

Resume of:

## JOHN M. CARDONE

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### CAREER SUMMARY

Demonstrated accomplishments in electronic packaging and mechanical engineering.

### EDUCATION

B.S., 1983, Mechanical Engineering, California State University at Northridge, CA

### PROFESSIONAL EXPERIENCE

#### **Electro-Mechanical Engineering and Design Service Provider, 6/05-present**

*DBA, JMC Design Services, Grenada, CA (<http://www.jmcdesignservices.com>)*

Provider of superior mechanical engineering and electronic packaging support to the aerospace and consumer markets as detailed in the "Significant Tasks" section.

#### **Member of Engineering Staff, Senior, 5/83-6/05**

*Jet Propulsion Laboratory, Pasadena, CA, Section 352, Electro-Mechanical Design Engineering Group*

Performed engineering and design support on all major and most minor JPL projects. Tasks included configuration studies, structure and housing design, electronic packaging, printed wiring board layout, lead design engineering roles, design management, documentation, and documentation review. Group Leader (4/95-6/05) providing oversight and review of the work of 10 design engineers within the Electro-Mechanical Design Engineering group.

#### **Electro-Mechanical Engineering Consultant, 1/91-1/98**

*Lober and Walsh Engineering, San Luis Obispo, CA (<http://www.comdev.ca>)*

Provided mechanical engineering and electronic packaging needs to consulting group specializing in satellite and cellular telephone communications. Tasks included printed wiring board layout, electronics packaging, and injection molded enclosure design. Group purchased by Com Dev International in 1999.

#### **Electro-Mechanical Engineering Consultant, 1/88-2/03**

*DKD Instruments Inc., Nipomo, CA (<http://www.dkdinst.com>)*

Provided mechanical engineering and electronic packaging needs to engineering firm specializing in micro-computer based high frequency test instruments. Tasks included electronics packaging consultation, high frequency printed wiring board layout, and electronics enclosure design.

#### **Associate Engineer, 10/80-5/83**

*Medical Communication and Instrumentation Inc., Canoga Park, CA*

Performed all mechanical engineering and electronic packaging on a radio frequency emergency medical communication product redesign. Utilizing injection molded engineering plastics and flexible circuit interconnects, this product competed with Motorola, and as of 1995 was still in production. Original product was the orange suitcase featured on the 1970s television series "Emergency."

## SIGNIFICANT TASKS

### AS JMC DESIGN SERVICES (6/05 - PRESENT)

- **NASA/JPL, Mars Science Laboratory (MSL), Rover Cabling Design**  
Developed printed flex cabling configuration, design details, and documentation for the Mars Science Laboratory rover to be launched in 2011. This included 3-phase motor drive power, engineering telemetry, and 100 ohm controlled impedance signals implemented in printed flex cables up to 10 meters in length. The design is based on my development of the JPL MER cabling design, and returned significant mass to the project while meeting stringent electrical and thermal requirements. Additional tasks included; review all circuit data sheets, development of rover and sub-system wiring diagrams, review of mechanical interface control documents, authoring of institutional printed flex circuitry design guidelines, and system design review as member of design review boards.
- **Alliance Space Systems (ASI), Design Printed Flex Cables for DARPA, SUMO Robotic Arm (EM Phase)**  
Designed mixed signal printed flex cabling for motor control and video telemetry on earth orbiting robotic satellite. The design was based on printed flex cabling technology that I developed for JPL MER task, under challenging cost and schedule requirements.
- **Hewlett-Packard, Multi-Zone Printed Flex Heater**  
Designed and documented flexible printed circuit heater comprised of 8 zones, tuned to specific thermal output densities, with over 14,000" of circuitry routed around 22,000 obstacles. The design challenge was referred to JMC Design Services after HP design engineers failed in their attempts.
- **Alliance Space Systems (ASI), Packaging and Structural Design for the Terminal Descent Sensor Assembly for use on the JPL MSL Mission**  
Designed and documented a thermally stable honeycomb sandwich structural panel with numerous unique kinematic component mounts, and high density electronic cabling, while meeting stringent schedule, volume, and mass constraints.

### AS JET PROPULSION LABORATORY EMPLOYEE AND PRIVATE CONSULTANCY (5/83 - 6/05)

- **Unigraphics NX Design Process**  
Member of the Unigraphics, NX design tools implementation team. Authored institutional Unigraphics NX design guidelines for the JPL mechanical engineering and design community.
- **Small Business Innovative Research (SBIR) Technical Monitor**  
Provided oversight and review of Phase I and Phase II SBIR technology development program of a castable silicon carbide material for use in thermally stable optical instruments.
- **DAWN, Solar-Electric Ion Thruster Gimbal**  
Provided lead mechanical design and documentation of unique solar-electric ion thruster gimbal which met a stringent mass allocation. Launched in 2007, DAWN will study asteroids within our solar system.
- **Mars Exploration Rover Electronic Packaging and Cabling**  
Proposed and developed the rover's electronic packaging and cabling scheme. Designed the rover's internal printed flex cabling which carried over 1600 signals to the rover's exterior. Provided design of, and/or design oversight, and review of the rover's subsystem printed flex cabling. Managed the rover's Warm Equipment Box (WEB) mechanical configuration, and design. Simultaneous member of the mechanical, avionics, and systems engineering teams. Developed and maintained the rover's system wiring diagram. These rovers are approaching 5 years of continuous operation beyond their initial, as designed, life of 90 days.

- **Jason-1, Turbo Rogue Space Receiver (TRSR), Electronics Packaging Design**  
Proposed, developed, and designed the TRSR instrument electronic packaging. Its high-density stacked configuration used a electronics packaging scheme (which I co-authored the patent of) consisting of stacked rigid-flex pwbs, and elastomeric connectors.
- **Micro-Spacecraft Technology Development (MTD) Program**  
Lead mechanical engineer of R & D program to develop innovative configurations and design solutions to enable the Second Generation Micro-Spacecraft concept, including silicon carbide structures, multi-functional design concepts, and ultra high-density electronics packaging.
- **DKD Instruments, 2.4GHz Spectrum Analyzer**  
Designed and documented the printed wiring board, and enclosure of 2.4GHz spectrum analyzer.
- **Topex/Poseidon, Solar Array Drive Electronics (SADE) Annex Design**  
Designed and documented an electronic package exposed to extreme thermal and radiation conditions using unique shielding methods. Design was developed under challenging schedule requirements to correct original design flaw in earth observing satellite that was otherwise ready to launch.
- **Mars Pathfinder Rover Electronic Packaging and Cabling**  
Proposed, developed, and designed two 30 layer rigid-flex printed circuit interconnect boards that resulted in an estimated mass savings of 1 kg while meeting stringent volume, noise isolation, and thermal isolation requirements in a severe operating environment. This was the first such application of rigid-flex printed circuit boards at JPL, and at the time, was the highest layer count produced by any known fabricator.
- **Lober and Walsh Engineering, Voice Box**  
Designed printed wiring board, electronics packaging and injection molded enclosure for aid to the hearing impaired community.
- **Cassini Pyro/Power Subsystem**  
Designed, and documented the Power/Pyro subsystem electronics packaging. This very high-density, high power assembly (filling 2 of the spacecraft's 8 electronic bays) resulting in a return of mass, and volume allocation to the project while exceeding subsystem requirements. This was JPL's first flight use of thru-hole technology flexible connector circuits.
- **Multi-angle Imaging Spectro-Radiometer (MISR), Electronic Packaging**  
Designed instrument electronics packaging, interconnect scheme, and configuration from initial concept to final documentation. This was JPL's first flight use of Rigid-Flex printed wiring boards that resulted in significant assembly schedule savings.
- **Mars Observer Spacecraft**  
Designed and documented the power subsystem electronic packaging. This mission was lost on entry into Mars orbit, but the power subsystem was subsequently used on the Mars Global Surveyor, and 2001 Mars Odyssey missions.
- **Soft X-Ray Telescope (SXT), Camera Development**  
Designed and documented a compact CCD camera using thermally stable composite materials. This camera has been incorporated on several aerospace applications.
- **Galileo, Command Data System (CDS) Electronic Repackage**  
Designed and documented 28 high-density printed wiring boards for the Galileo CDS. The effort was JPL's first demonstration of a full schematic to printed wiring board CAD design process.
- **Galileo, Command Data System Memory Module Repackage**  
Designed a high-density memory module to replace a failed ceramic substrate memory module of the CDS with JPL's first flight use of copper-envar-copper printed wiring boards.

## COMPUTER SYSTEMS/PROGRAMS

- Platforms: Unix, DOS, Windows, common office applications
- Programs: Unigraphics NX, ProE, Computervision, Solidworks, Autocad, OrCad, Protel, Mentor
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## PUBLICATIONS

- Design Practices in Unigraphics-NX, JPL Internal, 3/05
- Design, Modeling, and Integration Procedures for Printed Flex Cables, JPL Internal, 2/09
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## ACKNOWLEDGMENTS, CERTIFICATIONS, AWARDS

- Group and individual awards for efforts in Avionics, Systems Engineering, and Mechanical Design groups supporting the Mars Exploration Rover design
- U.S. Patent D487,715 S, co-author, "Mars Exploration Rover Athena"
- U.S. Patent 6,206,705, co-author, "Three-Dimensional Modular Electronic Interconnect System"
- William T. Pecora Award (DOI/NASA) for design of Topex/Poseidon earth science instrument
- Cassini Program Structures Design and Analysis Team; Group Achievement Award
- NASA Commendation for AES ADC Repackage Effort
- Metric Orientation for Technical Employees; Certificate of Achievement
- Hardware Engineering; Certificate of Achievement
- Topex/Poseidon Satellite Integration, Test and Launch; Group Achievement Award
- Mars Observer Pressure Modulator Infrared Radiometer; Group Achievement Award
- Total Quality Management; Certificate of Recognition, Electronic Parts Library
- UARS, Active Cavity Radiometer Design and Development; Group Achievement Award
- SXT Camera Development; Group Achievement Award
- Engineering Drawing, Dimensioning and Tolerancing; Certificate of Achievement

## PROFESSIONAL REFERENCES

### **Robert Keskinen, Supervisor (retired), JPL, Electro-Mechanical Design Engineering Group**

"John's performance in all aspects of his work is above reproach. He has been and still is the best designer in my group. He works at the highest level possible, always giving 100% to all he is asked to do. He has always taken the initiative on any project he has been involved in, and has tried to improve the process. John is an excellent designer and engineer. He has all the skills and willingness to do any job JPL has."

### **Lowell Stewart, Master Engineer, HP, Client of JMC Design Services**

"I asked John to lay out a difficult Flex PCB after two other (very good) layout people had tried to do the job and failed. John did a wonderful job very quickly. The final product worked the first time, it was well documented, and it looked nice. John was excellent to communicate with. He identified problems with the original design and suggested solutions. He handled changing design specifications well. Bring him your toughest design problems, he made mine look easy!"

### **Angel Garnica, System Cabling Group Supervisor and Technical Contract Manager for JMC Design Services Subcontract to JPL, MSL Project**

"John Cardone retains unique key esoteric technical experience in the design and implementation of flexprint cables for Mars Spacecrafts. He's been the primary lead designer for the last eleven months on the flexprint cable designs for MSL. Furthermore, as a JPL employee, he designed the flexprint cables for both the Mars Pathfinder and Mars Exploration Rover (MER) projects. The flexprint cable designs were an essential part of the operation, performance, and success of these spacecrafts. There currently is not an individual at JPL that has the experience and retains the necessary skill mix to design flexprint cables for the MSL project. It is imperative that John Cardone become a part of the MSL Flight Harness Design team as he will provide expert advice, guidance, and designs for the MSL flexprint cables."