In the exhaust port the gases are most compressed on the guild side, the area around the guild must be adequate for the gases to get beyond the guild. The TC has a pretty short exhaust port, combined with the 27°, it is quite efficient, thus easy to get more flow than you need. On full race spec engines, I've seen volumetric efficiencies of 100% and above, fantastic scavenging, but watch out when the exhaust valve is .050 off seat or in overlap, kiss that torque goodbye!

Another interesting area in the induction port is around the guild and into the valve pocket. From experiments with liquid flow, you can see how flow becomes delaminar as it hits the guild, and then settles down in the valve pocket, it is here a venturi shape is needed to accelerate the flow again and though the valve. But not to much, or you end up sending the charge down the exhaust. Maddening really, even with the accuracy of the CNC, there is still final finishing, and this is where the mistakes happen, and the critical volumetric efficiency is lost.

After I've swallowed, and deciding a particular head is worthy, there is one final tweak. With the computer simulation I can rotate the valve timing events, or lobe centers to promote the volumetric efficiencies I've measured from the flowbench. I suppose it is here that the overhead independent cam design really shines as you retard or advance the cams independent of one another. I've built my share of Crossflows and V-8's, single stick motors, they always leave me wanting to change the lobe separation.

Rod to stroke ratio will have an effective influence port flow, I've learned this from Dema Elgin, and noted differences on the engine dyno. What your looking for here is to maximize the piston speed at the most efficient time the port is filling or lift. This occurs between 70° and 80° ATDC. Through use of the computer we can determine how much of the intake cam area is being utilized at that timing event, compare this to the volumetric efficiency of that timing event, and you have optimized you rod to stroke ratio. For higher rpm engines a longer rod yielding a ratio closer to 2:1 will have a greater influence on the incoming charge, where as motor designed for lower rpm performance would have a shorter rod, or peak piston velocities sooner.

From all this it is my hope that the reader has developed a appreciation as to how much volumetric efficiency plays on how the final engine runs. The reader should be more constrained when tempted with that hot off the shelf cam. The order and progression of engine development starts with the head, establishing volumetric efficiencies from flow data, "then" cams are selected, degreed to optimum. Further support of the cylinder head system comes from the rod to stroke ratios, compression ratios and ignition timing.

For more information contact:
John McCoy, Omnitech Engineering, 3313 McAlpine Road, Suite C, Bellingham, Washington 98225. Phone: 360-671-1472. Fax: 309-210-7620
Email: info@omnitech-engineering.com
Website: www.omnitech-engineering.com

## LOTUS, LTD. LOCAL GROUPS

Please submit any local group info to Atwell Haines by e-mail at:
carbuff@lotusowners.com or by phone on (973) 927 3765 (5pm-9pm Eastern)

**ALABAMA**
Alabama Lotus Car Club - MIKE PEARCE, Birmingham, AL, (205) 951 7031

**CALIFORNIA**
Club Lotus L.A. - GORDON DAVIS, Los Angeles, CA, (818) 841 3189
The OC Lotus Club of Orange County California - SEAN SONGALIA, Placentia, CA, (714) 335 3721

**COLORADO**
Lotus Colorado (LOCO) - GREG CARPENTER, Denver, CO, (303) 973 9368

**FLORIDA**
Florida Lotus Owners Group (FLOG) - KARL-FRANZ MARQUEZ, Melbourne, FL (321) 253 4473
Florida Lotus Club - Palm Beach (FLC) - PETER MUIR, Jupiter, FL, (561) 799 3478
Associated Lotus Owners of Florida (ALOOF) - DENNIS FRESCH, Ft.Lauderdale, (954) 493 7976

**GEORGIA**
Lotus, Ltd. Southeast (LLSE) - MICK OPALAK, Atlanta, GA, (404) 250 0377

**INDIANA**
Club House for Indianapolis Lotus Lovers (CHILL) -YOUNG KIM, Indianapolis, (317) 507 3463

**IOWA**
Lotus Owners Touring Iowa (LOTI) - MARK DOUBET, Mt.Vernon, IA, (319) 624 4196

**KANSAS**
Amalgamated Lotus Owners - MARK BRACEWELL, Kansas City, MO/KS, (816) 459 7707

**LOUISIANA**
Louisiana Lotus (LALLA) - MICHAEL GLORE, Destrehan, LA, (985) 764 2396

**MARYLAND**
DC Chapter - PHILL MITCHELL, Wheaton, MD, (301) 942 6059

**MASSACHUSETTS**
New England Lotus Club - MARK MICHALSKI, W.Springfield, MA, (413) 785 5363

**MICHIGAN**
Great Lakes Lotus Club - CHRIS PRICE, Bloomfield Hills, MI, (248) 705 4895 (cell)

**MISSOURI**
St. Louis Area Lotus Lovers (STALLS) - ERIC NORDSTROM, St. Charles, MO, (636) 922 1723

**NEVADA**
Lotus Car Club of Southern Nevada - DAVE WEINBERG, Las Vegas, (702) 733 3111 (day)

**NEW JERSEY/NYC Area**
Lotus Enthusiastis Organization (LEO) - ATWELL HAINES, North New Jersey, (973) 927 3765

**NEW YORK**
Lotus Owners Of New York (LOONY) -TONY VACCARO, New York (Western), (716) 689 8644

**OHIO**
Cleveland Area Lotus, Ltd. (CALL) - MIKE ROHALEY, Mentor, OH, (440) 205 9456

**PENNSYLVANIA**
Philadelphia Area Lotus Society (PALS) - NATHAN DAVIS, Philadelphia, PA, (610) 860 9060
Western Pennsylvania - CHRISTIAN KAHLE, Pittsburgh, PA, (412) 736 9400

**TENNESSEE**
Tennessee Area Lotus Enthusiasts - CHRIS LAYTON, Memphis, TN, (901) 619 4872

**TEXAS**
Austin Lotus Enthusiasts (ALE) - ERIC TUCKER, TX, (512) 458 6400
Lotus Owners of Southern Texas (LOST) - NIGEL HARRISON, Houston, TX, (713) 824 1928
Texas Lotus Club - THOMAS BOHMIER, Dallas/Ft. Worth, TX, (469) 233 2332
North Texas Lotus Club - CODY McDANIEL, (214) 673 9943