DPA COMPONENTS INTERNATIONAL

TURN-KEY SOLUTIONS PROPOSAL

EEE Obsolete Parts Procurement
for
High Reliability Mission Critical Systems

2251 Ward Avenue
Simi Valley, California 93065 USA
Phone: (805) 581-9200 - FAX: (805) 581-9790
Website: www.dpaci.com

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1.0 INTRODUCTION

DPA Components International (DPACI) has vertically integrated unique capabilities in component engineering, parts manufacturing, qualification, screening, counterfeit testing, failure analysis and destructive physical analysis to support the high reliability industry ***totally in-house***. In each of these capabilities, specialized care has been taken to ensure that they are of the highest quality and to mutually support the overall goal of the Corporation to become the leader in supplying high reliability value added electronic devices. Our value to the high reliability parts industry is to provide "Greater Value, Turn-Key Solutions" in solving parts procurement problems created by vigorous mission critical requirements and market obsolescence.

Mission Statement:

DPACI provides manufacturing, testing and analytical services on electronic piece parts to the aerospace and military industry. We offer Greater Value by maintaining the company's capacity to offer Turn-Key Solutions to our customer's unique part requirements.

DPACI's unique selling proposition:

"Greater Value, Turn-Key Solutions"

To this end, we have created an inclusive, parts engineering service, dedicated to solving electronic parts procurement problems. This service specializes in electronic piece part searches, parts substitution, parts specification, candidate source search, custom parts manufacturing, parts upgrading through screening, qualification testing, and a patent pending process called DPEM for die recovery due to die obsolescence. For obsolete EEE Parts we have teamed with Falcon Electronics to provide the procurement of military and space level material for processing to customer's requirements. In the past company history, we have identified and delivered numerous hard-to-procure components to the DOD, NASA, FAA as well as other space, defense and aerospace prime contractors.

DPACI has the capability to provide cost-effective solutions in extending the operational life of military and aerospace projects, continuing long-run production lines, and supporting out-of-production spares requirements. These in-house capabilities and procedures have been carefully and deliberately developed over the past to combat the shortage of sources of supply for selected high reliability electronic components. Here are some of the actions that have been taken to achieve these goals:

- We (the owners of DPACI) have made a commitment to serve the aerospace and military electronic piece parts industry at onset of the company creation in 1979. Today DPACI is in a 40,000 square feet facility dedicated to the integrity of mission critical electronic piece parts.

- We have established a component test engineering staff and developed procedures to identify candidate replacement parts that can be upgraded for high reliability applications through screening and qualification testing.

- We have built a modern manufacturing capability in a Class 1000 clean room (Class 100 under flow hood), to efficiently assemble high reliability custom microcircuits, semiconductors and hybrids to precise specifications for QML level Q, V, Class B, Class S, Class H and Class K requirements.

- We have developed the capability to upgrade a wide variety of electronic components with state-of-the-art electrical, mechanical, environmental, and analytical test equipment, proven procedures, and qualified personnel.

- We have built an extremely effective component analysis laboratory to support our screening, qualification and custom parts manufacturing capabilities.

- We have created a custom production tracking and status system that integrates data from the quoting stage to the final shipping step ***totally in-house*** for our customers to access from the internet.

- We are AS9100/ISO9001: 2000 certified by SGS. We have a highly skilled and competent work force with proven operational and quality procedures to complement our comprehensive parts processing capabilities.

- We have received approvals by DLAM for lab suitability testing of Mil-Std-883 and Mil-Std-750 test methods. We have been granted QML status for M38535 at the Q and V level for assembly and manufacturing of microcircuits to military and space requirements.

- We have successfully performed prime contracts in the Obsolescence Parts Management arena for DOD Logistics agencies.

- We have created a patent pending process call DPEM to perform die recovery from plastic parts and reassemble into hermetic packages / or custom packages with reliability test data.

- We have teamed with Cypress Semiconductor to offer DLAM certified memory devices in hermetic packages to augment Re-engineering into our “Turn-Key Solutions” package.

- We have a proven purchasing system for parts and material supplied to applicable military and space level specifications.

2.0 SOLVING HIGH RELIABILITY PARTS SHORTAGE PROBLEMS

DPACI has recognized the ever-growing problems of finding solutions to high reliability parts obsolescence and shortages for ongoing military and aerospace programs by establishing a highly effective component engineering service. These parts shortage problems become particularly acute in the latter phases of long-running production programs or replenishment of spare parts. A review of the shortages reveals that most of them are caused by these kinds of events:

- New component technology has replaced the old component design, but is not always form, fit, and functional interchangeable.
- The demand for many high reliability component types is so low, due to cutbacks of overall aerospace programs and the use of commercial off the shelf (COTS) parts, that component suppliers have ceased production of many high reliability components.
- Substitute parts are available in form, fit and function, but they are not screened or tested to high reliability due to low demand.
- Original component manufacturers have moved on to new components and dropped old designs.
- Quantities required are too low for existing manufacturer to start-up a sunset technology manufacturing line cost effectively.

The DPACI's approach to solving this parts obsolescence problem is to offer the following types of solutions:

- **Obsolete Parts Source Search**: Extensive obsolete parts source search for small lot quantities.
- **Alternate Parts Search**: Component Engineering review to identify suitable replacement part, then create specification of suitable alternate parts in sufficient detail to allow replacement procurement.
- **Upgrade Parts Application**: Upgrading existing components to higher reliability specifications as defined in the specification.
- **Custom Manufacturing**: Manufacturing of selected hard-to-find replacements using custom packaging, hybridizing existing designs, die recovery and redesign.
- **Die Recovery**: Use our DPEM option to recover obsolete die from an existing plastic part and then assemble it into a custom package for form, fit, and high reliability applications.
- **Redesign**: Design and re-engineering of old IC and ASIC devices by our Tanner Research Team and recreate the part from full custom fabrication to deliverable product.

2.1 Obsolete Parts Source Search. In today's rapidly evolving electronics industry, complex electronic systems are likely to contain parts that will be discontinued by the original manufacturer during the life of the system. In recognition of this problem, DPACI has assembled a specialized capability to seek out sources of hard-to-find high reliability electronic components. This capability began in 1987 as a contract requirement to solve obsolete parts problems for the U.S. Air Force's aging Minuteman Missile Program. The accumulation of parts data during the five year Minuteman program created a significant database of sources for high reliability electronic components that is still maintained current for today's obsolete part searches. The component engineering and procurement staff, armed with this accumulated experience and extensive parts databases, are highly skilled in locating hard-to-find or out-of-production high reliability electronic components. DPACI will find obsolete parts sources if they exist.

2.2 Alternate Parts Search. In the event an obsolete part cannot be located after an extensive search, the next alternative is to define a suitable part replacement by Component Engineering. Frequently, an alternate may be an equivalent part with a different manufacturer's part number, or it may be a part of the same generic part number with the same form, fit and function but different processing or reliability levels.

2.2.1 Control Drawings. The task of locating a suitable alternate part is to first specify the key parameters of an electrically and functionally acceptable equivalent part. The function of specifying, selecting and assuring proper design applications, while maintaining control of parts used in complex electronic systems, is a major engineering task. The control effort includes the development of meaningful procurement documents and specification drawings that reflect a balance between design, performance, quality assurance, and reliability requirements. DPACI's component engineering staff works intimately with the customer's design engineering to ensure critical parameters are in the newly created control drawings. From the approved newly generated control drawings a test plan is created as the Lot Traveler for the process flow of each task.

2.2.2 Parts Source Search. A candidate source search will then be conducted to find sources that can be qualified to newly generated Source Control Drawings (SoCD), Specification Control Drawings (SCD), or Selected Item Drawings (SID). DPACI's extensive parts databases are employed to find the suitable replacement part. Once the candidates are found and before the qualification process starts, engineering performs inspection tests on a small sample in accordance with the newly generated control drawing, prior to procurement of the part from the source. We have successfully managed programs for a variety of military customers ***totally in-house*** with a wide range of requirements ranging from electrical verification of components to full qualification of radiation hardened components.

2.3 Upgrading Parts Applications. Frequently, existing lower grade alternates for high reliability components can be upgraded through screening and qualification to qualify as suitable equivalent replacements. When this situation exists, DPACI can perform the screening and qualification tests to upgrade components to JAN, JANTX, JANTXV, JANS, Class B, and Class S equivalent levels as required. The same capability for passive and electromechanical devices also exists within the facility. During the past ten years, many component types have been upgraded to space and airborne levels in this manner. Our in-house screening capability includes all tests as described in MIL-STD-750, MIL-STD-883, and MIL-STD-202.

2.3.1 Order of Precedence. This parts upgrading capability, through screening and qualification tests, has proven to be cost effective in solving many high reliability parts shortage problems. In this approach, the following order of precedence are used to ensure proper levels of upgrading offered for microcircuits (a similar order of precedence is also used for discrete semiconductors):

- Upgrade a MIL-PRF-38535 Class “B” component to a Class “S” level
- Upgrade a Specification Control Drawing (SCD) part to a Class “Q” level SMD
- Upgrade a MIL-STD-883 compliant part to a high reliability level as defined above
- Upgrade a commercial / industrial / 883 level part to an approved SCD, SoCD or SID

2.4 Manufacture of Selected Parts. Often unpackaged dice and/or wafers may exist for a defined part where no acceptable packaged, screened, and qualified part exists. In this event, DPACI offers the option of packaging, screening and qualifying high reliability components to customer requirements from available wafer sources. This option to solve component shortages can be effectively employed in those instances when excess die and wafers can be located. DPACI parts databases include many sources for such die and wafers with traceability requirements of Mil-PRF-38538.

2.4.1 Dice Inventory. To support the manufacturing of outdated components and devices, DPACI continues to procure excess die and wafers from original manufacturing sources. As of this date, an inventory of over 1500 device types, in both die and wafer configurations, are available for manufacture of small quantity replacements for the industry. Our procurement personnel continuously scour the industry to improve the inventory. This considerable inventory is stored in a temperature controlled dry nitrogen atmosphere to ensure the die and wafers are not degraded with time before being incorporated in hermetically sealed packages for test and delivery.

2.4.2 Class 1000 Cleanroom. DPACI has been manufacturing custom electronic components for high reliability commercial, military and aerospace applications since 1990. Custom Microcircuits, multi-chip, monolithic and hybrid components are assembled in our Class "1000" clean room environment with Class "100" laminar flow work stations to exacting FED-STD-209 requirements. This custom electronic device manufacturing operation is completely self-contained within our modern 40,000 sq. ft. facility. This facility was specifically designed for the efficient processing of Class "S" and B-level devices and utilizes state-of-the-art assembly equipment in conjunction with rigorous in-house certification programs.

2.5 Die Recovery Process. DPEM is a patent pending process DPACI owns and is presently being provided to some customers as a solution for obsolete die (chips). The purpose of DPEM is to remove a die from an existing plastic part and use it in another package, usually ceramic or metal for certain high reliability applications. Traditionally when a die is not available in the military grade and the die is needed for spare parts, a cost of approximately 1 million dollars is needed to reinvent the device. The DPEM process steps involve: 1) dissolving the plastic encapsulation of a semiconductor device, 2) removing the chip from within, 3) removing the bond wires from the chip keeping bond pad integrity, 4) relocating the chip into a high reliability package such as a ceramic or metal package, 5) attach the die onto the package substrate, 6) re-bond new wires onto the chip and then to the package lead frame 7) re-seal the package maintaining package hermeticity and 8) perform 100% testing and qualification to ensure reliability for aerospace and military applications. The DPEM solution is very price feasible and delivery is almost immediate if the companion plastic part in commercial form is available. The DPEM device can meet all the requirements of the military and space level specifications in terms of form, fit, function, quality and reliability. The DPEM product is one of the solutions that DPACI has taken the initiative to invent for the industry in its "Greater Value, Turn-Key Solutions" unique selling proposition.

2.6 Redesign Capability. DPACI has teamed with Tanner Research / Manuflex to augment our capabilities in system level re-engineering tasks. Using the latest design software and the Manuflex Shared Mask Gate Array (SMGA) for cost effective fabrication, we can reduce minimum quantities to 100 pieces for full custom designs. The Tanner software patented technology enables DPACI to re-architect and re-engineer chips, boards, and boxes to ASICs. With SMGA, we can share the large fixed tooling costs of semiconductor fabrication with many customers at once, reducing all prices.

3.0 BUY/SELL PROCUREMENT/SCREENING PROGRAM

In order to effectively implement our solutions to the parts shortage problems, DPACI has created a cost effective buy/sell procurement capability that allows the customer to order his parts shortage solution from a single source. DPACI will undertake the total responsibility of finding a suitable solution to a customer's high reliability parts shortage problem. Our buy/sell program is available to provide one-stop value added source, component engineering alternatives, quick pricing response and limited customer liability to our customers.

3.1 Buy/Sell Philosophy. The philosophy of one-stop shop for alternate, value-added, or hard-to-obtain parts can only have merit if the company doing the parts procurement and the value-added upgrading has experienced and knowledgeable personnel with proven corporate history for such tasks. DPACI is such a company. Our Buy/Sell Programs consist of material source search, parts pricing, alternate parts search, candidate source search, upgrade test plan, procurement of approved parts, and screening thereof. The end results our customers experience is a single order placement with a standard or non-standard parts list with DPACI and take delivery on time without the logistics or liability of source search, material procurement, manufacturing, engineering, testing, quality conformance and failure analysis.

3.1.1 Qualified Sources. Parts to be quoted/purchased are first validated for part numbering accuracy versus the customer's defined requirements. Next, a qualified source of manufacturer(s) of the part will be defined by a review of the customer-supplied SCD, SID or the Qualified Parts List, and entered into a quoting database. DPACI' purchasing database system is then utilized to automatically and electronically generate a request for quote (RFQ) from each identified source (authorized distributor, representative or manufacturer) and create tracking reports until receiving.

3.1.2 Cost Effective Pricing/Delivery. DPACI use a custom automated purchasing system to achieve the lowest total cost and fastest delivery for our customers. The process starts at the quoting stage by our buyers soliciting a variety of qualified sources for each material line item. AS RFQs are answered by the solicited sources, the data (such as price per piece, minimum buy quantity, and delivery) is entered into the Purchasing database along with miscellaneous comments. The quoter then decides on one of the three optional pricing determination criteria: Cheapest, Fastest, Both. The quoting system will take the minimum buy quantity into account for amortization of price per piece and determine the amortized price per piece. This system promotes the "Better, Cheaper, Faster" concept on off the shelf commodities from distributors and authorized dealers.

4.0 MATERIALS MANAGEMENT

4.1 Materials Acquisition. DPACI has an established parts procurement / materials management team with a combined experience of over three decades semiconductor materials and devices. With this core of professional buyers and material specialists, DPACI has successfully managed buy/sell programs for a variety of customers with a wide range of requirements ranging from electrical verifications of components to a space level equivalent. When the preferred part is not available within the allowable time limit, procurement specialists work closely with the component engineering specialists and supplier source specialists to select and procure the highest reliability replacement part. Parts are procured from approved suppliers which are constantly rated for quality performance per MIL-STD-1535 and our Quality Control Manual.

4.2 Parts Flow Tracking. To respond to the changing needs of parts procurement priorities, DPACI uses an existing tracking system (Material Status Tracking) with all the critical paths, schedules and priorities updated daily. Weekly status meetings of our program management team members regarding parts procurement status ensures fulfillment of parts procurement priorities. The tracking data of the procurement activity at DPACI provides the necessary information for each workstation as to perform the process as well as the following for custom status accessible from the internet with security code:

- DPA Job Number
- Buyer
- Purchase Order Number and Supplier Information
- Customer / Generic Part Number
- Date of Order Placement
- Expected date of Delivery
- Date Code
- Quantity Ordered
- Present Process and Step
- Operator Comments

DPACI has demonstrated experience in the procurement, manufacturing, screening and QCI of high reliability components for various high priority programs. The reliance of complex systems on the reliability of electronic components and customer security has been the impetus for the "**Total Solution**" concept with processes kept ***totally in-house***. To this end, DPACI has not only shown an acute understanding of the reliability and procurement requirements of critical systems, but also has first-hand experience in implementing them as a prime contractor.

4.3 Reporting. The materials management team's experience in production control gives the necessary experience to status the customer on a predetermined schedule with accurate updates on both the status of parts that are on order, as well as that product in process at DPACI. Statuses are individualized for each customer as well as the frequency of those reports. Daily interface is maintained with our customers on all facets of the order management.

5.0 DPACI's CUSTOM JOB DATABASE

DPACI maintains an on-line tracking jobs database for all operations within the company. The jobs database provides accurate, up-to-the-minute information on processes required to conduct effective operations in a consistent manner. The jobs database include: Quoting Database, Engineering Database, Test Program Database, Test Fixturing Database, Purchasing Database, Receiving Database and Production Database, which provide information for a Job Tracking System and Customer Status Reports.

5.1 Quoting Database. The origination of any potential task order or job is with Quoting, who is the first point of contact with customer requirements and technical definitions for each line item quoted. We define customer requirements in detail at the onset, therefore using data that defines each cost element within a quoted line item for the future production lot traveler. The quoted price is based on a complete definition of the customer requirements (each process step), test conditions, and applicable military standard test methods. The pricing has already been established by cost accounting for each process, condition and test method within the database to relieve quoters of price considerations and to promote consistency. The quoting database is shared with all quoters, purchasing, engineering, configuration management, and cost accounting for necessary data input needs. Below are the responsibilities of each of these organizations during the quoting phase of the job:

5.1.1 Quoting – Defines in detail each line item to be quoted. At this point each requirement is reviewed in detail and the process and condition of each test is defined to create a Lot Traveler. Pricing data is automatically determined as each process and condition is defined. A Line Item Detail Quote with price, test, conditions and delivery is created and printed as part of the quoting package

5.1.2 Purchasing – When a Buy/Sell requirement is invoked, the system will automatically query the appropriate sources with specified manufacturers and immediately send RFQs to approved distributors electronically. Once the pricing is received by fax or other electronics means, it is entered into the database relating to the correct quote and item number. The quoter then initiates the Buy/Sell program to automatically pick the most cost-effective vendor and enter the material pricing into the quote.

5.1.3 Engineering - Assists quoters in evaluating and pricing non-recurring engineering charges (NRE) and non-recurring fixturing charges (NRF). Engineering provides quotes for test program generation, test program modification, bench test fixturing, burn-in boards, and burn-in fixturing.

5.1.4 Configuration Management (CM) – Responsible for the release, accountability, and archive of test software / hardware as well as working documents. CM is in charge of all data entry of new test software releases into the database. The release set information is used during the quoting process for determining existing test programs, fixturing, and revisions for NRE and NRF charges.

5.1.5 Cost Accounting – Responsible for the pricing of each process as a function of the costs involved. Process time data relating to each process is also determined by this department. This data is used to determine scheduling and production planning once the job is in-house. Periodic review is made to update the price on real costs incurred with current burden, G&A, and profit profiles.

5.2 Test Program Database. DPACI Test Program database includes all information released in accordance with MIL-STD-1535, Requirements for Software Quality Assurance. Each test program when completed is reviewed and approved by QA, then released by Configuration Management into the database. The Test Program database is accessible from the Quoting database to determine non-recurring engineering charges.

5.3 Test Fixturing Database. The Test Fixturing database is a collection of various ATE test fixturing hardware, burn-in fixturing hardware, and bench test hardware. Each fixture release number is associated with (as a minimum) its part number, job number, test type, and socket type within the database. The Test Fixturing database is accessible from the Quoting database to determine the requirement for non-recurring fixturing charges.

5.4 Purchasing Database. DPACIs' purchasing database has been created to facilitate material purchases for Buy/Sell programs and wafer/die elements for custom electronic devices manufacturing. The manufacturers are categorized by approved source/distributors with the supplier quality approval rating and credit information. Each part number material request originating from Quoting will generate a quote for an approved source. As the pricing data is received from the sources, it is entered and evaluated automatically, based on the customer's criteria for selection of the most cost-effective vendor. If the quote is awarded to DPACI in the future, the quoter will invoke an award quote and purchase orders are automatically printed and sent to the selected vendor. The Purchasing database also stores all pricing data related to each line item quoted. Purchasing is responsible for all data within this database.

5.5 Receiving Database. The Receiving database is tied with the Quoting database to query parts received and locate quoting information. Once the quote and line item number (definition of a Job Number) information is located and verified, processing begins with entry of various receiving inspection data into the receiving database. The receiving report, job number bar code labels, production lot travelers, and the production schedule for that job are printed automatically as part of the job folder. The data from the Quoting and Purchasing databases are used at this point for order verification and job folder information

5.6 Production Database. As the job moves through the facility, the job processing information is logged into the Production database at each process station by bar code scanning. Information such as process name, step number, test system, employee, data, start and end times are recorded at each scan(s) This information is compared with the scheduling information on the Quoting database to determine production loading, on-time delivery, and rush jobs.

5.7 Job Tracking System. Job tracking is accomplished by various queries on the Production, Receiving, Purchasing and Quoting databases to determine the location, dates and steps of processes performed, responsible engineer, and up-to-date status of each job. The Job Tracking System enables immediate location and status of any job upon request. This is especially useful for production load scheduling and responding to customer inquiries.

5.8 Customer Status. The Customer Status Report is created from the production database for on-line reporting of total line items to specific customers. The report indicates the job number, customer part number, purchase order number, latest process within the lot traveler completed, date, location, and estimated completion date. This report may be obtained by various electronic means or faxed periodically as defined by the customer. Access codes into the DPACI Jobs database are required for security.

5.9 Internet Status. To obtain your status on the World Wide Web, you must have a customer identification (CUID) given to you by our customer service. Go to the internet at WWW.DPALABS.COM and scroll the left column for our ON-LINE STATUS SYSTEM. Double click on it and the customer service panel will come up. Enter the password **statusplease** (lower case) and click on the OK button. Now enter your CUID into the next box and click on Enter or SUBMIT QUERY button. All jobs in-house at DPACI will show up on the status report. This report is updated twice daily.

6.0 CLASS “S” AND CLASS “B” SCREENING

DPACI can perform the screening and qualification tests to upgrade components to JAN, JANTX, JANTXV, JANS, Class B, and Class S equivalent levels as required. DPACI have demonstrated experience in the procurement and upscreening of high reliability components from industrial / commercial to B level and B level to S level.

6.1 Class “S” Upgrade. A typical upgrade from Class “B” level to Class “S” would involve:

a. Receiving inspection
b. Temperature cycling, 10 cycles per MIL-STD-883, M1010, -65°C to 150C°
c. Particle Impact Noise Detection (PIND) M2020
d. Electrical Tests 100% read and record at 25°C, per customer SCD
e. HTRB per MIL-STD-883, M1015
f. Interim Electrical tests 100% read and record at 25° per customer SCD
g. Dynamic Burn-In per MIL-STD-883, M1015
h. Electrical tests 100% read and record at 25°C, -55°C, and 125°C per customer SCD
i. Radiography.
k. Final electrical tests
l. Hermeticity
m. Final Documentation
n. Perform QCI in accordance with MIL-PRF-38535 for Class “S” devices

6.2 Class “B” Upgrade. A typical Class “B” upgrade flow is as follows:

a. Receiving inspection, external visual inspection, and initial electrical test
b. Temperature cycling per MIL-STD-883, M1010, Condition C, 10 cycles
c. Interim electrical test
d. Static Power burn-in per MIL-STD-883, M1015, Condition B at 125°C for 160 hours
e. Final electrical test at 25°C, 125°C, and –55°C
f. Hermetic seal test per MIL-STD-883, M1014, Condition A2 for fine leak and C for gross leak
g. Perform QCI in accordance with MIL-PRF-38535 for Class “B” devices

DPACI provides all required test fixtures, test procedures, test equipment, and environmental chambers. DPA performs all the tests **in-house** with trained and certified personnel with the exception of Residual Gas Analysis (RGA). Atlantic Analytical performs RGA. Radiation testing is performed by ICS.

6.3 Electronic Components Test/Screening. In addition to Class “S” and Class “B screening, DPACI offers services to upgrade parts to JAN, JANTX, JANTXV equivalent level and conduct Group A, B, C, and D qualification tests to specific customer or military drawings.

6.4 Test Fixturing. The importance of an effective in-house test fixturing capability, to support volume testing of integrated, discrete and passive devices cannot be over-emphasized when considering burn-in and life-testing requirements of screening or qualification. The through-put of a critical process such as burn-in is determined primarily by the number of devices that can be processed at one time. The number that can be processed is based on the availability of effective test fixtures. Due to these considerations, DPACI developed its own in-house capability to design and build the required test fixtures to support all phases of test operations.

6.4.1 Fixture Inventory. DPACI has an inventory of static and dynamic test fixtures as well as burn-in boards developed for customers and retained for possible future needs. If test fixture requirements cannot be satisfied from the extensive fixture inventory, a one-time charge for fixturing is assessed and the time to produce special fixtures will be entered into the production schedule.

6.4.2 Fixture Fabrication. Our in-house fixture fabrication capability is complete in that we design the fixture on CAD, make our own printed circuit boards, and populate them with device connectors and other electronic components in a dedicated facility. The facility contains all of the equipment necessary to build the required fixtures. This includes a CAD system, a mylar processing capability, copper etching chambers, and a computer-controlled PCB hole drilling set-up. The test fixture complexities vary from multiple connector, 3-pin device, static test boards to 256-pin device dynamic test assemblies. Both through-board components mounting and surface mount techniques are employed in the designs. Test fixtures are designed and built to support all test activities including burn-in, bench test, and ATE conducted tests. The self-contained, in-house design and build capability has proven to be invaluable in minimizing schedules and cost normally associated with acquisition of test fixtures.

7.0 QUALIFICATION TESTING.

The Quality Conformance Inspection (QCI) or Qualification tests required to fully qualify a new product to the requirement of MIL-PRF-38535, MIL-PRF-19500, or MIL-H-38534 are available at DPACI. These tests, which include Groups A, B, C, D and E, can all be performed with our own test equipment and environmental chambers without the use of outside laboratories or contract personnel. With these total capabilities available in-house, program costs and schedule delays can be better controlled and minimized. Any test failures and subsequent re-test requirements can readily be witnessed and reviewed for quick corrective action, and therefore minimum schedule delays that would normally be experienced with outside test sources.

8.0 PEMS (PLASTIC ENCAPSULATED MODULE SEMICONDUCTORS) SCREENING

DPACI can perform the screening and qualification tests to upgrade components to the PEM-INST-001 and JEDEC Standard requirements. DPACI have demonstrated experience in the procurement and upscreening of high reliability components from industrial / commercial to Military and Space level.

8.1 PEM Screening A typical flow would involve:

a. Receiving inspection
b. Temperature cycling, MIL-STD-883, M1010
c. Radiography
d. C-SAM inspection
e. Initial electrical measurements, at 25°C
f. Static Burn-In per MIL-STD-883, M1015
g. Interim Electrical tests 100% read and record at 25° per customer SCD
h. Dynamic Burn-In per MIL-STD-883, M1015
i. Electrical tests 100% read and record at 25°C, -55°C, and 125°C per customer SCD
j. External visual
k. Final Documentation

8.2 QUALIFICATION

a. Visual inspection
b. CSAM
c. Preconditioning
d. Electrical Measurements, at 25°C
e. Life Test per MIL-STD-883, M1005
f. Electrical Measurements, at 25°C
g. Temperature Cycling, MIL-STD-883, M1010
h. Electrical Measurements, at 25°C
i. CSAM
j. DPA
k. High Accelerated Stress Test (HAST)
l. Electrical Measurements, at 25°C

9.0 CUSTOM PACKAGING/HYBRIDS

DPACI has the complete capability to fabricate, test and deliver high reliability components within its existing Simi Valley facility. This capability is dedicated to packaging and assembly of semiconductors and microcircuits to Class “B” and “S” requirements of MIL-PRF-38535. Hybrids are also assembled/tested to Class “K” and “H” of MIL-PRF-38534 requirements. The assembly operations are performed in a self-contained, stand-alone clean room outfitted with the latest state-of-the-art assembly equipment. The facility meets the Class 1000 requirements of FED-STD-209, all assembly processes are performed under “Class 100” laminar flow hoods. All manufacturing processes are performed by highly-skilled and well-experienced assembly personnel.

The DPACI packaging capability includes most known package styles:

- Ceramic Dual In-Line Packages (CERDIPs)
- Ceramic Flat Packs (CERPACKs)
- Pin Grid Array Packages (PGA)
- Leadless Chip Carriers (LCC)
- Surface Mount Packages
- Ceramic Ball Grid Arrays (BGA)
- Headers, TO-5, TO-18, TO-39, TO-46

The manufacturing processes required to package microcircuits, semiconductors and hybrids performed in the confines of the clean room environment are basically wafer processing, die attaching, wire bonding and package sealing. These processes are all performed by documented procedures and inspected to exacting specifications by experienced quality control personnel.

9.1 Wafer Processing. Custom packaging operations begin with either individual die or multiple die imbedded in wafers. Die processing begins with 100% incoming inspection to documented topography. Wafers are automatically probe-tested, and defective die are identified by inking. The electrical tests performed as part of the wafer probing are to customer-provided software or software developed by DPA software engineers to customer-provided specifications. In the Class 1000 clean room environment, wafers are mapped and saw-cut into die with our precision 5% wafer saw. After “dicing,” the individual die are placed in waffle packs according to customer specifications. ESD protective procedures are constantly enforced during each operation. The dice are stored in conductive metal containers in a dry nitrogen environment until further processes are performed.

9.2 Die Attaching. Various techniques are utilized at DPACI for die attaching. Eutectic die bonding is used extensively for silicon, GaAs, or metal-to-metal attaching. Our capabilities also include standard solder re-flow component attach, low-temperature firing silver glass, silver cynate, thermoplastic and conductive or non-conductive epoxy die bonding. The equipment used for die attach processes are manual, semi-automatic or batch mode capable. The die attach process is verified with radiographic, shear and vertical pull tests and residual gas analysis (RGA).

9.3 Wire Bonding. Wire bonding technologies utilized at DPACI include automatic thermosonic, manual thermosonic, and automatic and manual ultrasonic wedge. Our automatic wire bonders are K&S 1488, K&S 1474, and Hughes 2460 with one machine capable of deep access (1.0 inch) wire bonding. Gold and aluminum wire bonding with wire diameters of .0005 to .0400 inches are available. Wire bonding quality is monitored by wire bond pull testing throughout this important assembly operation.

9.4 Package Sealing. The hermetic sealing of a package is accomplished by roller seam welding and/or eutectic reflow soldering in an inert environment. Projection welding for cans is also performed on TO- packages. Post sealing hermeticity tests, including gross and fine leak testing, are utilized to verify the package seal integrity.

9.5 Quality/Reliability Testing. The full range of quality and reliability testing is available to support the manufacturing and assembly of semiconductors, microcircuits and hybrids. In order to be able to deliver fully qualified MIL SPEC devices components and assemblies, DPACI' extensive testing capability can perform all required qualification and reliability tests in-house. Many of these tests are performed in-line as an integral part of the assembly and packaging processes. For example, pre-seal burn-in tests, non-destructive bond pull tests, internal (pre-seal) visual inspections, radiographic die bond examinations, and pre-seal electrical tests. Additionally, 100% screening tests and Qualification Conformance Inspections can be performed in house.

10.0 COMPONENT ANALYSIS LABORATORY

DPACI is particularly proud of the capabilities embodied in the Component Analysis Laboratory, which supports efforts of fabrication, assembly, and testing of components and devices. This laboratory performs four major analytical functions in ensuring that components and devices are fabricated to high standards. These functions are:

- Destructive Physical Analysis
- Failure Analysis
- Material Analysis
- Construction Analysis
- Die Recovery (DPEM processs)

10.1 Destructive Physical Analysis. Destructive Physical Analysis is the process of disassembling, testing, and inspected a component for the purpose of determining conformance with applicable design and process requirements. This is a process of sample testing to ensure that a high reliability component or device is fabricated to the required standards. This process is also used effectively to discover process defects for troublesome production lot problems.

The Component Analysis Laboratory performs many crucial tests in the process of examining high reliability components. These tests include but are not limited to bond pull, die shear, lead fatigue, SEM, and fine/gross leak tests. Analyses used to support this activity are residual gas, material, chemical and metallurgical, and radiographic analyses. The array of equipment contained in this laboratory to support these tests and analyses is listed in Table 14-4.

10.1.1 External Photos. All samples are extensively photographed with various views and magnifications to accurately document external markings, package configurations, and any observed anomalies. External dimensions are accurately recorded to verify mechanical specification compliance.

10.1.2 Delidding. Delidding of sample electronic devices and components, to gain access to internal construction features, is an important step in the destructive physical analysis process. DPACI utilizes numerous techniques to accomplish this important function, taking care to preserve the specimen for future analysis. Delidding, disassembly and depotting of external packages is performed with extreme care so as not to induce particles or internal damage to the samples.

10.1.3 Internal Photos. Internal examinations are performed on samples after the package opening, and greatly magnified photos are recorded for use in detailed analysis. The enclosed Component Analysis Laboratory Equipment List, Table 14-4, identifies numerous cameras and microscopes utilized for this purpose. Photographs of typical internal conditions and observed anomalies are preserved and presented in summary reports.

10.1.4 Scanning Electron Microscope. Components and devices are subjected to SEM inspection of metallization to meet the requirements of MIL-STD-883, Method 2018. This inspection includes examination of the general metallization condition, metallization thickness, oxide step coverage, and an inspection of the bonding and die attach integrity. The inspection is performed on devices that have been deglassivated, using either a wet chemical or gas plasma etch. Photos of typical and worst case metallization conditions, oxide step coverages, bond attach, and die corners, as well as any observed anomalies, are taken to preserve the examination data.

10.1.5 Energy Dispersive X-Ray Analysis (EDXA). DPACI' extensive product evaluation capabilities include the use of EDXA systems to analyze material compositions for detection of organic surface contamination of devices and components.

10.1.6 Bond Pull. Devices, components and hybrids containing internal wire bonds are bond pull tested in accordance with the procedures of MIL-STD-883, Method 2011, Condition D. DPACI capabilities include testing different bond wire sizes as follows:

Wire (mil)	Minimum Strength (grams)
0.7 Au	0.7
1.0 Au	1.5
1.0 Al	1.0
2.0 Al	4.0
8.0 Al	50.0

10.2 Failure Analysis. The failure analysis capabilities of DPACI are extremely important to support our in-house manufacturing efforts, and are also available to analyze customer component and equipment problems. Techniques and equipment utilized in providing our Destructive Physical Analysis capability are also used effectively to analyze failures, determine failure causes, and recommend corrective actions. These capabilities are exceptionally important to finding early solutions to troublesome production problems that show up as device or component failures.

The failure analysis process covers investigations such as electrical failure analysis, material failure analysis, and structural failure analysis. All of these analytical methods may be employed in determining the failure mode and possible corrective action. The failure analysis process may use some or all of these types of existing capabilities in identifying the failure mechanism:

- Particle Impact Noise Detection (PIND)
- X-Ray Radiography
- Hermeticity Testing
- Surface Analysis Using EDXA
- Electron Microscopy
- Low/Medium/High Power Microscopy
- Metalographic Sectioning/Polishing
- Residual Gas Analysis

11.0 QUALITY ASSURANCE – AS 9100/ISO 9001: 2007

At DPACI, the Quality Assurance organization reports directly to the corporation president to ensure that quality issues and requirements receive priority attention. All quality actions and performance are governed by the Quality Control Manual, Document No. DPA-OID-0003, which is an AS 9100/ISO9001: 2000 document and is available upon request. This all-inclusive controlled document describes the responsibilities, policies and procedures for implementing and controlling quality control functions within the corporation.

11.1 Inspection Systems. DPACI maintains an inspection system in compliance with MIL-I-45208. The inspection system encompasses all inspection requirements include incoming receiving, supplier source, in-line production fabrication, final acceptance, and packing. All inspections are conducted by certified personnel trained to make accept/reject decisions on materials, processes and products.

11.2 Supplier Quality Assurance. A supplier quality assurance program to the requirements of MIL-STD-1535 is continuously enforced on all suppliers of material and equipment for DPACI products. Pre-award quality system surveys are conducted on each potential supplier of critical items prior to approval and placement of purchase orders with the supplier. Thereafter, each active supplier is subject to periodic reviews to determine the need for resurvey or audit. Supplier performance is continuously monitored to establish a rating for each supplier. The rating criteria are yield, quality system maintenance, corrective action implementation, and on-time delivery. This data is maintained in the Approved Supplier List to aid in the selection of suppliers for future purchases.

11.3 Equipment Calibration. DPACI maintains rigidly enforced procedures to assure the current calibration of tools, gauges, electronic test equipment, and other items used to determine the electrical, physical and dimensional conformance of parts and assemblies to customer drawings and specifications. These procedures are in accordance with MIL-STD-45662. All DPACI’s measuring/test equipment is calibrated in a controlled environment suitable for precision measurement against standards traceable to the National Institute of Standards and Technology, having an accuracy ratio of at least 4:1 with respect to the item to be calibrated.

Calibration logs are maintained for all measuring and test equipment, and state the schedule established for periodic inspection or re-calibration of individual equipment and their inspection history. Calibration status of a piece of equipment is indicated by labels which indicate the date of last calibration, the date when calibration is due, and by whom the calibration was performed. Calibration schedules are established for each piece of equipment and enforced by Quality Assurance.

12.0 COMPANY HISTORY

In the beginning, the owners, Douglas and Philip Young, were immigrants from Taiwan. They came over in 1959 and started their new life and education in Burbank, California. Their father, Ming Young, a former American embassy employee in Taiwan, also an electronics engineer, influenced their early education in the United States which led them to their present careers.

Douglas and Philip graduated from UCLA in the early 1970's with their BSEE and started their engineering career at companies such as Litton G/CSD Hughes Radar, Northrop Electronics, and Bendix Oceanics as component test and analysis engineers. Philip pursued a Master's Degree in Solid States Physics from USC as Douglas started his first business in 1975, a recording studio.

The studio was 100% designed, built and financed by Douglas and it was in the pre-digital music era. While delegating over the management of the studio to others more familiar with the industry, Douglas initially worked as a consultant in the aerospace industry doing testing and analysis on electronic components to support the demanding assets of the business. As the studio was becoming a well-known post-production facility, the music business was beginning to change. In 1979, with the oncoming of the new digital audio era and the need to re-capitalize soon, he sold the business and started another business, an engineering consulting firm, called DPA (Doug, Phil and Associates) Labs, Inc., with his brother Philip as a part-time partner.

The engineering firm took off very successfully in the early 1980's due to the high demand of temporary technical personnel in the aerospace industry such as engineers, technicians, draftsman, programmers, scientists, etc. DPA Labs, Inc. soon became the leading firm for high level technical personnel in the Southern California area serving all the military prime contractors. In 1983 Douglas decided to take advantage of the booming aerospace business and his experience. He acquired some test equipment he was familiar with, and asked Philip to leave his comfortable environment at Hughes to join the company fulltime. They started integrating DPA Labs, Inc., the engineering firm, with a testing and analytical laboratory doing business in the high reliability electronic piece parts industry.

Initial Major Obstacles

The initial DPA Labs, Inc. laboratory started in a less than 1,000 square foot retail store with 5 employees: Douglas, Philip and three others. The company had no credit and no track record other than that of the engineering firm. The two brothers immediately started to make contacts from their past experiences and acquired some analytical work on components performing a standard test called DPA (Destructive Physical Analysis) for certain major military programs through aerospace prime contractors. In times of need for expertise and manpower, the brothers called upon the same personnel they utilized in the engineering firm. As the business in the engineering firm declined due to fluctuations of the aerospace business, the testing and analytical business increased due to outsourcing of inspection and testing by the same prime contractors. This provided a smooth and natural transition for DPA Labs, Inc. from an engineering firm to a 40,000 square foot world class "Total Solutions" facility for high reliability electronic piece parts.

Growth and Development

The growth pattern of DPACI since 1979 parallels that of the military and aerospace spending of the United States Department of Defense. In times of low demand for value added services to electronic piece parts by the military, DPACI has shifted its marketing emphasis to manufacturing hybrids and custom packaging of space level devices to compensate for the shift.

Business Ecosystem Setbacks

One major setback which affected the growth of the entire high reliability industry in the United States in general was the Perry initiative of 1991, which stated that all new designs of DOD programs shall use “best commercial practice”, which immediately liberated all QPL parts lines that provided military parts. Major manufacturers such as Motorola, Intel, Phillips Semiconductor, etc. took the opportunity to get out of the military business since the budget was shrinking anyway. With the emphasis on using commercial parts for new programs, some added value on electronic piece parts was not needed and therefore the testing, manufacturing and analysis budget for piece parts was diminishing in the military.

Following the Perry initiative, in 1992 DPA Labs, Inc. had created a completely independent commercial test facility in Las Vegas, Nevada for the purpose of testing high volume commercial semiconductors and memory chips, while the facility in California continued to do military and aerospace business. In the years to follow, the overseas competition for the commercial parts business got fierce and DPA closed the Las Vegas division in 1995. The marketing effort generated in that facility initiated the foundation for DPACI’s international business today.

Northridge Earthquake

Another major setback to the growth of DPACI was the Northridge Earthquake of 1994. DPACI was in the midst of becoming recognized as a manufacturer of high reliability components for the military and aerospace industry. All the manufacturing facility and equipment was in place for high production on contracts acquired. The 6.9 earthquake set DPACI back approximately two years in growth due to the re-capitalization of some damaged assets (FEMA) and winning back customer confidence from competition rumors.

Vision Statement:

DPACI International will be a major contributor to the high reliability of mission critical systems in the military and aerospace industry. DPACI will be known as the “Company with Integrity” for high reliability applications.

13.0 COMPANY ORGANIZATION

The present company organization at DPACI is a hierarchy organization that concentrates on the development, procurement, fabrication, and test of high reliability electronic components. An up to date organizational chart can be found on our latest QA Manual DPA-OID-0003.

14.0 KEY EXECUTIVE PERSONNEL

The founders of the corporation, Doug and Phil Young, have devoted their careers to the creation of a company that specializes in providing high reliability integrated circuits, semiconductors, and hybrid assemblies to the military and aerospace industries.

Doug concentrates on the business aspects of the corporation, while Phil provides the technical leadership in attaining corporate capabilities. Their collective efforts have created a technically strong, well managed, and highly focused organization which specializes in supplying high reliability semiconductor devices to the electronic systems industry. In order to realize their goals, they have built a modern facility outfitted with state-of-the-art equipment, operated by an exceptionally talented and skilled work force.

Other key personnel are as shown in the Company Organization Chart including:

Quality Assurance – Douglas Young is the QA Systems Manager with Aaron Resella as the QA Manager of SQA and assisting all quality audit functions of DPACI.

Human Resources – Dee Anna Shedlock is in charge of all human resources and payroll.

Controller – Wayne Popp provides all finance and budget functions of the corporation.

Marketing/Sales – Douglas Schweitzer is responsible for the worldwide marketing and sales activities for DPACI.

Operations – Douglas and Philip Young together have over 50 years of experience in the high reliability electronics industry. The Young brothers account for all operations via six department managers: Manufacturing, Engineering, Analysis Laboratory, Sales/Marketing, Production, Fixture Fabrication.

14.1.1 <u>Personnel Resources</u>. All personnel at DPACI are located at 2251 Ward Avenue, Simi Valley, California, in a modern 40,000 square feet facility. The skills classification and experience of the work force in-house are as listed below:

Management – Program Managers, Department Mangers, Technical Supervisors
Technical – Engineers, Technicians, Analysts, Programmers
Administrative – Accountant, AP/AR personnel, Customer Service
Procurement – Buyers, Planners, Expediters
Marketing – Sales, Inside Sales, Quoting
Support – Clerks, Parts Handlers, Facilities Personnel

15.0 FACILITIES AND EQUIPMENT

In 1990, DPACI had a 40,000 square foot facility constructed specifically to support the corporate goal of expertise in component engineering solutions. This facility is unique in that the central theme of the design was to create special engineering, manufacturing and test capabilities to produce value-added and custom components. All equipment listed in tables are presently in use, continuously maintained and periodically calibrated.

15.1 Testing Facility and Equipment. The electronic test and screening facility has 4000 sq. ft. of raised floor construction which distributes cooling air to test equipment, and which allows easy reconfiguration of power and equipment to keep pace with ever-changing test technology. Equipment locations within this area are easily changed to improve test flows and overall efficiency. This raised floor area is environmentally controlled to limit temperature excursions and maintain a stable and clean air workspace. Table 15-1 lists the equipment currently utilized in this facility.

15.2 Custom Packaging Facility and Equipment. Of special interest in the DPA facility is the Custom Packaging assembly facility, which includes a 3000 sq. ft. clean room devoted to assembly and packaging of high reliability components and devices. This Class 1000 clean room is equipped to package high reliability devices to QML Level Q and V, MIL-STD-883 “S/B” and hybrid assemblies to MIL-H-38534 Class “K”/”H” requirements. The list of equipment contained within the clean room is shown in Table 15-2.

15.3 Environmental and Test Facility Equipment. A modern environmental test facility is operated to support the many and varied environmental test requirements of high reliability components and devices. The temperature and burn-in chambers can provide temperature extremes to meet the severe test requirements of today’s high reliability components and devices. The facility also contains mechanical shock and vibration capabilities to meet the military stress screening requirements of MIL-STD-883 and MIL-STD-750. Table 15-3 lists all of the environmental equipment itemizing each item’s capability.

15.4 DPA / Component Analysis Facility and Equipment. DPACI has a unique Component Analysis Laboratory with electrical and chemical analysis capabilities to conduct detailed physical analyses of device failures and workmanship. Both Destructive Physical Analysis (DPA) and Failure Analysis (FA) are carried out in facilities designed specifically to allow these important tasks to be performed. All outputs and results from the laboratory can be digitally transferred to anywhere in the world. The Component Analysis laboratory is equipped with state-of-the-art equipment as shown in Table 15-4.

15.5 Engineering and Administrative. The engineering and administrative functions of DPACI occupy 5000 sq. ft. of primarily office space in support of the main operations of the business. Each engineering and administrative work station contains desk space and networked personal computers to allow effective performance of duties. These work spaces are adjacent, and provide immediate access to, the fabrication and testing facilities.

Table 15-1 Electronic Test Facility Equipment List

Equipment:	Description:
Teradyne – Ultra Flex HD w / Mix Signal implementation	High Performance Digital Memory and Mixed Signal SOC with 192 I/O channels 500 Mbs, expandable to 1024 pins.
Teradyne Voyager (aka MCT 1149)	VLSI integrated circuit test system, up to 228 I/O channels, and 50 MhzTeradyne Strobe capability, expandable to 768 channels.
SZ Test Systems M3650	VLSI mixed signal ATE, 190 pins digital, 64 pins analog.
Schlumberger Sentry 20 Schlumberger Sentry 21	SSI, MSI, LSI, digital integrated circuit test system. Full test and characterization. Capability up to 120 pins, with multiple test heads.
LTX CP80, TS80, DX90, CP90	Linear / Analog, Data signal processing, hybrid and linear/digital test system.
LTX Synchro Resolver	Data signal processing, hybrid and linear/digital test system.
Analog Devices LTS 2020	Linear, A/D and D/A test capability.
Data I/O Unisite	Programming & verifying PLD, PAL, and EPROM;s.
Lorlin Impact III	Discrete semiconductor ATE, optocouplers, discrete arrays, 4 test heads, up to 200 Amps, 2000 volts.
STI 5150	Discrete semiconductor ATE, high and low current tests.
SAI /SAGE OAI235	Thermal parametric test system for die attachment.
Data Acquisition Software	RF Circuit Design and programming for data acquisition, Rack & Stack Instrumentation.
Bruno-1, -2 Surge Current System	10,000 cycles programmable surge current tester.
Anritsu 37247A	RF components, Vector network analyzer, 40 Mhz to 20 Ghz.
AGILENT 5071B ENA Series Network Analyzer	30 KHz – 8.5 GHz, ENA Series Network Analyzer
AGILENT E4980A LCR meter	20 Hz – 2 MHz, Precision LCR meter
AGILENT 8753ES Network Analyzer	30KHz – 6 GHz, S Parameter Network Analyzer
AGILENT 4405B ESA-E Series Spectrum Analyzer	9KHz – 13.2 GHz.
AGILENT E4419B, AGILENT E4419B	EPM Series Power Meter

AGLENT ESG - D3000A	250 KHz – 3 GHz Digital Signal Generator (Qty. 3)
TEKTRONIX TDS 5104B,	Digital Phospher Oscilloscope 1GHz, 5GS/s
AGILENT 53230A	350MHz – 20ps Universal Frequency Counter/timer
AGILENT 34970A	Data Acquisition/Switch Unit
Orion III ATE Platform (RF)	Custom Rack & Stack Test System for RF Parametric Testing
Anritsu MS2601A	Spectrum analyzer, 100 hz to 2.2 Ghz.
Anritsu 37369D VNA	Lightning VNA 40 MHz to 40 GHz.
Gen Rad 1658 (2), Gen Rad 1687B Wayne Kerr 4220	Automatic LCR bridges.
Sym Tek HC5 (3)	Hot/cold dip handler with 5 rail load capacity.
Hewlett Packard 4191A	RF impedance analyzer, 1 – 1000 Mhz.
Hewlett Packard 8563A	Spectrum Analyzer, 9KHz to 22GHz.
Hewlett Packard 436A	Power Meter.
Hewlett Packard 4284A	Precision LCR meter, 20 hz to 1 Mhz.
Hewlett Packard 3048A	Phase Noise Analyzer Test System.
Aglient N8974A	Noise Figure Meter 10 MHz to 6.7 GHz.
Anritsu ML2437A	RF Power Meter.
RVSI Systemation MT-30	Tape & Reel machine, with TP-150 force peel tester.
Temptronics TP0412A (2)	Precision forced air temperature testing.
Temptronics 4010A (2)	Precision forced air temperature testing.
Wafer Prober - Electroglas 4080	Automatic wafer prober with cassett handler and hot chuck for 4"-8" wafers. Interface available to LTX, Ultraflex, SZ, Sentry test heads.
Various Electronic Measuring & Forcing equip	Tektronix, Hewlett Packard, Power Design, Sorensen, Keithley, Kepco, Wayne Kerr, Lambda, Fluke, Meters, power supplies, gauges, fixtures for bench test, etc.
ABI Sentry Counterfeit IC Detector	Signature analysis of IC pins, unknown vs. known good parts.
ICMS 7000 Technology System	Programmable ESD Tester with options for high pin count.
Temptronics TP04300A (3)	Precision forced air temperature testing.
Temptronics TP04000A (5)	Precision forced air temperature testing.
Xeltek Superpro 6004GP	Universal IC Chip Programmer
IR Labs	Custom Cryostat (vessel to maintain constant low temperature). Used for RF component analysis and testing down to 5 degrees K.

Table 15-2 Custom Packaging Equipment List

Equipment:	Description:
Clean Room	Federal STD 209E Class 1000. Atmospherically controlled and monitored assembly inspection laboratory with Class 100 workstations.
Benchmark International Inc. ALPHA-1500SR	Projection welding system (for hermetic seal using metal cans).
Cleantech Dry Nitrogen Cabinet (8)	10 bay dry nitrogen storage cabinets.
Kulicke & Soffa 1488 Turbo	Automatic wire bonder-gold ball bonding.
Kulicke & Soffa 1474V/FP	Automatic wire bonder-aluminum wedge bonding.
Orthdodyne Electronics Model 20-R	Large wire diameter ultrasonic wedge bonder.
K & S Model 4124-21	Manual thermosonic wire bonder.
Westbond 7400A	Manual thermosonic wire bonder.
Scientific Sealing Technology (SST) Model DAP-2200	Hermetic package sealer for metal reflow lid attach.
Solid State Equipment Corp. 2000D4382	Vacuum furnace and environmental system.
Solid State Equipment Corp. 2200DLL	Parallel seam sealer with digital lid locator.
VAC Vacuum Atmospheres AH2051	Moisture analyzer.
VAC Vacuum Atmospheres 10-1	Oven controller.
VAC Vacuum Atmospheres 803N	Gloved vacuum dry box.
VAC Vacuum Atmospheres N0-40-2H	Vacuum pump.
Solid State Equipment Corp. Model 1000C	Parallel seam sealing machine.
Solid State Equipment Corp. 1000p-13	Parallel seam sealer power supply.
Vacuum Atmospheres Company Model OC-1 VAC	Inert atmosphere with microprocessor controlled vacuum bake entry moisture analyzer – 4 glove – environmental chamber.
Mech-El Model 709	Semiautomatic die bonder.
Westbond, Inc. 7200A (2)	Semiautomatic die bonder.
Westbond 7476E	Wire bonder, ball and stitch.

Equipment:	Description:
Sebastian III	Tensile Tester for die attach integrity.
Leitz ErgoLux	Wafer Microscope.
Nikon (4)	Low power Microscope.
Hesse & Knipps BJ-820	Automatic fine-pitch Aluminum & Gold wedge bonder.
Miyachi Laser Marking System	Laser marking system for labeling of parts.
Sikama Furnace	Falcon 5-C belt furnace for solder reflow, lid seal.
DPVEEN 1200	Manual die bonder
Watkins/Johnson Model 1545	Conveyor furnace – lot temperature silver glass firing processor
Dage 2400PC automatic Bond Pull Testers	For automatic non-destructive and destructive testing of bond wires.
Fancort Industries (2)	Pneumatic lead form/trim.
Blue M Model OV-472-2	Epoxy cure oven.
Sikama Model Falcon 5X5	Component reflow system.
Universal Instruments Model 17 8”x10” Screen Printer	8”x10” Screen Printer for part marking
Sony Model UP-1800MD	Color video printer.
Nikon Opti-shot	75-600X high power microscope with Sony DCX-960MD 3660 color video camera.
Olympus-SZH	Low power 7.5-64X zoom inspection stereoscopic microscope.
Mitutoyo Model TM	Optical measurement scope 30X.
Vistascope Model 600	Optical comparator 20X
Vacuum Atmospheres Company Model LPC-525A	Laser particle counter.
Thermco 422	1100°C firing furnace.
Simcon Top Gun F10	Ionization gun.
Olympus BHM	High power microscope.
Fancort Industries (2)	Pneumatic lead form/trim.
Mark-10 BG200	Digital depth tensile gauge and tester.
Quantum Materials 750	Tensile tester.
Fluke 51 K/J	Thermometer.
Flovel Engineering LTD FV-21	Camera.
TOEI Musen Co. TMC-9M	Picture monitor.

Equipment:	**Description:**
Semiconductor Equipment Model 4450	Hybrid hot gas die remover
MIDAS Technology DL-4	Hybrid delidder
White Box, Inc. H65 T6	Temperature/humidty recorder.
Charge-Guard 3M 740	Wrist strap / heel strap tester.
NIKON MEASURESCOPE, MODEL II	CALIBRATED LINEAR MEASUREMENTS UNDER MICROSCOPE
NAVITAR DIGITAL MEASURE SCOPE	DIGITAL OUTPUT FROM SCOPE MEASUREMENT
CLEATECH ESD SAFE DRY NITROGEN WAFER/DIE STORAGE CABINETS	/DIE STORAGE CABINETS WITH AUTOMATIC PURGE CONTROL UNITS
NIKON SMZ-1B MICROSCOPES VARIOUS MAGNIFICATION POWER	VARIOUS MAGNIFICATION POWER
SEBASTIAN	FIVE DIE/STUD PULL TESTER
LAB-LINE DUO-VAC, THERMAL/VACUUM OVEN	THERMAL/VACUUM OVEN CHAMBER

Table 15-3 Environmental / Burn-In Test Equipment List

Equipment:	Description:
BMA ECL 1	Humidity chamber.
ESPEC EHS-221M	Highly accelerated stress test (HAST) chamber.
ESPEC TPC-212M	Highly accelerated stress test (HAST) chamber.
EG&G Wakefield Systems (4)	Computer controlled high reliability burn-in chambers with racks and boards.
Advanced Microtechnology, Inc. AMT Optimum 16000	The Burn-In chamber is 18 Cu FT. 56 position test rack with 88 Signal I/O Feed thru interface. (We currently have 21 positions with Drivers) 11.45” x 23.6” BIB format. Temperature Range is 80- 150C.
AEHR Burn-in Systems MAX-64000 (2)	Dynamic burn-in system with network controller. Pattern generator – 32K vector depth, 5/10 Mhz.
Blue M/ESP-400C (14)	High temperature burn-in chamber.
AMT 7000 (2)	Burn-in oven with chart recorders.
Despatch (3)	Burn-in ovens with large capacity.
Bruno-2 ACOL Burn-in (3)	ACOL Burn-in system ½ AC (Io=240A max), ½ VR (1500Vmax), 8.3 ms
LJ-3 ACOL Burn-in (3)	ACOL Burn-in system ½ AC (Io=150A max), ½ VR (1000Vmax), 8.3 ms
Delta Design 9039 Tenny Versa Tenn II	Programmable temperature cycling chamber.
FTS Systems MC880A1	Temperature bath ambient/cold constant temperature circulator.
Cole Parmer Ploystat 12100	Temperature bath ambient/hot constant temperature circulator.
Associated Environmental Systems MX-9204	Salt spray chamber.
BMA AH-2002	Humidity chamber, programmable, microprocessor controlled.
VTS-100 BMST-E500	Sine and variable vibration test system for electronic components.
B&W MST-C3000	Mechanical shock tester for electronic components.
Trio-Tech Int. C103-006	Centrifuge.
B&W B-2000 PIND	Particle impact noise detection tester.
B&W B-LPD-D4000 Tester	Particle impact noise detection tester.
Trio-Tech Int. G-489, G-400 (2)	Pressurization system, flurocarbon gross leak.
Trio-Tech Int. S-203	Bubble leak detector for gross leak.

Equipment:	Description:
Veeco MS-40	High production fine and gross helium leak detector.
Sikama Vapor Reflow	Programmable ramp rate oven used for Pre-Conditioning of HAST testing
Robotic Process Systems ST-1, ST-2	Programmable steam aging system.
Robotic Process Systems 202 TL	Programmable solderability tester.
Infrared IC heater T-962A	IR Reflow system for soldering.
ESPC TSE-11-A (2)	Thermal shock chamber - 65ºC/150ºC.
Test Equity 3000	Programmable Temperature Chamber.
Test Equity 3007C	Programmable Temperature Chamber -72C to +175C.
GPD LTS-1000	Solderability Test / Tinning machine, robotic, programmable, automatic.
Test Equity 123C	Programmable Temperature Chamber.
Test Equity 107	Programmable Temperature Chamber.
Test Equity 115	Programmable Temperature Chamber.
BMA BHD-403 (3)	Moisture chamber, 80/85, Variable.
BMA LH 1.5 (2)	Humidity chamber, 80/85.
Dickson PRO SERIES	Temperature data logger system for all chambers, read & record graphs.
PAD PRINT OF VERMONT PAD PRINT MARKING MACHINE	PAD PRINT MARKING MACHINE
MARKEM 527	WARNOW INK MARKING MACHINE
MIYACHI/UNITEK	LASER MARKING MACHINE
ROBOTIC PROCESSING SYSTEMS, ANTHEM TINNING/SOLDERABILITY MACHINE.	ANTHEM TINNING/SOLDERABILITY MACHINE.
RVSI SYSTEMATION MT-30	TAPE & REEL MACHINE
SYSTEMATION TP-150	PEEL STRENGTH ANALYZER
Q-CORPORATION REEL TO REEL PARTS COUNTER MACHINE	REEL TO REEL PARTS COUNTER MACHINE
AMERIVAC	NITROGEN/VACUUM HEAT SEALER MACHINE
B & W PIND TESTER, BW	, BW-LPD-D4000 WITH STU UNITS BW-012
PIND ARBOR PRESS FIXTURE	WITH DIGITAL FORCE GAUGE PRESSURE LIMITER

Table 15-4 DPA / Component Analysis Laboratory Equipment List

Equipment:	Description:
NEOPHOT 21	Uses: Cross-sectioned samples for metallography. Magnification ranges from 50X to 4000X. Optical, screen, and digital camera viewing.
Wild 246634 Microscopes (2)	Range: 4.36X to 88.2X.
Leitz Weitzler Microscopes (2)	Range: 89X to 620X.
Leitz Laborlux 12HL Organic microscopes (2)	For detecting organic contaminants and particles.
Nikon SMZ-2T Optical microscope	Range: 10X to 63X.
Cannon Rebels DSLR T3I cameras (2)	18 Mega Pixel, low power magnification
Olympus CMOS cameras (4)	for high and medium power microscopes
Olympus BH (2)	High power microscopes
Nikon UV Fluorescent high power microscope	Dye Penetrant Testing
Hitachi Scanning Electron Microscope S3400N (2)	With EDS/EDX unit – IXRF Systems model 500i
Hiatchi 2400 SEM / Thermo Fisher Noran System 7 ESD Unit.	Scanning Electron Microscope with up to 300,000X magnification. Coupled with the Noran Ultra dry Energy Dispersive X-ray Analysis (EDXA/EDS) spectral imaging system for elemental analysis.
Robinson Detector Model RBH-2400M	Mounted on Hitachi S-2400 SEM. Imaging using backscattered electrons. Differentiates metal surfaces with more that 5 atomic numbers difference. Also, used to view contour of metalized surfaces.
Thermoscientific/Nicolet iS5, FTIR tester	Material correlation analysis with certified data library.
XTek Real Time X-Ray	Up to 160Kv in real time images with digital imaging.
Feinfocus X-Ray	Model FXS/100/25
Nicolet X-ray machine	Model NXR 1400
Hewlett Packard 43805N X-ray Systems	Faxitron series. Up to 110KV. Single cabinet.
Sonoscan CSAM System D-9000 (2)	Acoustic Scanning Acoustic Microscope System.
Micromanipulator 6000	With liquid crystal hot spot detection capabilities for F/A.
RIE PETS	Planar plasma system for removal of glassivation and contaminants from die.

XRF – SII Model SFT9250	Voltage 45(kV) Prohibited Material Analysis
Royce 650	Bond pull, ball shear and die shear tester.
Chatillon Force Gages	For non-destructive and destructive testing of die.
LADD and Hummer VI Gold Sputter Machine	Used for preparing non-conductive samples for SEM viewing by applying a thin layer of gold over the surface.
Lead Integrity Testers	Used for applying load cycles to leads of electronic packages to determine their resistance to fatigue.
March Plasmod	Barrel system for reactive ion etching of glassivation from die surfaces.
Bausch and Lomb Stereozooms III, IV,VII (6)	Low–power microscopes: Range 10X–63X
Unitron BH Metallograph	Invertescope Metallographic System for examination and photomicrography of cross-section samples.
Dage 23 Bond Pull Testers	For non-destructive and destructive testing of bond wires.
Cross-sectioning wheels (7)	With capabilities from 80 grit to ¼ micron diamond. Glass wheel for cross-sectioning metallization on die.
Nikon SMZ-1 & 1B (4)	Low-power microscopes: Range 10X-63X
B & G Lid Torque Testers	For determining strength of frit glass sealed packages.
Ultraviolet Lamps	For fluorescent gross leak dye penetrant test.
Buehler Isomet Low Speed Diamond Wheel Saw	For sectioning.
Nisene Jet Etch II	Plastic decapsulation for die inspection and accurate bond pull analysis.
Xerox Phaser 7400 Color Laser Printer (2)	High resolution color printer for reports.
Mettler AG145 Toledo Scale	Micro measurements from 41g to 210g d-0.001mg, 0.1g
Omega Solder Melting Temperature Tester	For determining melting points of solders and other material.
Technic PETS-1 Plasma Etching System	Planar plasma system for removal of Silicon-Nitride glassivation, oxides, and contaminants from die, microprocessor controlled for repeatability.
Dillon Snap Shot Tensile & Compression Test System	PC based mechanical test system for measuring ultimate tensile strength, compression, flexing characteristics, elongation, Poisson’s ratio, time-to-rupture curves of leads, PWB’s, terminals, welds, solder joints.
Zeiss Universal Microscope	Hi-magnification optical microscope for general microscopy laboratory inspection work. Range 50X – 1,000X
B & G Model 250 Decapsulator	Microprocessor controlled automatic acid etching system to decapsulate plastic encapsulated I.C. devices to expose internal die for analysis.
Sony video 3-CCD cameras with microscope adapters	High resolution cameras using PAX software for digital photo data capture and storage, networked.
MP4 Macro-photo Camera systems (2)	Low magnification photo capabilities for external visual and lagre format photo-documentation.

Nikon SMZ-2T Optical microscope	Low-power macroscopes. Range: 10X to 63X.
Buehler Cross-sectioning polishing wheels (5)	With capabilities from 80 grit to ¼ micron diamond. Glass wheel for cross-sectioning and lapping of semiconductor die.
Buehler Ecomet IV Auto Lapping System	Automatic lapping and polishing machine for cross-sectioning of samples.
Seiko Instruments SFT9250 XRF System	Microprocessor based X-ray Fluorescence (XRF) Test System for identification of lead-free solder and other prohibited materials in High-Rel components (45KV) to DIN EN ISO3497, and ASTM B568. Meaures coating thickness to high precision byt the beta-backscatter.
Kullike & Soffa 442-2 Eutectic Die-Attach Station	For removal of eutectic bonded die from packages, can also be used to de-lid metal lids from packages, crystals, and relays.
Tektronics 576, 577 Curve Tracer (4)	Curve Tracers for semiconductor electrical characterization and failure analysis work.
Intelleitest FA1800 Bond Pull tester	Wire bond pull tester for non-destructive and destructive testing of bond wires.
B & G and Motorola Can-openers	Custom can-openers for delidding of TO-5, TO-18, TO-99, and TO-3 metal can packages.
Midas Package Milling Delidder	For removal of hybrid package lids while in an inverted position to prevent milling particulates from falling into the device cavity during the delid process.
Dye Penetrant Pressure Tank and UV Light Source	For UV dye penetrant testing to inspect for hermeticity cracks or seal integrity of components.
VWR and Cole Palmer Ultrasonic Baths (2)	Ultrasonic baths for deprocessing of potting material and epoxies during wet chemical etching and acid etching and cleaning
Alphatron PT-100 Wire Crimp Pull Tester	Wire crimp pull tester with digital force gauge for testing of wire connection strength to connector crimps.
Xerox printer, Phasor 7800 high resolution printer	For color report and presentations
Thermolyne 1300 Furnace	Kiln for high temperature processing of metallurgical samples for failure analysis studies, such as Kirkendal voiding phenomena in bi-metal systems. Furnace has a maximum test temperature of +1,300ºC.