**BUDGET**

To December 1987 the project spend was £13,2m against a plan of £14.0m. This temporary situation has arisen due to material cost being below estimate. Delays with availability of validation material means the difference will be used to cover the extra labour requirement from June '88 to the revised SSV in October 88.

**I.M. DOBLE,**
General Manager - LT5,
Lotus Engineering

# INDEX OF LT5 REPORTS

| REPORT NO | DESCRIPTION | ISSUED | AUTHOR |
|---|---|---|---|
| 0462 | Design Analysis Summary (Interim Report) LT5. | LT5 | N Fleming |
| 0465 | LT5 Throttle Body Heating Gallery Cold Fill Purge Performance | | T Holland |
| 0473 | Port Model Air Flow Performance | | J Vaughan |
| 0474 | Performance of Corvette with Air Shroud Inlet System Fitted to L98 Engine | | J Larsen |
| 0475 | Predicted LT5 Heat Rejection to Coolant | | J Larsen |
| 0476 | LT5 Induction Airflow | | M Gray |
| 0477 | Hydraulic Tappet Comparability | | M Gray |
| 0486 | Design Analysis Concept Study | | N Fleming |
| 0487 | Fully Supported Crankshaft | | N Fleming |
| 0488 | Crankshaft Simply Supported Bending Tests | | N Fleming |
| 0494 | Bending Vibration Analysis of the LT5 Crankshaft | | A H Green |
| 0502 | LT5 Calibration Update | | A Manias |
| 0503 | Engine Parameter Investigations | | A MacGilp |
| 0504 | Engine Breathing | | A MacGilp |
| 0505 | - | | A MacGilp |
| 0506 | Mechanical Development | | A MacGilp |

| NO | DESCRIPTION | ISSUED | AUTHOR |
|---|---|---|---|
| 0508 | LT5 Corvette Emission Review to 18th October 1986 | | J Bloomfield |
| 0509 | LT5 Crankshaft Analysis | | C Carey |
| 0512 | Engine Breather Survey | | M Gray/ A MacGilp |
| 0518 | LT5 Fuel and Ignition Calibration Interim Report 1/12/86 - 11/12/86 | | M Berry/ I S James |
| 0525 | LT5 Crankshaft Distortion Analysis | Jan 87 | A H Green |
| 0528 | LT5 Preliminary Blowby | Feb 87 | A Nobbs |
| 0533 | LT5 Corvette Gearbox Rattle & Vibration Analysis | Feb 87 | A Manias |
| 0536 | Photo-elastic Stress Analysis on the LT5 Crankshaft | | A M Crooks |
| 0539/ 87 | LT5 Corvette Noise Drive Pass Test | | M Gray/ T Holland |
| 0540/ 87 | Cold Weather Driveability Development Trip | | T Holland |
| 0542/ 87 | Valve Spring Wear - An Interim Report | | A MacGilp |
| 0547/ 87 | LT5 Hot Climate Performance (Interim) | | M Berry |
| 0549/ 87 | LT5 Emission Testing - Luxembourg | | I James/ M Berry |
| 0550/ 87 | LT5 Emission/Fuel Economy Development (Interim) | | I James/ M Berry |
| 0551/87 | Vacuum Actuators - Status 11.4.87 | | A MacGilp |

| NO | DESCRIPTION | ISSUED | AUTHOR |
|---|---|---|---|
| 0553/87 | Engine Test and Strip Report LT5 035 | | A Nobbs |
| 0555/87 | Tappet failures on 5/30 oil | | A MacGilp |
| 0558/87 | The Photo-elastic Model Analysis of the LT5 Engine Left Hand Cylinder Head | | A M Crooks |
| 0563/87 | LT5 Engine Cold Rig Testing | | A Manias |
| 0587/87 | Hot Climate Development Trip | | LT5 |
| 0589/87 | LT5 067 Engine History | | LT5 |
| 0594/87 | Photo-elastic Stress Analysis of the LT5 Crankshaft | | A M Crooks |
| 0597/87 | LT5 Cylinder Block and Crankcase Photo-elastic Results Analysis | 27.11.87 | H Shearman |
| 0599/87 | LT5 Denver Altitude Emission Performance | 2.12.87 | M Berry/ I James |
| 0607/87 | LT5 Cold Weather Development Trip | 23.12.87 | A Manias |
| - | Friction Motoring Tests, LT5 and L98 Engines | | D Coltman |
| - | LT5 Piston Hot Scuff Testing | | D Coltman |
| - | Preliminary Piston & Pin Scuffing Test (hot) LT5 | | D Coltman |
| - | LT5 Main Bearing Bore Investigation | | D Coltman |

DC/IND/D2/TAB

PROJECT 1EP.....

ENGINEERING PROGRESS REPORT

REVIEW DATE 9 January 1988

| ACTIVITY | CURRENT STATUS | PROPOSED PLAN | TARGETS |
|---|---|---|---|
| 0.01<br>CYLINDER CASE ASSEMBLY | Engine 069<br><br>Lower and upper crankcase extensively cracked after 121.5 hours, running on the Lotus high speed car cycle.<br><br>Analysis of the failure showed fatigue cracks propagating from the upper surface of the cast iron insert.<br><br>See attached report.<br><br>Production intent Phase III cylinder blocks have the following modifications -<br><br>a) Webs Nos. 2, 3 and 4 have section increased from 3.6 to 5.5mm<br><br>b) Rear main bearing length increased due to use of dual mass flywheel.<br><br>c) Revised oil flow to duplex chain.<br><br>d) Incorporation of separate rear seal housing.<br><br>LOWER CRANKCASE<br><br>Due to extensive cracking of the lower crankcase, seen on durability engines, the lower crankcase has been modified to incorporate increased stiffness cast iron inserts. Further investigation to improve lower crankcase location and clamping | Run a Phase III engine which incorporates increased section in the upper crankcase for comparison.<br><br>Monitor performance on durability engine tests.<br><br>Modify prototype tooling in line with design changes | On test 14 Jan 88.<br><br>Castings available Feb 88. |

| PROJECT ..... | ENGINEERING PROGRESS REPORT<br>REVIEW DATE 9 January 1988 ..... | | |
|---|---|---|---|
| ACTIVITY | CURRENT STATUS | PROPOSED PLAN | TARGETS |
| | incorporated into prototype equipment are:-<br>a) Improved engagement of fixing bolts allowing higher torque and increased clamp loads.<br>b) Increased bolt spacing by 3mm.<br>c) Incorporation of 12mm Ø ring dowels.<br>See attachment No. 2,101 to 2,106 | Conduct line bore trials to assess bore roundness with icnreased clamp load. | Castings available Feb. 88. |
| 40.03<br>OIL PAN ASSEMBLY | Oil pan baffle re-designed to simplify manufacture. | Modify baffle when design finalised. | |
| | Drawings supplied to Mercury Marine for comment. | Monitor on validation tests. | Parts available |
| | Oil surge tests carried out on Phase II engine fitted with Phase III oil pan.<br>Report attached. 2,107 to 2,108<br>High speed racetrack tests at Mosport revealed no oil surge problem, when Phase II oil pan design. | Repeat sump surge tests when parts become available. | |
| | Oil pick up pipe assembly modified to simplify manufacture "Reinz" gasket fitted between sump and lower crankcase on Phase III engines. | Monitor on durability tests. | |
| | Oil level indicator requires calibration. | Calibration on completion of oil surge and breather development. | |

PROJECT ..... 17 .....

ENGINEERING PROGRESS REPORT

REVIEW DATE ..... 9 January 1988

| ACTIVITY | CURRENT STATUS | PROPOSED PLAN | TARGETS |
|---|---|---|---|
| 40.05<br>CYLINDER HEADS | Phase III cylinder heads and cam covers incorporate production intent breather system. | Assess production machined parts on engines supplied by Mercury Marine. | |
| | Cylinder head and cam cover not machined on production tools. | | |
| | Current die cast cam covers supplied by Mercury Marine have severe porosity due to poor metal flow. | Mercury marine to improve casting process. | |
| | Port core location to be monitored in Production head on an ongoing basis. | Visit Birmal | End Jan '88 |
| | Oil feed system modified due to space requirements of Duplex chains. | | |
| | Valve rotation checks using triple groove collets show no improvement in rotation below 5,600 rpm. | Assess effects of inner and outer springs wound in the same direction with triple groove collets. | |
| | See attached report no. 2,109 to 2,111 | | |
| | Exhaust manifold bolt pattern modified to facilitate assembly at Bowling Green. | | |
| | Lotus are concerned with possible adverse effects on gasket durability. | | |
| | Four fixing holes are retained in cylinder head as back up. | | |

| PROJECT<br>TP5 | ENGINEERING PROGRESS REPORT<br>REVIEW DATE 9 January 1988 | | |
|---|---|---|---|
| ACTIVITY | CURRENT STATUS | PROPOSED PLAN | TARGETS |
| | Cylinder head gasket cycling test to be carried out with Phase II engine to provide early data on gasket performance. | Test to commence by the end of Jan. 88.<br><br>Phase III validation engine on test end of Feb. 88 | |
| 40.07<br><br>CAMSHAFT AND HOUSING ASSEMBLY | Production intent camshaft material is Lydmet 77 Mo Cu alloy with large base circle radius and tapered to induce tappet rotation.<br><br>Camshaft thrust washer position revised on Duplex engines, now fitted into slave bearing cap.<br><br>This modification simplifies assembly and improves serviceability.<br><br>Production intent cam profiles are:<br><br>A + B inlet<br>A + A exhaust<br>Camshaft timing<br>114° ATDC inlet 114° BTDC exhaust.<br><br>See attachment number 2,112 to 2,114 | Monitor on durability engines. | |

| PROJECT LT5 | ENGINEERING PROGRESS REPORT<br>REVIEW DATE 9 January 1988 | | |
|---|---|---|---|
| ACTIVITY | CURRENT STATUS | PROPOSED PLAN | TARGETS |
| 40.07 | The slow speed cam rig has completed 522 hours with steel camshafts and phosphated tappets using 10W30 oil.<br>Attachment No. 2,115<br>Cam cover sealing plugs re-designed to improve sealing.<br>Cam cover logo drawing released to Mercury Marine 7th January 1988. | Test with production intent components and 10W30 oil.<br>Incorporate on validation engine 072. | Test start date w/c 18.01.88. |

| PROJECT LTS | ENGINEERING PROGRESS REPORT<br>REVIEW DATE 9th January 1988 | | |
|---|---|---|---|
| ACTIVITY | CURRENT STATUS | PROPOSED PLAN | TARGETS |
| 40.08<br><br>CAMSHAFT DRIVE SYSTEM | Prototype Duplex chain with clearance centre link failed on engine 069 after 121.5 hours. Failure mode was fatigue failure of the joining link.<br><br>Failed components returned to Borg Warner.<br><br>Improved strength Duplex chains received from Borg Warner, these chains have an interference fit centre link with a 60% pre-stressing operation. Production intent.<br><br>Borg Warner state that chain life when compared to the prototype chain increases by a factor of 5.<br><br>Fitted to engine 070.<br><br><u>Back Up</u><br><br>Engine 090 build with 'silent' inverted tooth chain. | Monitor on durability Lotus High Speed Car cycle.<br><br>Evaluate chain control to 7,000 rpm. | |