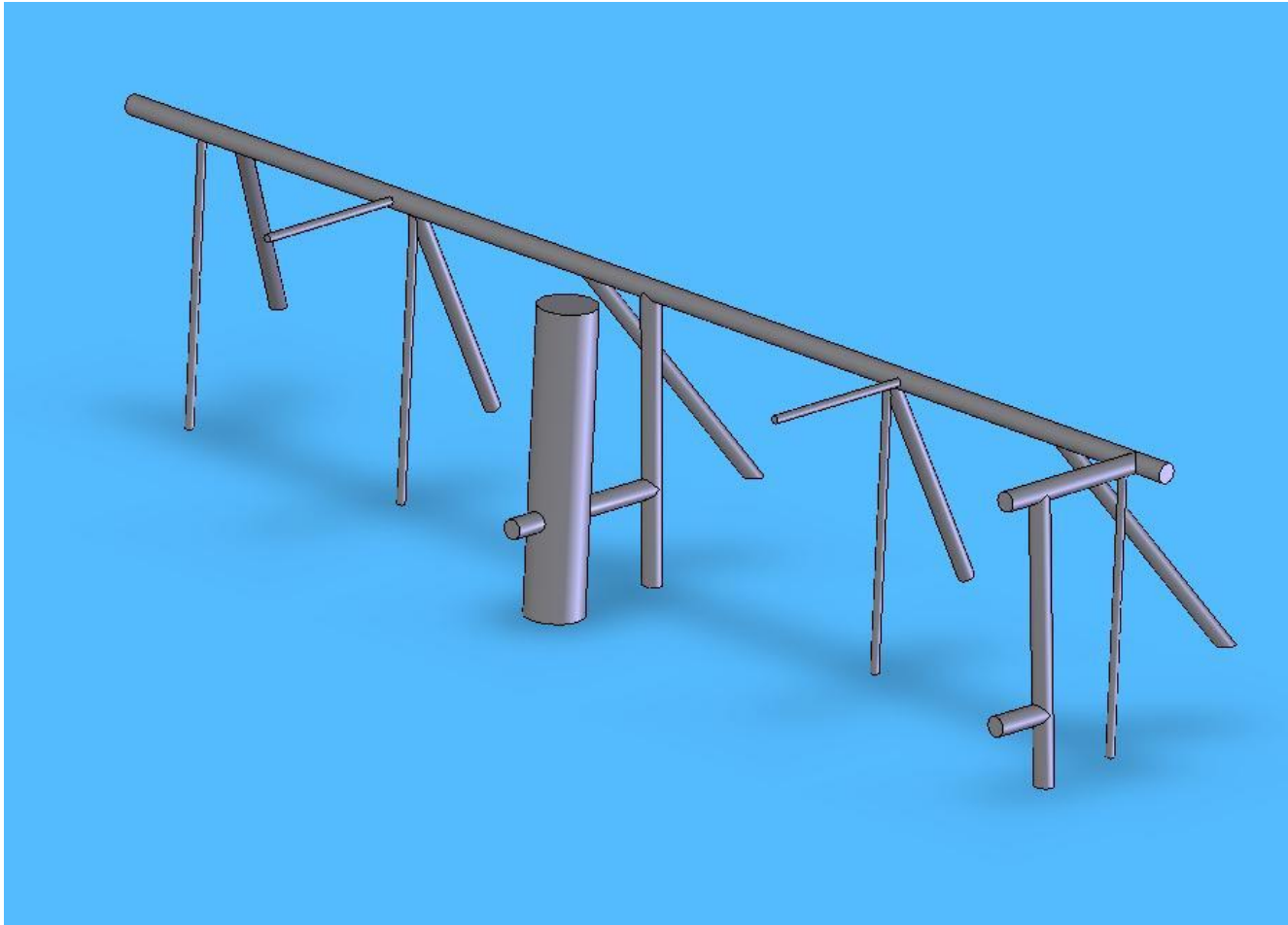
Solid Model of Original Cylinder Block



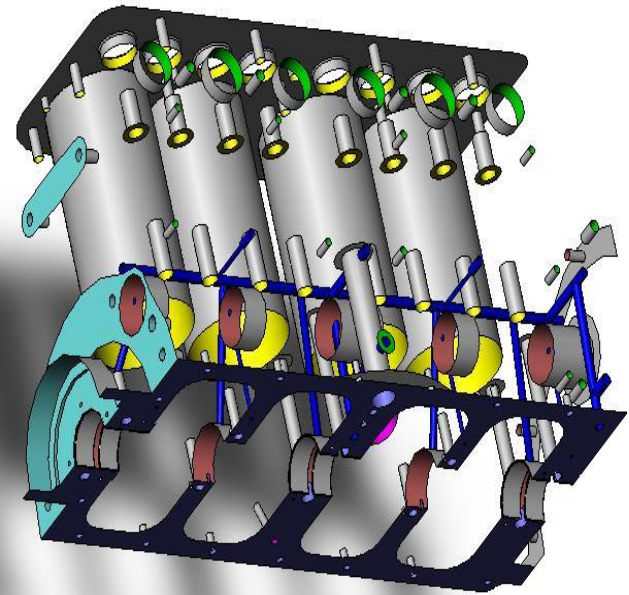
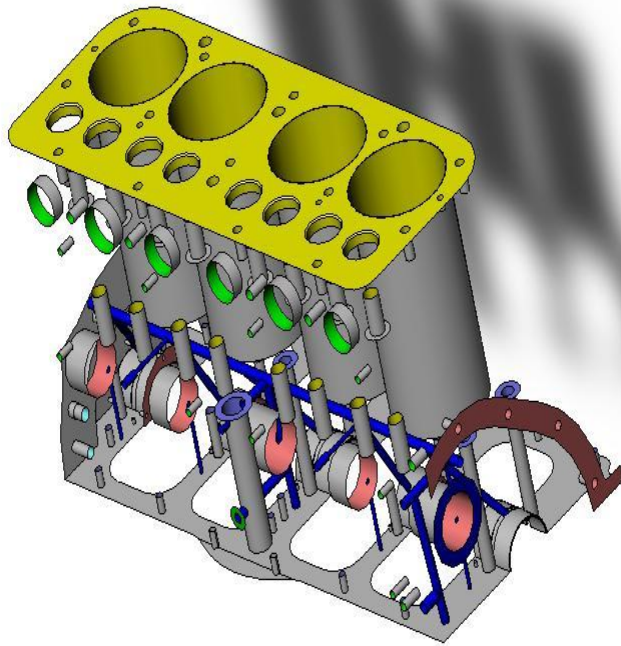
Solid Model Of Original Cylinder Block



Oil Passages and Routing



Oil Passages and Routing



Cylinder Block Machining



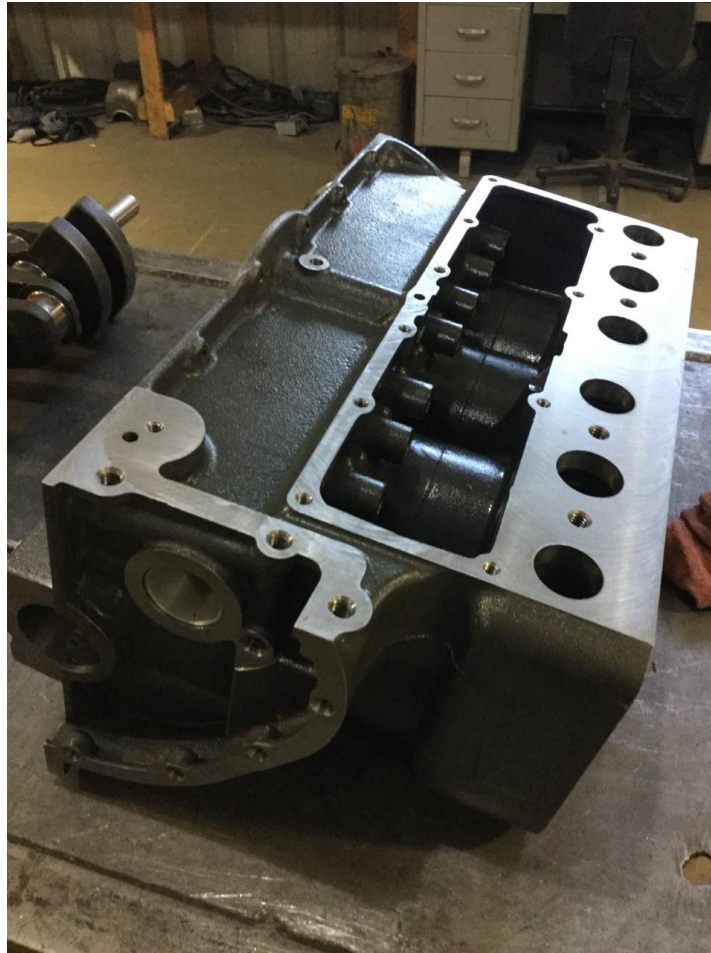
Partially Machined Cylinder Blocks



QA and Oil Passage Drilling



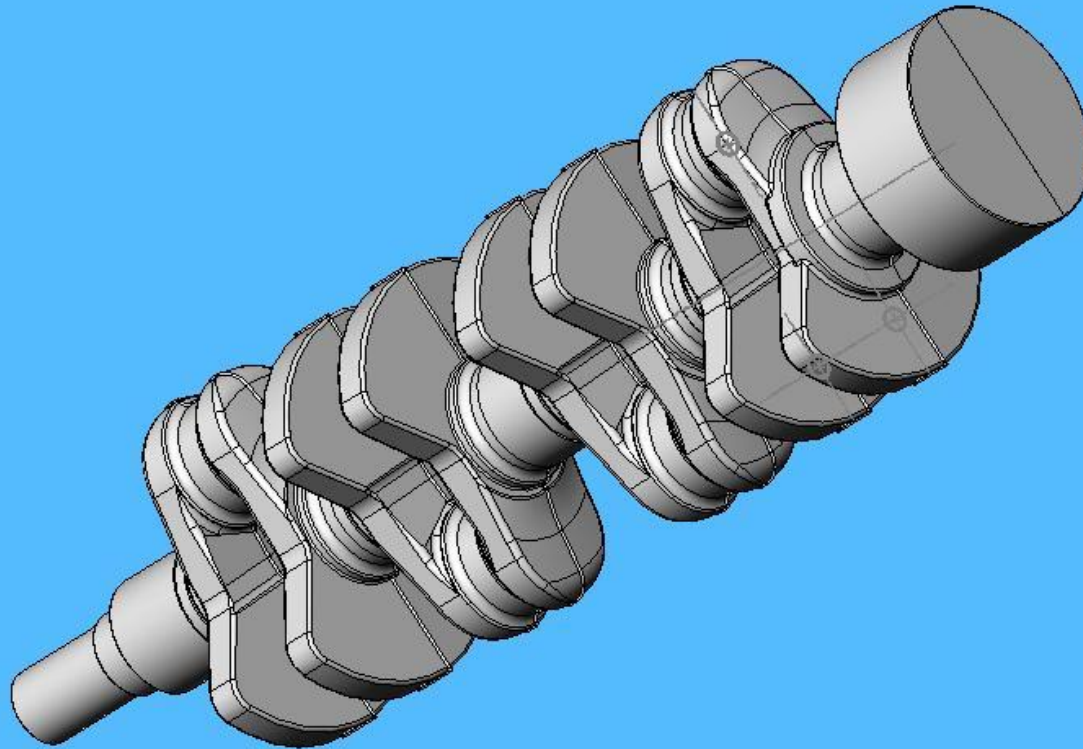
New Cylinder Block



New Crankshaft Design

- **Interfaces**
 - All interfaces with mating parts (except main and connecting rod bearings) are identical to stock Model A and from Ford drawing A-6303
- **Modern Nodular Iron Alloy**
 - Non-resonating material, 106 KSI yield
- **5 Main Journals**
 - 2.000-inch Dia. (Stock Model A has 3 mains, 1.625-inch diameter)
- **Connecting Rod Journals**
 - 2.000-inch Dia. (Stock Model A is 1.500-inch diameter)
- **8 Counterweights**
 - Counterweights are equal and on both sides of connecting rod (no bending)
- **Drilled from mains to rod journals for oil pressure**
 - Main and connecting rod journals are cross drilled
- **Extra wide flywheel mounting flange**
 - Shorter bearing = added stiffness
 - Provides a rubbing surface for full circle radial lip seal(s)
- **Balancing**
 - Static and dynamically balanced to 0.5 oz-in
- **Weight**
 - 53.5 pounds
- **Filletts**
 - All journal fillets are rolled (compacted) to minimize stress risers
- **Hardening**
 - The seal rubbing surface is induction hardened to Rc 42

Solid Model of Crankshaft



Crankshaft Castings



New Crankshaft

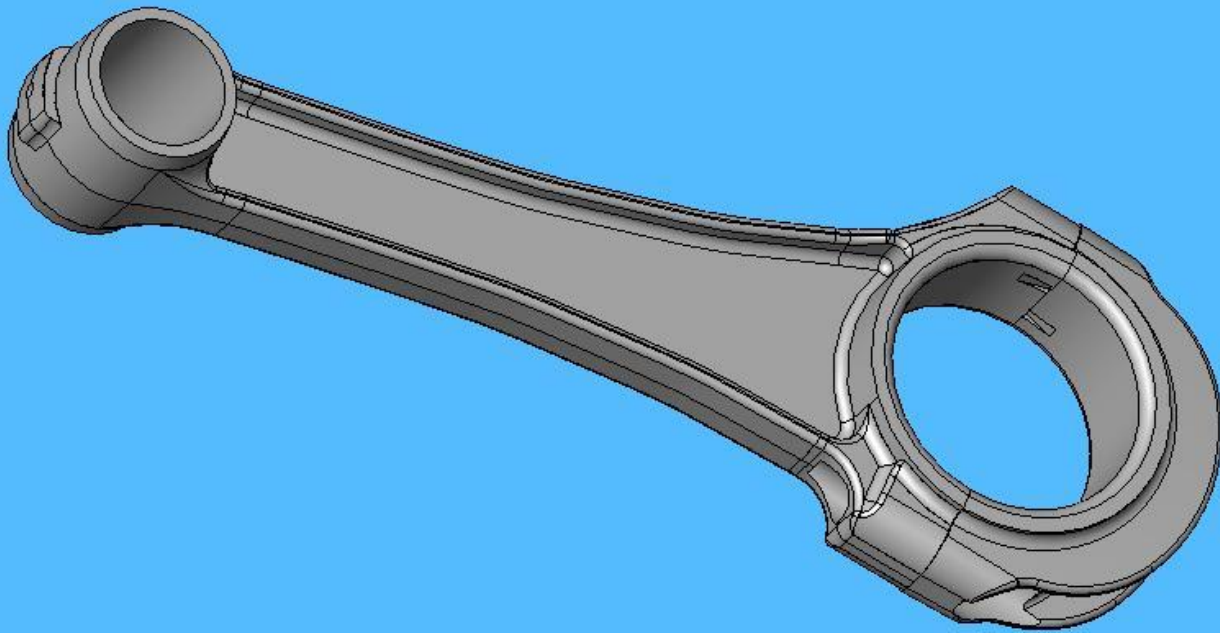
Material is 106 Ksi Ductile Iron



Connecting Rod Redesign

- Material is forged steel
- Interface at small end (bushing) is identical to stock Model A (same 1.000 in. inside dia. bushing is used)
- Interface at big end is 2 in. dia. journal (Stock is 1 ½ in. dia.)
- “I” section (spread flanges help direct loads to bolts)
- Parting line is at a 76-degree angle
- Bearing insert is the same as the main bearing inserts
- Dowel pins are used for cap alignment
- Analyzed with FEA for peak loading at 5000 RPM
 - Peak loading is at TDC at end of exhaust stroke
 - Analyzed with stock (1.55 lb piston)
 - Analyzed with heavy (2.00 lb piston)
- Balanced in sets of 4

Solid Model of Connecting Rod



Connecting Rods



New Connecting Rod

Material is Steel Forging



New Camshaft Design

- Material is modern nodular Iron
- 5-bearings
- Interfaces from Ford drawing A-6250
- Oil passages create 17th pressure fed bearing
- Induction hardened (no stress risers)
- Lobes Rc 58/62, bearings and gear Rc 40/52
- .340-inch lift
- 113-degree lobe separation (cam deg.)
- 248-degree duration at seat (crank deg.)

New Camshaft



Induction Hardening Advantage

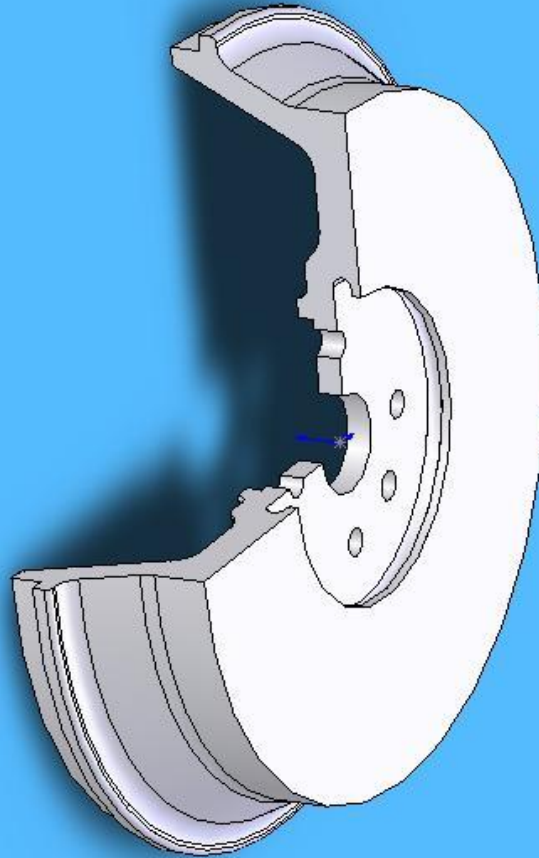
No Stress Risers



New Flywheel Design

- Material is Grey Iron
- Interfaces from Ford drawings A-6375 and 48-6375
- Weight is 30 pounds
- Drilled for V-8 9-inch Long design pressure plate (48-7563 or 09A-7563)
- 8N-7563 Tractor pressure plate is not recommended
- Use shoulder bolts to attach pressure plate
- Balanced
- No ring gear or pilot bearing supplied
 - Bevel forward/aft Bushing/ball bearing

SolidWorks New Flywheel Cutaway



New Flywheel, Front View



New Flywheel, Rear View



New Head Design

- Interfaces from Ford drawing A-6050
- Original production head was laser scanned
 - Delta foundry mark chosen (I,/ were also used)
 - Core wire bosses are included
 - No moats around head nut bosses
- Design documented with SolidWorks
- Replacement Ford heads are different
- 6.5 compression ratio
- 140cc chamber is a “heart” design
- Center deck is thicker
- Center oval hole removed (return to original design)
- Water passages resized to divert cool water to rear

Building the New Engine

- The latest “Builders Guide”, “Doubling the Flow Area of a Model A Oil Pump”, and “Installing an Oil Filter” can be found at www.modelaengine.com under guides. These guides are evolving, so it is important to check the website for the latest revision.
- Facebook group “The Burtz Ford Model A Engine” is a valuable hands-on resource with many comments, pictures, and videos.
- FordBarn and Vintage Ford Forum have many posts
- **We strongly recommend that you have your new engine built by a professional mechanic that has the knowledge, experience, and equipment to ensure a product that he can guarantee.**