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PARTIAL LIST OF COMPLETED AND ONGOING CONSULTING PROJECTS

RGB Laser

For initial prototype product in 2009-2010, designed and fabricated over $100k in custom alignment tooling including but not limited to;

- Demountable kinematic optic mounts
- Demountable kinematic position references machine to tolerances <3um.
- Precision custom flexure tip, tilt and position stations, resolutions 1um, 1 arc-sec
- Detail drawings and reviews.
- Material selection and finishing.
- Bonding materials and procedures.
- Optics and component mounting and fixation methods
- Structural and thermal analysis of system having active cooling system
- Materials selection including 2-part epoxies, UV cure epoxies, metals and plastics
- Tight collaboration with client and contract manufacturer
- Production drawings
- Thermal heat analysis and design of cooling system
- Thermal stress analysis of laser components for minimizing thermally induced distortions
- Structurally analysis of optic mounts for minimizing mount induced distortions
- Structural analysis of system for stiffness, stress and 1g sag.

Tooth Imaging System

Provided design reviews and design consultations of tooth optical imaging system as it progressed including review and design of alignment and assembly tooling. Designed, fabricated and assembled and delivered two precision (1 um res.) 6-axis laser diode alignment stations.

- Optomechanical design and engineering support of existing tooth imaging system test bench.
- Optical alignment tooling design, fabrication and delivery.
- Detail drawings and reviews.
- Material selection and finishing.
- Bonding materials and procedures.

Jet Fighter Surveillance Camera

Provide detail design reviews and design consultations of product as it progresses. Additionally, provided the following:

- System structural and dynamic analysis of gimbaled imaging system.
- Isolation system design review and analysis.
- Design of thermal stress compensated bearing interfaces.
- Design of alignment procedures and tooling.

Heat Engines

Principle mechanical engineers responsible for the design and development of novel alternative energy heat engines. Responsibilities include structural analysis, mechanical design, requirements definition and project scheduling. Provided fabrication and assembly of prototypes.

Project 1: Concentrated Solar Engine Prototype

- Designed a prototype of the core technology flexure guided reciprocating engine.
- Presentation to technology to investors.

Project 2: Heat Engine Prototype. For the following project, provided all the mechanical engineering, analysis and detail drawings of a heat engine based on a four-cylinder diesel engine. Also provided manufactured and purchased parts and final assembly and testing. Major tasks include the design/analysis of the following:

- Design of completely new cylinder head with novel metal seating poppet valves.
- Desmodromic cam train including cams, rockers, camshaft, cam chain and cam block.
- Cam train dynamic loads and life analysis.
- Custom engine vibration isolators.
- ASME certified pressure vessel for containment of heat engine.
- Magnetic drive coupling, splined drive shaft and installation tooling.
- Generator drive train design.
- Globe valve actuator for system control and emergency shutdown.
- Electrical hermetic feedthrus.
- Thermally isolated and hermetic fluid feethru.
- High pressure (725 psi) high temperature (400 F) plumbing.
- Design and analysis of system space frame to house and support all mechanical components and generator (3500lbs total).

Solar Panel Mounting Systems

Principal mechanical engineers responsible for the concept design, development and analysis of solar photovoltaic mounting systems. These are low cost, quick install ballasted and fixed solar panel mounting systems. All products are in production and in service. For these efforts, Exact Engineering provided the following design, engineering and structural analysis services.

- Design of machined, sheet metal, extruded, cast and forged products for high volume production (millions per year).
- Development of manufacturing processes for cost reductions of up to 75% for high volume products.
- Structural analysis and CFD analysis of all products.
- Wind tunnel testing.
- Production Drawings
- Design of three Flat Roof ballasted systems.
- Design of two Flat Roof attached systems.
- Design of two Ground mount systems.

Real Time X-Ray Imaging System
Mechanical design and improvement of a real-time medical x-ray imaging system.

- Design of optical packaging.
- Electronics packaging.
- Optical alignment/assembly tooling.
- Production drawings

Handheld IR Camera
Lead Optomechanical engineer responsible for design and analysis of a handheld IR imaging system. Design of the optical bench and all optic mounts for a multi-mirror reflective/transmissive optical imaging system. Designed, fabricated and delivered a 13 axis optical alignment and bonding station, an optical measuring microscope and optic mount bonding fixtures.

- Provided optomechanical design of a multi-element reflective/refractive optical system.
- Designed system optical bench structure.
- Performed FEA for static, dynamic, temperature and shock loads.
- Support of presentations for TIM's, PDR and CDR.
- Developed optical alignment procedures.
- Selected epoxies and developed bonding procedures.
- Designed and manufactured the following tooling.
    - 13 axis optic alignment station.
    - Optical measuring and alignment microscope.
    - Optic mount bonding fixtures.
- Onsite alignment support and training of personnel.

UAV Sensors

Lead mechanical engineer responsible for design and analysis of high precision stabilized UAV (unmanned air vehicle) surveillance cameras.

Project 1: UAV Stabilized Camera

Lead mechanical engineer for a UAV camera for the protection of the US Navy Fleet. Major tasks include design and analysis of the following

- Athermal kinematic demountable mirror mount.
- Frameless servo motor actuators.
- Voice coil and servo actuated two-axis scan mirror.
- Composite graphite/titanium insert dome structure.
- Composite graphite layup and analysis for strength, stiffness, CTE and bonded metal inserts.
- Light-weighted AlBeMet mirror scan mirror and AlBeMet optical bench.
- Prediction of mirror surface figure distortion due to actuation accelerations, thermal loads and mounting.
- FEA for whole-system static, dynamic and thermal loads.
- Supplier visits to ensure products met specifications and provide engineering and manufacturing support.
- Detailed drawings for all manufactured parts and assemblies
- Manufacturing of select components.
- Supported presentations for TIM's, PDR and CDR.
- Developed optical alignment concept and procedures for <10 arc second alignments.
- Designed, fabricated and assemble all alignment tooling.
- Performed alignment of system and provided training of personnel.

Project 2: UAV Visible/IR Stabilized Camera

Re-design of existing yet un-built gimbaled camera for use on unmanned surveillance vehicles.

- Engineering review and re-design of existing design to ensure performance and assembly.
- Stress analysis of components and system.
- Production drawings for all components.
- The instrument has completed testing and is currently in production.

NIR and Raman Spectrometer

Provided the optomechanical design, structural analysis and assembly tooling for the development of a number of spectrometers.

- NIR spectrometer for pharmaceutical applications.
- Raman spectrometer for pharmaceutical applications.
- The Raman spectrometer probe head. Designed an entire optical probe head including detail drawings in two weeks. System was built and assembled without mechanical issues.
- Design of alignment and assembly tooling.

Whale Saving Device

Engineered, developed and manufactured a unique device for freeing whales from entanglement in lobster buoy lines. Funding was provided by the National Marine Fisheries

- Provided design of a complex hydraulic actuator having a time delay rope cutting actuator for deep sea conditions.
- Structural analysis of system
- Manufacture and delivery of working prototypes.
- Test of system.

Explosives Detection

Designed a device to facilitate sampling of air within shipping containers for explosives detection. The device provided the interface to the shipping container and sampling machine.

- Designed a device for cutting access holes in shipping containers to facilitate sampling of the contained air.
- The cutter is unique in that it cuts a circular hole without penetrating beyond the material thickness.