

DOE/MC /31173--24

Industrial Advanced Turbine Systems: Development and Demonstration

**Annual Report
October 1, 1996 - September 30, 1997**

Work Performed Under Contract No.: DE-FC21-95MC31173

For
U.S. Department of Energy
Office of Fossil Energy
Federal Energy Technology Center
P.O. Box 880
Morgantown, West Virginia 26507-0880

By
Solar Turbines
2200 Pacific Highway
PO Box 85376
San Diego, California 92186-5376

RECEIVED
JUN 19 1998
OSTI

Jose **MASTER**

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Disclaimer

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

**Portions of this document may be illegible
electronic image products. Images are
produced from the best available original
document.**

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) has initiated a program for advanced turbine systems (ATS) that will serve industrial power generation markets. The objective of the cooperative agreements granted under the program is to join the DOE with industry in research and development that will lead to commercial offerings in the private sector. The ATS will provide ultra-high efficiency, environmental superiority, and cost competitiveness. The ATS will foster (1) early market penetration that enhances the global competitiveness of U.S. industry, (2) public health benefits resulting from reduced exhaust gas emissions of target pollutants, (3) reduced cost of power used in the energy-intensive industrial marketplace and (4) the retention and expansion of the skilled U.S. technology base required for the design, development and maintenance of state-of-the-art advanced turbine products.

The Industrial ATS Development and Demonstration program is a multi-phased effort. Solar Turbines Incorporated (Solar) has participated in Phases 1 and 2 of the program. On September 14, 1995 Solar was awarded a Cooperative Agreement for Phases 3 and 4 of the program (DE-FC21-95MC31173) by the DOE's Office of Energy Efficiency and Renewable Energy (EE). Technical administration of the Cooperative Agreement will be provided from EE's Chicago Operations Office. Contract administration of the Cooperative Agreement will be provided from DOE's Office of Fossil Energy, Federal Energy Technology Center (FETC).

Phase 3 of the work is separated into two subphases: Phase 3A entails Component Design and Development; Phase 3B will involve Integrated Subsystem Testing. Phase 4 will cover Host Site Testing. The cooperative agreement funding is separated into three budget periods. Budget Period 1 expires March 14, 1998.

2.0 SUMMARY PROGRAM ASSESSMENT

2.1 Estimate at Completion

Forecasts call for completion of the program within budget as originally estimated. Scheduled completion is forecasted to be approximately 3 years late to original plan. This delay has been intentionally planned in order to better match program tasks to the anticipated availability of DOE funds. To ensure the timely realization of DOE/Solar program goals, the development schedule for the smaller system (Mercury 50) and enabling technologies has been maintained, and commissioning of the field test unit is scheduled for May of 2000. The development schedule for the larger system (ATS-L) has been delayed to accommodate the funding shortfall without undue impact to near-term program goals, with commissioning of the field test unit planned for March of 2002.

Significant efforts have been spent since mid-year to reforecast and control expenditures due to Solar's and DOE's current funding and resource constraints. Selective reductions and delays in program activities were identified and implemented. Although these actions will increase technical risk and the attainment of stretch goals, it is not anticipated that the schedule for initial test units or the attainment of basic program performance requirements will be impacted.

2.2 Overall Assessment of Performance

As of the end of the reporting period work on the program is 22.80% complete based upon

milestones completed. This measurement is considered quite conservative as numerous drawings on the Mercury 50 are near release. (In order to main objectivity in assessing schedule progress, Solar uses a 0/100 percent complete assumption for milestones rather than subjectively estimating progress toward completion of milestones.) Variance information is provided in Section 4.0-Program Management.

Mercury 50: Work this year has focused on detailed design and the release of long-lead, critical part drawings. As is usually the case with programs involving any major turbine design, stages 1 and 2 blades and nozzles are pacing items and are consuming a large portion of the design resource.

Major design reviews held this year include those listed in Table 1. Each of the reviews resulted in positive suggestions for design improvements (mechanical integrity or cost); none were sufficient to impact the engine schedule.

Good progress has been made on the release of compressor parts during this reporting period, there being only two remaining stages of blades and disks left to release to the suppliers. The aft hub is the only remaining critical compressor part of significance.

The latest estimate of engine drawing completion is 45-50%.

Subassembly / Component	Date
Stage 2 Nozzle and Diaphragm Assembly	7 March
Preswirl Assembly	7 April
Exhaust Collector	8 April
Stage 2 Blade	15 April
Combustor End Cover	17 April, 9 May
Center Frame Assembly	3 May
Nozzle Case Assembly	6 May
Combustion System Assembly	9 May
Fuel Injector Assembly	9 May
Stage 1 Blade and Disk	15 August
Stage 1 Nozzle	27 August
Catalytic Combustor	05 Sept

Table 1. Mercury 50 Design Reviews

Over 200 preliminary drawings were issued over the past 12 months. In order to maintain an aggressive schedule, Solar design engineers, manufacturing engineers and suppliers work

concurrently based upon various levels of controlled preliminary drawings (CPDs) rather than working in serial manner based on the formal release of final drawings. Also some 160 tools are now order to support engine and rig build dates.

Solar received three development gear box housings this quarter, which were machined and delivered to assembly at Kearny Mesa. Kearny Mesa Assembly has completed the assembly of one gear box and delivered it to Superior Gear for test.

Twelve compressor case casting halves have been received and are awaiting the machining design release. The first development nozzle support forging was received, which will be used for machining development at the supplier. This first part is a Haynes 242 alloy and will be reserved for future testing.

Howmet is building casting tools for the first stage nozzle, second stage nozzle, first stage blade and second stage blade. Texas Steel built the patterns for the combustor end cover and the forward and aft end plates on the center frame. Many castings and forgings are scheduled to arrive during the next quarter.

Rigs and Technology Development: Work on the test rigs and in the enabling technology development programs is also progressing well. Significant milestones during the year have included:

- The design, assembly, installation, instrumentation and running of the compressor test rig at Wright Patterson Air Force Base. The rig was designed and constructed by The Agilis Group. Test results demonstrated compressor efficiency more than two points better than state-of-the-art industrial compressors.
- The designed, fabrication, instrumentation, assembly and running of the squeeze film damper rig in support of the Mercury 50 gas turbine anti-friction bearing system. Baseline testing using an existing damper design was completed; follow-on configurational option tests using a new Solar design is scheduled in early 1998.
- The design, fabrication and commencement of test activities on the half scale, uncooled, two and a half stage turbine aerodynamic test rig. The stage 1 nozzle flow tests have been completed, and baseline testing will commence in the upcoming reporting period.
- The completion of f&j testing (combined and gas-side core) on the Caterpillar Technology Center transient rig, and the fabrication, delivery and installation of a 100-cell performance core at the Caterpillar Technology Center, to measure the thermal effectiveness to establish the heat transfer and pressure drop characteristics of the Mercury 50 primary surface recuperator (PSR).
- Completion of testing on thermally painted screw cooled blades in Mars test engine confirming the effectiveness of this advanced airfoil cooling design to reduce blade leading edge temperatures while using less cooling air flow.
- Completion of single can catalytic combustion tests, demonstrating successful startup and transition from part load to catalytic operation, with NOx emissions consistently below 5 ppmv in catalytic operation at full load.

- The completion of design of the ultra-lean premix annular combustor rig and the construction of the housing and endcover, as well as the assembly of the first injector, for the rig. Atmospheric testing on the rig is scheduled to commence in the upcoming reporting period.
- Completion of a 2000 hour test of thermal barrier coatings (TBC) on Stage 1 turbine blades in a Mars field engine and a 50 hour test of TBC on a Centaur 50 combustor liner with no degradation or spallation of TBC observed.
- Successful forging, heat treating and mechanical property testing of subscale Udimet 720 turbine disks for the first two engines. Test results exceeded creep and rupture life targets.
- Installation and commencement of testing of the 4000 hour Ceramic Stationary Gas Turbine (CSGT) field test engine at the ARCO Bakersfield site. The successful startup of this engine under the CSGT contract marks the first ever operation of a gas turbine incorporating ceramic components in an industrial application environment. The modified Centaur 50 gas turbine contains AS-800 silicon nitride Stage 1 turbine blades fabricated by Allied Signal Ceramic Components and inner and outer SIC/SIC CFCC combustor liner fabricated by Dupont Lanxide Corporation.
- Construction of the vortex cooling heat transfer rig at University of Utah to evaluate heat transfer coefficients.
- The completion of vacuum die cast process and the receipt of test bars for material testing.
- The modification of 347 SS to produce a potential recuperator material having two to four times the creep life of standard 347 SS. A patent disclosure on the process has been initiated.

ATS-L: Work during the past year focused upon concept design. The Product requirements specification was completed, and the Business Plan was approved, in the second quarter 1997. An engine concept design review was held in July. Preliminary design proceeded with considerable effort spent on investigating alternative combustor designs. A preliminary design review is anticipated by year end.

Commercialization: Solar completed its ATS Commercialization Plan detailing the required efforts to promote distributed generation appropriately shape the ATS product and communicate the applicability of ATS products to fit these needs. The Plan was submitted to DOE in March 1997. The following subcontracted studies and reports were included as appendices to the Plan:

- Global Market Survey Report prepared by Duke/Fluor Daniel;
- Energy Use in the Industries of the Future prepared by Onsit Energy Corporation; and
- Environmental, Energy and Social Issues Affecting Distributed Generation Siting prepared by Resource Catalysts.

The latter study was funded with matching funds provided by the California Trade and Commerce Agency, Office of Strategic Technologies.

A full time Mercury 50 Sales and Marketing Manager was appointed in mid-April reporting to Solar's Director of Worldwide Industrial Power Generation (IPG) Sales. The Mercury 50 product was formally announced at the American Society of Mechanical Engineers (ASME) Turbo Exhibition in Orlando, Florida the first week in June. A Mercury 50 data sheet was released two weeks later at PowerGen Europe in Madrid.

Meetings were held in Rochelle, Illinois and at Solar's San Diego facilities during the Third quarter to pursue locating the Mercury 50 field demonstration unit within the Rochelle Municipal Utilities' service district. Formal announcement of the host site is anticipated in December.

Detailed highlights from the most recent quarter are discussed below.

3.0 TECHNICAL PROGRESS BY TASK

3.1 Mercury 50 Engine and Package

WBS 10200: Engine Design

Task complete.

WBS 10300: Package Definition

A design review was held in early September to status the package design effort and to ensure that the overall system schedule will be supported. As of that meeting the following subjective estimates of completion were made: frame design - 60%; recuperator support structure - 25%; lube oil system - 75%; gas fuel system - 50%; air assist system - 50%; and electrical packaging - 25%.

This quarter saw comprehensive development of detail design for the package with a focus on engine assembly removal from the forward end. The air inlet duct and the relief valve system design were completed.

WBS 11100: Air Inlet System

The inlet muff drawing has been fully reviewed with the supplier (Ketema) during this reporting period. Several minor changes have been requested to simplify the fabrication of this part. After a number of aerodynamic CFD (computational fluid dynamics) iterations based on preferences from Package Design, the air inlet duct configuration was accepted by all parties concerned, with minimal pressure loss compared with original designs.

WBS 11200: Compressor Assembly-Mercury 50

Compressor Static Structure: Detail design of static hardware has progressed well during this

reporting period.

Preliminary machining drawings for the air inlet housing, compressor case and compressor discharge were issued for hardware procurement. #1, #2, and #3 bearing housing casting drawings were also issued and parts were ordered. Some changes to the datum system have been requested by Manufacturing relating to the compressor discharge machining drawing. These changes will be made, and the drawing will be reissued.

The inner diffuser assembly has been issued to allow fabrication of this part. The outer diffuser assembly is also being detailed. Oil seals for the #1 bearing housing have been issued.

The outlet guide vane (OGV) went through a couple of major iterations during this reporting period. Product cost considerations played an important role in the final design selection. The inner diffuser casting and the semi-machined stator ring were redesigned accordingly. Changed castings will support the first few engines with extra machine time required.

Casting drawings for the IGV, VGV1, and VGV2 have been issued for part procurement. The stator vane 6 drawing has been issued for tooling. Stator vane design is complete for stages 7 and 8, and drawings are in the process of being created at Agilis.

Variable Guide Vane Actuation System: During this reporting period the layout of the vane actuation system has been completed. Drawings for the IGV, 1st stage and 2nd stage vane actuation rings were issued to initiate tooling. Two of the three rings have been designed similar to existing Solar engines, and the 2nd stage will be manufactured using tooling common with the IGV and 1st stage rings. No new tooling will be required for any of the rings. The supplier has reviewed the design and given feedback, which facilitated manufacturing processes.

Prototype components for the new variable vane shaft design were fabricated by the current vane supplier and are in transit to Solar. Availability of prototype test pieces will speed up the release of machined vane drawings.

Casting drawings for the IGV inner guide vane ring have been issued. The interface with the air inlet housing, the 1st stage compressor disk, and the inlet guide vane have been worked sufficiently to allow the supplier to proceed with the machining of the inner ring. Sufficient latitude has been incorporated in the design to allow for future potential changes without having to delay component delivery.

Compressor Rotor: Issuance of blade drawings progressed well during this reporting period. Drawings and electronic data for compressor blades 1 and 2 have been issued to the new forging supplier. Blades 3, 4, and 5 castings were received, and the first article inspections were completed for these blades. Some minor issues were evident relating to the chord width and platform contour profile; however the airfoils themselves were excellent in quality. The first metal samples of blade 6 castings were completed. Casting drawings of blades 7 and 8 were recently issued to the supplier. The machining supplier was recently chosen for blades 3 through 10.

Disk and spacer drawings were also worked vigorously during the last reporting period. Disk assembly drawings for tooling purposes were issued for stages 1 through 9. The forward and aft hub semi-machined drawings were completed and issued.

WBS 11300: Combustor Assembly

Combustor Case: The endcover castings were received from Texas-Steel. These two castings will be used for the combustor rig testing. Also, the combustor housing casting drawing was released to Wisconsin Centrifugal enabling tooling fabrication.

A visit was made to the machining supplier, Major Machining, to review the endcover and housing machining drawings in detail. Many suggestions were made based on Major's experience with Solar parts. Most of these suggestions have been incorporated into the drawings.

A material test plan has also been conceptualized. This will involve testing 347 stainless steel keel bars for creep and fatigue properties. Test samples will then be removed from an endcover casting. These will be correlated to the keel bars. These tests will be used to verify design margins.

A 3D elastic/plastic analysis of transient thermal and static loads was completed for engine startup to shutdown. These results have been compared to the original 2D analyses and to standard ASME Boiler Code. Several areas of high stress concentration were identified which necessitated the introduction of an additional heat shield to buffer the thermal gradients during the engine transients.

WBS 11400: PSR Section

A design review was held with recuperator manufacturing in July. The core, air inlet and outlet ducts, gas inlet and outlet ducts, mounts, thermally balanced restraint system (TBRS), end beam and mount drawings were reviewed by manufacturing.

Final assembly drawings completed and are undergoing final check.

Factory assembly of a Solar prototype core is in progress. All air cells have been manufactured for that core, and core assembly is in progress.

Transient structural analyses during start up of the recuperator are being performed. Preliminary results have shown that the air out duct tee is excessively stressed. The high stresses are due to thermal gradients that occur during start up. Structural supports are being redesigned to alleviate the thermal stresses that develop.

Sample welds of the tee to core weld were fabricated and analyzed. The analysis revealed poor penetration due to the difference in thickness of components. Modification to the weld preparation of the tee and the resulting impact on the structural integrity is being analyzed.

TBRS stud stress analysis was performed to validate change in thread. Gas ducting deflection analysis was performed to verify the clearance of stiffener tube during operation.

WBS 11500: Fuel System -Mercury 50

Ultra lean premix (ULP) combustion system: The majority of the drawings for the ULP

combustion system assembly and the annular combustion test rig were released during this last reporting period for the manufacture of combustion development hardware. The combustion liner hole patterns have still not been fully defined but liner drawings were released to the allow design and manufacture of the required tooling.

A decision was made to modify and use Centaur 40 fuel manifolds for the Mercury 50 engine. CFD and flow modeling work has been continuing to support definition of the injector plenum air deflector baffle. Other sheet metal parts which go into the injector plenum, i.e., the air flow baffle and end plate heat shield are still being worked.

The injector design was released, but certain key dimensions will not be fully defined until test results from the prototype injector are obtained.

Concerns relating to the ability of the electro-chemical milling supplier to meet target dates for the turbulated liner cylinders forced a decision to go with wire turbulators for the first engine build. The ECM liners will now be used for the 2nd development liner.

The first prototype Mercury 50 ULP gas only fuel injector was assembled and underwent cold flow testing to measure its flow effective areas for comparison with the design intent. The injector also was tested in a cold air flow combustor rig to visually observe the flame from the main and pilot systems. Thus far all testing has met expectations, but the design will not be fully qualified until testing at representative inlet air temperatures and pressures is completed. Manufacturing of components to make a full engine set for the annular combustion rig tests has been ongoing during this reporting period.

WBS 11600: Turbine Assembly

Stage 1 Blade: Mercury Machine Tool Company is in the process of developing the airfoil wax die and the electrodes for the ceramic core die. They have completed 40% of the wax die and approximately 80 % of the ceramic core electrodes during this reporting period. They have also completed 20 % of the machining fixtures. A drawing/tooling design review was held in July. Attendees included Solar personnel from design, heat transfer and layout as well as representatives from Howmet and Mercury Machine Company. An electrode review was held in September.

A critical design review (CDR) was held in late August for the stage 1 blade and disk. A few minor issues were raised, but the design team sanctioned the blade design. The design team has been evaluating three different suppliers for the abrasive tip coating deemed necessary for optimal engine efficiency. Solar and Howmet are in process of evaluating a Pt-Al coating/CMSX-10 material combination. Solar and Howmet are also of consolidating the thermal cycles for the CMSX-10 blade.

Drawings for the stage 1 disk and rim seals have been released for tooling purposes, with the disk rough machining drawing released to order actual parts. Rough machining disks have been received in house. Blade damper drawings have also been issued.

Stage 2 Blade: The second stage turbine blade drawing was issued this reporting period for tooling purposes. Release of the turbine blade casting definition has allowed for investment casting tooling procurement. Details of the blade firtree attachment have been thoroughly analyzed for adverse

tolerance conditions and the design definition incorporated into the blade configuration. Similarly, rough machined disk definition release has stimulated progress on the Udimet 720 intermediate grain size development program. Ladish Corporation has developed forging die and ultrasonic inspection shapes and completed preliminary cooling rate studies. Wyman-Gordon Corporation completed the first four pancake forgings for Udimet 720 and has developed ultrasonic and heat-treat shapes from the released disk design definition.

Detail design of the turbine shaft and center-shaft has progressed over the last reporting period. Seal stress calculations for the threaded labyrinth seal were completed using ANSYS finite element modeling. The shape was optimized to fit in the available space with due regard to thermal and centrifugal deflections matched with acceptable stress. Curvic coupling separation forces and required assembly interference for pressing the seal disk on the turbine shaft were calculated and found acceptable. Both shafts modeled using finite element techniques and acceptable stresses/deflections were demonstrated as a result. Appropriate spline dimensions and pilot dimensions were assessed and incorporated into the design.

Stage 1 Blade Cooling Design: The cooling design of the first stage turbine blade was completed during the last reporting period. Design options were identified in an effort to reduce risk and to be rainbow-tested. A 15.4X scaled leading edge model with the screw-shaped swirl cooling configuration was tested for heat transfer coefficients using a transient liquid crystal technique. The measured values matched within 5% of the predicted values. A 7X polyurethane model of the overall cooling core is being constructed that will be used for a flow visualization and pressure drop and heat transfer measurements.

The aft nozzle support was redesigned during this reporting period in order to minimize thermal distortion.

A finite element thermal model is being constructed to provide transient response data for turbine tip clearance predictions. This model will include a 3D centerframe along with 2D combustor, turbine and compressor sections. The complete engine thermal model is 50% defined, pending completion of nozzle support/centerframe interface redesign. The thermal FE model will make use of a recently completed engine dynamic simulation database which predicts dynamic transient behavior characteristics for the recuperated Mercury 50 engine for all operating conditions.

WBS 11800: Exhaust Assembly/Center Frame

Center Frame: A design review of the center frame design was held in July. The review confirmed the acceptability the center frame under steady-state, and full load conditions. A simplified 3D finite element transient thermal and stress model for the center frame (based solely on the axial deflections) was completed in August.

Drawings for the forward and aft end plates have been issued for tooling purposes and have been sent to the supplier for procurement. The full center frame assembly supplier has been selected and is awaiting the full assembly drawing release.

The preliminary relief valve piping system were defined. Engine design is working closely with Packaging to assure that the system performs as required.

Exhaust Collector: A Critical Design Review for the exhaust collector was held in July. Agilis representatives presented the current design and analysis to the Mercury design team. The design was approved, pending action items documented in the review. During this visit, Agilis and Solar's engineers visited Solar's collector supplier, Ketema. A few modifications to the design were incorporated based on this visit.

Drawings have been released to the supplier for tool fabrication. These drawings include the flange forging, the flange machining and the outer flowpath.

A stress analysis of the collector without heat shields resulted in a design modification to exclude the heat shield. This will reduce cost and the complexity of the assembly.

A CFD analysis was undertaken during this reporting period which demonstrated an increase in pressure recovery with the addition of a simple baffle plate. As a result of this analysis, a baffle plate will be added during engine development testing to verify predicted efficiency increases. If the test is successful, the plate will be introduced into the collector design.

A detailed conceptual study was undertaken by Agilis during this reporting period to investigate the feasibility of incorporating a hot strut design in place of the current EGV and nozzle case support system. The hot strut would mitigate the sensitivity of the stage 1 blade tip clearance from centerframe thermal effects. The conceptual design has been completed. A preliminary hot strut drawing will be prepared in order to send to potential suppliers for cost assessment.

WBS 12110: Generator

The generator specification was issued and Request for Quotes were issued to several suppliers. Only one supplier had responded as of the end of the quarter.

WBS 12140: Package/Generator Frame

The basic skid was designed, and a CAD model was completed. The base design includes the generator support, oil tank (inclusive to frame/not removable), pivoting trunnion mount, 'soft foot' mount, tie down pads and lifting devices.

The recuperator support is still in the concept stage - no detail design was done this quarter.

WBS 12150: Enclosure Assembly and WBS 12160: Ancillary Equipment

Package heat rejection for ventilation requirements and package noise signature were established after technical interfaces between package and engine design engineers. Ancillary engineering finalized the air inlet duct configuration with a comprehensive interface with engine design engineering. The 'relief valve system' silencer design was modified to allow for updated design conditions. The associated control scheme was revised. The air inlet filtration system and the ventilation system for the enclosure were initially sized, thus allowing an assessment of the feasibility of innovative package design concepts. The 'drop-over' enclosure concept was presented at the package design review. Work was initiated on the design of an overhead engine

removal system that will be integral with the package support structure.

WBS 122210: Control Console

Conceptual control concepts were developed and sketches reviewed sketches within the Controls Group. An input/outlet list was completed based on available current information relating to the engine and package equipment. A CO analyzer was selected on an interim basis.

WBS 12220: Lube Oil System

The lube oil system was 80% complete. Work was done towards selection of suppliers of oil pump/motor/valve assembly. A further iteration of the on-going update of lube oil schematic was completed. The thermo control valve was defined.

WBS 12230: Fuel System

Another iteration of the gas fuel schematic was completed. The design of the system is approximately 80% complete.

WBS 12240: Start System

Design of the start system is complete.

3.2 TECHNOLOGY DEVELOPMENT PROGRAMS

WBS 19100: Advanced Turbine Cooling and Sealing

Blade Screw Cooling: A test rig to evaluate the heat transfer coefficients in a screw-shaped vortex cooling chamber was completed at the University of Utah. The engineering report on the flow phenomena for this cooling technique was submitted to Solar. A test report on the effects of rotation on screw-shaped cooling effectiveness was completed at MIT and submitted to Solar.

Nozzle Film Cooling: Validation testing on the upscaled turbine nozzle film cooling test rig was completed. Testing included steady state and transient testing, as well as the secondary (coolant entry) flow systems.

Disk Cooling: The gas ingress test on the unsealed disk cavity was completed on the rig as a baseline for evaluating optimized turbine disk sealing and cooling. Comparison tests on the sealed disk cavity have been started.

Semi-active Tip Clearance Control: A Saturn engine demonstration test with semi-active tip clearance control was successfully completed, and results are under evaluation.

Other: A feasibility study was performed for application of dimples for heat transfer augmentation without and increase in pressure loss penalties. Results are promising for both

turbine hot section and combustor liner cooling.

WBS 19200: Advanced Combustion

Ultra-lean Premixed (ULP) Combustor Development: CFD runs on the initial design of the Mercury 50 lean premixed injector indicate flow detaches from the downstream portion of the centerbody due to the flow expanding into the liner. This can be prevented by recessing the centerbody.

The first Mercury 50 prototype fuel injector was assembled and cold flow tested. A single injector test section was initially commissioned with a standard SoLoNOx injector. Testing of the Mercury 50 injector will begin next period.

Advanced Combustor Controls: Attempts to operate the CEMCAT carbon monoxide (CO) sensor on a wet (undried) gas sample failed. The need to dry the gas sample and control flow rate over the sensor requires nearly as much flow conditioning as a conventional CEMS system. On the other hand, testing at Servomex has shown that its CO sensor has the sensitivity necessary to measure concentrations of less than 50 ppm, without the complexity of the CEMCAT system.

Advanced Liner Cooling: Dimpled plates were prepared and tested in the heat transfer rig. This surface has demonstrated the required high heat transfer coefficients with very low pressure losses. This offers potential for significant improvement in the combustor cooling approach, and manufacturing methods are being evaluated.

Catalytic Combustion: Atmospheric rig tests of a subscale catalyst bed was completed at PCI. Local overheating of the catalyst was evident, and a redesign is in progress. At Catalytica, the subscale tests for durability and the effects of contamination continued. At Solar, the layout of the Mercury 50 combustion system was completed, and a very successful preliminary design review was held.

WBS 19300: Ceramic and Composite Materials

Ceramic Blade Development: The rub rig is being prepared to test ceramic blades (from CSGT) rubbing against an abradable tip shoe. Effort on the design of a ceramic blade for the Mercury has been delayed indefinitely due to funding limitations.

Ceramic Nozzle Development: A patent application for the long term conditioning of silicon nitride was finalized. No further effort will be spent on the ceramic nozzle at this time.

Ceramic (Composite) Interstage Seal Ring: The rub test disk knife edges were coated with chrome carbide, and the disk and CFCC seal ring are ready for rub testing.

WBS 19400: Advanced Turbine Materials Development

Forged Disk Development: Results of initial creep and rupture tests of course-grained Udimet

720 at Ladish Company meet the minimum life targets established for the Mercury 50 second stage disk design. At the design operating temperature, the Udimet 720 disk is expected to have 20 times the life of a Waspaloy disk. Notch ductile behavior has been observed on all creep rupture specimens to date. Promising results were also obtained from the first low cycle fatigue tests at 1325° F.

At Wyman Gordon, mechanical tests of the course grain material are 60% completed. Tensile tests at 1000° F and 1200° F exceed program targets and creep rupture tests are in progress. On this material notch brittle behavior was observed, which is a critical issue being investigated further. Pancake forgings for the first two Mercury 50 engines have been forged, heat treated, and ultrasonically inspected. Machining at the supplier will be completed next period, following release of the drawing.

Dual Property Disk: Hub materials and rim castings have been received, and samples are being tested for material properties. No further effort will be spent on this program at this time due to funding limitations.

Advanced Casting Techniques: The vacuum die cast mold for test bars was modified to provide straight test bars, and bars were received for materials property testing. A mold for the compressor blades was fabricated. Test blades will be cast during the next reporting period. A sliding ring for the Mercury 50 engine has been spraycast and HIPed, reducing manufacturing cost. Test data shows properties similar to wrought ring-rolled Waspaloy.

Low Coefficient of Expansion Material: The first Mercury 50 nozzle support rings produced in Haynes 242 from 12" diameter billet were delivered. They are being used for mechanical testing and machining trials, and one ring will be made available for engine testing. Mechanical properties have met the specified requirements. The prime path material for this part is Waspaloy due to its superior high temperature properties.

Single Crystal Blade Material -CMSX-10: Experiments have led to a 33% reduction of solution heat treating cycle time, which is a cost saving factor. Mechanical tests are being made to determine the effects of the reduced solution time.

WBS 19500: Recuperator Material Development

Initial testing of the modified 347 SS has shown excellent results in both creep and oxidation tests. The modification is achieved via new thermomechanical processing techniques, and the material has an estimated creep life of two to four times that of standard 347 SS. A patent disclosure on the process has been initiated. This material is expected to increase recuperator life at 1200°F from 30,000 hours to 100,000 hours.

Other materials were reviewed as candidates to increase operating temperature capability to 1300°F. Three candidates are being tested, and one shows good potential based on early creep tests, and another may actually be capable of 1400°F for low pressure applications.

WBS 19700: Advanced Coating Systems

Thermal Barrier Coatings: An instrumented test on a thermal barrier coated (TBC) combustor liner demonstrated metal temperature reductions up to 150°F. A longer term test is being prepared. Engineering Design Memos (EDM) were issued on material property data measurements of plasma sprayed TBCs and on a life prediction method for plasma sprayed TBCs.

Thermal cycling tests to 2000°F were completed on four different TBC systems. The tests showed that TBC life is shorter for 10-hour thermal cycles than it is for 100-hour cycles. EB-PVD TBCs were applied on Taurus turbine blades for evaluation.

Rub rig tests of un-tipped blades against functionally graded material and thick ceramic abradable tipseals were completed at temperatures of 1100°F, 1650°F and 1800°F. Some blade tip loss was observed, and evaluation is ongoing.

Internal Coatings: 1000 hours of oxidation tests at 1500°F and hot corrosion tests at 1200° F were completed on thin aluminide coatings on single crystal alloys CMSX-4, CMSX-10, and CMSX-11. In the hot corrosion tests, the coated samples had one tenth the weight change of the uncoated samples, indicating that the aluminide coating provides ten times the stability of the base alloy. They may help provide a component life of 5 to 10 times that of one of uncoated alloy. Chemical Vapor Deposition and Above the Pack processes were performed on sample blades. Uniform coating distribution and clean coating/substrate interface were accomplished. A successful cleaning process for internal coatings was established.

Alloy Coatings: The evaluation of as-coated Chromalloy UK Platinum-Aluminide on CMSX-10 single crystal alloy was completed. Results showed no topologically close packed (TCP) phase formation on the machined surfaces. In comparison, state-of-the-art coatings such as MDC-150 exhibited up to 1 mil in TCP phase formation. After oxidation at 2100°F for 100 hours, the CUK coating exhibited 2.5 to 3 mils in TCP phases, whereas the MDC-150 coating exhibited 5-6 mils TCP phases. Oxidation testing at lower temperature is in progress.

WBS 19800: Advanced Diffusers

Diffuser tests with vortex generators installed demonstrated greater improvement on diffusers without collectors than those with collectors. Preparations are now in work for the half scale diffuser for the turbine test rig.

WBS 19900: Man-Machine Interface

All of the run-time services for the MMI have been demonstrated, as has the multi-language and historical data playback capability. The graphical editor toolkit has been integrated. Testing is continuing on the Integrated Development Environment and the View Editor. Development is also continuing on the integration of Visual Basic for Application to perform the math calculations and on the MMI setup programs for alarms and data.

3.3 ATS L-ENGINE

WBS 202000: Engine Definition

The ATS-L engine concept design was reviewed at a Concept Review meeting on July 10. All aspects of the engine and some of the package features were presented by the design engineering staff responsible for the various sections and/or overall engine configuration. Following this major review the efforts of the Design Team are focused on the preliminary design. The Preliminary Design Review is planned before the end of 1997.

The engine design must meet the criteria specified in the ATS-L Business Plan and the Product Requirement Specification (PRS) incorporated in the plan. The document specifying the "L" engine design criteria were completed in early August. This document is a supplement to the PRS and provides specific technical criteria relating to the design of the engine.

Accessibility will be a major factor in the "L" package design. Specific operations carried out during a standard overhaul of Solar's current products will be conducted in the field. Thus, the engine and package design will maximize the ability to change out components and parts in the field. Space requirements are also critical for the "L" package. Package footprint, volume, and height are to be kept as small as practical.

Preliminary design work has proceeded including a preliminary selection of materials for most components. A major focus of the effort was on the examination of alternative combustion schemes. Considerations include the ability to operate under part load conditions without performance penalties, and the ability to retrofit an ultra-lean premix combustion system to a catalytic design, rotor dynamics issues and product cost.

A detailed product cost analysis was undertaken using a bottoms-up approach involving a careful estimate of cost for the individual components and assemblies. The initial estimate indicates that the L will be able to achieve the 10% cost of power reduction goal as well as more aggressive internal cost goals. The cost estimate will change further as the design becomes more detailed.

The "L" Development Plan is being refined along with the conceptual and preliminary design efforts. The basis for the plan are schedule, effort and cost estimates from the current ATS-L time line and Management Plan and data from the Solar ATS-L Business Plan. The estimates are being updated with bottoms-up cost estimates for the components and assemblies.

The schedule, effort, and cost estimates will be incorporated in a project plan being loaded into the Open Plan software. This software is currently the subject of a conference room pilot project at Solar; use of the software may ultimately be extended to encompass all of Solar's development projects. The plan enables rapid estimates of effort and cost and "what if" scenarios. A new program plan for the ATS-L should be in place before the end of November.

3.4 TEST RIGS

WBS 42100: Compressor Rig Testing

The Advanced Component Efficiency (ACE) compressor rig testing was completed at the end of July. The Phase V testing completed the optimum mapping with various vane positions. Exit

traverse surveys determined that exit flow profiles per the NASA code over-predict blade row interactions. The code will be refined accordingly. Inlet duct straightener additions demonstrated no measurable differences compared to the original inlet configuration. A test summary report draft has been completed by Wright Patterson AFB with the final report expected by November.

The rig and test compressor were disassembled, and high cycle fatigue (HCF) cracking was found on the compressor stators of stages 5,6 and 7. An investigation was undertaken to find out the cause of the deficiencies, and the extent to which the current Mercury 50 stator design would need to be modified to ensure hardware longevity. Following an analysis of the modal characteristics of the stators, the team and concluded that stator 4 needed minor redesign to avoid a sixth engine order interference. This redesign has been successfully accomplished without negative impact to schedule or to downstream aerodynamics.

In addition to the stator cracking, the ACE rig exhibited stage 9 disk cracking. Investigation into the possible causes was ongoing at the close of the reporting period.

WBS 42210: Ultra Lean Premixed (ULP) Combustor Test Rig

The combustor housing end cover has been cast and delivered to Solar for machining. The combustor housing itself is currently being cast. The first prototype fuel injector has been assembled. The test facility is being modified to accept the combustor rig, and testing is scheduled to begin in December.

WBS 42400: Turbine Test Rig

Airfoil designs were completed, and procurement of test hardware is in process. First stage nozzle flow tests were completed, and the flow capacity agrees with design calculations although the nozzle configuration used does not account for the effect of cooling flow on the overall turbine. Baseline testing with the full two-stage rig is scheduled to start in December.

WBS 42500: Squeeze Film Damper Test Rig

A squeeze film damper from Waukesha has completed its characterization testing, and the Solar damper is being fabricated for comparison testing.

WBS 65000: RAMD

The specification for the RAMD Interface/Display System has been completed identifying inputs, data processing requirements, workstation and presentation program requirements, system operation and maintenance manuals and other documentation.

3.5 COMMERCIALIZATION

WBS 52500: Product Cost Management

The current estimate of the engine cost is comfortably below the program goal of 10% reduced cost of power although the estimated product cost increased slightly during the past quarter as current quoting is showing higher than expected costs on some components. Of the drawings released, 32% have current quotes. Costs under scrutiny and receiving significant attention include the Stage1 nozzle, center frame, combustor end cover, compressor rotor spacers, air diverter valve, and package controls. In all cases, cross-functional groups are looking at cost reduction options to get cost and target to align.

WBS 62000: Manufacturing Readiness Plan

Work continues on the Readiness Plan in the Cold CAM, Hot CAM, Rotor CAM and Controls. All areas are at different phases of the project, and work is progressing smoothly. Recently, a new shop layout was selected by the Cold CAM. This layout includes a significant amount of floor space for a stand-alone Mercury Cell. This cell will manufacture many parts including the air inlet, diffuser, compressor case, and gear box housing and will also have an assembly area. The cell will be designed so that at some point it could be relocated as a part of a Mercury specific factory, if required.

The Rotor CAM is evaluating long range strategies in concert with shop layouts. Significant work will have to take place to accommodate the equipment required to manufacture the hardware forecasted for five years out and beyond.

Hot CAM and Controls are in the load analysis and assessment stage. The bottlenecks and problem areas are not yet clearly defined. Studies are ongoing. At some point both areas will progress to the current stage of the Cold CAM.

WBS 71100: Host Site Research and Selection

Solar and Rochelle Municipal Utilities (RMU) moved closer to locating a host site for the 8,000 hour demonstration of the Mercury 50. Solar's ATS Commercialization Manager made a presentation in late July with RMU and members of local industry in Rochelle, IL regarding the ATS program, Solar's ATS product, and the selection of the host site. Following continued strong interest, an August meeting was held in Rochelle with the GM of RMU and representatives of Hormel Foods. In September, RMU's General Manager and Solar's Commercialization Manager made a joint presentation to DOE's Steve Waslo, Pat Hoffman and Lisa Barnett, as well as to Solar's ATS and Sales & Marketing personnel. They proposed that RMU locate the demonstration unit in its service area. The presentation was favorably received by all parties. A proposal was later sent to RMU. Communications are ongoing to finalize an arrangement.

4.0 PROGRAM MANAGEMENT

Program Activities: Considerable efforts were initiated in August, as part of the company's annual budget planning process, to reforecast and control '97 and '98 ATS labor and material expenditures. The continuing shortfall of DOE funding from levels identified in the cooperative

agreement together with heavy demands on Solar resources for product development and support, as well as the constant need to meet investors' financial performance expectations, has forced Solar to commence selective reductions or delays in program activities. These reductions also are reflective of the progress made to date on engine design and analysis and technology development activities. As with any relatively high risk R&D, parallel pathways were required to be pursued until sufficient knowledge and data was available to make design decisions and technology down selections. Solar has reached a stage where it may commence such selective reductions consistent with its RD&T plan.

A detailed investigation and analysis of technology development and test rig planned activities identified potential cost savings as described further below. The ground rules were to identify those activities that are not deemed absolutely critical to (i) preserve Mercury 50 the schedule for the initial test units and (ii) meet ATS performance requirements.

Ceramic blade and nozzle design and development programs have been placed on hold. Efforts related to basic material characterization will continue at a minimal level, but the plan to test ceramic components in the field demonstration (and the development engine) has been canceled.

Continuous Fiber Ceramic Composite (CFCC) programs have similarly been reduced to basic material characterization. The CFCC transition duct will continue to be considered for a back-up for the L engine.

An effort to establish a life prediction model for the TBC turbine blades has been canceled at the Southwest Research Institute. TBCs may be applied to blades on either the S or L engines, but the insulating benefit is not being considered in the design life due to the uncertainty in TBC adherence life.

Effort planned to establish a life prediction model for superalloy turbine disks has been eliminated from the ATS technology program.

Down selection to a single supplier for the Udimet 720 turbine disk material will occur at the beginning of 1998 rather than later in the year. At this time the material from one supplier is meeting all the material test goals, and the early down selection will add minimal risk to the success of the material development program.

Development of the dual alloy turbine disk will be discontinued, except for continuation of material creep testing already underway. The primary need for the dual alloy disk was for supporting the ceramic blades, which would typically operate with a higher disk rim temperature.

Development of alternate recuperator foil materials to extend the service life and operating temperature capability have been reduced. Initial test results of the 1200° F material are encouraging and indicate a substantial life increase over standard 347 stainless steel is possible. Efforts to develop a higher temperature material capable of 1300° F have been eliminated from the program.

ATS funding of the vacuum die casting and spray casting process development efforts for product cost reduction has been stopped. This activity will be continued by Howmet as a part of their internally-funded technology development activities.

A portion of the combustion research testing not considered vital for the ATS program has been terminated. Similarly, portion of the tests planned for the half scale turbine test rig have been eliminated from the test program because they are not vital to support the initial development of the Mercury 50. Tests of the turbine diffuser and collector have also been reduced to the minimum considered necessary. A plan to test a scale model of the compressor inlet has been canceled because of high confidence in the analytical model, and the low risk of an adverse consequence on performance.

Although the above program revisions add some risk to the attainment of low cost and long life goals, they are considered low risk as far as engine schedule and performance are concerned. Some of the eliminated or reduced activities may resume later as deemed necessary for the achievement of program objectives.

ATS Program Status: The Financial Status Report (SF 269) and Federal Assistance management Summary Report (DOE Form F4600.5) for the month of September are attached.

As of the end of September there was an unfavorable 53.6% schedule variance against the 6 year baseline for the overall ATS program (59.5% last quarter). This is attributable to (i) continuing funding constraints and (ii) a 0/100 percent complete assumption for program milestones. Solar also shows an unfavorable cost variance of 15.1% (16.21% last quarter) that is due in large part to the high degree of outsourcing. The unfavorable variances are expected to continue to diminish somewhat over the next few months as preliminary drawings are issued.

The Mercury 50 Team is holding to the key target of a March 1998 commencement of assembly on the first engine build. The principal items currently pacing the Mercury 50 schedule are:

- Stage 1 and 2 Turbine Blades
- Stage 1 Turbine Nozzle Segment
- Stage 1 and 2 Turbine Disks
- Stage 10 Compressor Aft Hub
- Stage 10 Compressor Outlet Guide Vane
- Stage 9 and 10 Compressor Blades
- Center Frame Structure
- Rotor Bearings

Based upon the components that are currently most critical to schedule, it is estimated that the Mercury program is some four months behind schedule.

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
6074	Advanced Turbine Systems (ATS)		9/14/95	9/18/03	0	23%										
10000	Advanced Turbine System - S		9/14/95	8/31/00	0	38%										
10100	Technical Coordination - S		9/14/95	8/31/00	0	33%										
10200	Engine Definition - S		9/14/95	4/10/96	0	100%										
10200.1	Complete Flowpath Definition - S		3/15/96	3/15/96	0.40	100%										
10200.2	Preliminary Design Review (PDR) - S		4/3/96	4/3/96	0.60	100%										
10300	Package Definition - S		11/14/95	8/15/97	0	100%										
10300.1	Complete Design Review, Package - S		8/15/97	8/15/97	1.00	100%										
11000	Engine Assembly - S		9/14/95	12/1/99	0	52%										
11010	Engine Build - S		10/3/97	3/18/99	0	0%										
11010.1	Complete Engine Assembly Drawings - S		2/4/98	2/4/98	0.10	0%										
11010.2	Complete Engine Build, In House Test Engine - S		5/15/98	5/15/98	0.90	0%										
11010.3	Complete Engine Build, Field Engine - S		3/18/99	3/18/99	0	0%										
11100	Air Inlet System - S	Various	9/14/95	3/31/98	0	57%										
11110	Air Inlet Duct Assy - S	245055-100	4/1/96	3/31/98	0	25%										
11110.1	Start DLA, Air Inlet Duct Assy - S	245055-100	4/1/96	4/1/96	0.05	100%										
11110.2	Appd CPD / Dwg, Air Inlet Duct Sub-Assy - S	245056	7/3/97	7/3/97	0.20	100%										
11110.3	Need Dwg, Air Inlet Duct Sub-Assy - S	245056	4/25/97	4/25/97	0	100%										
11110.4	Appd CPD / Dwg, Air Inlet Duct Assy - S	245055	1/15/97	1/15/97	0.25	0%										
11110.5	Need Dwg, Air Inlet Duct Assy - S	245055	3/1/98	3/1/98	0	0%										
11110.6	Complete Assy, Air Inlet Duct Assy - S	245055-100	3/1/98	3/1/98	0.50	0%										
11110.7	Need Assy, Air Inlet Duct Assy - S	245055-100	3/31/98	3/31/98	0	0%										
11120	Air Inlet / Bearing Case Assy - S	245060-100	9/14/95	3/31/98	0	80%										
11120.1	Start DLA, Air Inlet / Bng Case Assy - S	245060-100	4/1/96	4/1/96	0.03	100%										
11120.2	Start CFD, Air Inlet / Bng Case Assy - S	245060-100	7/10/96	7/10/96	0.02	100%										
11120.3	Complete CFD, Air Inlet / Bng Case Assy - S	245060-100	3/17/97	3/17/97	0.05	100%										
11120.4	Appd Casting CPD / Dwg, Inlet Air Assy - S	245062	12/2/97	12/2/97	0.10	100%										
11120.5	Need Casting CPD, Inlet Air Assy - S	245062	2/21/97	2/21/97	0	100%										
11120.6	Appd Machining CPD / Dwg, Air Inlet Assy - S	245061	9/2/97	9/2/97	0.10	100%										
11120.7	Need Machining Dwg, Air Inlet Assy - S	245061	9/15/97	9/15/97	0	100%										
11120.8	Complete Thrust Load Anal, Turbine Rotor Assy - S		4/16/96	4/16/96	0.02	100%										
11120.9	Confirm Damper Requirement, Turbine Rotor Assy - S		3/14/96	3/14/96	0.02	100%										
11120.10	Complete, Shaft / Support Dimensions - S		6/17/96	6/17/96	0.02	100%										
11120.11	Send Out RFQ, Rotor Bearings - S		8/8/96	8/8/96	0.02	100%										
11120.12	Send Out RFQ, Squeeze Film Damper - S		1/24/97	1/24/97	0.05	100%										
11120.13	Review RFQ, Bearings/Dampers - S		1/20/97	1/20/97	0.05	100%										
11120.14	Complete, Bearings/Damper Integration - S		5/20/97	5/20/97	0	100%										
11120.15	Start, Backup Bearing Plan (if Needed) - S		4/5/97	4/5/97	0.05	100%										
11120.16	Appd CPD / Dwg, Roller Bearing Assy - S	245067	4/9/97	4/9/97	0.05	100%										
11120.17	Place PO, Roller Bearing Assy - S	245067-1	4/9/97	4/9/97	0.10	100%										
11120.18	Appd Casting CPD / Dwg, #1 Bearing Case - S	245065	5/19/97	5/19/97	0	100%										
11120.19	Need Casting Dwg, #1 Bearing Case - S	245065	3/31/97	3/31/97	0	100%										
11120.20	Appd Machining CPD / Dwg, #1 Bearing Case - S	245064	7/8/97	7/8/97	0.10	100%										
11120.21	Need Machining Dwg, #1 Bearing Case - S	245064	6/11/97	6/11/97	0	100%										
11120.22	Appd Assy CPD / Dwg, Air Inlet / Bng Case Assy - S	245060	10/15/97	10/15/97	0.10	0%										
11120.23	Need Assy Dwg, Air Inlet / Bng Case Assy - S	245060	1/14/98	1/14/98	0	0%										
11120.24	Complete Assy, Air Inlet / Bng Case Assy - S	245060-100	12/24/97	12/24/97	0.10	0%										
11120.25	Need Assy, Air Inlet / Bng Case Assy - S	245060-100	3/31/98	3/31/98	0	0%										
11200	Compressor Section - S	Various	9/14/95	3/31/98	0	55%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11210	Compressor Rotor Assembly - S	245070-100	9/14/95	3/31/96	0	74%										
11210.1	Start DLA, Compr Rotor Assy - S	245070-100	4/1/96	4/1/96	0.03	100%										
11210.2	Start CFD, Compr Rotor Assy - S	245070-100	4/1/96	4/1/96	0.04	100%										
11210.3	Appd Forging CPD / Dwg, Fwd Compr Cone - S	245076	5/19/97	5/19/97	0.01	100%	Late - Need 4-5-97 (Past Due)									
11210.4	Need Forging Dwg, Fwd Compr Cone - S	245076	10/17/97	4/5/97	0	0%	Past Due									
11210.5	Appd CPD / Dwg, Fwd Compr Cone - S	245075	10/17/97	10/17/97	0.01	0%	Late - Need 5-18-97 (Past Due)									
11210.6	Need Dwg, Fwd Compr Cone - S	245075	5/18/97	5/18/97	0	100%										
11210.7	Complete Aero Design, Compr Blade Sig 1 - S	245090-1	9/20/96	9/20/96	0.01	100%										
11210.8	Complete Mech Design, Compr Blade Sig 1 - S	245090-1	9/27/96	9/27/96	0.02	100%										
11210.9	Appd CPD / Dwg, Compr Blade Sig 1 - S	245090	5/21/97	5/21/97	0.02	100%										
11210.10	Need Dwg, Compr Blade Sig 1 - S	245090	7/8/97	7/8/97	0	100%										
11210.11	Appd Forging CPD / Dwg, Compr Disk Sig 1 - S	245089	10/3/97	10/3/97	0.01	0%	Late - Need 6-10-97 (Past Due)									
11210.12	Need Forging Dwg, Compr Disk Sig 1 - S	245089	6/10/97	6/10/97	0	100%										
11210.13	Appd Machine CPD / Dwg, Compr Disk Sig 1 - S	245110	9/26/97	9/26/97	0.01	100%										
11210.14	Need Machine Dwg, Compr Disk Sig 1 - S	245110	6/26/97	6/26/97	0	100%										
11210.15	Appd CPD / Release Dwg, Compr Disk Assy Sig 1 - S	245110	9/26/97	9/26/97	0	100%										
11210.16	Need Dwg, Compr Disk Assy Sig 1 - S	245110	9/15/97	9/15/97	0	100%										
11210.17	Appd CPD, New Cunic Tooth Dwg	105242	4/21/97	4/21/97	0.02	100%										
11210.18	Need Dwg, New Cunic Tooth Dwg	105242	3/3/97	3/3/97	0	100%										
11210.19	Complete Aero Design, Compr Blade Sig 2 - S	245100-1	9/20/96	9/20/96	0.01	100%										
11210.20	Complete Mech Design, Compr Blade Sig 2 - S	245100-1	9/24/96	9/24/96	0.01	100%										
11210.21	Appd CPD / Dwg, Compr Blade Sig 2 - S	245100	5/1/97	5/1/97	0.02	100%										
11210.22	Need Dwg, Compr Blade Sig 2 - S	245100	7/8/97	7/8/97	0	100%										
11210.23	Appd Forging CPD / Dwg, Compr Disk Sig 2 - S	245097	7/30/97	7/30/97	0.01	100%	Late - Need 6-10-97 (Past Due)									
11210.24	Need Forging Dwg, Compr Disk Sig 2 - S	245097	6/10/97	6/10/97	0	100%										
11210.25	Appd Machine CPD / Dwg, Compr Disk Sig 2 - S	245120	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)									
11210.26	Need Machine Dwg, Compr Disk Sig 2 - S	245120	6/26/97	6/26/97	0	100%										
11210.27	Appd CPD / Dwg, Compr Disk Assy Sig 2 - S	245120	9/5/97	9/5/97	0.01	100%										
11210.28	Need Dwg, Compr Disk Assy Sig 2 - S	245120	9/15/97	9/15/97	0	100%										
11210.29	Complete Aero Design, Compr Blade Sig 3 - S	245115-1	9/26/96	9/26/96	0.01	100%										
11210.30	Complete Mech Design, Compr Blade Sig 3 - S	245115-1	12/16/96	12/16/96	0.01	100%										
11210.30a	Appd Casting CPD / Dwg, Compr Blade Sig 3 - S	245116	4/11/97	4/11/97	0.01	100%										
11210.30b	Need Casting Dwg, Compr Blade Sig 3 - S	245116	4/23/97	4/23/97	0	100%										
11210.31	Appd CPD / Dwg, Compr Blade Sig 3 - S	245115	9/24/97	9/24/97	0.01	100%	Late - Need 7-8-97 (Past Due)									
11210.32	Need Dwg, Compr Blade Sig 3 - S	245115	7/8/97	7/8/97	0	100%										
11210.33	Appd Casting CPD / Dwg, Compr Disk Sig 3 - S	245112	6/2/97	6/2/97	0.01	100%	Critical - Need 6-10-97									
11210.34	Need Casting Dwg, Compr Disk Sig 3 - S	245112	6/10/97	6/10/97	0	100%										
11210.35	Appd Machine CPD / Dwg, Compr Disk Sig 3 - S	245130	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)									
11210.36	Need Machine Dwg, Compr Disk Sig 3 - S	245130	6/26/97	6/26/97	0	100%										
11210.37	Release Dwg, Compr Disk Assy Sig 3 - S	245130	9/5/97	9/5/97	0.01	100%										
11210.38	Need Dwg, Compr Disk Assy Sig 3 - S	245130	9/15/97	9/15/97	0	100%										
11210.39	Complete Aero Design, Compr Blade Sig 4 - S	245131-1	10/7/96	10/7/96	0.01	100%										
11210.40	Complete Mech Design, Compr Blade Sig 4 - S	245131-1	10/10/96	10/10/96	0.01	100%										
11210.40a	Appd Casting CPD / Dwg, Compr Blade Sig 4 - S	245132	4/29/97	4/29/97	0.01	100%										
11210.40b	Need Casting Dwg, Compr Blade Sig 4 - S	245132	3/24/97	3/24/97	0	100%										
11210.41	Appd CPD / Dwg, Compr Blade Sig 4 - S	245131	9/25/97	9/25/97	0.01	100%	Late - Need 7-8-97 (Past Due)									
11210.42	Need Dwg, Compr Blade Sig 4 - S	245131	7/8/97	7/8/97	0	100%										
11210.43	Appd Forging CPD / Dwg, Compr Disk Sig 4 - S	245127	6/23/97	6/23/97	0.01	100%	Critical - Need 6-10-97									
11210.44	Need Forging Dwg, Compr Disk Sig 4 - S	245127	6/10/97	6/10/97	0	100%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11210.45	Appd Machine CPD / Dwg, Compr Disk Sig 4 - S	245140	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)			▲						
11210.46	Need Machine Dwg, Compr Disk Sig 4 - S	245140	6/26/97	6/26/97	0	100%				▲						
11210.47	Release Dwg, Compr Disk Assy Sig 4 - S	245140	9/5/97	9/5/97	0.01	100%				▲						
11210.48	Need Dwg, Compr Disk Assy Sig 4 - S	245140	9/15/97	9/15/97	0	100%				▲						
11210.49	Complete Aero Design, Compr Blade Sig 5 - S	245145-1	4/25/97	4/25/97	0.01	100%				▲						
11210.50	Complete Mech Design, Compr Blade Sig 5 - S	245145-1	4/25/97	4/25/97	0.01	100%				▲						
11210.50a	Appd Casting CPD / Dwg, Compr Blade Sig 5 - S	245146	4/15/97	4/15/97	0.01	100%				▲						
11210.50b	Need Casting Dwg, Compr Blade Sig 5 - S	245146	3/24/97	3/24/97	0	100%				▲						
11210.51	Appd CPD / Dwg, Compr Blade Sig 5 - S	245145	9/26/97	9/26/97	0.01	100%	Late - Need 7-8-97 (Past Due)			▲						
11210.52	Need Dwg, Compr Blade Sig 5 - S	245145	7/8/97	7/8/97	0	100%				▲						
11210.53	Appd Forging CPD / Dwg, Compr Disk Sig 5 - S	245142	5/15/97	5/15/97	0.01	100%				▲						
11210.54	Need Forging CPD / Dwg, Compr Disk Sig 5 - S	245142	6/10/97	6/10/97	0	100%				▲						
11210.55	Appd Machine CPD / Dwg, Compr Disk Sig 5 - S	245150	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)			▲						
11210.56	Need Machine Dwg, Compr Disk Sig 5 - S	245150	6/26/97	6/26/97	0	100%				▲						
11210.57	Appd CPD / Dwg, Compr Disk Assy Sig 5 - S	245150	9/5/97	9/5/97	0.01	100%				▲						
11210.58	Need Dwg, Compr Disk Assy Sig 5 - S	245150	9/15/97	9/15/97	0	100%				▲						
11210.59	Complete Aero Design, Compr Blade Sig 6 - S	245161-1	5/1/97	5/1/97	0.01	100%				▲						
11210.60	Complete Mech Design, Compr Blade Sig 6 - S	245161-1	5/6/97	5/6/97	0.01	100%				▲						
11210.60a	Appd Casting CPD / Dwg, Compr Blade Sig 6 - S	245162	7/22/97	7/22/97	0.01	100%	Late - Need 4-23-97 (Past Due)			▲						
11210.60b	Need Casting Dwg, Compr Blade Sig 6 - S	245162	4/23/97	4/23/97	0	100%	Past Due			▲						
11210.61	Appd CPD / Dwg, Compr Blade Sig 6 - S	245161	10/10/97	10/10/97	0.01	0%	Late - Need 7-8-97 (Past Due)			▲						
11210.62	Need Dwg, Compr Blade Sig 6 - S	245161	7/8/97	7/8/97	0	100%				▲						
11210.63	Appd Forging CPD / Dwg, Compr Disk Sig 6 - S	245157	5/27/97	5/27/97	0.01	100%				▲						
11210.64	Need Forging Dwg, Compr Disk Sig 6 - S	245157	6/10/97	6/10/97	0	100%				▲						
11210.65	Appd Machine CPD / Dwg, Compr Disk Sig 6 - S	245160	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)			▲						
11210.66	Need Machine Dwg, Compr Disk Sig 6 - S	245160	6/26/97	6/26/97	0	100%				▲						
11210.67	Appd CPD / Release Dwg, Compr Disk Assy Sig 6 - S	245160	9/5/97	9/5/97	0.01	100%				▲						
11210.68	Need Dwg, Compr Disk Assy Sig 6 - S	245160	9/15/97	9/15/97	0	100%				▲						
11210.69	Complete Aero Design, Compr Blade Sig 7 - S	245175-1	5/9/97	5/9/97	0.01	100%				▲						
11210.70	Complete Mech Design, Compr Blade Sig 7 - S	245175-1	5/16/97	5/16/97	0.01	100%				▲						
11210.70a	Appd Casting CPD / Dwg, Compr Blade Sig 7 - S	245176	9/13/97	9/13/97	0.01	100%	Late - Need 4-23-97 (Past Due)			▲						
11210.70b	Need Casting Dwg, Compr Blade Sig 7 - S	245176	4/23/97	4/23/97	0	100%	Past Due			▲						
11210.71	Appd CPD / Dwg, Compr Blade Sig 7 - S	245175	10/15/97	10/15/97	0.01	0%	Late - Need 7-8-97 (Past Due)			▲						
11210.72	Need Dwg, Compr Blade Sig 7 - S	245175	7/8/97	7/8/97	0	100%				▲						
11210.73	Appd Forging CPD / Dwg, Compr Disk Sig 7 - S	245172	5/8/97	5/8/97	0.01	100%				▲						
11210.74	Need Forging Dwg, Compr Disk Sig 7 - S	245172	6/10/97	6/10/97	0	100%				▲						
11210.75	Appd Machine CPD / Dwg, Compr Disk Sig 7 - S	245170	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)			▲						
11210.76	Need Machine Dwg, Compr Disk Sig 7 - S	245170	6/26/97	6/26/97	0	100%				▲						
11210.77	Appd CPD / Dwg, Compr Disk Assy Sig 7 - S	245170	9/5/97	9/5/97	0.01	100%	Late - Need 9-15-97			▲						
11210.78	Need Dwg, Compr Disk Assy Sig 7 - S	245170	9/15/97	9/15/97	0	100%				▲						
11210.79	Complete Aero Design, Compr Blade Sig 8 - S	245191-1	5/13/97	5/13/97	0.01	100%				▲						
11210.80	Complete Mech Design, Compr Blade Sig 8 - S	245191-1	6/6/97	6/6/97	0.01	100%				▲						
11210.80a	Appd Casting CPD / Dwg, Compr Blade Sig 8 - S	245192	9/18/97	9/18/97	0.01	100%	Late - Need 4-30-97 (Past Due)			▲						
11210.80b	Need Casting Dwg, Compr Blade Sig 8 - S	245192	4/23/97	4/23/97	0	100%	Past Due			▲						
11210.81	Appd CPD / Dwg, Compr Blade Sig 8 - S	245191	10/17/97	10/17/97	0.01	0%	Late - Need 4-30-97 (Past Due)			▲						
11210.82	Need Dwg, Compr Blade Sig 8 - S	245191	7/8/97	7/8/97	0	100%	Past Due			▲						
11210.83	Appd Forging CPD / Dwg, Compr Disk Sig 8 - S	245187	5/8/97	5/8/97	0.01	100%				▲						
11210.84	Need Forging Dwg, Compr Disk Sig 8 - S	245187	6/10/97	6/10/97	0	100%				▲						
11210.85	Appd Machine CPD / Dwg, Compr Disk Sig 8 - S	245180	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)			▲						

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11210.86	Need Machine Dwg, Compressor Disk Sig 8 - S	245180	6/26/97	6/26/97	0	100%										
11210.87	Appd CPD / Release Dwg, Compressor Disk Assy Sig 8 - S	245180	9/5/97	9/5/97	0.01	100%										
11210.88	Need Dwg, Compressor Disk Assy Sig 8 - S	245180	9/15/97	9/15/97	0	100%										
11210.89	Complete Aero Design, Compressor Blade Sig 8 - S	245205-1	5/6/97	5/6/97	0.01	100%										
11210.90	Complete Mech Design, Compressor Blade Sig 9 - S	245205-1	5/7/97	5/7/97	0.01	100%										
11210.90a	Appd Casting CPD / Dwg, Compressor Blade Sig 9 - S	245206	10/15/97	10/15/97	0	0%	Late - Need 4-23-97 (Past Due)									
11210.90b	Need Casting Dwg, Compressor Blade Sig 9 - S	245206	4/23/97	4/23/97	0	100%	Past Due									
11210.91	Appd CPD / Dwg, Compressor Blade Sig 9 - S	245205	10/24/97	10/24/97	0.01	0%	Late - Need 7-8-97 (Past Due)									
11210.92	Need Dwg, Compressor Blade Sig 9 - S	245205	7/8/97	7/8/97	0	100%										
11210.93	Appd Forging CPD / Dwg, Compressor Disk Sig 9 - S	245202	5/8/97	5/8/97	0.01	100%										
11210.94	Need Forging Dwg, Compressor Disk Sig 9 - S	245202	6/10/97	6/10/97	0	100%										
11210.95	Appd Machine CPD / Dwg, Compressor Disk Sig 9 - S	245190	9/5/97	9/5/97	0.01	100%	Late - Need 6-26-97 (Past Due)									
11210.96	Need Machine Dwg, Compressor Disk Sig 9 - S	245190	6/26/97	6/26/97	0	100%										
11210.97	Appd CPD / Dwg, Compressor Disk Sig 9 - S	245190	9/5/97	9/5/97	0.01	100%										
11210.98	Need Dwg, Compressor Disk Sig 9 - S	245190	9/15/97	9/15/97	0	100%										
11210.99	Complete Aero Design, Compressor Blade Sig 10 - S	245220-1	5/8/97	5/8/97	0.01	100%										
11210.100	Complete Mech Design, Compressor Blade Sig 10 - S	245220-1	6/11/97	6/11/97	0.01	100%										
11210.100a	Appd Casting CPD / Dwg, Compressor Blade Sig 10 - S	245221	10/22/97	10/22/97	0.01	0%	Late - Need 4-23-97 (Past Due)									
11210.100b	Need Casting Dwg, Compressor Blade Sig 10 - S	245221	4/23/97	4/23/97	0	100%	Past Due									
11210.101	Appd CPD / Dwg, Compressor Blade Sig 10 - S	245220	10/27/97	10/27/97	0.01	0%	Late - Need 7-8-97 (Past Due)									
11210.102	Need Dwg, Compressor Blade Sig 10 - S	245220	7/8/97	7/8/97	0	100%										
11210.103	Appd Forging CPD / Dwg, Compressor All Hub Sig 10 - S	245217	9/10/97	9/10/97	0.01	100%	Late - Need 5-27-97 (Past Due)									
11210.104	Need Forging Dwg, Compressor All Hub Sig 10 - S	245217	5/27/97	5/27/97	0	100%	Past Due									
11210.105	Appd Machine CPD / Dwg, Compressor All Hub Sig 10 - S	245200	10/3/97	10/3/97	0.01	0%	Late - Need 7-26-97 (Past Due)									
11210.106	Need Machine Dwg, Compressor All Hub Sig 10 - S	245200	7/26/97	7/26/97	0	100%										
11210.107	Appd CPD / Dwg, Compressor All Hub Assy Sig 10 - S	245200	10/3/97	10/3/97	0.01	0%	Late - Need 9-15-97									
11210.108	Need Dwg, Compressor All Hub Assy Sig 10 - S	245200	9/15/97	9/15/97	0	100%										
11210.109	Appd CPD / Dwg, Compressor Center Bolt - S	245079	10/10/97	10/10/97	0.01	0%	Late - Need 9-16-97									
11210.110	Need Dwg, Compressor Center Bolt - S	245079	9/16/97	9/16/97	0	100%										
11210.111	Appd CPD / Dwg, Compressor Rotor Assy - S	245070	12/8/97	12/8/97	0.01	0%	Late - Need 10-16-97									
11210.112	Need Dwg, Compressor Rotor Assy - S	245070	10/16/97	10/16/97	0	0%										
11210.113	Complete Assy, Compressor Rotor Assy - S	245070-100	3/19/98	3/19/98	0.16	0%										
11210.114	Need, Compressor Rotor Assy - S	245070-100	3/31/98	3/31/98	0	0%										
11220	Compressor Casing / Stator Assy - S	245230-100	9/14/95	3/31/98	0	75%										
11220.1	Start DLA, Compressor Housing Assy - S	245231-100	4/1/96	4/1/96	0.05	100%										
11220.2	Appd Casting CPD / Dwg, Compressor Casing Half - S	245232	1/17/96	1/17/96	0.15	100%										
11220.3	Need Casting Dwg, Compressor Casing Half - S	245232	1/17/97	1/17/97	0	100%										
11220.4	Appd Mach CPD / Dwg, Compressor Housing - S	245231	11/29/97	11/29/97	0.15	0%	Late - Need 6-2-97 (Past Due)									
11220.5	Need Assy Dwg, Compressor Housing Assy - S	245231	6/2/97	6/2/97	0	100%										
11220.6	Complete DLA, VGV Actuation System - S	245234	7/1/97	7/1/97	0.05	100%										
11220.7	Appd CPD / Dwg, VGV Split Ring Actuating Assy - S	245234	8/18/97	8/18/97	0.10	100%										
11220.8	Need Dwg, VGV Split Ring Actuating Assy - S	245234	9/15/97	9/15/97	0	100%										
11220.9	Complete Assy, VGV Split Ring Actuating Assy - S	245234-100	8/18/97	8/18/97	0.10	100%										
11220.10	Need Assy, VGV Split Ring Actuating Assy - S	245234-100	1/29/98	1/29/98	0	100%										
11220.11	Appd CPD / Dwg, Sig 1 VGV Split Ring - S	245241	8/18/97	8/18/97	0.05	100%	Late - Need 7-1-97 (Past Due)									
11220.12	Need Dwg, Sig 1 VGV Split Ring - S	245241	7/1/97	7/1/97	0	100%										
11220.13	Appd CPD / Dwg, Sig 1 VGV Split Ring Actuating Assy - S	245235	9/13/97	9/13/97	0.05	100%	Critical - Need 9-15-97									
11220.14	Need Dwg, Sig 1 VGV Split Ring Actuating Assy - S	245235	9/15/97	9/15/97	0	100%										
11220.15	Complete Assy, Sig 1 VGV Split Ring Actuating Assy - S	245235-100	9/13/97	9/13/97	0.10	100%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11220.16	Need Assy, Sig 1 VGV Split Ring Actuating Assy - S	245235-100	12/9/96	12/9/96	0	100%										
11220.17	Appd CPD / Dwg, Sig 2 VGV Split Ring - S	245242	9/15/97	9/15/97	0.05	100%	Late - Need 7-1-97 (Past Due)									
11220.18	Need Dwg, Sig 2 VGV Split Ring - S	245242	7/1/97	7/1/97	0	100%										
11220.19	Appd CPD / Dwg, Sig 2 VGV Split Ring Actuating Assy - S	245236	9/13/97	9/13/97	0.05	100%	Critical - Need 9-15-97									
11220.20	Need Dwg, Sig 2 VGV Split Ring Actuating Assy - S	245236	9/15/97	9/15/97	0	100%										
11220.21	Complete Assy, Sig 2 VGV Split Ring Actuating Assy - S	245236-100	1/9/98	1/9/98	0.10	0%										
11220.22	Need Assy, Sig 2 VGV Split Ring Actuating Assy - S	245236-100	12/9/98	12/9/98	0	0%										
11220.23	Compressor Stator Assy - S	Various	9/14/95	3/31/98	0	64%										
11220.24	Complete Mech Design, IGV - S	245250-1	2/11/97	2/11/97	0.02	100%										
11220.25	Appd Casting CPD / Dwg, IGV - S	245251	8/1/97	8/1/97	0.02	100%	Late - Need 5-17-97 (Past Due)									
11220.26	Need Casting Dwg, IGV - S	245251	5/17/97	5/17/97	0	100%	Past Due									
11220.27	Appd Airfoil CPD / Dwg, IGV - S	245250	11/17/97	11/17/97	0.02	0%	Late - Need 7-2-97 (Past Due)									
11220.28	Need Airfoil Dwg, IGV - S	245250	7/2/97	7/2/97	0	100%										
11220.29	Complete Aero Design, Stage 1 Comp Stator Vane - S	245260-1	8/23/96	8/23/96	0.02	100%										
11220.30	Complete Mech Design, Stage 1 Comp Stator Vane - S	245260-1	9/6/96	9/6/96	0.02	100%										
11220.31	Appd Casting CPD / Dwg, Stage 1 Comp Stator Vane - S	245261	5/1/97	5/1/97	0.02	100%										
11220.32	Need Casting Dwg, Stage 1 Comp Stator Vane - S	245261	5/1/97	5/1/97	0	100%										
11220.33	Appd Airfoil CPD / Dwg, Stage 1 Comp Stator Vane - S	245260	11/17/97	11/17/97	0.02	0%	Late - Need 7-2-97 (Past Due)									
11220.34	Need Airfoil Dwg, Stage 1 Comp Stator Vane - S	245260	7/2/97	7/2/97	0	100%										
11220.35	Complete Aero Design, Stage 2 Comp Stator Vane - S	245270-1	9/20/96	9/20/96	0.02	100%										
11220.36	Complete Mech Design, Stage 2 Comp Stator Vane - S	245270-1	9/25/96	9/25/96	0.02	100%										
11220.37	Appd Casting CPD / Dwg, Stage 2 Comp Stator Vane - S	245271	5/8/97	5/8/97	0.02	100%										
11220.38	Need Casting Dwg, Stage 2 Comp Stator Vane - S	245271	5/17/97	5/17/97	0	100%										
11220.39	Appd Airfoil CPD / Dwg, Stage 2 Comp Stator Vane - S	245270	11/17/97	11/17/97	0.02	0%	Late - Need 7-2-97 (Past Due)									
11220.40	Need Airfoil Dwg, Stage 2 Comp Stator Vane - S	245270	7/2/97	7/2/97	0	100%										
11220.41	Complete Aero Design, Stage 3 Comp Stator Vane - S	245280-100	9/25/96	9/25/96	0.02	100%										
11220.42	Complete Mech Design, Stage 3 Comp Stator Vane - S	245280-100	10/1/96	10/1/96	0.02	100%										
11220.43	Appd CPD / Dwg, Stage 3 Comp Stator Vane - S	245281	7/23/97	7/23/97	0.03	100%	Late - Need 6-1-97 (Past Due)									
11220.44	Need Dwg, Stage 3 Comp Stator Vane - S	245281	6/1/97	6/1/97	0	100%										
11220.45	Appd CPD / Dwg, Stage 3 Comp Stator Assy - S	245280	8/14/97	8/14/97	0.03	100%	Late - Need 7-2-97 (Past Due)									
11220.46	Need Dwg, Stage 3 Comp Stator Assy - S	245280	7/2/97	7/2/97	0	100%										
11220.47	Complete Aero Design, Stage 4 Comp Stator Vane - S	245285-100	10/15/96	10/15/96	0.02	100%										
11220.48	Complete Mech Design, Stage 4 Comp Stator Vane - S	245285-100	10/22/96	10/22/96	0.02	100%										
11220.49	Appd CPD / Dwg, Stage 4 Comp Stator Vane - S	245286	7/23/97	7/23/97	0.03	100%	Late - Need 6-1-97 (Past Due)									
11220.50	Need Dwg, Stage 4 Comp Stator Vane - S	245286	6/1/97	6/1/97	0	100%										
11220.51	Appd CPD / Dwg, Stage 4 Comp Stator Assy - S	245285	8/14/97	8/14/97	0.03	100%	Late - Need 7-2-97 (Past Due)									
11220.52	Need Dwg, Stage 4 Comp Stator Assy - S	245285	7/2/97	7/2/97	0	100%										
11220.53	Complete Aero Design, Stage 5 Comp Stator Vane - S	245290-100	5/9/97	5/9/97	0.02	100%										
11220.54	Complete Mech Design, Stage 5 Comp Stator Vane - S	245290-100	5/9/97	5/9/97	0.02	100%										
11220.55	Appd CPD / Dwg, Stage 5 Comp Stator Vane - S	245291	7/23/97	7/23/97	0.03	100%	Late - Need 6-1-97 (Past Due)									
11220.56	Need Dwg, Stage 5 Comp Stator Vane - S	245291	6/1/97	6/1/97	0	100%										
11220.57	Appd CPD / Dwg, Stage 5 Comp Stator Assy - S	245290	8/14/97	8/14/97	0.03	100%	Late - Need 7-2-97 (Past Due)									
11220.58	Need Dwg, Stage 5 Comp Stator Assy - S	245290	7/2/97	7/2/97	0	100%										
11220.59	Complete Aero Design, Stage 6 Comp Stator Vane - S	245295-100	5/5/97	5/5/97	0.02	100%										
11220.60	Complete Mech Design, Stage 6 Comp Stator Vane - S	245295-100	5/5/97	5/5/97	0.02	100%										
11220.61	Appd CPD / Dwg, Stage 6 Comp Stator Vane - S	245296	10/1/97	10/1/97	0.03	0%	Late - Need 6-1-97 (Past Due)									
11220.62	Need Dwg, Stage 6 Comp Stator Vane - S	245296	6/1/97	6/1/97	0	100%										
11220.63	Appd CPD / Dwg, Stage 6 Comp Stator Assy - S	245295	10/1/97	10/1/97	0.03	0%	Late - Need 7-2-97 (Past Due)									
11220.64	Need Dwg, Stage 6 Comp Stator Assy - S	245295	7/2/97	7/2/97	0	100%										

Advanced Turbine Systems
Phase 3 and 4
Filler: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11220.64	Complete Aero Design, Stage 7 Comp Stator - S	245300-100	5/8/97	5/6/97	0.02	100%										
11220.65	Complete Mech Design, Stage 7 Comp Stator - S	245300-100	5/23/97	5/23/97	0.02	100%										
11220.66	Appd CFD / Dwg, Stage 7 Comp Stator Vane - S	245301	10/3/97	10/3/97	0.03	0%	Late - Need 6-1-97 (Past Due)									
11220.67	Need Dwg, Stage 7 Comp Stator Vane - S	245301	6/1/97	6/1/97	0	100%										
11220.68	Appd CFD / Dwg, Stage 7 Comp Stator Assy - S	245300	10/2/97	10/2/97	0.03	0%	Late - Need 7-2-97 (Past Due)									
11220.69	Need Dwg, Stage 7 Comp Stator Assy - S	245300	7/2/97	7/2/97	0	100%										
11220.70	Complete Aero Design, Stage 8 Comp Stator - S	245305-100	5/29/97	5/29/97	0.02	100%										
11220.71	Complete Mech Design, Stage 8 Comp Stator - S	245305-100	6/18/97	6/18/97	0.02	100%										
11220.72	Appd CFD / Dwg, Stage 8 Comp Stator Vane - S	245306	10/9/97	10/9/97	0.03	0%	Late - Need 6-1-97 (Past Due)									
11220.73	Need Dwg, Stage 8 Comp Stator Vane - S	245306	6/1/97	6/1/97	0	100%										
11220.74	Appd CFD / Dwg, Stage 8 Comp Stator Assy - S	245305	10/16/97	10/16/97	0.03	0%	Late - Need 7-2-97 (Past Due)									
11220.75	Need Dwg, Stage 8 Comp Stator Assy - S	245305	7/2/97	7/2/97	0	100%										
11220.76	Complete Aero Design, Stage 9 Comp Stator - S	245310-100	5/20/97	5/20/97	0.02	100%										
11220.77	Complete Mech Design, Stage 9 Comp Stator - S	245310-100	5/21/97	5/21/97	0.02	100%										
11220.78	Appd CFD / Dwg, Stage 9 Comp Stator Vane - S	245311	10/10/97	10/10/97	0.03	0%	Late - Need 6-1-97 (Past Due)									
11220.79	Need Dwg, Stage 9 Comp Stator Vane - S	245311	6/1/97	6/1/97	0	100%										
11220.80	Appd CFD / Dwg, Stage 9 Comp Stator Assy - S	245310	10/17/97	10/17/97	0.03	0%	Late - Need 7-2-97 (Past Due)									
11220.81	Need Dwg, Stage 9 Comp Stator Assy - S	245310	7/2/97	7/2/97	0	100%										
11220.82	Appd CFD / Dwg, Compas Casing / Stator Assy - S	245230	10/31/97	10/31/97	0.03	0%										
11220.83	Need Dwg, Compas Casing / Stator Assy - S	245230	12/15/97	12/15/97	0	0%										
11220.84	Complete Assy, Compas Casing / Stator Assy - S	245230-100	3/19/98	3/19/98	0.03	0%										
11220.85	Need Assy, Compas Casing / Stator Assy - S	245230-100	3/21/98	3/21/98	0	0%										
11240	Compressor Diffuser / Bearing Assy - S	245330-100	9/14/95	3/31/98	0	62%										
11240.1	Start DLA, Comp Diffuser / Bearing Assy - S	245330-100	6/11/96	6/11/96	0.06	100%										
11240.2	Start CFD, Comp Diffuser / Bearing Assy - S	245330-100	8/13/96	8/13/96	0.06	100%										
11240.3	Complete CFD, Comp Diffuser / Bearing Assy - S	245330-100	2/11/97	2/11/97	0.06	100%										
11240.4	Appd Casting CFD / Dwg, Comp Discharge Hsg - S	245361	4/20/97	4/20/97	0.06	100%	Late - Need 3-24-97 (Past Due)									
11240.5	Need Casting Dwg, Comp Discharge Hsg - S	245361	3/24/97	3/24/97	0	100%	Past Due									
11240.6	Release Machine Dwg, Comp Discharge Hsg - S	245360	8/13/97	8/13/97	0.06	100%	Late - Need 7-29-97 (Past Due)									
11240.7	Need Machine Dwg, Comp Discharge Hsg - S	245360	7/29/97	7/29/97	0	100%										
11240.8	Appd CFD / Dwg, Comp Diffuser Inner - S	245331	10/3/97	10/3/97	0.07	0%	Late - Need 7-11-97 (Past Due)									
11240.9	Need Dwg, Comp Diffuser Inner - S	245331	7/11/97	7/11/97	0	100%										
11240.10	Appd Casting CFD / Dwg, #2 Bearing Case - S	245334	5/12/97	5/12/97	0.06	100%	Late - Need 3-26-97 (Past Due)									
11240.11	Need Casting Dwg, #2 Bearing Case - S	245334	3/26/97	3/26/97	0	100%	Past Due									
11240.12	Appd Maching CFD / Dwg, #2 Bearing Case - S	245333	7/30/97	7/30/97	0.07	100%	Late - Need 6-1-97 (Past Due)									
11240.13	Need Maching Dwg, #2 Bearing Case - S	245333	6/1/97	6/1/97	0	100%										
11240.14	Appd CFD / Dwg, #2 Bearing Case Assy - S	245333	7/30/97	7/30/97	0.07	100%										
11240.15	Need Dwg, #2 Bearing Case Assy - S	245333	10/15/97	10/15/97	0	100%										
11240.16	Complete Aero Design, Compas OGV - S	245315-100	6/3/97	6/3/97	0.06	100%										
11240.17	Complete Mech Design, Compas OGV - S	245315-100	6/12/97	6/12/97	0.06	100%										
11240.18	Appd CFD / Dwg, Compas OGV Vane - S	245317	11/7/97	11/7/97	0.06	0%	Late - Need 5-2-97 (Past Due)									
11240.19	Need Dwg, Compas OGV Vane - S	245317	5/2/97	5/2/97	0	100%										
11240.20	Appd CFD / Dwg, Compas OGV Assy - S	245315	11/7/97	11/7/97	0.07	0%	Late - Need 5-2-97 (Past Due)									
11240.21	Need Dwg, Compas OGV Assy - S	245315	5/2/97	5/2/97	0	100%										
11240.22	Appd Assy CFD / Dwg, Comp Diffuser / Bearing Assy - S	245330	11/15/97	11/15/97	0.07	0%	Late - Need 9-16-97									
11240.23	Need Assy Dwg, Comp Diffuser / Bearing Assy - S	245330	9/16/97	9/16/97	0	100%										
11240.24	Complete Assy, Comp Diffuser / Bearing Assy - S	245330-100	3/19/98	3/19/98	0.11	0%										
11240.25	Need Assy, Comp Diffuser / Bearing Assy - S	245330-100	3/31/98	3/31/98	0	0%										
11250	Compressor Common Parts - S	245050-100	4/1/98	3/31/98	0	1%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11250.1	Appd CPD / Dwg, Compressor Common Parts - S	245050-100	12/1/97	12/1/97	0.75	0%	Late - Need 11-30-97									
11250.2	Need Dwg, Compressor Common Parts - S	245050-100	11/30/97	11/30/97	0	0%										
11250.3	Complete, Compressor Common Parts - S	245050-100	2/15/98	2/15/98	0.25	0%										
11250.4	Need, Compressor Common Parts - S	245050-100	3/31/98	3/31/98	0	0%										
11300	Compressor System - S		2/28/96	12/1/99	0	23%										
11310	Compressor Inlet Scroll (Req'd deleted)		2/28/96	4/10/96	0	100%										
11320	Compressor Assy - S	245450-100	3/26/96	3/31/96	0	43%										
11320.1	Complete CFD, Compressor Housing - S	245450-100	8/2/96	8/2/96	0.03	100%										
11320.2	Appd Casting CPD / Dwg, Compressor Housing Assy - S	245460	8/13/97	8/13/97	0.05	100%	Late - Need 4/18/97 (Past Due)									
11320.3	Need Casting Dwg, Compressor Housing Assy - S	245460	4/18/97	4/18/97	0	100%	Past Due									
11320.4	Appd Machine CPD / Dwg, Compressor Housing Assy - S	245459	9/29/97	9/29/97	0.05	100%										
11320.5	Need Machine Dwg, Compressor Housing Assy - S	245459	10/16/97	10/16/97	0	100%										
11320.6	Appd CPD / Dwg, Compressor Hsg Assy - S	245459	9/29/97	9/29/97	0.05	100%										
11320.7	Need Dwg, Compressor Hsg Assy - S	245459	3/31/98	3/31/98	0	100%										
11320.7a	Appd Casting CPD / Dwg, Compressor End Cover - S	245457	5/23/97	5/23/97	0.03	100%	Late - Need 3-18-97 (Past Due)									
11320.7b	Need Casting Dwg, Compressor End Cover - S	245457	3/18/97	3/18/97	0	100%	Past Due									
11320.8	Appd CPD / Dwg, Compressor End Cover - S	245458	10/3/97	10/3/97	0.02	0%	Late - Need 6-30-97 (Past Due)									
11320.9	Need Dwg, Compressor End Cover - S	245458	6/30/97	6/30/97	0	100%										
11320.10	Start DLA, Air Diverter Valve Assy - S	245510-100	8/21/96	8/21/96	0.02	100%										
11320.11	Appd CPD / Dwg, Air Diverter Valve Assy - S	245510	10/3/97	10/3/97	0.05	0%	Late - Need 8-6-97									
11320.12	Need Dwg, Air Diverter Valve Assy - S	245510	8/6/97	8/6/97	0	100%										
11320.13	Complete Assy, Air Diverter Valve Assy - S	245510-100	2/18/98	2/18/98	0.05	0%										
11320.14	Need Assy, Air Diverter Valve Assy - S	245510-100	2/18/98	2/18/98	0	0%										
11320.15	Start DLA, Stage 1 Diaphragm - S	245470-100	1/7/97	1/7/97	0.03	100%										
11320.16	Appd Casting CPD / Dwg, Stage 1 Diaphragm - S	245471	10/20/97	10/20/97	0.05	0%	Late - Need 4-16-97 (Past Due)									
11320.17	Need Casting Dwg, Stage 1 Diaphragm - S	245471	4/16/97	4/16/97	0	100%	Past Due									
11320.18	Appd Machine CPD / Dwg, Stage 1 Diaphragm - S	245470-1	10/24/97	10/24/97	0.05	0%	Late - Need 8-15-97									
11320.19	Need Machine Dwg, Stage 1 Diaphragm - S	245470-1	9/4/97	9/4/97	0	100%										
11320.20	Appd CPD / Dwg, Stage 1 Diaphragm Assy - S	245470-100	10/24/97	10/24/97	0.05	0%										
11320.21	Need Dwg, Stage 1 Diaphragm Assy - S	245470-100	9/30/97	9/30/97	0	100%										
11320.22	Start DLA, Turbine Preswiffer Sig 1 - S	245472-1	11/1/96	11/1/96	0.02	100%										
11320.23	Appd CPD / Dwg, Piston Ring Preswiffer Sig 1 - S	245475	10/3/97	10/3/97	0.05	0%	Late - Need 4-26-97 (Past Due)									
11320.24	Need Dwg, Piston Ring Preswiffer Sig 1 - S	245475	4/26/97	4/26/97	0	100%	Past Due									
11320.27	Appd Casting CPD / Dwg, Turbine Preswiffer Sig 1 - S	245473	9/13/97	9/13/97	0.10	100%	Late - Need 7-27-97 (Past Due)									
11320.28	Need Casting Dwg, Turbine Preswiffer Sig 1 - S	245473	7/27/97	7/27/97	0	100%										
11320.29	Appd CPD / Dwg, Turbine Preswiffer Sig 1 - S	245472	10/31/97	10/31/97	0.05	0%	Late - Need 7-11-97 (Past Due)									
11320.30	Need Dwg, Turbine Preswiffer Sig 1 - S	245472	7/11/97	7/11/97	0	100%										
11320.31	Appd CPD / Dwg, Compressor Assy - S	245450	10/15/97	10/15/97	0.05	0%										
11320.32	Need Dwg, Compressor Assy - S	245450	11/5/97	11/5/97	0	0%										
11320.33	Complete Assy, Compressor Housing - S	245459-100	10/31/97	10/31/97	0.05	0%										
11320.34	Need Assy, Compressor Housing - S	245459-100	3/31/98	3/31/98	0	0%										
11320.35	Complete Assy, Compressor Assembly - S	245450-100	10/15/97	10/15/97	0.15	0%										
11320.36	Need Assy, Compressor Assembly - S	245450-100	3/31/98	3/31/98	0	0%										
11330	LPM Compressor Liner Assy - S	245460-100	5/28/96	5/28/96	0	75%										
11330.1	Start DLA, Compressor Liner Assy - S	245460-100	5/28/96	5/28/96	0.10	100%										
11330.2	Complete DLA, Compressor Liner Assy - S	245460-100	5/5/97	5/5/97	0.15	100%										
11330.3	Appd CPD / Dwg, Compressor Liner Details - S	245480	7/25/97	7/25/97	0.25	100%										
11330.4	Appd CPD / Dwg, Compressor Liner Assy - S	245480	9/23/97	9/23/97	0.25	100%	Late - Need 7-7-97 (Past Due)									
11330.5	Need Dwg, Compressor Liner Assy - S	245480	7/7/97	7/7/97	0	100%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11330.6	Complete Assy, Combustor Liner Assy - S (Rig)	245480-100	11/15/97	11/15/97	0.25	0%										
11330.7	Need Assy, Combustor Liner Assy - S (Prod)	245480-100	3/31/98	3/31/98	0	0%										
11340	Ignitor Torch Assy - S	245530-100	3/1/97	5/28/98	0	100%										
11340.1	Start DLA, Ignitor Torch Assy - S	245530-100	2/28/97	2/28/97	0.10	100%										
11340.2	Appt CPD / Dwg, Ignitor Torch Assy - S	245530	10/31/97	10/31/97	0.40	0%	Late - Need 4/24/97 (Past Due)									
11340.3	Need Dwg, Ignitor Torch Assy - S	245530	4/24/97	4/24/97	0	0%	Past Due									
11340.4	Complete Assy, Ignitor Torch Assy - S	245530-100	11/15/97	11/15/97	0.50	0%										
11340.5	Need Assy, Ignitor Torch Assy - S	245530-100	3/31/98	3/31/98	0	0%										
11350	Combustor Outlet Scroll (Req'dm deleted)	245530-100	5/1/96	5/15/96	0	100%										
11360	Catalytic Combustor Liner Assy - S	245530-100	12/19/96	12/19/96	0	1%										
11360.1	Appt CPD / Dwg, Catalytic Liner Assy - S	245530-100	7/28/98	7/28/98	0.25	0%										
11360.2	Select, Catalytic Concept - S	245530-100	12/15/98	12/15/98	0.25	0%										
11360.3	Appt CPD / Dwg, Catalytic Liner S	245530-100	3/3/99	3/3/99	0.25	0%										
11360.4	Complete Fab, Catalytic Liner S Rig	245530-100	12/1/99	12/1/99	0.25	0%										
11400	Recuperator Section - S	245900-100	9/14/95	3/31/98	0	21%										
11410	Recuperator Assembly - S	245900-100	9/14/95	3/31/98	0	20%										
11410.1	Appt CPD / Dwg, Recuperator Assy - S	245900	2/15/97	2/15/97	0.20	100%										
11410.2	Complete Assy, Recuperator Assy - S (1985)	245900-100	10/15/97	10/15/97	0.30	0%										
11410.3	Complete Assy, Recuperator Assy - S	245900-100	2/28/98	2/28/98	0.50	0%										
11410.3	Need Assy, Recuperator Assy - S	245900-100	3/31/98	3/31/98	0	0%										
11420	Recuperator Piping - S	245900-100	4/1/96	2/27/98	0	40%										
11420.1	Appt CPD / Dwg, Recup Air Inlet Assy - S	245901	9/30/97	9/30/97	0.15	100%										
11420.2	Appt CPD / Dwg, Recup Air Outlet Exp Joint Assy - S	245902	6/7/97	6/7/97	0.12	100%										
11420.3	Appt CPD / Dwg, Recup Gas Inlet Flex Duct Assy - S	245903	6/7/97	6/7/97	0.13	100%										
11420.4	Complete Fab, Recuperator Air Inlet Assy Left - S	245901-100	2/28/98	2/28/98	0.15	0%										
11420.5	Complete Fab, Recuperator Air Inlet Assy Right - S	245901-200	2/28/98	2/28/98	0.15	0%										
11420.6	Complete Fab, Recup Air Outlet Exp. Joint Assy - S	245902-100	2/28/98	2/28/98	0.15	0%										
11420.7	Complete Fab, Recup Gas Inlet Flex Duct Assy - S	245903-100	2/28/98	2/28/98	0.15	0%										
11500	Gas Fuel Assembly - S	245500-100	2/28/96	11/30/99	0	7%										
11510	Fuel Injector Assy - S	245515-100	2/28/96	3/31/96	0	25%										
11510.1	Start DLA, Fuel Injector Assy - S	245515-100	6/24/96	6/24/96	0.10	100%										
11510.2	Complete CFD, Fuel Injector Assy - S	245515-100	5/30/97	5/30/97	0.15	100%										
11510.3	Appt CPD / Dwg, Fuel Injector Assy Fabricated - S	246260	11/28/97	11/28/97	0.25	0%	Late - Need 9-5-97									
11510.4	Need Dwg, Fuel Injector Assy Fabricated - S	246260	9/5/97	9/5/97	0	100%										
11510.5	Appt CPD / Dwg, Gas Fuel Assy - S	245500	10/10/97	10/10/97	0.25	0%										
11510.6	Need Dwg, Gas Fuel Assy - S	245500	12/15/97	12/15/97	0	0%										
11510.7	Complete Assy, Fuel Injector Assy - S	245515-100	11/30/97	11/30/97	0.25	0%										
11510.8	Need Assy, Fuel Injector Assy - S	245515-100	3/31/98	3/31/98	0	0%										
11520	Fuel Manifolds / Tube Assy - S	Various	12/5/96	3/31/98	0	10%										
11520.1	Start DLA, Fuel Manifolds / Tube Assy - S	Various	3/1/97	3/1/97	0.10	100%										
11520.2	Appt CPD / Dwg, Manifold Assy, Gas (Main) - S	245520	10/10/97	10/10/97	0.10	0%	Late - Need 5/18/97 (Past Due)									
11520.3	Need Dwg, Manifold Assy, Gas (Main) - S	245520	5/18/97	5/18/97	0	100%										
11520.4	Appt CPD / Dwg, Manifold Assy, Gas (Pilot) - S	245495	10/10/97	10/10/97	0.10	0%	Late - Need 5/18/97 (Past Due)									
11520.5	Need Dwg, Manifold Assy, Gas (Pilot) - S	245495	5/18/97	5/18/97	0	100%										
11520.6	Appt CPD / Dwg, Tube Assy, Gas (Main) - S	245521	10/10/97	10/10/97	0.10	0%										
11520.7	Need Dwg, Tube Assy, Gas (Main) - S	245521	9/15/97	9/15/97	0	100%										
11520.8	Appt CPD / Dwg, Tube Assy, Gas (Pilot) - S	245526	10/10/97	10/10/97	0.10	0%										
11520.9	Need Dwg, Tube Assy, Gas (Pilot) - S	245526	9/15/97	9/15/97	0	100%										
11520.10	Complete Assy, Manifold Assy, Gas (Main) - S	245520-100	11/15/97	11/15/97	0.15	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11520.11	Need Assy, Manifold Assy, Gas (Main) - S	245520-100	3/3/98	3/3/98	0	0%										
11520.12	Complete Assy, Manifold Assy, Gas (Pilot) - S	245525-100	11/15/97	11/15/97	0.15	0%										
11520.13	Need Assy, Manifold Assy, Gas (Pilot) - S	245525-100	3/3/98	3/3/98	0	0%										
11520.14	Complete Assy, Tube Assy, Gas (Main) - S	245521-100	11/15/97	11/15/97	0.10	0%										
11520.15	Need Assy, Tube Assy, Gas (Main) - S	245521-100	3/3/98	3/3/98	0	0%										
11520.16	Complete Assy, Tube Assy, Gas (Pilot) - S	245526-100	11/15/97	11/15/97	0.10	0%										
11520.17	Need Assy, Tube Assy, Gas (Pilot) - S	245526-100	3/3/98	3/3/98	0	0%										
11530	Fuel Injector, Catalytic - S	3/1/96	11/30/99	11/30/99	0	1%										
11530.1	Appd CPD / Dwg, Catalytic Rig Fuel Injector - S	10/17/97	10/17/97	10/17/97	0.15	0%										
11530.2	Appd CPD / Dwg, Catalytic Fuel Injector - S	3/2/99	3/2/99	3/2/99	0.45	0%										
11530.3	Complete Fab, Catalytic Fuel Injector - S	11/30/99	11/30/99	11/30/99	0.40	0%										
11600	Turbine Section - S	3/1/96	3/1/96	3/3/98	0	67%										
11610	Turbine Rotor Assy - S	245706-100	3/7/96	3/3/98	0	61%										
11610.1	Start DLA, Stage 1 Blade - S	245710-100	6/3/96	6/3/96	0.02	100%										
11610.2	Appd Casting CPD / Dwg, Stage 1 Blade - S	245711	6/5/97	6/5/97	0.03	100%	Late - Need 11-7-96 (Past Due)									
11610.3	Need Casting Dwg, Stage 1 Blade - S	245711	11/7/96	11/7/96	0	100%	Past Due									
11610.4	Appd Machine CPD / Dwg, Stage 1 Blade - S	245710	8/18/97	8/18/97	0.03	100%	Late Need 3-16-97 (Past Due)									
11610.5	Need Machine Dwg, Stage 1 Blade - S	245710	3/18/97	3/18/97	0	100%	Past Due									
11610.6	Start DLA, Stage 1 Disk - S	245702-1	7/8/96	7/8/96	0.02	100%										
11610.7	Appd Forging CPD / Dwg, Stage 1 Disk - S	245703	4/21/97	4/21/97	0.03	100%										
11610.8	Need Forging Dwg, Stage 1 Disk - S	245703	11/7/97	11/7/97	0	100%										
11610.9	Appd Machining CPD / Dwg, Stage 1 Disk - S	245702	8/22/97	8/22/97	0.03	100%	Late - Need 2-16-97 (Past Due)									
11610.10	Need Machining Dwg, Stage 1 Disk - S	245702	2/16/97	2/16/97	0	100%	Past Due									
11610.11	Appd CPD / Dwg, Stage 1 Disk Assy - S	245701	10/8/97	10/8/97	0.03	0%	Late - Need 6-2-97 (Past Due)									
11610.12	Need Dwg, Stage 1 Disk Assy - S	245701	6/2/97	6/2/97	0	100%										
11610.13	Complete Assy, Stage 1 Disk Assy - S	245701-100	2/13/98	2/13/98	0	0%										
11610.14	Need Assy, Stage 1 Disk Assy - S	245701-100	6/3/96	6/3/96	0.02	100%										
11610.15	Start DLA, Stage 2 Blade - S	245761	9/4/97	9/4/97	0.03	100%	Late - Need 2-5-97 (Past Due)									
11610.16	Appd CPD / Dwg, Stage 2 Blade - S	245761	2/5/97	2/5/97	0	100%	Past Due									
11610.17	Need Casting Dwg, Stage 2 Blade - S	245761	10/3/97	10/3/97	0.03	0%	Late - Need 5-7-97 (Past Due)									
11610.18	Appd Machine CPD / Dwg, Stage 2 Blade - S	245760	5/7/97	5/7/97	0	100%										
11610.19	Need Machine Dwg, Stage 2 Blade - S	245760	7/12/96	7/12/96	0.02	100%										
11610.20	Start DLA, Stage 2 Disk - S	245751-1	8/5/97	8/5/97	0.03	100%	Late - Need 1-14-97 (Past Due)									
11610.21	Appd Forging CPD / Dwg, Stage 2 Disk - S (EI)	245752	1/14/97	1/14/97	0	100%	Past Due									
11610.22	Need Forging Dwg, Stage 2 Disk - S	245752	10/3/97	10/3/97	0.03	0%	Late - Need 1-29-97 (Past Due)									
11610.23	Appd Machine CPD / Dwg, Stage 2 Disk - S	245751	1/29/97	1/29/97	0	100%	Past Due									
11610.24	Need Machine Dwg, Stage 2 Disk - S	245751	10/7/97	10/7/97	0.03	0%	Late - Need 7-17-97 (Past Due)									
11610.25	Appd CPD / Dwg, Stage 2 Disk Assy - S	245750	7/17/97	7/17/97	0	100%										
11610.26	Need Dwg, Stage 2 Disk Assy - S	245750	1/15/98	1/15/98	0.03	0%										
11610.27	Complete Assy, Stage 2 Disk Assy - S	245750-100	2/13/97	2/13/97	0	100%										
11610.28	Need Assy, Stage 2 Disk Assy - S	245750-100	1/1/96	1/1/96	0.02	100%										
11610.29	Start DLA, Turbine Rim Seal - S	Various	4/1/97	4/1/97	0.03	100%	Late - Need 3-23-97 (Past Due)									
11610.30	Appd Forging CPD / Dwg, Turbine Rim Seal, Fwd - S	245721	3/23/97	3/23/97	0	100%	Past Due									
11610.31	Need Forging Dwg, Turbine Rim Seal, Fwd - S	245721	8/22/97	8/22/97	0.03	100%	Late - Need 4-2-97 (Past Due)									
11610.32	Appd Mach CPD / Dwg, Turbine Rim Seal, Fwd - S	245720-1	4/2/97	4/2/97	0	100%	Past Due									
11610.33	Need Mach Dwg, Turbine Rim Seal, Fwd - S	245720-1	4/1/97	4/1/97	0.03	100%	Late - Need 3-23-97 (Past Due)									
11610.34	Appd Forging CPD / Dwg, Turbine Rim Seal, Aft - S	245731	3/23/97	3/23/97	0	100%	Past Due									
11610.35	Need Forging Dwg, Turbine Rim Seal, Aft - S	245731	8/22/97	8/22/97	0.03	100%	Late - Need 4-2-96 (Past Due)									
11610.36	Appd Machine CPD / Dwg, Turbine Rim Seal, Aft - S	245720-2	8/22/97	8/22/97	0.03	100%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11610.37	Need Mach Dwg, Turbine Rim Seal, Air - S	245720-2	4/2/97	4/2/97	0	100%	Past Due									
11610.38	Start DLA, Turbine Shaft Assy - S	Various	11/4/96	11/4/96	0.02	100%										
11610.39	Appd Forging CPD / Dwg, Turbine Shaft Assy - S	245777	7/2/97	7/2/97	0.03	100%	Late - Need 2-4-97 (Past Due)									
11610.40	Need Forging Dwg, Turbine Shaft Assy - S	245777	2/4/97	2/4/97	0	100%	Past Due									
11610.41	Appd Machine CPD / Dwg, Turb. Shaft Assy - S	245776	10/15/97	10/15/97	0.03	0%	Late - Need 7-20-97 (Past Due)									
11610.42	Need Machine Dwg, Turbine Shaft Assy - S	245776	7/20/97	7/20/97	0	100%										
11610.43	Appd CPD / Dwg, Turbine Shaft Assy - S	245775	10/15/97	10/15/97	0.03	0%	Late - Need 8-7-97 (Past Due)									
11610.44	Need Dwg, Turbine Shaft Assy - S	245775	8/7/97	8/7/97	0	100%										
11610.45	Appd Forging CPD / Dwg, Turbine Shaft Assy, Center - S	245792	7/24/97	7/24/97	0.03	100%	Late - Need 2-4-97 (Past Due)									
11610.46	Need Forging Dwg, Turbine Shaft Assy, Center - S	245792	2/4/97	2/4/97	0	100%	Past Due									
11610.47	Appd Machine CPD / Dwg, Turbine Shaft Assy, Center - S	245791	8/7/97	8/7/97	0.03	100%										
11610.48	Need Machine Dwg, Turbine Shaft Assy, Center - S	245791	7/20/97	7/20/97	0	100%										
11610.49	Appd CPD / Dwg, Turbine Shaft Assy, Center - S	245790	10/23/97	10/23/97	0.03	0%	Late - Need 8-7-97 (Past Due)									
11610.50	Need Dwg, Turbine Shaft Assy, Center - S	245790	8/7/97	8/7/97	0	100%										
11610.51	Start DLA, Tiebolt - S	245740-1	11/4/96	11/4/96	0.02	100%										
11610.52	Appd CPD / Dwg, Tiebolt - S	245740	10/15/97	10/15/97	0.03	0%	Late - Need 6-17-97 (Past Due)									
11610.53	Need Dwg, Tiebolt - S	245740	6/17/97	6/17/97	0	100%										
11610.54	Start DLA, #3 Bearing Case Assy - S	245800-100	10/16/96	10/16/96	0.02	100%										
11610.55	Appd Casting CPD / Dwg, #3 Bearing Case - S	245807	7/11/97	7/11/97	0.02	100%	Late - Need 5-5-97 (Past Due)									
11610.56	Need Casting Dwg, #3 Bearing Case - S	245807	5/5/97	5/5/97	0	100%										
11610.57	Appd Machine CPD / Dwg, #3 Bearing Case Assy - S	245806	9/26/97	9/26/97	0.02	100%	Late - Need 6-16-97 (Past Due)									
11610.58	Need Machine Dwg, #3 Bearing Case Assy - S	245806	6/30/97	6/30/97	0	100%										
11610.59	Appd CPD / Dwg, #3 Bearing Case Assy - S	245800	10/19/97	10/19/97	0.02	0%										
11610.60	Need Dwg, #3 Bearing Case Assy - S	245800	10/16/97	10/16/97	0	0%										
11610.61	Appd CPD / Dwg, Thrust Bearing Assy - S	245555	5/16/97	5/16/97	0.02	100%										
11610.62	Procure, Thrust Bearing Assy - S	245555-100	5/10/97	5/10/97	0	100%	Critical - Need 10-31-97									
11610.63	Appd CPD / Dwg, Turbine Rotor Assy - S	245700	10/23/97	10/23/97	0.02	0%										
11610.64	Need Dwg, Turbine Rotor Assy - S	245700	10/31/97	10/31/97	0	0%	Late - Need 5-18-97 (Past Due)									
11610.65	Appd CPD / Dwg, Exhaust Collector Inner - S	245801	10/9/97	10/9/97	0.02	100%	Past Due									
11610.66	Need Dwg, Exhaust Collector Inner - S	245801	5/18/97	5/18/97	0	0%										
11610.67	Complete Assy, Turbine Rotor Assy - S	245700-100	3/19/98	3/19/98	0.03	0%										
11610.68	Need Assy, Turbine Rotor Assy - S	245700-100	3/31/98	3/31/98	0	0%										
11620	Turbine Housing Assy - S		3/7/96	3/31/98	0	75%										
11630	Turbine Nozzle Assy - S		3/1/96	3/31/98	0	75%										
11630.1	Start DLA, Nozzle Segment Assy Sig 1 - S	245600-100	6/3/96	6/3/96	0.05	100%										
11630.2	Appd Casting CPD / Dwg, Nozzle Segment Sig 1 - S	245602	5/30/97	5/30/97	0.10	100%	Late - Need 12-23-96 (Past Due)									
11630.3	Need Casting Dwg, Nozzle Segment Sig 1 - S	245602	12/23/96	12/23/96	0	100%	Past Due									
11630.4	Appd Machine CPD / Dwg, Nozzle Segment Sig 1 - S	245601	7/30/97	7/30/97	0.05	100%	Late - Need 3-4-97 (Past Due)									
11630.5	Need Machine Dwg, Nozzle Segment Sig 1 - S	245601	3/4/97	3/4/97	0	100%	Past Due									
11630.6	Appd Assy CPD / Dwg, Nozzle Segment Sig 1 - S	245600	10/17/97	10/17/97	0.10	0%										
11630.7	Need Assy Dwg, Nozzle Segment Sig 1 - S	245600	1/30/98	1/30/98	0	0%										
11630.8	Start DLA, Stage 2 Nozzle Assy - S	245650-100	7/17/96	7/17/96	0.05	100%	Late - Need 2-21-97 (Past Due)									
11630.9	Appd Casting CPD / Dwg, Stage 2 Nozzle Segment - S	245652	5/30/97	5/30/97	0.10	100%	Past Due									
11630.10	Need Casting Dwg, Stage 2 Nozzle Segment - S	245652	2/21/97	2/21/97	0	100%										
11630.11	Appd Machine CPD / Dwg, Stage 2 Nozzle Segment - S	245651-100/200	9/25/97	9/25/97	0.05	100%	Late - Need 7-2-97 (Past Due)									
11630.12	Need Machine Dwg, Stage 2 Nozzle Segment - S	245651-100/200	7/2/97	7/2/97	0	100%										
11630.13	Appd CPD / Dwg, Stage 2 Nozzle Assy - S	245650	9/25/97	9/25/97	0.05	100%										
11630.14	Need Dwg, Stage 2 Nozzle Assy - S	245650	10/31/97	10/31/97	0	100%										
11630.15	Complete Assy, Stage 2 Nozzle Assy - S	245650-100	3/19/98	3/19/98	0.05	0%										

Advanced Turbine Systems
Phase 3 and 4
Filler: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1993	1996	1997	1998	1999	2000	2001	2002	2003
11630.16	Need Assy, Stage 2 Nozzle Assy - S	245560-100	3/3/96	3/3/96	0	0%										
11630.17	Start DLA, Stage 2 Diaphragm - S	245560-100	7/22/96	7/22/96	0.05	100%										
11630.18	Appd Forging CPD / Dwg, Stage 2 Diaphragm - S	245562	6/20/97	6/20/97	0.10	100%	Late - Need 3-15-97 (Past Due)									
11630.19	Need Forging Dwg, Stage 2 Diaphragm - S	245562	3/15/97	3/15/97	0	100%	Past Due									
11630.20	Appd Machine CPD / Dwg, Stage 2 Diaphragm - S	245561	7/1/97	7/1/97	0.05	100%	Late - Need 6-13-97 (Past Due)									
11630.21	Need Machine Dwg, Stage 2 Diaphragm - S	245561	6/13/97	6/13/97	0	100%										
11630.22	Appd CPD / Dwg, Stage 2 Diaphragm Assy - S	245560	7/1/97	7/1/97	0.10	100%										
11630.23	Need Dwg, Stage 2 Diaphragm Assy - S	245560	8/13/97	8/13/97	0	100%										
11630.24	Complete Assy, Stage 2 Diaphragm Assy - S	245560-100	10/31/97	10/31/97	0.10	0%										
11630.25	Need Assy, Stage 2 Diaphragm Assy - S	245560-100	2/13/98	2/13/98	0	0%										
11640	Turbine Common Parts - S	245550-100	9/2/96	3/3/98	0	45%										
11640.1	Start DLA, Stage 1 Tipshoe - S	245580-100/500	11/20/96	11/20/96	0.05	100%										
11640.2	Appd Casting CPD / Dwg, Stage 1 Tipshoe - S	245581	9/25/97	9/25/97	0.05	100%	Late - Need 7/31/97 (Past Due)									
11640.3	Need Casting Dwg, Stage 1 Tipshoe - S	245581	7/31/97	7/31/97	0	100%										
11640.4	Appd Machine CPD / Dwg, Stage 1 Tipshoe - S	245580	10/2/97	10/2/97	0.05	0%										
11640.5	Need Machine Dwg, Stage 1 Tipshoe - S	245580	10/15/97	10/15/97	0	0%										
11640.6	Start DLA, Nozzle Htg Assy - S	245575-100/200	8/6/96	8/6/96	0.05	100%										
11640.7	Order Raw Material, Nozzle Htg Assy - S	245577	1/9/97	1/9/97	0.05	100%										
11640.8	Appd Forging CPD / Dwg, Nozzle Htg Assy - S	245577	2/13/97	2/13/97	0.05	100%										
11640.9	Need Forging Dwg, Nozzle Htg Assy - S	245577	1/12/97	1/12/97	0	100%										
11640.10	Appd CPD / Dwg, Nozzle Htg Assy - S	245576	10/17/97	10/17/97	0.05	0%	Late - Need 6-1-97 (Past Due)									
11640.11	Need Dwg, Nozzle Htg Assy - S	245576	6/1/97	6/1/97	0	100%										
11640.12	Appd CPD / Dwg, Turbine Nozzle Case Assy - S	245575	8/1/97	8/1/97	0.05	100%										
11640.13	Need Dwg, Turbine Nozzle Case Assy - S	245575	10/15/97	10/15/97	0	100%										
11640.14	Appd Forging CPD / Dwg, Nozzle Htg Ar - S	245579	10/17/97	10/17/97	0.10	0%	Late - Need 5-28-97 (Past Due)									
11640.15	Need Forging Dwg, Nozzle Htg Ar - S	245579	5/28/97	5/28/97	0	100%										
11640.16	Appd CPD / Dwg, Nozzle Htg Ar - S	245578	10/17/97	10/17/97	0.05	0%										
11640.17	Need Dwg, Nozzle Htg Ar - S	245578	10/15/97	10/15/97	0	0%										
11640.18	Start DLA, Stage 2 Tipshoe - S	245570-100	2/13/97	2/13/97	0.05	100%										
11640.19	Appd Casting CPD / Dwg, Stage 2 Tipshoe - S	245571	10/3/97	10/3/97	0.05	0%	Late - Need 7-16-97 (Past Due)									
11640.20	Need Casting Dwg, Stage 2 Tipshoe - S	245571	7/16/97	7/16/97	0	100%										
11640.21	Appd Machine CPD / Dwg, Stage 2 Tipshoe - S	245570	10/3/97	10/3/97	0.05	0%										
11640.22	Need Machine Dwg, Stage 2 Tipshoe - S	245570	10/15/97	10/15/97	0	0%										
11640.23	Start DLA, Exit Guide Vane - S	245590-100	10/24/96	10/24/96	0.05	100%										
11640.24	Appd Casting CPD / Dwg, EGV Ring - S	245591	9/18/97	9/18/97	0.05	100%	Late - Need 7-31-97 (Past Due)									
11640.25	Need Casting Dwg, EGV Ring - S	245591	7/31/97	7/31/97	0	100%										
11640.26	Appd CPD / Dwg, EGV Vane - S (Agilis)	245590	10/22/97	10/22/97	0.05	0%	Late - Need 7-31-97 (Past Due)									
11640.27	Need Dwg, EGV Vane - S	245590	7/31/97	7/31/97	0	100%										
11640.28	Appd CPD / Dwg, Exit Guide Vane Assy - S	245590	10/22/97	10/22/97	0.05	0%										
11640.29	Need Dwg, Exit Guide Vane Assy - S	245590	10/15/97	10/15/97	0	0%										
11640.30	Complete Assy, Exit Guide Vane Assy - S	245590-100	2/28/98	2/28/98	0.10	0%										
11640.31	Need Assy, Exit Guide Vane Assy - S	245590-100	3/15/98	3/15/98	0	0%										
11800	Exhaust Section - S		2/15/96	3/31/98	0	40%										
11810	Exhaust Diffuser / Bng Assy - S		2/15/96	3/31/98	0	50%										
11820	Exhaust Assy - S		11/20/96	3/31/98	0	20%										
11820.1	Start DLA, Exhaust Assy - S	245825-100	12/27/97	12/27/97	0.10	100%										
11820.2	Appd CPD / Dwg, Exhaust Collector Assy - S	245826	1/1/97	1/1/97	0.20	0%	Late - Need 7-17-97 (Past Due)									
11820.3	Need Dwg, Exhaust Collector Assy - S	245826	7/17/97	7/17/97	0	100%										
11820.4	Start DLA, Cooler Frame - S	245830-100	4/15/96	4/15/96	0.10	100%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
11820.5	Appd CPD / Dwg, Center Frame - S	245830	10/30/97	10/30/97	0.20	0%	Late - Need 5-18-97 (Past Due)									
11820.6	Need CPD, Center Frame - S	245830	5/18/97	5/18/97	0	100%	Past Due									
11820.7	Appd CPD / Dwg, Exhaust Assy - S	245825	11/1/97	11/1/97	0.20	0%	Late - Need 8-17-97									
11820.8	Need Dwg, Exhaust Assy - S	245825	8/17/97	8/17/97	0	100%										
11820.9	Complete Assy, Exhaust Assy - S	245825-100	1/8/98	1/8/98	0.20	0%										
11820.10	Need Assy, Exhaust Assy - S	245825-100	3/31/98	3/31/98	0	0%										
11900	Engine Common Parts - S		7/1/96	3/25/98	0	1%										
11910	Bleed Valve & Duct Assy - S	228687	2/8/98	2/8/98	0	0%										
11910.1	Release Final Design, Relief Valve & Duct Assy - S	10/15/97	10/15/97	10/15/97	0.40	0%										
11910.2	Complete Fab, Relief Valve & Duct Assy - S	12/2/97	12/2/97	12/2/97	0.60	0%										
11920	Engine Assembly Hardware - S	711/96	3/25/98	3/25/98	0	1%										
11920.1	Release Design, Engine Assy Hardware - S	11/15/97	11/15/97	11/15/97	0.40	0%										
11920.2	Complete Fab, Engine Assy Hardware - S	3/25/98	3/25/98	3/25/98	0.60	0%										
12000	Package Mechanical Systems - S	12/1/95	12/31/99	12/31/99	0	18%										
12100	Generator - S	12/1/95	4/12/99	4/12/99	0	23%										
12110	Release, Generator Spec - S	10/18/96	7/14/98	7/14/98	0	30%										
12110.1	Release, Generator Procurement Drawing - S	7/1/97	7/1/97	7/1/97	0.10	100%										
12110.2	Review, Supplier Generator Documentation - S	9/1/97	9/1/97	9/1/97	0.20	100%										
12110.3	Procure, Generator - S	10/15/97	10/15/97	10/15/97	0.20	0%										
12110.4	Reduction Gearbox - S	7/14/98	7/14/98	7/14/98	0.50	0%										
12120	Release, Reduction Gearbox Spec - S	12/1/95	8/28/97	8/28/97	0	50%										
12120.1	Complete Supplier Proposals, Gearbox - S	3/15/96	3/15/96	3/15/96	0.20	100%										
12120.2	Release P.O., Reduction Gearbox - S	10/16/96	10/16/96	10/16/96	0.10	100%										
12120.3	POR Complete, Dev. Reduction Gearbox - S	2/5/97	2/5/97	2/5/97	0.10	100%										
12120.4	POR Complete, Production Reduction Gearbox - S	7/1/97	7/1/97	7/1/97	0.10	100%										
12120.5	Complete Fab, Dev. Reduction Gearbox - S	10/1/97	10/1/97	10/1/97	0.10	0%										
12120.6	Complete Assy, Dev. Reduction Gearbox - S	10/31/97	10/31/97	10/31/97	0.10	0%										
12120.7	Receive, Reduction Gearbox - S	11/15/97	11/15/97	11/15/97	0.15	0%										
12130	Electrical Conduit / J-Boxes - S	12/1/97	12/1/97	12/1/97	0.15	0%										
12130.1	Release, Electrical Conduit / J-Boxes - S	9/2/97	3/25/98	3/25/98	0	1%										
12130.2	Procure Electrical System Components - S	10/31/97	10/31/97	10/31/97	0.40	0%										
12140	Package / Generator Frame - S	3/25/98	3/25/98	3/25/98	0.60	0%										
12140.1	Release, Final Design, Package Frame - S	7/18/97	6/22/98	6/22/98	0	40%										
12140.2	Complete Fab, Package Frame - S	9/30/97	9/30/97	9/30/97	0.40	100%										
12150	Enclosure Assembly - S	12/15/97	12/15/97	12/15/97	0.60	0%										
12150.1	Release Final Design, Package Enclosure - S	12/1/97	4/1/99	4/1/99	0	0%										
12150.2	Procure, Package Enclosure - S	6/12/98	6/12/98	6/12/98	0.40	0%										
12160	Inlet Filler / Silencer / Ducting - S	4/12/99	4/12/99	4/12/99	0.60	0%										
12160.1	Release, Final Design, Inlet Filler - S	9/2/97	1/1/99	1/1/99	0	1%										
12160.2	Procure / Fab, Inlet Filler - S	11/13/97	11/13/97	11/13/97	0.40	0%										
12170	Recuperator Support - S	10/1/97	5/18/98	5/18/98	0	1%										
12170.1	Release, Final Design, Recuperator Support - S	7/13/98	7/13/98	7/13/98	0.40	0%										
12170.2	Procure Fab, Recuperator Support - S	5/18/98	5/18/98	5/18/98	0.60	0%										
12200	Package Control & Indicating System - S	5/1/96	2/14/99	2/14/99	0	9%										
12210	Control Console - S	5/1/96	2/12/99	2/12/99	0	10%										
12210.1	Release, Controls Spec - S	4/21/97	4/21/97	4/21/97	0.10	100%										
12210.2	Complete Design, On Skid Controller Prototype - S	11/15/97	11/15/97	11/15/97	0.10	0%										
12210.3	Complete Test, In-House OSC - S	2/28/98	2/28/98	2/28/98	0.15	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1985	1986	1987	1988	1989	2000	2001	2002	2003
17200.2	Procure, Balance of Plant - S		2/8/99	2/8/99	0.50	0%										
18000	Tooling / Fixtures - S		11/3/95	12/1/99	0	39%										
18100	Cold Section Tooling - S		11/3/95	5/28/99	0	55%										
18200	Hot Section Tooling - S		9/3/96	5/28/99	0	40%										
18300	Rotor Tooling - S		9/3/96	1/28/99	0	35%										
18400	Recuperator Tooling - S		10/1/96	3/31/98	0	35%										
18500	Engine Assy Tooling - S		9/28/97	12/1/99	0	1%										
18700	Superior Gear Tooling - S		9/28/97	8/31/98	0	1%										
19000	Technology Development		9/14/95	12/30/99	0	25%										
19100	Advanced Cooling & Sealing		9/14/95	3/15/98	0	57%										
19110	Advanced Rotor Sealing (ARS)		9/14/95	2/2/98	0	65%										
19110.1	Complete, Fir Tree Attachment Cooling Definition - ARS		7/26/96	7/26/96	0.15	100%	Design Info to Design									
19110.2	Complete, Rim Seal Flow Optimization Definition - ARS		12/1/97	12/1/97	0.15	100%	0% D45 Priority & Test Egr Req'd									
19110.3	Complete Rotor Def, Impingement Cooling Optimization - ARS		12/10/96	12/10/96	0.10	100%										
19110.4	Complete Build, Test Rig - ARS		12/17/96	12/17/96	0.15	100%										
19110.5	Rim Seal Design Info to Mech. Design - ARS		5/1/97	5/1/97	0.15	100%	Rim Seal Design Info to Design									
19110.6	Complete Build, Test Rig - ARS		6/1/97	6/1/97	0.10	100%										
19110.7	Complete, Test Report Cooling Technologies - ARS		12/23/97	12/23/97	0.10	0%										
19110.8	Complete, Topical Report, Adv Cooling & Sealing - S&C		2/2/98	2/2/98	0.10	0%										
19120	Advanced Airfoil Cooling - AAC		9/14/95	12/23/97	0	55%										
19120.1	Complete, Screw Cooling Development - AAC		6/14/96	6/14/96	0.25	100%										
19120.2	Complete, Blade Vortex Cooling Test Rig - AAC		12/13/96	12/13/96	0.25	100%										
19120.3	Complete Topical Report, Screw Cooling - ACC		12/15/97	12/15/97	0.10	0%										
19120.4	Complete Test Rig, Film Cooling - AAC		6/30/97	6/30/97	0.05	100%										
19120.5	Complete Topical Report, Film Cooling - ACC		12/15/97	12/15/97	0.10	0%										
19120.6	Complete, Cooling Flow Optimization - ACC		10/1/97	10/1/97	0.15	0%										
19120.7	Complete Topical Report, Cooling Flows - ACC		12/31/97	12/31/97	0.10	0%										
19130	Tip Clearance Control - TCC		9/14/95	9/30/97	0	40%										
19130.1	Complete, Saum Concept Selection - TCC		4/15/96	4/15/96	0.20	100%										
19130.2	Complete Build, Saum Engine - TCC		2/15/98	2/15/98	0.30	0%	Slipped due to Test Bed Availability									
19130.3	Complete, Saum Test Report - TCC		3/15/98	3/15/98	0.30	0%										
19130.4	Complete, Mars Concept Selection - TCC		5/10/96	5/10/96	0.20	100%										
19200	Low Emission Combustion		9/14/95	6/30/99	0	47%										
19210	Ultra Lean Premix (ULP)		9/14/95	12/23/97	0	50%										
19210.1	Release Prelim. Design, Injector Assy - ULP		2/16/96	2/16/96	0.10	100%										
19210.2	Start Test, Injector Assy, Single Can - ULP		5/15/96	5/15/96	0.15	100%										
19210.3	Complete Selection, Injector Concept - ULP		7/15/96	7/15/96	0.15	100%										
19210.4	Complete Redesign, Injector Assy - ULP		4/1/97	4/1/97	0.10	100%	Completed without redesign									
19210.5	Complete Test, Single Injector - ULP		10/30/97	10/30/97	0.15	0%										
19210.6	Complete Test, Combustor Liner - ULP		10/30/97	10/30/97	0.15	0%										
19210.7	Complete Topical Report, ULP Proof of Concept - ULP		12/30/97	12/30/97	0.20	0%										
19220	Catalytic Combustion (CAT)		9/14/95	6/30/99	0	35%										
19220.1	Start Design, Single Can Catalytic Combustor Rig - CAT		9/14/95	9/14/95	0.10	100%										
19220.2	Start Tests, Single Can Catalytic Combustion Rig - CAT		8/30/96	8/30/96	0.10	100%										
19220.3	Complete Tests, Single Can Catalytic Combustion Rig - CAT		12/31/96	12/31/96	0.15	100%										
19220.4	Complete Design, Catalytic Combustor - CAT		12/30/97	12/30/97	0.15	0%										
19220.5	Complete Engine Assy, Catalytic Combustor - CAT		8/30/98	8/30/98	0.15	0%										
19220.6	Complete Tests, Catalytic Combustor - CAT		3/30/99	3/30/99	0.15	0%										
19220.7	Complete Topical Report, Low Emission Combustion		6/30/99	6/30/99	0.20	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
12210.4	Release, Control Schematic / Wiring Drawing - S		7/18/98	7/18/98	0.10	0%					Δ					
12210.5	Assemble, Control Console - S		12/5/98	12/5/98	0.15	0%						Δ				
12210.6	Complete, Control Console Static Test - S		2/14/99	2/14/99	0.25	0%							Δ			
12210.7	Complete Design, On Skid Controller - S		2/14/99	2/14/99	0.15	0%								Δ		
12220	Lube Oil System - S		5/1/96	6/8/98	0	1%										
12220.1	Release, Lube Oil System Schematic - S		10/15/97	10/15/97	0.25	0%										
12220.2	Release, Lube Oil Piping - S		4/15/98	4/15/98	0.25	0%										
12220.3	Procure, Fuel System Components - S		6/8/98	6/8/98	0.50	0%										
12230	Package Fuel System - S		10/18/96	9/23/98	0	15%										
12230.1	Release, Fuel System Schematic - S		3/25/97	3/25/97	0.15	100%										
12230.2	Procure, Fuel System Components - S		5/18/98	5/18/98	0.25	0%										
12230.3	Release, Fuel Piping - S		7/17/98	7/17/98	0.25	0%										
12230.4	Complete Fab Lube & Fuel Piping - S		9/23/98	9/23/98	0.35	0%										
12240	Start System - S		12/1/96	6/22/98	0	1%										
12240.1	Release Final Design, Start System - S		10/15/97	10/15/97	0.40	0%										
12240.2	Procure, Start System Components - S		6/22/98	6/22/98	0.60	0%										
12300	Package Build - S		3/16/98	12/31/99	0	0%										
12300.1	Critical Design Review (CDR) - S		5/29/98	5/29/98	0.04	0%										
12300.2	Develop, Package Build Book S		8/21/98	8/21/98	0.02	0%										
12300.3	Review, Preproduction Design - S		8/28/98	8/28/98	0.03	0%										
12300.4	ACS, Package / Engine # 3 (CFE) - S		4/15/98	4/15/98	0.03	0%										
12300.5	Package Cash, Package / Engine # 3 (CFE) - S		9/23/98	9/23/98	0.04	0%										
12300.6	Ship, Package / Engine # 3 (CFE) - S		2/28/99	2/28/99	0.06	0%										
12300.7	ACS, Package / Engine # 4 (CFE) - S		6/16/98	6/16/98	0.03	0%										
12300.8	Package Cash, Package / Engine # 4 (CFE) - S		12/1/98	12/1/98	0.04	0%										
12300.9	Ship, Package / Engine # 4 (CFE) - S		4/30/99	4/30/99	0.06	0%										
12300.10	ACS, Package / Engine # 5 (CFE) - S		8/14/98	8/14/98	0.03	0%										
12300.11	Package Cash, Package / Engine # 5 (CFE) - S		2/5/99	2/5/99	0.04	0%										
12300.12	Ship, Package / Engine # 5 (CFE) - S		6/30/99	6/30/99	0.06	0%										
12300.13	ACS, Package / Engine # 6 (CFE) - S		10/16/98	10/16/98	0.03	0%										
12300.14	Package Cash, Package / Engine # 6 (CFE) - S		4/6/99	4/6/99	0.04	0%										
12300.15	Ship, Package / Engine # 6 (CFE) - S		8/31/99	8/31/99	0.06	0%										
12300.16	ACS, Package / Engine # 7 (CFE) - S		12/18/98	12/18/98	0.03	0%										
12300.17	Package Cash, Package / Engine # 7 (CFE) - S		6/9/99	6/9/99	0.04	0%										
12300.18	Ship, Package / Engine # 7 (CFE) - S		10/31/99	10/31/99	0.06	0%										
12300.19	ACS, Package / Engine # 2 (DOE) - S		12/1/99	12/1/99	0.03	0%										
12300.20	Package Cash, Package / Engine # 2 (DOE) - S		7/6/99	7/6/99	0.04	0%										
12300.21	Ship, Package / Engine # 2 (DOE) - S		11/30/99	11/30/99	0.06	0%										
12300.22	ACS, Package / Engine # 8 (CFE) - S		2/17/99	2/17/99	0.03	0%										
12300.23	Package Cash, Package / Engine # 8 (CFE) - S		8/2/99	8/2/99	0.04	0%										
12300.24	Ship, Package / Engine # 8 (CFE) - S		12/31/99	12/31/99	0.06	0%										
12400	O & M Manual / Illustrated Parts List - S		10/1/97	12/3/99	0	1%										
12400.1	First Draft, O & M Manual - S		3/31/98	3/31/98	0.40	0%										
12400.2	Publish O & M Manual - S		1/29/99	1/29/99	0.60	0%										
17000	Balance Of Plant - S		9/14/95	7/28/99	0	1%										
17100	Reference Plant Standardization		9/14/95	5/15/97	0	1%										
17100.1	Complete, Reference Plant Standardization		10/15/97	10/15/97	1.00	0%										
17200	Balance of Plant - S		9/2/97	7/28/99	0	1%										
17200.1	Release, Balance of Plant Design - S		12/24/97	12/24/97	0.40	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
19230	Advanced Combustion Controls		1/2/96	10/30/97	0	75%										
19230.1	Complete Injector Seal Test - Var Geometry		5/13/96	5/13/96	0.15	100%										
19230.2	Complete System Definition - CO Sensor		5/30/96	5/30/96	0.10	100%										
19230.3	Complete Loop Test - Var Geometry		6/30/96	6/30/96	0.10	100%										
19230.4	Complete Variable Geometry Controls		11/30/96	11/30/96	0.15	100%										
19230.5	Complete Loop Test - CO Sensor		5/23/97	5/23/97	0.25	100%	Slipped due to Test Bed Availability									
19230.6	Complete CO Sensor Controls		10/30/97	10/30/97	0.25	0%										
19240	Advanced Liner Cooling (ALC)		1/2/96	12/31/97	0	25%										
19240.1	Complete Topical Report, Low Emission Combustion		12/23/97	12/23/97	1.00	0%										
19300	Ceramic & Composite Materials Dev.		9/14/95	10/29/99	0	16%										
19310	Ceramic Combustor Materials Dev.		4/1/96	12/31/98	0	25%										
19310.1	Fab. Prototype Rings - Combustor		8/31/97	8/31/97	0.25	100%										
19310.2	Complete Combustor Materials Dev.		12/30/98	12/30/98	0.75	0%										
19320	Ceramic Tip Shoe Evaluation		7/1/96	11/30/98	0	25%										
19320.1	Complete Procurement, Ceramic Tip Shoes		5/30/97	5/30/97	0.25	100%										
19320.2	Complete Ceramic Tip Shoe Evaluation		11/30/98	11/30/98	0.75	0%										
19330	Ceramic Bushing / Ball Bearing		9/1/96	12/31/97	0	25%										
19330.1	Complete Procurement, Ball / Ball Bearing		5/30/97	5/30/97	0.25	100%										
19330.2	Complete Ceramic Bushing / Ball Bearing		12/23/97	12/23/97	0.75	0%										
19340	Ceramic Interstage Ring Seal Dev.		10/1/96	6/30/99	0	10%										
19340.1	Complete Selection, Ring Seal Material		12/2/96	12/2/96	0.10	100%										
19340.2	Complete Rub Testing - Ring Seal		12/30/97	12/30/97	0.25	0%										
19340.3	Complete Ceramic Interstage Ring Seal Dev.		6/30/99	6/30/99	0.65	0%										
19350	Ceramic Blade Dev.		9/14/95	9/30/98	0	10%										
19350.1	Complete Material Selection, Ceramic Blade Dev.		2/29/96	2/29/96	0.10	100%										
19350.2	Complete Attachment Test - Blade		1/30/98	1/30/98	0.25	0%										
19350.3	Complete Proof Test - Blade		7/30/98	7/30/98	0.25	0%										
19350.4	Complete Ceramic Blade Dev.		9/30/98	9/30/98	0.40	0%										
19360	Ceramic Nozzle Dev.		1/2/96	10/29/99	0	10%										
19360.1	Complete Material Selection, Ceramic Nozzle		6/27/97	6/27/97	0.10	100%										
19360.2	Complete Procure Specimen - Ceramic Nozzle		6/30/98	6/30/98	0.15	0%										
19360.3	Complete Simulation Testing - Ceramic Nozzle		1/30/99	1/30/99	0.25	0%										
19360.4	Complete Ceramic Nozzle Dev.		8/31/99	8/31/99	0.25	0%										
19360.5	Complete Topical Report, Ceramic & Composite Material		10/29/99	10/29/99	0.25	0%										
19400	Turbine Material Development		1/2/96	12/30/99	0	25%										
19410	Forged Disk Materials		1/2/96	12/30/98	0	30%	Design Info to Design									
19410.1	Complete Prototype Forged Disk		3/30/97	3/30/97	0.10	100%										
19410.2	Deliver, Prelim Design Info to Design - Forged Disk		11/5/97	11/5/97	0.10	100%										
19410.3	Start, Mechanical Properties Tests - Forged Disk		6/30/97	6/30/97	0.10	100%										
19410.4	Complete Scale Design - Forged Disk		2/28/98	2/28/98	0.15	0%										
19410.5	Complete Life Predictions - Forged Disk		8/15/98	8/15/98	0.15	0%										
19410.6	Complete Engine Test - Forged Disk		12/15/98	12/15/98	0.25	0%										
19410.7	Complete Topical Report, Disk Materials Dev.		12/30/99	12/30/99	0.15	0%										
19420	Dual Alloy Disks		1/2/96	12/30/99	0	1%										
19420.1	Complete Alloy Cost Evaluation - Dual Alloy Disks		12/15/97	12/15/97	0.15	0%										
19420.2	Complete Engine Test - Dual Alloy Disk		10/30/99	10/30/99	0.25	0%	10/97 Design Info to Design									
19420.3	Complete Mechanical Properties - Dual Alloy Disk		11/30/98	11/30/98	0.35	0%										
19420.4	Complete Topical Report - Dual Alloy Disk Material Dev		12/30/99	12/30/99	0.25	0%										
19430	GMSX-10 Material Dev.		1/2/96	12/31/98	0	30%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
19430.1	Complete, Casting Trials - CMSX-10		7/15/96	7/15/96	0.15	100%										
19430.2	Complete, Coating Evaluation - CMSX-10		4/30/97	4/30/97	0.15	100%										
19430.3	Complete, Mechanical Properties - CMSX-10		5/30/98	5/30/98	0.15	0%										
19430.4	Complete, Engine Test - CMSX-10		10/15/98	10/15/98	0.25	0%										
19430.5	Complete, Topical Report - CMSX-10 Material Dev		12/30/98	12/30/98	0.25	0%										
19440	Low CTE Materials		1/2/96	12/23/98	0	20%										
19440.1	Complete, Forging Dev. - CTE		1/15/96	1/15/96	0.15	100%										
19440.2	Complete, Prototype Demo (12") - CTE		8/25/97	8/25/97	0.05	100%	Changed to engine specific materials.									
19440.3	Complete, Heat Treat Optimization - CTE		12/30/97	12/30/97	0.15	0%	12/96 Design Info to Design									
19440.4	Complete, Prototype Demo (10") - CTE		1/15/98	1/15/98	0.10	0%	Changed to engine specific materials									
19440.5	Complete, Mechanical Properties - CTE		5/30/98	5/30/98	0.15	0%										
19440.6	Complete, Engine Test - CTE		10/30/98	10/30/98	0.25	0%										
19440.7	Complete, Topical Report - Low CTE Materials Develop		12/30/98	12/30/98	0.15	0%										
19450	Advanced Casting Techniques (AdCst)		1/2/96	12/30/99	0	50%										
19450.1	Complete, PMC Alloy Selection - AdCst		1/5/96	1/5/96	0.10	100%										
19450.2	Complete, Spraycast Alloy Selection - AdCst		5/1/96	5/1/96	0.10	100%										
19450.3	Complete, Perm Mold Casting Process - AdCst		10/31/96	10/31/96	0.15	100%										
19450.4	Complete, Optimize Spray Cast Process - AdCst		1/31/97	1/31/97	0.05	100%	11/96 Design Info to Design									
19450.4a	Complete, Optimization HT / HIP for Haynes 242 - AdCst		3/1/97	3/1/97	0.10	100%										
19450.5	Complete, Mechanical Properties - AdCst		5/30/98	5/30/98	0.15	0%	2/97 Spraycast Design Info to Design									
19450.6	Complete, Engine Test - AdCst		10/30/99	10/30/99	0.20	0%										
19450.7	Complete, Topical Report - Adv. Casting Techniques		12/30/99	12/30/99	0.15	0%										
19460	NDE / Life Prediction (NDE)		1/2/96	12/23/98	0	15%										
19460.1	Complete, Program Plans - NDE		4/30/96	4/30/96	0.15	100%										
19460.2	Complete, Technique Demos - NDE		5/1/98	5/1/98	0.20	0%	Replanned one year out on 5-1-97									
19460.3	Complete, Dev. Inspection Techniques - NDE		8/31/98	8/31/98	0.25	0%										
19460.4	Complete, Analyze Components - NDE		12/24/98	12/24/98	0.15	0%										
19460.5	Complete, NDE Life Predictions		12/24/98	12/24/98	0.25	0%										
19500	Recuperator Material Development		9/14/95	12/30/99	0	25%										
19500.1	Complete, Plan For Material Selection - Recup		5/30/96	5/30/96	0.10	100%										
19500.2	Complete, Fabrication Trials - Recup		3/1/97	3/1/97	0.15	100%										
19500.3	Complete, Cost Model - Recup		12/15/97	12/15/97	0.10	0%										
19500.4	Complete, Mechanical Properties - Recup		12/15/98	12/15/98	0.15	0%										
19500.5	Complete, Engine Test - Recup		11/30/99	11/30/99	0.25	0%										
19500.6	Complete, Topical Report, Recuperator Material Dev.		12/30/99	12/30/99	0.25	0%										
19600	Variable Area Nozzle (VAN) (Effort on Hold)		11/98	9/23/98	0	0%	No Current Need for VAN									
19700	Advanced Coating Systems		9/14/95	12/17/99	0	32%										
19710	Thermal Barrier Coatings (TBC)		9/14/95	12/17/98	0	30%										
19710.1	Complete, System Evaluation - TBC		7/31/96	7/31/96	0.10	100%	8/96 Design Info to Design									
19710.2	Complete, Screening Tests - TBC		5/30/97	5/30/97	0.10	100%	7/97 Design Info to Design									
19710.3	Complete, Mars Field Test - TBC		5/30/97	5/30/97	0.10	100%	Design Info to Design									
19710.4	Complete, ATS Component Evaluation - TBC		10/31/97	10/31/97	0.10	0%										
19710.5	Complete, Life Predictions - TBC		12/31/97	12/31/97	0.10	0%										
19710.6	Complete, ATS Component Coatings - TBC		12/31/97	12/31/97	0.10	0%										
19710.7	Complete, Ass'y, Engine Hardware - TBC		3/31/98	3/31/98	0.10	0%										
19710.8	Complete Test, Engine Hardware - TBC		11/30/98	11/30/98	0.15	0%										
19710.9	Complete Topical Report, Adv Coating Systems Dev.		12/17/98	12/17/98	0.15	0%										
19720	Chemical Vapor Deposition (CVD)		1/2/96	12/23/97	0	40%										
19720.1	Complete, Sample Coatings - CVD		8/30/96	8/30/96	0.25	100%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
21210	Compressor Rotor Assy - L		6/30/97	4/19/00	0	1%										
21210.1	Release Final Design, Compressor Rotor Assy - L		12/4/98	12/4/98	0.40	0%										
21210.1	Complete Procure, Compressor Rotor Assy - L		6/1/99	6/1/99	0	0%										
21210.2	Complete Fab, Compressor Rotor Assy - L		2/22/00	2/22/00	0.60	0%										
21220	Compressor Casing / Stator Assy - L		6/30/97	4/19/00	0	1%										
21220.1	Release Final Design, Compressor Casing Assy - L		2/1/99	2/1/99	0.20	0%										
21220.1	Complete Procure, Compressor Casing Assy - L		6/1/99	6/1/99	0.40	0%										
21220.2	Complete Fab, Compressor Casing Assy - L		2/22/00	2/22/00	0.40	0%										
21230.1	Release Final Design, Compressor Stator Assy - L		2/1/99	2/1/99	0	0%										
21230.1	Complete Procure, Compressor Stator Assy - L		6/1/99	6/1/99	0	0%										
21230.2	Complete Fab, Compressor Stator Assy - L		2/22/00	2/22/00	0	0%										
21240	Compressor Diffuser / Bearing Assy - L		6/30/97	4/19/00	0	1%										
21240.1	Release Design, Comp Diffuser/Bearing Assy - L		2/1/99	2/1/99	0.20	0%										
21240.1	Complete Procure, Comp Diffuser/Bearing Assy - L		6/1/99	6/1/99	0.40	0%										
21240.2	Complete Fab, Comp Diffuser/Bearing Assy - L		2/22/00	2/22/00	0.40	0%										
21250	Compressor Common Parts - L		3/23/98	9/9/99	0	0%										
21250.1	Release Compressor Common Parts - L		3/22/99	3/22/99	0.40	0%										
21250.2	Complete Compressor Common Parts - L		9/9/99	9/9/99	0.60	0%										
21300	Combustor System - L		6/30/97	4/26/00	0	1%										
21320	Combustor Casing Assy - L		6/30/97	1/24/00	0	1%										
21320.1	Release Preliminary Design, Combustor Casing - L		10/6/97	10/6/97	0.10	0%										
21320.2	Complete Fab, Combustor Casing - L RIG		3/6/98	3/6/98	0.15	0%										
21320.3	Release Final Design, Combustor Casing - L		4/9/99	4/9/99	0.25	0%										
21320.4	Complete Fab, Combustor Casing - L		11/24/99	11/24/99	0.50	0%										
21330	LPM Combustor Liner Assy - L		6/30/97	4/26/00	0	1%										
21330.1	Release Preliminary Design, Combustor Liner - L		10/6/97	10/6/97	0.10	0%										
21330.2	Complete Fab, Combustor Liner - L RIG		4/3/98	4/3/98	0.15	0%										
21330.3	Release Final Design, Combustor Liner - L		6/7/99	6/7/99	0.25	0%										
21330.4	Complete Fab, Combustor Liner - L		2/29/00	2/29/00	0.50	0%										
21340	Ignitor Torch Assy - L		6/30/97	11/26/99	0	1%										
21340.1	Release Preliminary Design, Ignitor Torch Assy - L		4/15/98	4/15/98	0.10	0%										
21340.2	Complete Fab, Ignitor Torch Assy - L RIG		4/15/98	4/15/98	0.15	0%										
21340.3	Release Final Design, Ignitor Torch Assy - L		4/9/99	4/9/99	0.25	0%										
21340.4	Complete Fab, Ignitor Torch Assy - L		9/29/99	9/29/99	0.50	0%										
21500	Fuel System - L		6/30/97	4/26/00	0	1%										
21510	Fuel Injectors, LPM Gas - L		6/30/97	4/26/00	0	1%										
21510.1	Release Preliminary Design, Fuel Injectors - L		11/17/97	11/17/97	0.10	0%										
21510.2	Complete Fab, Fuel Injectors - L RIG		5/15/98	5/15/98	0.15	0%										
21510.3	Release Final Design, Fuel Injectors - L		6/7/99	6/7/99	0.25	0%										
21510.4	Complete Fab, Fuel Injectors - L		2/29/00	2/29/00	0.50	0%										
21520	Fuel Manifolds / Tube Assy - L		6/30/97	11/26/99	0	1%										
21520.1	Release Prelim Design, Fuel Manifolds - L		10/6/97	10/6/97	0.10	0%										
21520.2	Complete Fab, Fuel Manifolds - L RIG		2/6/98	2/6/98	0.15	0%										
21520.3	Release Final Design, Fuel Manifolds - L		4/9/99	4/9/99	0.25	0%										
21520.4	Complete Fab, Fuel Manifolds - L		9/29/99	9/29/99	0.50	0%										
21600	GP Turbine Section - L		6/30/97	3/23/99	0	1%										
21610	GP Turbine Rotor Assy - L		6/30/97	3/23/99	0	1%										
21610.1	Release Final Design, GP Turbine Rotor Assy - L		4/3/98	4/3/98	0.40	0%										
21610.2	Complete Fab, GP Turbine Rotor Assy - L		1/25/99	1/25/99	0.60	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
19720.2	Complete, Process Assessment - CVD		1/15/97	1/15/97	0.15	100%										
19720.2	Complete, Optimize Process - CVD		12/30/97	12/30/97	0.20	0%	Prioritization									
19720.3	Complete, Chemical Vapor Deposition Tests - CVD		12/30/97	12/30/97	0.40	0%										
19730	Alloy Coating Systems (Coat)		5/1/96	9/29/98	0	50%										
19730.1	Complete, External Coatability - Coat		7/15/97	7/15/97	0.25	100%										
19730.2	Complete, Internal Coatability - Coat		9/20/97	9/20/97	0.25	100%										
19730.3	Complete, Alloy Coating Systems		5/3/98	5/3/98	0.50	0%										
19800	Advanced Diffuser Development (ADD)		8/14/95	12/23/97	0	75%										
19800.1	Complete, Design Annular Model - ADD		1/30/96	1/30/96	0.10	100%										
19800.2	Complete, Test Annular Model - ADD		9/30/96	9/30/96	0.20	100%										
19800.3	Start, Design Engine Diffuser - ADD		9/30/96	9/30/96	0.20	100%										
19800.4	Complete, Test Engine Diffuser - ADD		5/3/97	5/3/97	0.25	100%	Test deferred to S Engine due to test engine availability									
19800.5	Complete, Topical Report, Advanced Diffuser		12/30/97	12/30/97	0.25	0%										
19900	Advanced Man-Machine Interface		4/15/96	4/21/98	0	15%										
19900.1	Complete, Analyze Data - MMI		5/16/97	5/16/97	0.15	100%										
19900.2	Complete, Test - MMI		12/1/98	12/1/98	0.20	0%										
19900.3	Complete, Standardize - MMI		3/20/98	3/20/98	0.25	0%										
19900.4	Complete, Topical Report - MMI		4/21/98	4/21/98	0.40	0%										
20000	Advanced Turbine System - L		1/2/96	5/1/02	0	8%										
20100	Technical Coordination - L		5/1/97	5/1/02	0	6%										
20200	Engine Definition - L		1/2/96	8/31/97	0	100%										
20200.1	Complete 1st Draft, Marketing Reqm't Spec - L		5/10/96	5/10/96	0.10	100%										
20200.2	Complete, 1st Engine Cross-section Dwg - L		6/1/96	6/1/96	0.10	100%										
20200.3	Complete 1st Draft, Product Spec - L		6/25/96	6/25/96	0.10	100%										
20200.4	Complete 1st Draft, Business Plan Review - L		7/10/96	7/10/96	0.10	100%										
20200.5	Revised Market Reqm't Spec - L		11/1/96	11/1/96	0.10	100%										
20200.6	Complete Draft, Business Plan - L		12/10/96	12/10/96	0.05	100%										
20200.7	Present, Business Plan For PC Approval - L		12/19/97	12/19/97	0.10	100%										
20200.8	Finalize, Business Plan - L		2/28/97	2/28/97	0.15	100%										
20200.9	Approval, Business Plan - L		3/31/97	3/31/97	0.10	100%										
20200.9	Complete, Concept Design - L		8/31/97	8/31/97	0.10	100%										
20300	Package Definition - L		7/1/97	10/31/97	0	1%										
20300.1	Complete, System Design Review - L		10/31/97	10/31/97	1.00	0%										
21000	Engine Assembly - L		6/30/97	8/1/01	0	1%										
21010	Engine Design Support - L		7/31/97	3/30/01	0	1%										
21020	Engine Build - L		2/15/99	8/1/01	0	0%										
21010.1	Complete, Engine Assembly Drawings - L		9/29/99	9/29/99	0.25	0%										
21010.2	Cash, Engine #1 - L		11/1/99	11/1/99	0.40	0%										
21010.3	Cash, Engine #2 - L		2/11/00	2/11/00	0	0%										
21010.4	Complete Build, Engine #3 - L		1/31/01	1/31/01	0	0%										
21010.5	Complete Rebuild, DOE Demo Engine #1 - L		8/1/01	8/1/01	0.35	0%										
21100	Air Inlet System - L		6/30/97	3/8/00	0	1%										
21110	Inlet Collector - L		6/30/97	8/26/99	0	1%										
21110.1	Release Final Design, Inlet Air Assembly - L		5/1/98	5/1/98	0.40	0%										
21110.2	Complete Fab, Inlet Air Assembly - L		6/29/99	6/29/99	0.60	0%										
21120	Inlet Air Assembly - L		6/30/97	3/8/00	0	1%										
21120.1	Release Final Design, Inlet Air Assembly - L		10/1/98	10/1/98	0.40	0%										
21120.2	Complete Fab, Inlet Air Assembly - L		1/11/00	1/11/00	0.60	0%										
21200	Compressor Assembly - L		6/30/97	4/19/00	0	1%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1993	1996	1997	1998	1999	2000	2001	2002	2003
21820	Turbine Casing Assy - L		9/10/98		0	1%										
21820.1	Release Final Design, Turbine Casing Assy - L		12/3/98	1/23/98	0.40	0%										
21820.2	Complete Fab, Turbine Casing Assy - L		7/14/98	7/14/98	0.60	0%										
21830	GP Turbine Nozzle Assy - L		8/30/97	9/10/98	0	1%										
21830.1	Release Final Design, GP Turbine Nozzle Assy - L		12/3/98	1/23/98	0.40	0%										
21830.2	Complete Fab, GP Turbine Nozzle Assy - L		7/14/98	7/14/98	0.60	0%										
21840	GP Common Parts - L		8/30/98	12/5/98	0	1%										
21840.1	Release, GP Common Parts - L		9/11/98	9/11/98	0.40	0%										
21840.2	Complete, GP Common Parts - L		12/5/99	12/5/99	0.60	0%										
21700	Power Turbine Section - L		6/30/97	5/4/99	0	1%										
21710	Power Turbine Rotor Assy - L		6/30/97	5/4/99	0	1%										
21710.1	Release Final Design, Power Turbine Rotor Assy - L		5/1/98	5/1/98	0.40	0%										
21710.2	Complete Fab, Power Turbine Rotor Assy - L		3/8/99	3/8/99	0.60	0%										
21720	PT Nozzle Assy - L		6/30/97	7/29/98	0	1%										
21720.1	Release Final Design, PT Nozzle Assy - L		12/3/97	12/3/97	0.40	0%										
21720.2	Complete Fab, PT Nozzle Assy - L		6/1/98	6/1/98	0.60	0%										
21730	PT Common Parts - L		6/1/98	1/25/99	0	0%										
21730.1	Release, PT Common Parts - L		9/30/98	9/30/98	0.40	0%										
21730.2	Complete, PT Common Parts - L		1/25/99	1/25/99	0.60	0%										
21800	Exhaust Section - L		6/30/97	5/17/99	0	1%										
21810	Exhaust Diffuser / Bearing Assy - L		6/30/97	5/17/99	0	1%										
21810.1	Release Final Design, Exhaust Diffuser / Bearing Assy - L		4/15/98	4/15/98	0.40	0%										
21810.2	Complete Fab, Exhaust Diffuser / Bearing Assy - L		3/20/99	3/20/99	0.60	0%										
21820	Exhaust Collector Assy - L		6/30/97	3/23/99	0	1%										
21820.1	Release Final Design, Exhaust Collector Assy - L		11/15/97	11/15/97	0.40	0%										
21820.2	Complete Fab, Exhaust Collector Assy - L		1/5/99	1/5/99	0.60	0%										
21900	Engine Common Parts - L		5/1/98	3/10/99	0	0%										
21900	Engine Common Parts - L		3/10/99	3/10/99	0	0%										
21910.1	Release Final Design, Bleed Valve & Duct Assy - L		10/15/98	10/15/98	0.40	0%										
21910.2	Complete Fab, Bleed Valve & Duct Assy - L		3/10/99	3/10/99	0.60	0%										
21920.1	Release Design, Engine Assembly Hardware - L		10/15/98	10/15/98	0.40	0%										
21920.2	Complete Fab, Engine Assembly Hardware - L		3/10/99	3/10/99	0.60	0%										
22000	Package Systems - L		9/2/97	2/14/02	0	0%										
22100	Package Mechanical Systems - L		9/2/97	3/9/01	0	0%										
22110	Generator - L		9/2/97	1/10/00	0	1%										
22110.1	Release, Generator Spec - L		10/4/97	10/4/97	0.10	0%										
22110.2	Release, Generator Procurement Drawing - L		10/18/97	10/18/97	0.15	0%										
22110.3	Review, Supplier Generator Documentation - L		12/21/97	12/21/97	0.25	0%										
22110.4	Procure, Generator - L		1/10/00	1/10/00	0.50	0%										
22120	Reduction Gearbox - L		9/2/97	1/17/00	0	1%										
22120.1	Release, Reduction Gearbox Spec - L		10/15/97	10/15/97	0.10	0%										
22120.2	Release, Reduction Gearbox Procurement Drawing - L		11/23/97	11/23/97	0.15	0%										
22120.3	Review, Gearbox Supplier Documentation - L		3/19/98	3/19/98	0.25	0%										
22120.4	Procure, Reduction Gearbox - L		1/17/00	1/17/00	0.50	0%										
22130	Electrical Conduit / J-Boxes - L		6/3/98	1/4/00	0	0%										
22130.1	Release, Electrical Conduit / J-Boxes - L		9/2/98	9/2/98	0.40	0%										
22130.2	Procure Electrical System Components - L		1/4/00	1/4/00	0.60	0%										
22140	Package / Generator Frame - L		3/10/98	1/27/00	0	0%										
22140.1	Release, Final Design, Package Frame - L		11/5/98	11/5/98	0.20	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
27200.2	On Site - Balance of Plant - L		12/14/01	12/14/01	0.60	0%										
28000	Tooling / Fixtures - L		3/25/98	5/17/00	0	0%										
28100	Cold Section Tooling - L		3/25/98	5/17/00	0	0%										
28200	Hot Section Tooling - L		3/25/98	5/17/00	0	0%										
28300	Rotor Tooling - L		3/25/98	5/17/00	0	0%										
28500	Engine Assy Tooling - L		3/25/98	5/17/00	0	0%										
28600	Production Test Tooling - L		4/23/98	4/19/99	0	0%										
28700	Superior Gear Tooling - L		3/25/98	5/17/00	0	0%										
30000	Product Support		9/14/95	12/5/02	0	2%										
30100	Customer Services Coordination - S		9/14/95	5/21/01	0	33%										
30100	Customer Services Coordination - L		9/19/97	12/5/02	0	1%										
31000	Product Support - S		3/1/96	5/21/01	0	0%										
31100	Product Support Planning - S		3/1/96	5/21/01	0	0%										
31110	Product Support Plan - S		3/1/96	7/1/97	0	1%										
31110.1	Complete Product Support Plan - S		11/15/97	11/15/97	1.00	0%										
31120	Rec. Spare Parts List (RSPL) - S		3/1/96	4/15/97	0	1%										
31120.1	Complete, Spare Parts List - S		11/15/97	11/15/97	1.00	0%										
31130	Customer Services Provisioning Plan - S		3/1/96	8/1/97	0	1%										
31130.1	Complete Customer Support Provision Plan - S		11/15/97	11/15/97	1.00	0%										
31140	Service Support Plans - S		3/1/96	5/18/00	0	1%										
31140.1	Complete, Maintenance & Overhaul Plan - S		11/15/97	11/15/97	0.25	0%										
31140.2	Complete, Field Service Plan - S		12/17/98	12/17/98	0.25	0%										
31140.3	Complete, Warranty Plan - S		12/17/98	12/17/98	0.25	0%										
31140.4	Complete, Extended Warranty Plan - S		4/27/00	4/27/00	0.25	0%										
31200	Training - S		7/1/97	5/21/01	0	1%										
31200.1	Complete First Draft Information Handbook - S		10/15/97	10/15/97	0.10	0%										
31200.2	Publish Information Handbook - S		11/17/97	11/17/97	0.15	0%										
31200.3	Complete Training Plan - S		3/20/98	3/20/98	0.15	0%										
31200.4	Complete Course Material - S		3/6/99	3/6/99	0.15	0%										
31200.5	Begin Instructional Classes - S		6/22/00	6/22/00	0.10	0%										
31200.6	Complete Training - S		5/21/01	5/21/01	0.35	0%										
31300	Product Support Capital Items - S		11/19/99	3/28/01	0	0%										
31300.1	Complete, Overhaul Tooling - S		12/11/00	12/11/00	0.30	0%										
31300.2	Complete, Product Support Upgrades - S		3/28/01	3/28/01	0.35	0%										
31300.3	Complete, Product Support Equipment - S		3/28/01	3/28/01	0.35	0%										
32000	Product Support - L		1/5/98	12/5/02	0	0%										
32100	Product Support Planning - L		1/5/98	1/29/02	0	0%										
32110	Product Support Plan - L		1/5/98	6/23/99	0	0%										
32110.1	Complete, Product Support Plan - L		6/23/99	6/23/99	1.00	0%										
32120	Recom. Spare Parts List - L		1/5/98	6/23/99	0	0%										
32120.1	Complete, Recom. Spare Parts Lists - L		6/23/99	6/23/99	1.00	0%										
32130	Customer Services Provisioning Plan - L		1/5/98	6/23/99	0	0%										
32130.1	Complete, Services Provisioning Plan - L		6/23/99	6/23/99	1.00	0%										
32140	Service Support Plans - L		1/5/98	1/29/02	0	0%										
32140.1	Complete, Maintenance & Overhaul Plan - L		6/23/99	6/23/99	0.25	0%										
32140.2	Complete, Field Service Plan - L		9/15/00	9/15/00	0.25	0%										
32140.3	Complete, Warranty Plan - L		9/15/00	9/15/00	0.25	0%										
32140.4	Complete, Extended Warranty Plan - L		1/29/02	1/29/02	0.25	0%										
32200	Training - L		1/4/99	3/28/02	0	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
22140.2	Complete Fab. Package Frame - L		12/7/00	12/7/00	0.30	0%										
22140.3	Release, Final Design, Generator Frame - L		11/5/98	11/5/98	0.20	0%										
22140.4	Complete Fab. Generator Frame - L		12/7/00	12/7/00	0.30	0%										
22150	Enclosure Assembly - L		8/27/98	12/6/01	0	0%										
22150.1	Release Final Design, Enclosure Assembly - L		2/16/99	2/16/99	0.40	0%										
22150.2	Procure, Enclosure Assembly - L		1/26/01	1/26/01	0.60	0%										
22160	Inlet Filter / Silencer / Ducting - L		3/28/99	9/26/00	0	0%										
22160.1	Release, Final Design, Inlet Filter - L		8/9/99	8/9/99	0.40	0%										
22160.2	Procure Fab. Inlet Filter - L		9/26/00	9/26/00	0.60	0%										
22170	Ancillary Support - L		3/24/99	3/9/01	0	0%										
22170.1	Release, Final Design, Ancillary Support - L		8/5/99	8/5/99	0.40	0%										
22170.2	Procure Fab. Ancillary Support - L		3/9/01	3/9/01	0.60	0%										
22200	Package Control & Indicating System - L		9/2/97	5/30/00	0	1%										
22210	Control Console - L		9/2/97	9/2/97	0	1%										
22210.1	Release, Controls Spec - L		11/30/97	11/30/97	0.15	0%										
22210.2	Release, Control Schematic / Wiring Drawing - L		12/1/99	12/1/99	0.25	0%										
22210.3	Assemble, Control Console - L		9/7/99	9/7/99	0.25	0%										
22210.4	Complete, Control Console Static Test - L		1/31/00	1/31/00	0.35	0%										
22220	Lube Oil System - L		10/1/97	3/11/99	0	1%										
22220.1	Release, Lube Oil System Schematic - L		3/9/98	3/9/98	0.40	0%										
22220.2	Release Final Design, Lube Oil System - L		7/8/98	7/8/98	0.60	0%										
22220.3	Procure, Lube Oil System Components - L		1/5/99	1/5/99	0	0%										
22220.4	Complete Fab, Lube Oil System - L		3/11/99	3/11/99	0	0%										
22230	Package Fuel System - L		8/5/98	2/29/00	0	0%										
22230.1	Release, Package Fuel System Schematic - L		11/2/98	11/2/98	0.40	0%										
22230.2	Release Final design, Package Fuel System - L		6/25/99	6/25/99	0	0%										
22230.3	Procure, Package Fuel System Components - L		12/16/99	12/16/99	0.60	0%										
22230.4	Complete Fab, Package Fuel System - L		2/29/00	2/29/00	0	0%										
22240	Start System - L		1/6/98	3/23/98	0	0%										
22240.1	Release Final Design, Start System - L		3/30/98	3/30/98	0.40	0%										
22240.2	Procure, Start System Components - L		3/22/99	3/22/99	0.60	0%										
22300	Package Build - L		8/6/99	2/14/02	0	0%										
22300.1	Develop, Package Build Book - L		1/5/00	1/5/00	0.10	0%										
22300.2	Review, Preproduction Design - L		3/8/00	3/8/00	0.15	0%										
22300.3	Complete Assy, Package #1 - L		1/8/01	1/8/01	0.20	0%										
22300.4	Complete Assy, Package #1 Enclosure - L		3/5/01	3/5/01	0.25	0%										
22300.5	Ship, Package #1 - L		5/17/01	5/17/01	0.30	0%										
22300.6	Complete Assy, Package #2 - L		3/7/01	3/7/01	0	0%										
22300.7	Complete Assy, Package #2 Enclosure - L		5/2/01	5/2/01	0	0%										
22300.8	Ship, Package #2 - L		7/19/01	7/19/01	0	0%										
22300.9	Complete Assy, DOE Demo Package #3 - L		5/14/01	5/14/01	0	0%										
22300.10	Complete Assy, DOE Demo Package #3 Enclosure - L		7/6/01	7/6/01	0	0%										
22300.11	Ship, DOE Demo Package #3 - L		2/14/02	2/14/02	0	0%										
22400	O & M Manual / Illustrated Parts List - L		7/9/99	9/18/00	0	0%										
22400.1	First Draft, O & M Manual / Illustrated Parts List - L		3/1/00	3/1/00	0.40	0%										
22400.2	Publish, O & M Manual / Illustrated Parts List - L		9/18/00	9/18/00	0.60	0%										
27000	Balance Of Plant - L		10/1/97	12/14/00	0	1%										
27200	Balance Of Plant - L		10/1/97	12/14/00	0	1%										
27200.1	Release, Balance of Plant Design - L		11/12/99	12/14/01	0.40	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
32200.1	Complete First Draft, Information Handbook - L		12/9/99	12/9/99	0.10	0%										
32200.2	Complete, Training Plan - L		6/5/00	6/5/00	0.15	0%										
32200.3	Publish, Information Handbook - L		8/1/00	8/1/00	0.15	0%										
32200.4	Complete, Course Material - L		5/21/01	5/21/01	0.15	0%										
32200.5	Begin, Instruction - L		9/28/01	9/28/01	0.10	0%										
32200.6	Complete Training - L		3/28/02	3/28/02	0.35	0%										
32300	Product Support Capital Items - L		5/1/00	12/5/02	0	0%										
32300.1	Complete Product Support Upgrades - L		12/5/02	12/5/02	0.30	0%										
32300.2	Complete, Product Support Equipment - L		8/30/01	8/30/01	0.35	0%										
32300.3	Complete, Overhaul Tooling - L		8/30/01	8/30/01	0.35	0%										
40000	Test & Evaluation		9/14/95	9/18/03	0	21%										
40100	Test Coordination - S		9/14/95	6/29/01	0	33%										
40100	Test Coordination - L		9/19/97	8/20/03	0	1%										
42000	Component Testing - S		9/14/95	11/21/00	0	35%										
42100	Compressor Rig Test - ACE		9/14/95	8/1/97	0	85%										
42100.1	Deliver Design to Agilis, Compressor Rig - ACE		10/3/95	10/3/95	0.10	100%										
42100.2	Complete Design, Compressor Rig - ACE		4/10/96	4/10/96	0.25	100%										
42100.3	Complete Assembly, Compressor Rig - ACE		12/30/96	12/30/96	0.25	100%										
42100.4	Complete Test, Compressor Rig - ACE		7/31/97	7/31/97	0.25	100%										
42100.5	Complete Test Report, Compressor Rig - ACE		11/1/97	11/1/97	0.15	0%										
42200	Combustor Rig Test - S		1/16/96	3/31/99	0	22%										
42210	ULP Combustion Rig Test - S		1/16/96	3/31/98	0	35%										
42210.1	Complete Mod. Single Sector Combustor Rig - S		6/29/96	6/29/96	0.10	100%										
42210.2	Start Design, ULP Combustor Rig - S		9/1/96	9/1/96	0.10	100%										
42210.3	Complete Design, ULP Combustor Rig - S		4/30/97	4/30/97	0.15	100%										
42210.4	Complete Fab. ULP Combustor Rig - S		12/10/97	12/10/97	0.15	0%										
42210.5	Complete Tests, Single Sector Combustor Rig - S		10/30/97	10/30/97	0.15	0%										
42210.6	Start Tests, ULP Combustor Rig - S		12/15/97	12/15/97	0.15	0%										
42210.7	Complete Tests, ULP Combustor Rig - S		3/15/98	3/15/98	0.20	0%										
42220	Catalytic Combustion Rig Test - S		12/31/96	3/31/99	0	10%										
42220.1	Start Design, Catalytic Combustor Rig - S		12/31/96	12/31/96	0.10	100%										
42220.2	Complete Design, Catalytic Combustion Rig - S		12/31/97	12/31/97	0.15	0%										
42220.3	Start Tests, Catalytic Combustion Rig - S		6/30/98	6/30/98	0.10	0%										
42220.4	Complete Tests, Catalytic Combustion Rig - S		2/28/99	2/28/99	0.25	0%										
42220.5	Complete Topical Report, Catalytic Combustion Rig - S		3/31/99	3/31/99	0	0%										
42400	Turbine Rig Test - S		5/1/96	12/15/97	0	35%										
42400.1	Design to CAT Tech Ctr. Turbine Rig - S		6/29/96	6/29/96	0.15	100%										
42400.2	Complete Design, Turbine Rig - S		4/30/97	4/30/97	0.25	100%										
42400.3	Complete Assy, Turbine Rig - S		11/15/97	11/15/97	0.25	0%										
42400.4	Complete Test, Turbine Rig - S		12/15/97	12/15/97	0.35	0%										
42500	Squeeze Film Damper Test - S		5/10/96	8/29/97	0	50%										
42500.1	Start Design, Squeeze Film Damper Rig - S		5/10/96	5/10/96	0.10	100%										
42500.2	Complete Assy, Squeeze Film Damper Rig - S		4/30/97	4/30/97	0.40	100%										
42500.3	Complete Tests, Squeeze Film Damper Rig - S		11/15/97	11/15/97	0.50	0%										
42600	In-House Engine Test - S		6/1/97	11/21/00	0	1%										
42600.1	Start Build, Engine # 1 - S		3/31/98	3/31/98	0.05	0%										
42600.2	Start Dev Test, Engines # 1 & 2 - S		5/12/98	5/12/98	0.10	0%										
42600.3	Start Build, Engine # 2 (DOE) - S		5/12/98	5/12/98	0.10	0%										
42600.4	Complete, Engine # 2 (DOE) Test - S		10/31/98	10/31/98	0.25	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
42000.5	Complete Engine #1 ULP Test - S		4/10/00	4/10/00	0.25	0%							Δ			
42000.6	Complete Engine #1 Catalytic Test - S		1/12/00	1/12/00	0.25	0%								Δ		
42000	Component Testing - L		9/30/97	3/30/01	0	0%										
42300	Compressor Rig Test - L		9/30/97	8/1/98	0	0%										
42300.1	Complete Design, Compressor Rig - L		10/20/97	10/20/97	0	0%										
42300.2	Complete Assy, Compressor Rig - L		1/15/98	1/15/98	0	0%										
42300.3	Complete Tests, Compressor Rig - L		7/14/98	7/14/98	0	0%										
42700	In-House Engine Test - L		2/11/00	12/4/00	0	0%										
42700.1	Start Tests, Engine #1 - L		6/1/00	6/1/00	0	0%										
42700.2	Complete Prod. Test, Engine #2 - L		12/22/00	12/22/00	0	0%										
42700.3	Complete Prod. Test, Engine #3 - L		2/28/01	2/28/01	0	0%										
42700.4	Complete Prod. Test, DOE Demo Engine #1 - L		3/30/01	3/30/01	0	0%										
42800	Compressor Rig Test - L		6/1/00	3/30/01	0	0%										
43000	System Test / Demo - S		2/13/98	11/1/99	0	0%										
43100	Engine & Package Test / Demo - S		2/13/98	11/1/99	0	0%										
43100.1	Release, Engine Acceptance Test Specification - S		5/5/98	5/5/98	0.15	0%										
43100.2	Release, Package Test Specification - S		9/9/98	9/9/98	0.15	0%										
43100.3	Start Test, Package / Engine #2 (DOE) - S		10/5/99	10/5/99	0.30	0%										
43100.4	Complete Demo, Package / Engine #2 (DOE) - S		11/1/99	11/1/99	0.40	0%										
43200	System Test / Demo - L		8/4/00	6/21/01	0	0%										
43200.1	Engine & Package Test / Demo - L		8/4/00	6/21/01	0	0%										
43200.2	Release, Engine Acceptance Test Specification - L		8/31/00	8/31/00	0.15	0%										
43200.3	Release, Package Test Specification - L		10/27/00	10/27/00	0.15	0%										
43200.4	Start Test, Package #1 - L		1/9/01	1/9/01	0.30	0%										
43200.5	Complete Acceptance, Package #1 - L		2/19/01	2/19/01	0	0%										
43200.6	Complete Acceptance, DOE Demo Package #3 - L		4/18/01	4/18/01	0	0%										
44000	Host Site Test & Evaluation - S		6/21/01	6/21/01	0.40	0%										
44100	Host Site Test & Evaluation - S		10/1/97	6/30/01	0	0%										
44100.1	Release, System Test Plan - S		10/1/97	6/29/01	0	0%										
44100.2	Deliver Host Site Service Parts - S		1/27/99	12/7/99	0.10	0%										
44100.3	Commission, ATS System - S		2/2/99	2/2/99	0.15	0%										
44100.4	Complete, Host Site Evaluation - S		5/31/00	5/31/00	0.25	0%										
44200	Host Site Test & Evaluation - L		6/30/01	6/30/01	0.45	0%										
44200.1	Host Site Test & Evaluation - L		9/30/97	9/18/03	0	0%										
44200.2	Release, System Test Plan - L		9/30/97	9/18/03	0	0%										
44200.3	Deliver Host Site Service Part - L		3/27/01	3/27/01	0.10	0%										
44200.4	Commission, ATS System - L		8/20/01	8/20/01	0.15	0%										
50000	Program Management		8/14/02	8/14/02	0.25	0%										
50100	Program Coordination		8/14/03	8/14/03	0.45	0%										
50200	Management Reserve		9/14/95	8/20/03	0	33%										
51000	Customer Present. & Reports		9/14/95	10/1/01	0	33%										
51100	Periodic Reports		9/14/95	5/7/02	0	33%										
51200	Special Reports		9/14/95	10/1/01	0	33%										
51200.1	Complete, Phase 3B Cost Proposal		12/15/97	8/20/03	0	0%										
51200.2	Complete, Phase 3A Progress Report		8/6/98	8/6/98	0	0%										
51200.3	Complete, Phase 4 Cost Proposal		8/6/99	8/6/99	0	0%										
51200.4	Complete, Phase 3B Progress Report		9/2/00	9/2/00	0	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
51200.5	Complete, Phase 4 Final Report		8/20/03	8/20/03	0	0%	Rescheduled One Year Later, 12/96									Δ
51300	Reviews & Presentations		9/14/95	10/1/01	0	33%										
52000	Project Support		9/14/95	10/1/01	0	33%										
52100	Business Management		9/14/95	10/1/01	0	33%										
52200	Contract Administration		9/14/95	10/1/01	0	33%										
52300	Cost / Schedule Control		9/14/95	10/1/01	0	33%										
52400	Marketing Coordination		9/14/95	10/1/01	0	33%										
52500	Product Cost Management		9/14/95	10/1/01	0	33%										
60000	Commercialization		9/14/95	5/1/02	0	24%										
61000	Market Development		9/14/95	10/1/01	0	33%										
61000.1	Complete, Market Strategy & Commercialization Plan		3/14/97	3/14/97	0.15	100%	Completed Draft									
61000.2	Complete, Market Readiness Plan - Prelim		9/30/97	9/30/97	0.10	100%										
61000.3	Start, Market Plan Implementation		3/1/99	3/1/99	0.25	0%										
61000.4	Complete, Market Plan Implementation		6/31/01	6/31/01	0.50	0%										
62000	Manufacturing Readiness		9/14/95	5/1/02	0	20%										
62100	Production Implementation - S		9/14/95	9/28/01	0	40%										
62100.1	Complete, Production Tooling Plan - S		6/14/96	6/14/96	0.10	100%										
62100.2	Complete, Production Equipment Requirements - S		10/17/96	10/17/96	0.15	100%										
62100.3	Complete, Equipment Design & Facility Requirements - S		6/16/97	6/16/97	0.15	100%										
62100.4	Complete, Equip Acquisition & Facilities Rearrange - S		5/15/98	5/15/98	0.15	0%										
62100.5	Complete Equip Installation, Manpower Acquisition - S		5/13/99	5/13/99	0.15	0%										
62100.6	Start, Production - S		4/27/00	4/27/00	0.15	0%										
62100.7	Complete, Production Implementation - S		8/30/01	8/30/01	0.15	0%										
62200	Production Implementation - L		9/2/97	5/1/02	0	1%										
62200.1	Complete, Production Tooling Plan - L		1/15/97	1/15/97	0.10	0%										
62200.2	Complete, Production Equipment Requirements - L		1/15/97	1/15/97	0.15	0%										
62200.3	Complete, Equipment Design & Facility Requirements - L		3/19/98	3/19/98	0.15	0%										
62200.4	Complete, Equip Acquisition & Facilities Rearrange - L		2/17/99	2/17/99	0.15	0%										
62200.5	Complete, Equip Installation, Manpower Acquisition - L		3/2/00	3/2/00	0.15	0%										
62200.6	Start, Production - L		4/27/01	4/27/01	0.15	0%										
62200.7	Complete, Production Implementation - L		2/28/02	2/28/02	0.15	0%										
63000	Spin-Off Technology Plan		9/14/95	8/31/01	0	33%										
63000.1	Complete, Preliminary Spin Off Technology Plan		3/15/98	3/15/98	0.40	0%										
63000.2	Complete, Final Spin Off Technology Plan		8/31/01	8/31/01	0.60	0%										
64000	Life-Cycle Cost Analysis		9/14/95	8/31/01	0	33%										
65000	RAMD		9/14/95	8/31/01	0	30%										
65000.1	Complete, RAMD System Spec		8/27/97	8/27/97	0.30	100%										
65000.2	Complete, RAMD Software & Hardware Procurement		6/15/98	6/15/98	0.30	0%										
65000.3	Complete, RAMD Demonstration		8/31/01	8/31/01	0.35	0%										
70000	Host Sites		9/14/95	5/2/00	0	2%										
71000	Host Site - S		9/14/95	11/1/99	0	5%										
71100	Host Site Research & Selection - S		9/14/95	5/30/97	0	100%										
71100.1	Complete, Host Site Research - S		9/14/96	9/14/96	0.40	100%										
71100.2	Complete, Host Site Selection - S		5/31/97	5/31/97	0.60	100%										
71200	Host Site Design - S		10/1/97	11/2/98	0	1%										
71200.1	Complete, Host Site Conversion Plan - S		5/31/98	5/31/98	0.40	0%										
71200.2	Complete Design, Host Site - S		11/20/98	11/20/98	0.60	0%										
71300	Host Site Construction - S		10/1/98	11/1/99	1.00	0%										
71300.1	Complete Construction, Host Site - S		11/1/99	11/1/99	1.00	0%										

Advanced Turbine Systems
Phase 3 and 4
Filter: Total Program

WBS	Task Name	Dwg / Part No	Start Date	End Date	Value	Percent Complete	Notes	1995	1996	1997	1998	1999	2000	2001	2002	2003
72000	Host Site - L		10/1/97	5/2/00	0	0%										
72100	Host Site Research & Selection - L		10/1/97	12/18/98	0	0%										
72100.1	Complete, Host Site Research - L		5/1/98	5/1/98	0.35	0%										
72100.2	Complete, Host Site Selection - L		12/18/98	12/18/98	0.65	0%										
72200	Host Site Design - L		10/22/98	10/7/99	0	0%										
72200.1	Complete, Host Site Conversion Plan - L		2/22/99	2/22/99	0.25	0%										
72200.2	Complete Design, Host Site - L		10/7/99	10/7/99	0.75	0%										
72300	Host Site Construction - L		10/8/99	5/2/00	0	0%										
72300.1	Complete Construction, Host Site - L		5/2/00	5/2/00	1.00	0%										
80000	Industrial Facilities		5/1/97	7/31/99	0	0%										
81000	Test Cells - S		5/1/97	3/31/99	0	1%										
81000.1	Complete A/R, Test Cell Facility - S		12/1/97	12/1/97	0.15	0%										
81000.2	Complete Permits, Test Cell Facility - S		1/31/98	1/31/98	0.25	0%										
81000.3	Start Construction, Test Cell Facility - S		2/18/98	2/18/98	0.25	0%										
81000.4	Complete Checkout, Test Cell Facility - S		3/31/99	3/31/99	0.35	0%										
82000	Test Cells - L		10/1/97	7/30/99	0	0%										
82000.1	Complete A/R, Test Cell Facility - L		1/12/98	1/12/98	0.15	0%										
82000.2	Complete Permits, Test Cell Facility - L		5/18/98	5/18/98	0.25	0%										
82000.3	Start Construction, Test Cell Facility - L		10/1/98	10/1/98	0.25	0%										
82000.4	Complete Checkout, Test Cell Facility - L		7/31/99	7/31/99	0.35	0%										