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UAV-Related Capabilities of San Diego Area Companies

**A Survey Conducted by the Naval Command, Control
and Ocean Surveillance Center RDT&E Division (NRaD)**

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INTRODUCTION

During 6-8 May 1997, the Naval Command, Control and Ocean Surveillance Center RDT&E Division, commonly referred to as NRaD, hosted a meeting of the Unmanned Aerial Vehicle (UAV) Joint Technology Steering Committee (JTSC). The JTSC, which is chartered by the UAV Joint Program Office (JPO), is charged to "coordinate ongoing and proposed technology programs, identify opportunities for leveraging relevant technologies, and aid in optimizing the investment strategy for new UAV research and development initiatives." To assist the JTSC in responding to these broad objectives, NRaD has compiled this document which describes the UAV-relevant capabilities of San Diego area companies.

An additional motivation in assembling this information was to foster and encourage the pursuit of teaming opportunities between NRaD and private industry, as well as among the private industry members. Strong partnerships between the government and private sectors strengthens our nation's ability to rapidly transform invention and innovative effort into needed products and capabilities, For further information regarding the procedures available to establish and support private industry partnerships with NRaD, please contact NRaD.

For further technical information regarding UAV-related efforts at NRaD, please contact NRaD.

ADVANCED TELECOMMUNICATIONS, INC.

1. Company name, address:

Advanced Telecommunications, Inc.
Information Sciences & Simulation Division
4025 Hancock Street, Ste 200
San Diego, CA 92110-5167

2. Company URL: (In development)

3. Point of contact for UAV business, telephone number, e-mail:

Greg Bushnell (619) 221-5117 gbushnell@ati-sd.com	Rich Medved (619) 221-5152 rmedved@ati-sd.com
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4. Company Product/Service:

ATI is a leading provider of systems design, development, and integration of modeling & simulation (M&S) systems supporting Navy and Joint C4I systems engineering programs for over seven years. We successfully participate as systems integrators, planners, developers, implementers, testers, controllers, and evaluators in all elements of advanced concepts technology demonstrations (ACTDs), proof of concept operational exercises such as the Synthetic Theater of War (STOW) series, Kernel Blitz (KB) exercises, and simulations such as Navy Synthetic Forces (NSF), Marine Corps Synthetic Forces (MCSF), and the Joint Countermine Operational Simulation (JCOS).

5. UAV-related company capabilities:

Simulation Interoperability - ATI's approach to interoperability of Live, Constructive, and Virtual simulations is to create a "level playing field" between the systems which interoperate in an exercise. The major challenges in this approach are in accommodating the differences in levels of simulation synchronization, fidelity, and accuracy. The Advanced Interface Unit (AIU), developed by ATI personnel, has provided a flexible, scaleable, and configurable interface to the DIS world for a variety of exercises, including the Unmanned Aerial Vehicle - Joint Development Facility (UAV-JDF) project to interface UAV developmental hardware to DIS systems.

Synthetic Forces - ATI personnel have been developing Synthetic Forces in four specific technical disciplines: System Engineering and Requirements Definition; Knowledge Engineering and Analysis; Simulation Design, Development and Integration; and Test and Evaluation. ATI, as part of the NRaD team, is developing the MCSF Individual Combatants (ICs), ground, and air vehicle models under Project LeatherNet. ATI, as part of the NRaD team, is also developing NSF generation, control, and associated behavior at the entity level. Platforms include the Carrier Battle *Group* (CVBG) ship classes, as well as the Amphibious Readiness Group (ARG) components.

Exercise Engineering & Integration - ATI personnel successfully participate as planners, implementers, testers, controllers, and evaluators in advanced technology and engineering demonstrations, and proof of concept operational exercises such as the STOW series, and the Kernel Blitz (KB), Synthetic Environment for Research and Concepts Evaluation Synthesis (SERCES), and WarBreaker exercises. ATI expertise in M&S engineering and integration technology includes detailed knowledge and experience in software and hardware engineering, instrumentation, training and management, security, communications, technical control, data collection and analysis, and system test and evaluation.

ANTEON CORPORATION

1. Company name, address:

Anteon Corporation (formerly Ogden Govt Services)
7480 Mission Valley Road Suite 101
San Diego, CA 92108

2. Company URL: None

3. Point of contact for UAV business area, telephone number, e-mail address:

Dr. P.R. Martin
Director of San Diego Operations
(619) 908-3334
bob_martin@anteonwest.com

4. Company products/service:

Engineering services to include IT-related capabilities, software development, electromagnetics, electromagnetic compatibility, system design and analysis.

5. UAV-related company capabilities:

UAV capabilities include all aspects that are served by the services noted in item 4. above. We are presently providing EIM/EMV services to NAVSEA for topside integration of the Hunter UAV and the OUTFRIDER UAV system in LHA class ships.

APPLIED TECHNOLOGY GROUP, SCIENCE APPLICATIONS INTERNATIONAL CORPORATON

1. Company name, address:

Applied Technology Group, Science Applications International Corporation
6725 Odyssey Drive
Huntsville, Alabama 35806-3301

2. Company URL: Non-UAV specific Corporate URI is www.saic.com

3. Point of contact for UAV business area, telephone number, e-mail address:

Larry Alexander
205-876-0358
lalex@sed.redstone.army.mil

4. Company product/service:

SAIC ATG provides System and Software Engineering Support for the UAV Joint Technology Center/System Integration Laboratory (JTC/SIL). The JTC/SIL is located at the Software Engineering Directorate, Research, Development and Engineering Center, Redstone Arsenal, Huntsville, Alabama.

5. UAV-related company capabilities:

SAIC ATG is currently providing a full range of system and engineering services, including software development, system integration and testing, prototyping, simulation and modeling, sensor development and testing, data links, and military field exercise support. Specific systems being worked include development of the Tactical Control System (TCS), a common ground control station capability for the family of tactical UAVs, and development of the System Integration and Test Environment (SITE), incorporating the Hunter, Outrider and Predator UAVs.

BALL AEROSPACE & TECHNOLOGIES CORPORATION

1. Company name, address:

Ball Aerospace & Technologies Corp.
2021 Cirard Blvd, SE, Suite 203
Albuquerque, NM 87106

2. Company URL: <http://www.ball.com/>

3. Point of contact for UAV business area, telephone number, e-mail address:

Ken Travis
505-260-2758
FAX: 505-260-2797
ktravis@ball.com (company e-mail)
travisk@desa.osd.mil (official e-mail)

4. Company product/service:

Ball Aerospace & Technologies Corp. (BATC) Systems Engineering Operations (BSEO) provides quality systems engineering and software-based products to federal and state agencies, prime contractors, and commercial customers.

5. UAV-related company capabilities:

Since 1992, BSEO has provided program management, analytical and engineering support to the Defense Evaluation Support Activity's (DESA's) Program Manager (PM) for UAVs in support of T&E and related programs. Customers have included the Defense Airborne Reconnaissance Office (DARO), the UAV Joint Program Office (JPO), and the Defense Advanced Research Projects Agency (DARPA). BSEO developed strategies for support to client's advanced concepts technology demonstration (ACTD) requirements, prepared technical proposals and support plans for satisfying customer's UAV support requirements, and conducted independent assessments to ensure that required customer support is consistent with DESA's overall mission and strategic objectives.

BSEO's systems engineering support focused on developing and maintaining a baseline UAV evaluation capability, developing and maintaining an operational UAV infrastructure, developing an interactive client base, and the continuous evaluation of UAV capabilities.

Through support to DESA, BSEO contributed to the development of a robust UAV infrastructure in the related areas of safety, airspace management, operator certification, frequency management, legal and environmental considerations, technology integration, and UAV systems availability. This

dynamic infrastructure has been employed to support the Predator, Pointer, Vixen, Ex-Drone, Centurion, Tern, Javelin, X-Cell, and KALT Gas Alpha UAVs. BSEO currently supports DESA's development of the assessment methodology for the Global Hawk and DarkStar UAVs in the High Altitude Endurance UAV ACTD.

BROADCAST MICROWAVE SERVICES, INC.

1. Company name, address:

Broadcast Microwave *Services*, Inc.
5636 Ruffin Road
San Diego, CA 92126
Phone: (619) 560-8601
Fax: (619) 560-1637

2. Company URL: www.bms-inc.com

3. Point of contact for UAV business area, e-mail:

Graham Bunney
gbunney@bms-inc.com

4. Company product/service:

Manufactured microwave video/data links since 1982. The B.M.S. standard product line consisted of fixed and portable video microwave links at frequencies from 1.4 GHz to 13 GHz. In December 1984, B.M.S. was purchased by, and became a wholly owned subsidiary of, Cohu, Inc. (NASDAQ-COHU). Since that time the company has focused on finding new applications and techniques for transmission of video signals using microwave links.

We have provided microwave video links for the various Olympic Games, both summer and winter, since the 1984 games in Los Angeles. These have included roving camera links, mobile links from motorcycles, airborne relays, fixed installations and security video links, at frequencies from 1.7 GHz up to 40 GHz.

In 1984, a non-compete agreement expired that had prohibited B.M. S. from building tracking antennas. At that time, an automatic tracking antenna was developed, used to follow an RF signal radiating from an aircraft. This allowed live video news pictures to be sent from a helicopter back to a television station, for re-broadcasting. This technology was later used in producing more rugged systems for transportable in the field uses such as receiving video from unmanned air vehicles OTAVs.

B.M.S. became heavily involved in the UAV video and datalink business in 1990, when working with McDonnell Douglas to develop a Short Range Unmanned Air Vehicle. This program had high MTBF requirements that had to be verified through analysis, and stringent shock, vibration and temperature specifications that had to be tested. ESS temperature and vibration testing were also a requirement. That program was eventually canceled, but B.M. S. is now part of the Joint Tactical Unmanned Air Vehicle program, providing video and command and control links to Alliant TechSystems, the prime contractor.

A product improvement program has been implemented over the last three years to take advantage of surface mount technology. This allows us to offer smaller and lower cost microwave video transmitters and receivers. Investment was also made in capital equipment, that now provides B.M.S. with its own in house capability to assemble surface mount circuit boards. Our surface mount capability includes screen printing of solder paste, an automatic pick and place machine, and a reflow oven for soldering.

Our surface mount capabilities have enabled us to manufacture and test large volume orders efficiently. Over the last four years B.M.S. has manufactured 4,000 seismic data transceivers (400 kb/s) for oil exploration. Production rates varied from 40 to 75 units per week, depending on customer requirements. B.M.S. currently has a contract to re-design this product from eight boards down to one, and has an initial order for 2,000 new units, to be delivered over a one year period. Low current operation and ruggedness are important, since the transceiver is part of a battery operated field unit.

COMGLOBAL SYSTEMS, INC.

1. Company name, address:

ComGlobal Systems, Inc. (a San Diego-based, California, small business)
1235 Hotel Circle South, Suite G
San Diego, CA 92108

2. Company URI: comglobal.com

3. Point of contact for UAV business area, telephone number, e-mail:

Frank F. Hewitt
(619) 294-8743
fhewitt@cts.com

4. Company product/services: Systems engineering support and software development

5. UAV-related company capabilities

ComGlobal Systems, Inc. is very experienced in Tomahawk C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) systems engineering that directly relates to UAV requirements. Presently ComGlobal is under contract to support the Reconfigurable Land-Based Test Site (RLBTS) laboratory on-site at the Naval Command, Control and Ocean Surveillance Center (NCCOSC) Research, Test, and Evaluation Division (NRaD), San Diego. NCCOSC is the Navy's lead C4I *laboratory*, and the RLBTS laboratory is tasked with testing C4ISR systems that will interface with OTCIXS and TADIXS systems, the communication systems that support Tomahawk in a variety of ways. We, also, provide NRaD with JTIDS/Link-16 NDF (Network Design Facility) expertise and are supporting initiatives to add real-time systems, such as JTIDS, to the RLBTS laboratory interoperability and testing programs. Additionally, we are under contract to provide support for ADNS (Advanced Digital Networking Systems), both fleet support and systems engineering support, to NRaD. ADNS is the latest shipboard network that interfaces shipboard LANs and systems such as JMCIS with communications nodes such as OTCIXS/TADIXS. Plus, for the past year and a half, we have been under contract to support OED (OSIS Baseline Upgrade *Evolutionary* Development) related work. Our three senior systems engineers have been involved with Tomahawk Command and Control from the early 80's, operationally, one as NOSC civil service engineer, and all as contractor systems engineers supporting the program. Our experience includes major systems engineering inputs to the APS CONOPS (Tomahawk Afloat Planning System, Concept of Operations), and the APS HARDMAN (Hardware and Manpower Analysis) Study that includes the training approach. This experience can be easily applied and leveraged toward improved mission effectiveness of UAVs.

CUBIC DEFENSE SYSTEMS, INC.

1. Company name, address:

Cubic Defense Systems, Inc.
9323 Balboa Avenue
San Diego, CA 92123

2. Company URL: www.cubic.com

3. Point of contact for UAV business area, telephone number, e-mail:

Cal Ogata
(619) 505-2879
cal.ogata@cubic.com

4. Company product/service:

Cubic Defense Systems (CDS) provides avionics, data links, aerospace systems and instrumented training systems for the U.S. Army, Air Force and Navy, as well as product logistical support.

Cubic Defense Systems has been an electronics innovator for almost 50 years. Its experience in telemetry and data links products dates back to the 1950s, and includes precision tracking systems, range instrumentation systems, tactical reconnaissance data links and satellite electronics.

Cubic data links were used in the company's world famous Top Gun air combat electronic training system and most recently in the company's newer products including Air Combat Training - Rangeless, Nellis Air Combat Training system, and the ground combat training instrumentation systems at Combat Maneuver Training Center and the Joint Readiness Training Center.

Cubic's technological experience with data link communications has been applied most recently in two highly visible projects: the Hubble Telescope telemetry and the Joint Surveillance Target Attack Radar System, or Joint STARS. Joint STARS, in particular, required a level of data link expertise that few companies could match. The specifications were challenging; the requirement for technical performance and reliability was absolute. Joint STARS required a robust data link communication with more built-in technology and reliability than any other company has ever built.

CDS is a member of Team Joint STARS. The company's bulletproof data link is a key component in the Air Force's Joint STARS. This battle management system first demonstrated its capabilities during Operation Desert Storm. It provides both air and ground commanders with moving target indicators and synthetic aperture radar imagery of enemy forces that show the number, location, speed, and direction of moving vehicles overlaid on accurate terrain maps. This past year, it was put to use to help monitor the separation of forces in Bosnia.

CDS' Personnel Locator System (PLS) is the standard search and rescue system for the U. S. Army, Navy, Air Force, and NATO. It enables rescue units to accurately locate downed flyers without giving away their position to the enemy. A spin-off from PLS is the ARX-3 000

Emergency Location Transmitter(ELT). By using global positioning satellite data and the international search and rescue satellite system, the ELT can provide the exact position of downed aircraft. ELT can be used as a peace-time aircraft emergency location device and can also provide real-time position location information for command and control of aircraft.

5. UAV-related company capabilities.

CDS is currently engaged in an improvement program for the Joint STARS data link to reduce the size, weight, power and cost. The improved data link equipment will be suitable for UAV use and will retain all of its current capabilities, i.e., bulletproof anti-jam, real-time line-of-sight omni-broadcast, encryption and all-weather operation. CDS is also working with UAV manufacturers to develop commercial telecommunication applications. Additionally, CDS' ELT can be used to track and locate downed UAVs.

DELFIN SYSTEMS

1. Company name, address:

Delfin Systems
3000 Patrick Henry Drive
Santa Clara, CA 95054

2. Company URL: None

3. Point of contact for UAV business area, telephone number, e-mail address:

Syd Erickson
(408) 562-1106
FAX: (408) 748-1140
syd@delfin.com

4. Company product/service:

Delfin Systems provides analysis, development, and integrated systems solutions, products and services for Signal exploitation, intelligence, and information resource management requirements. For over a decade Delfin Systems has demonstrated a commitment to technical excellence and an acute responsiveness to customer needs, serving the defense, intelligence, and commercial marketplaces.

The Delfin team includes experts in hardware and software engineering, artificial intelligence, signal processing, and operations analysis. In-depth operational and business process experience is combined with both custom and off-the-shelf technology to develop innovative and affordable solutions.

5. UAV-related company capabilities:

Delfin Systems provides analysis, development, and integrated systems solutions, products and services for Signal exploitation, intelligence, and information resource management requirements. For over a decade Delfin Systems has demonstrated a commitment to technical excellence and an acute responsiveness to customer needs, serving the defense, intelligence, and commercial marketplaces.

The Delfin team includes experts in hardware and software engineering, artificial intelligence, signal processing, and operations analysis. In depth operational and business process experience is combined with both custom and off-the-shelf technology to develop innovative and affordable solutions.

DRS/PACIFIC TECHNOLOGIES

1. Company name, address:

DRS/Pacific Technologies
2535 Camino Del Rio South, Ste 300
San Diego, CA. 92108

2. Company URL: Currently under construction, inquire with POC personnel below

3. Point of contact for UAV business area, telephone number, e-mail address:

Dave Leedom (619) 299-3210 leedom@pacifictech.com	Larry Blumberg (619) 299-3210 blumberg@pacifictech.com
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4. Company product/service:

DRS/Pacific Technologies provides a variety of technical support services for U.S. Navy and other DoD customers in the San Diego area. These services include systems engineering, simulation software development, hardware maintenance, system test planning, development, conduct, and reporting, test tool development, and configuration management.

Our systems engineering services support engineering teams as well as a number of individual efforts, including Interface Requirement Specification/Interface Design Document (IRS/IDD) and Software Requirement Specification/Software Design Document (SRS/SDD) development.

Our software engineers design, develop, and document a variety of simulation programs, designed to support both Combat System test and U.S. Navy training environments. We have extensive experience in the area of modeling and simulation, both in the modeling of environmental effects (e.g., radar propagation/attenuation) and the interaction of vehicular objects within the environment (e.g., ships, aircraft, submarines, land vehicles). We also participate in the development of distributed simulations, using the Distributed Interactive Simulation (DIS) standard.

Our hardware maintenance technicians handle maintenance calls, ensuring timely resolution of all reported hardware problems. Our technicians handle various calls to field activities using the Q-70 display suite and support the maintenance of the NSWC PHD ICSTF test bed.

Our Combat System and Simulation test engineers handle all phases of test planning, specification/documentation (including scenario development), conduct, and reporting. We are supporting virtually all ongoing test efforts performed at NSWC PHD ICSTF.

5. UAV-related company capabilities:

DRS/Pacific Technologies capabilities can support the UAV projects in the following areas:

- System Engineering as required to ensure UAV compliance with end-user requirements (includes HCI development, Object definition, and interface designs)
- Development of simulation software for UAV modeling, test, and associated trainer software
- Development of UAV sensor models for use in simulated runs, prior to live system test, aiding in early detection of potentially costly faults during a live prototype phase
- Hardware maintenance of UAV components during early prototype development and into the system's life cycle
- Development and execution of a test program, supporting early fault detection and isolation, in addition to enabling early documentation of potential product enhancements
- Development of test tools for use in system test and maintenance.

ELDYNE, INC.

1. Company name, address:

Eldyne, Inc.
A subsidiary of the Titan Corporation
3033 Science Park Road
San Diego, CA 92121
(800)359-9700

2. Company URL: <http://www.eldyne.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

Mr. Wayne Mieth
(619) 552-9504
wmieth@eldyne.com

4. Company product/service:

Eldyne, a subsidiary of the Titan Corporation, is fully capable and committed to provide the entire range of technical support required by NCCOSC. Our experience totals over 15 years and includes system requirements identification and definition, engineering, procurement, maintenance, logistics, training, software and hardware integration, software development, software IV&V, pre-installation test and checkout, and installations, both ashore and shipboard. We have in-depth experience and highly skilled personnel who possess background and expertise relevant to this effort.

Eldyne is an established DOD support contractor possessing expertise in virtually all Navy electronic systems. We have extensive and unique experience in providing highly specialized engineering, scientific and fleet support for programs and disciplines required by NCCOSC. Our experience in communications systems and their support requirements has contributed to making Eldyne a recognized leader in engineering and technical disciplines associated with UAV. Our company is founded on the belief of professionalism, competence, responsiveness and value.

Our corporate strength resides in our staff. Our staff is made up of dedicated, high experienced personnel including practical, knowledgeable engineers, many of whom are former active duty Naval electronics personnel. These engineers are supported by Eldyne specialists in the areas of software design/testing, DLS, CM, QA, and graphics support. Additionally, Eldyne managers recognize the advantages of advanced tools primarily in the form of microcomputers, connectivity, automated electronic test and CAD equipment, and software, to maximize throughput and minimize costs, and optimize the quality of our services and hardware.

5. UAV-related company capabilities:

Eldyne, Inc. personnel were involved in the initial fielding of the Pioneer system. Installation guidance and EMC testing of the Pioneer shipboard system onboard USS Iowa (BB61) was provided during the first shipboard installation. Installation guidance included bonding, grounding of cables and equipment, cable routing and separation, and cable/connector selection to provide maximum isolation from existing shipboard installations.

Once installation of the Pioneer system was completed, testing to ensure proper operation of the system was accomplished. This testing included cold wire checks, cable insertion loss measurements, and system operational testing with a static electromagnetic shipboard environment.

At-sea operational EMC testing was also accomplished during the testing of the Pioneer system. EMC testing ensured proper operation of the equipment in a high level RF environment present during an operational scenario. Multiple problems were noted due to onboard emitter characteristics and Pioneer design deficiencies. Recommendations were developed to correct observed or measured problems. Once the deficiencies were corrected an appreciable improvement to system operation was noted.

ENCORE COMPUTER CORPORATION

1. Company name, address:

Encore Computer Corporation 6901 West Sunrise Boulevard Fort Lauderdale, FL 33313

2. URL: <http://www.encore.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

Mike Pushkar
5446 Linda Rosa Ave.
La Jolla, CA 92037
619-459-6650
619-551-9830 (Fax)
mpushkar@encore.com

4. Products: ALL Standards based and commercial off-the-shelf (COTS):

Real-Time Computers based on DEC Alpha or Pentium. Real-Time hardware value-adds and real-time software based on Digital UNIX. Other real-time OSs available.

REFLECTNE MEMORY - VME or PCI based, fastest, lowest latency and connects similar or dissimilar computers. We invented Reflective Memory, hold patents and trade marks.

High Availability - facilitates high availability systems at a fraction of the cost of proprietary fault tolerant computers.

Can integrate for custom installs including ruggedization, conform to Mil Std such as 461 and 810.

Disk Storage Products: High performance Raid with DataShare (UO UNIX or IBM mainframe files from one Storage Unit)

5. UAV capability:

Provide ground station or onboard computing technology. We are a center for providing open, deterministic, scaleable computer systems L/O subsystems, real-time software CASE tools and component technologies for demanding mission-critical applications. We provide High-Available Systems (better than fault-tolerant).

Use Reflective Memory to connect different platforms that work on a common problem.

ENERDYNE TECHNOLOGIES, INC.

1. Company name, address:

Enerdyne Technologies, Inc.
8402 Magnolia Ave., Suite C
Santee, CA 92071

2. Company URL: www.enerdyne.com

3. Point of Contact for UAV business area, telephone number, e-mail address:

Tony Di Fade, Sales Manager
Telephone: 619/562-3061
Telephone: 619-562-3061
FAX: 619/562--802
tony@enerdyne.com

4. Company product/service:

Enerdyne Technologies, Inc., established in 1984, is the market leader in video compression equipment for military, ruggedized, and commercial applications. We design and build our products in our dedicated facility, where we offer electrical, mechanical, and software engineering; quality assurance; environmental testing; system integration; and product support. With all these capabilities under one roof, Enerdyne has the ability to respond rapidly to constant advances in technology, as well as the ever changing needs of the market.

5. UAV-related company capabilities:

Enerdyne offers complete digital video system solutions in a wide variety of applications. Enerdyne video encoders range in size from 4 cubic inches (5 ounces) to standard 19-inch rack mounting units for any real-time airborne, space or ground surveillance application. Listed below are a few examples of real-time monitoring applications using Enerdyne video compression systems :

- UAV surveillance and guidance systems
- Space-based *microgravity* experiments onboard the NASA Shuttle
- Missile sensor and guidance validation
- Aircraft test instrumentation
- Military training exercises
- Command and control systems
- Secure area surveillance
- Traffic surveillance
- Law enforcement
- Industrial security
- Mobile personnel monitors

GENERAL ATOMICS

1. Company Name, Address

General Atomics
3550 General Atomics Court
San Diego, CA 92121-1194

2. URL: www.ga.com

3. Point of contact for UAV business area, telephone number, e-mail: Alternate

Willard R Becraft	Larry D. Stewart
619-455-4523	619-455-4281
becraft@gav.gat.com	stewart@gav.gat.com

4. Company product/service:

General Atomics (GA) and its affiliated companies comprise one of the world's leading resources for high technology systems development and nuclear technology. GA specializes in diversified research and development in energy, defense and other advanced technologies, many for environmentally sensitive applications.

5. UAV-related company capabilities:

SURVEILLANCE AND DETECTION SENSOR PAYLOADS TO BE CARRIED ON UAVs

GA is developing two sensor/imaging UAV payloads; (a) one uses passive millimeter waves (PMMW), and the other uses LIDAR.

(a) The GA PMMW system will be able to image through clouds, fog, and smoke. Its resolution, if integrated with a Predator UAV, e.g., is under 1 meter from a UAV altitude of 8000 feet. Penetration of light foliage and camouflage netting is also achievable. The installed system would weigh about 100 pounds and use approximately 500 watts. This work has been done in collaboration with a small business; Innovative Research & Technology. The system could be ready for demonstration from a Predator in about 24 months.

(b) The GA miniature LIDAR imaging system is planned for detection/imaging of the mines in the surf zone. One system design allows mine imaging to water depths of 125 feet, with the payload on a Predator UAV flying at 60-100 kts, at an altitude of 300 feet. The resolution of this sensor/ imager is under 6 inches. It would weigh 150 pounds, have a volume of 3 cubic feet, and require only 800 watts of power. Such a system can be built and integrated into a Predator UAV ready for testing in 20 months.

GENERAL ATOMICS AERONAUTICAL SYSTEMS, INC.

1. Company name, address:

General Atomics Aeronautical Systems, Inc.
16761 Via Del Campo Court
San Diego, California 92127

2. Company URL: www.gat.com/asi/aero/html

3. Point of contact for UAV business area, telephone number, e-mail address:

Larry Ernst
(619)455-2609
larry.emst@gat.com

4. Company product/service:

General Atomics Aeronautical Systems, Inc. produces a full spectrum of state-of-the-art unmanned aircraft surveillance systems.

5. UAV-related company capabilities:

The GNAT 750 and an improved version, the I GNAT, offer the combination of long endurance (over 40 hours), large payload capacity, ease of use and low maintenance while providing a very low cost per flight hour. The state-of-the-art GNAT-750 has been flying since 1989 and normally carries an Electro-Optical/Infrared Radar stabilized gimbal payload. This multi-functional UAV uses conventional takeoff and landing and can operate from any surface from a graded soft field to a commercial runway. It is currently operational with the U.S. Government and has been exported to Turkey. An improved version of the GNAT is being procured by the Department of Defense and by NASA for scientific research and the DOE for atmospheric research. I GNATs are also being procured by the U.S. Government and a foreign customer. The GNAT 750 system has already completed five combat deployments to date.

Predator is a growth evolution of the proven GNAT-750 UAV. It uses common avionics and mechanical systems developed on the GNAT-750 and incorporates a Retax 912 engine to power the larger airframe. The Predator houses a UHF and Ku band satellite data link system, an EO/IR Stabilized Gybble, a SAR radar, and has a fuel capacity for up to 60 hours endurance. Predator is in production for the U.S. Department of Defense with procurement planned for 17 systems of four aircraft.

Predator, also officially known as Tier II and Medium Altitude Endurance (MAE) UAV program, was one of the original DOD Advanced Concept Technology Demonstrations (ACTD). A contract for production of 10 aircraft and integration of the overall system was awarded to General Atomics Aeronautical Systems, Inc. in January 1994. The first aircraft flew in July 1994, less than one year

after contract award. Less than one year after first flight, Predator deployed to Albania to conduct flight operations over Bosnia where Predator flew over 850 hours and 128 missions in support of NATO operations Provide Promise, Deny Flight and Deliberate Force from July to October 1995. Predator redeployed to Hungary to support Bosnia operations on March 1, 1996 with its synthetic aperture radar (SAR) installed. The SAR allows true all-weather surveillance for the first time from a UAV in combat. Predator has also successfully completed trials, in June 1996, with the submarine USS *Chicago* controlling the Predator and receiving video from Predators onboard sensors.

Predator is the only reconnaissance system available in the U.S. inventory that can provide near real time video and photographs of the war zone day or night in all weather via satellite worldwide; and it does so without exposing pilots to combat fire.

It is the first successful unmanned aircraft surveillance program to be fielded in decades that provides tactical and strategic intelligence to operational commanders worldwide.

The PROWLER is a scaled-down version of the GNAT-750. It was designed to participate in the Close UAV Demonstration in Yuma, Arizona in 1992 and was competed for the Tactical UAV Program.

All our UAVs are controlled by a common solid-state digital ground control station (GCS) through a C Band line of sight data link. The vehicles are capable of direct control and passing real-time surveillance data to the GCS at ranges up to 150 NM or operating autonomously to the range limits of the vehicle. Predator also incorporates satellite data links for near real-time over-the-horizon surveillance operations. Day and night video as well as synthetic aperture radar imagery obtained through cloud cover is processed onboard Predators and distributed to operational commanders worldwide.

GRCI, INC.

1. Company name, address:

GRCI, Inc.

2. Company URL: www.grci.com

3. Point of contact for UAV business area, telephone number, e-mail address:

James K. Bell
(703) 416-2406/(703) 506-5805
jkbell@grci.com

4. Company product/services. Professional Services (CSS)/SETA/Information Technology

5. UAV-related company capabilities:

* Tethered communication:

- BGPHEs Surface Terminal Interoperability (with Airborne Component)
- Common Data Link
- Common High Band Width Data Link

* SATCOM

* Airborne Reconnaissance

- Joint ORD
- mission analysis
- operational requirements analysis
- advanced sensor development / integration - airborne DF (TDOA / AOA)
- RF distribution
- antenna performance analysis

* Data fusion

* Operator / Machine Interface requirements

* Joint SIGINT Avionics Family / Joint Airborne SIGINT Architecture / Standards

- High Band Processor System
- Low Band Sensor System

GREYSTONE TECHNOLOGY, INC.

1. Company name, address:

GreyStone Technology, Inc.
4950 Murphy Canyon Road
San Diego, CA 92123

2. Company URL: <http://www.gstone.com>

3. Point of contact UAV business area, telephone number, e-mail address:

Tom "Buzz" Aldern
(619) 874-7000
FAX: (619) 87407007
taldem@gstone.com

4. Company product/service:

GreyStone is a systems and software engineering company with expertise in developing solutions that employ virtual environments, advanced visualization, real-time simulation and intelligent system technologies. GreyStone's Real-time Advanced Graphics Environment (RAGETM) is a licensed, object-oriented software product that enables real-time 3D representation of dynamic, virtual environments complete with graphic entity models and including non-visual phenomena. RAGE displays environments for system simulations, constructive and virtual mission simulations, mission support systems and mission visualizations by enabling realistic, immersive graphics to be generated from dynamically acquired images from flight recorders, sensors or satellite imagery collected and displayed in real-time.

5. UAV-related company capabilities:

RAGE has been selected by the System Integration Laboratory for Unmanned Aerial Vehicles as the visualization software tool for the Multiple UAV Simulation Environment (MUSE) installations. RAGE provides the visualization support and simulation base for each UAV and UAV payload sensor as well as a "stealth" view of the exercise. RAGE interface to the VUAV control stations is via a serial data port to obtain VUAV vehicle position data and sensor pointing information. Using this information, RAGE places the VUAV at the appropriate position in the virtual environment and generates the sensor video data. Electro-optic sensors which work in the visual spectrum are featured and work is nearing completion on the Synthetic Aperture RADAR (SAR) sensor capability. An Infrared Red (LR) sensor feature will follow. The MUSE hub is at the SIL with nodes currently operational at Ft. Hood, White Sands Missile Range, Ft. Huachuca, with plans for NAWC Patuxent River.

This system provides customers with a low-cost prototype VUAV simulator that satisfies initial operator training requirements and provides reconnaissance squadron personnel with the capability to

develop, test, and refine UAV employment concepts and tactics. The system is a cost-effective solution to UAV platform and payload simulation, leveraging existing GOTS products (platform flight models, ground control stations, 3-D object models, terrain data bases, etc.) and GreyStone's RAGETM commercial product. This simulation is Distributed Interactive Simulation (DIS) certified and is in the process of achieving compliance with the High Level Architecture as well.

Although tasked initially with supporting Pioneer and Hunter UAV simulations, the VUAV is designed as a modular, flexible, "dial-a-collector" system capable of simulating any UAV platform and sensor. The system has proved invaluable for UAV concept of employment and operational utility demonstrations for over 20 US Army training exercises (e.g. Ulchi Focus Lens, Unified Endeavor, Prairie Warrior, Task Force XXI et.al.) and force modernization Advanced Warfighting Experiments (AWEs) since December '94 at Forts Hood, Irwin, Campbell, Leavenworth, and Huachuca, often networked across multiple sites for the same exercise. The SIL deployed to multiple sites with the VUAV for Ulchi Focus Lens '96 (4 sites) and Ft. Hood (1 site) all operating in a common, real-time synthetic environment of Korea created by the VUAV simulation.

HUGHES AIRCRAFT COMPANY

1. Company name, address:

Hughes Aircraft Company
3970 Sherman St.
San Diego, CA 92110

2. Company URL: <http://hacitweb.hac.com/hachome/index.htm>

3. Point of contact for UAV business area, telephone number, e-mail address:

W. G. Sherman
(61 9)543 -4102/(310) 334-4259
wgsherman@ccgate.hac.com

4. Company product/service:

Radar/Electro-Optical VSATCOM/Data Links/EW/Processors

5. UAV-related company capabilities:

Radar and Electro-Optical System Provider for TIER II Plus/Global Hawk

INTEGRATED SPACE SYSTEMS INC.

1. Company name, address:

Integrated Space Systems Inc.
7940 Silverton Ave., Suite 202
San Diego, Calif. 92126

2. Company URL: None

3. Point of contact for UAV business area, telephone number, e-mail address:

Philip Smith
(619) 684-3 570
pres@spaceinc.com

4. UAV-related company capabilities:

Integrated Space Systems together with our team members, the Electronic Vision Systems Division of SAIC and Lawrence Livermore Laboratory, bring both sensors and telemetry integration capability to the UAV customer. The following paragraphs provide a summary of our technologies and capabilities.

Technical Integration Capabilities

Integrated Space Systems is composed of highly skilled managers, engineers and support personnel each with an average of 15 years of successful mission integration experience. ISS personnel have performed all tasks required to integrate existing and developing payloads onto unmanned aerial vehicles and space vehicles. These include feasibility studies, cost price analyses, trade studies, design, engineering analyses, design test, acceptance test, payload integration support, site integration, range safety, site operations and post flight evaluations. As an added plus, ISS personnel have extensive experience with both MIL Standards/Specifications and Range Safety Requirements.

Light Detection and Ranging (LIDAR)

The ISS LIDAR Distant Air Monitoring Systems (DAMS) employs an optical heterodyning technique using either a free-space laser system or a more robust and compact fiber optic coupled system. A packaging study has shown that the photonics for this type of Doppler LIDAR transceiver can be packaged in a module no bigger than 40 cm x 61 cm x 20 cm (16" x 24" x 8"). This unit is capable of measuring aerosol motion in space (wind shears) with a wind speed resolution of ± 0.01 meter/sec and a wind speed range of 1 to 500 meter/sec. DAMS LIDAR Unit Pulsed system uses the core unit described above as an injector/seeder for a more powerful single frequency Q-switched laser. This unit is capable of

measuring aerosol motion in space (wind shears) with a wind speed resolution of ± 0.1 meter/sec, with a wind speed range of 1 to 100 meter/sec, a spatial resolution of 10 meters and a Max Altitude of 12 km (from ground, standard atmosphere conditions). The unit can also be modified to operate in a higher dynamic load and environmental state based upon various mobile platforms. Turbulent conditions can be detected in real time. Current applications include: 1) non-intrusive wind tunnel air flow measuring systems; 2) Upper Atmospheric Wind Measurement systems; 3) Impact and Collision and Avoidance Systems; 4) Aircraft Wind Shear measurement systems; 5) National and Local Natural Hazards wind measuring instruments, and 6) Pollution and Environmental monitoring systems.

Electro-Optical Sensors and Systems

SAIC's Electronic Vision Systems Division has developed sensor systems for low-light-level imaging, surveillance, and earth observation. These systems include imaging sensors that operate in the ultraviolet, visible, and infrared spectral regions. The payload includes two infrared imaging sensors and a visible imaging spectrometer with a common telescope and gimballed scan mirror assembly. Pointing is GPS-referenced. Each IR camera has a seven-position filter wheel providing high spatial and spectral resolution imagery in the 2.5-4.5 micron spectral region. The visible camera has a CCD imager with a wedge filter that provides hyperspectral imaging with 17nm resolution in the 600 to 800 nm region. The ground resolution from the 425 km polar orbit is >better than 10 m in the visible and approximately 43 m in the IR. The Payload is remotely controlled from the ground with uploaded commands. Total MSTI payload weight is 119 pounds and it consumes approximately 150 watts of power; it was launched in May of 1996 and is currently providing measurements of IR background clutter to the SBIRS Program for the USAF (See Figure 2, page 2). This technology can readily be utilized for high resolution, multi/hyperspectral imaging for UAV applications.

IPD, INC.

1. Company name, address:

IPD, Inc. (a subsidiary of Analysis & Technology, Inc.)

2. Company URL: www.ipdinc.com (corporate URL www.aati.com)

3. Point of contact for UAV business area, telephone number:

Dennis Kelly
(401) 849-5952 X3335

4. Company product/services:

Software and systems integrators for Government and commercial customers. Segment developers within the Defense Information Infrastructure (DII) Common Operating Environment (COE) for JMCIS and GCCS. Currently providing services associated with combat systems simulation and modeling, acoustic and electromagnetic sensor modeling, USW systems performance predictions, and meteorological and oceanographic data management and product generation.

5. UAV-related company capabilities.

The IPD team provided a sensor-to-shooter solution during SHAREM 110 in the Arabian Gulf and Gulf of Oman during Feb/Mar 1995 and during a follow-on SHAREM in the Mediterranean during 1996. SPAWAR used the database management component provided by IPD to manage data from sensors on a number of ships operating in the AG and data from shore sites and the Fleet Numerical METOC Center to create a value-added product. The value added product was a 3-D filed of atmospheric refractivity for the operating area. This data set was transmitted to the USS *Lake Erie* using JMCIS communications. Onboard the *Lake Erie* the data set was used to create a range-dependent propagation loss input for the sensor performance predictions for the ship's radar. IPD used the backscatter data from the radar and the pathless values to model the radar range equation. The resultant performance assessment was the best available and supported the commander's decision-making process. Although the sensors were mounted on the ship's masts, the data source could have been from UAVs.

IPD supported SPAWAR in Mar/Apr 1996 at the Predator and USAREUR (Forward) sites in Taszar, Hungary. IPD installed a JMCIS TAC-4 workstation at the Predator site that included the METOC segment. The weather forecasters at the Predator site routinely pull satellite imagery and other products from ships in the Adriatic using Trojan Spirit and SIPRNet. These personnel create products for display in JMCIS and GCCS.

LITTON SYSTEMS, INC., DATA SYSTEMS DIVISION

1. Company name, address:

Litton Data Systems
29851 Agoura Road
Agoura Hills, CA 91301-0500.

2. Company URL: <http://www.littoncorp.com>

3. Point of contact for UAV business area, telephone, e-mail address:

David D. Johnson
818-706-4485
djohnson@vines.littondsd.com

4. Company product/service:

Litton Data Systems Division (DSD) is the command and control (C2) systems and software division of Litton Industries, Inc., a \$3.6 billion aerospace, defense, and commercial electronics company. Litton DSD is an autonomous organization with annual sales of about \$280 million and 1600 employees. The division is headquartered in Agoura Hills, California, with production facilities in Moorpark, California, and Ocean Springs, Mississippi. SAI Technology (SAIT), San Diego, became part of DSD in February 1997, adding their expertise in ruggedized laptop computers and workstations and a presence in San Diego.

Litton DSD has successfully integrated both large-scale and small-scale C3 programs for over 30 years, providing high technology C3 systems to all branches of DoD as well as international customers. DSD's technological focus encompasses system/equipment integration, mission simulation, communications, sensor data processing, system development/concept definition, applications software, displays and man-machine interface, and message processing. DSD recently won the prime contract for the Region/Sector Air Operations Center (R/SAOC) Modernization program. Litton is also the prime systems contractor for the USAF/USMC AN/TYQ-23 Tactical Air Operations Module/Modular Control Equipment (TAOM/MCE) and the MCE Pre-Planned Product Improvement (P3I) programs, and is also responsible for the BM/C3 segment on the U.S. Army's Theater High Altitude Area Defense (THAAD) demonstration/validation program.

5. UAV-related company capabilities:

Litton DSD's related experience and products satisfy both onboard and offboard requirements. On-board requirements are fulfilled by our optical correlator and Vector Neural Network (VNN) products which enable low observable target detection and prescreening of data from all imaging sensors. Litton DSD also has a broad range of offboard capabilities based on numerous C3 systems which, in general, integrate data from multiple sensors into a fused air/surface surveillance picture, evaluate and identify tracks and threats within an assigned area of responsibility, control countermeasures against identified threats, and communicate and interoperate with weapon systems, other agencies, and higher echelon or subordinate units as required. Our C3 systems have provided

satellite, radio, landline, TADIL A, TADIL B, TADIL J, WAN, LAN, video and broadcast communications.

Litton's IRAD-developed VNN for low observable target detection is being further developed and demonstrated under Contract Research and Development (CRAD). The VNN achieves low observable target detection by multi-scan integration of signal amplitudes or low threshold hits. In a shipboard application, severe sea clutter is canceled to reveal small vessels and aircraft on or near the surface. Demonstrations have also shown surface surveillance performance required for evolving littoral operations. Other applications include Infrared Search and Track (IRST), coastal defense radar, and missile seekers.

The Wright Laboratory Optical Signal Component Application Research (OSCAR) program demonstrated Litton's optical processor with a video camera on a remotely piloted vehicle (RPV) to simulate terminal guidance. The optical processor consists of an image converter and an IRAD-developed Miniature Ruggedized Optical Correlator (MROC) which, together with the proper spatial filters, demonstrated the performance needed by tactical missiles to perform autonomous target acquisition and identification. Also, the second phase of the Optical Processor Enhanced LADAR (OPEL) program was recently awarded to Litton to build and flight test an optical processor integrated with a laser radar system for future missile systems.

LOCKHEED MARTIN SKUNK WORKS

1. Company name, address:

Lockheed Martin Skunk Works
1011 Lockheed Way
Palmdale, CA 93599

2. Company URL: none

3. Point of contact for UAV business area, telephone number, e-mail address:

DarkStar Related
George Zielsdorff
(805) 572-3251
gzielsdo@ladc.lockheed.com

4. Company product/services:

DarkStar UAV

5. UAV-related company capabilities:

- Vehicle development
- Avionics/Flight Control/System Development - Stealth Technology applied to UAVs
- System T&E
- Communications and Sensor Integration

M.TECH AEROSPACE SYSTEMS

1. Company name, address:

M.Tech Aerospace Systems
6161 El Cajon Blvd. Suite B-20
San Diego, California 92115

2. Company URL: TBD

3. Point of contact for UAV business area, telephone number, e-mail address:

Peri M. Moore, President
(619) 458-0496
PMMoore@pacbell.net

4. Company product/service:

M.Tech Aerospace Systems is a development stage company. We plan to provide UAV operations services, and access to advance UAV payload for civil and commercial customers. Our initial projects involve the use of High Altitude UAVs for imaging and telecommunications services.

5. UAV-related company capabilities:

Marketing analysis for domestic and international UAV services. In the near future, we plan to provide imaging and telecommunications services to customers in the western U.S. and in several international markets.

MAXWELL TECHNOLOGIES, INC. FEDERAL DIVISION

1. Company name, address:

Maxwell Technologies, Inc. Federal Division
2501 Yale Blvd. SE, Suite 300
Albuquerque, NM 87106
Alternate: 8888 Balboa Avenue, San Diego, CA 92123

2. Company URL: None

3. Point of contact for UAV business area, telephone number, e-mail address:

Dr. Jason Will<enfeld, Vice President, Manager Electronics Technology
505-764-3104
FAX: 505-843-7995
jason@maxwell.com (e-mail)

4. Company Products/Services:

Scientific Modeling and Simulation Software
Simulation of Advanced Weapons Effects
Space Mission Analysis and Design
Advanced High Power Conversion and R&D
On-Site Contractor Support Services
Electronics and electro-optical technology management, development, test & evaluation
Space, nuclear and electromagnetic environmental effects analysis and testing Geophysical and geothermal research and analysis

5. UAV-related company capabilities:

Our group manages a large team of aerospace contractors in support of an USAF Phillips Laboratory managed program to develop sensors and related technologies for DoD and USAF space systems across the electromagnetic spectrum. Areas of emphasis have included IR and visible sensor technology, signal processors, and high-density packaging. Our role in the program, in addition to providing overall management, has been technology evaluation, management, testing, and prototype construction. In addition, we have performed electromagnetic environment effects evaluation on military aerospace systems. The latter may be significant for the operation of UAVs subject to both unintended and active interference with the sensor and communication packages which they carry. In addition, some of space mission planning tools and architecture which we have developed for applications such as the NASA Space Station may be transferable to similar functions for UAVs.

MIDCON CABLES COMPANY

1. Company name, address:

Midcon Cables Company
2500 Davis Boulevard
Joplin, MO 64802

2. Company URL: <http://www.midconcables.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

John W. Dunlop
619-299-9950
FAX: 619-299-9955
galaxiel@ix.netcom.com

4. Company product/service:

EverFlex(r), Midcon Cables' new technology for wire management, combines any type, size, and number of discrete wire products into a flat ribbon, custom built to your configuration. EverFlex Wire Management Systems offer many advantages over conventional harnesses and flex circuit cables including field reparability, increased flex life, controlled circuit positions, ease of installation, elimination of wire pinch points, cooler operation, integrated mechanical tie-downs, low start-up tooling cost, and improved abrasion resistance. EverFlex assemblies are uniquely designed to provide "drop-in" installation for the most challenging packaging situations.

Molded cables from Midcon Cables provide superior durability and environmental protection. Custom layed-up and braided low profile harnesses that are electro-magnetically shielded to meet the most stringent requirements are available in such materials as tinned copper, bronze, stainless steel, nickel coated copper, and aluminum.

Backshells, transitions, and box connectors are also available for terminating Midcon cables to the specified electrical connector or junction box. Commercial harnesses of all shapes and sizes are also available.

5. UAV-related company capabilities:

Aircraft, engine, and ground support equipment drop-in harnesses manufactured with the latest technology (EverFlex) for low life-cycle and assembly cost.

MITRE CORPORATION

1. Company name, address:

The MITRE Corporation, Washington C3 Center
1820 Dolley Madison Blvd.
McLean, VA 22102-3481

The MITRE Corporation, San Diego Site
49185 Transmitter Rd.
San Diego, CA 92152-7335

2. Company URL: <http://www.mitre.org>

3. Point of contact for UAV business area, telephone number, e-mail address:

Mr. Wayne Spealman
UAV Projects Manager
(703) 883-5362
wspealma@mitre.org

4. Company product/service:

C4ISR and Systems Engineering Federally Funded Research and Development Center (FFRDC)

5. UAV-related company capabilities:

The Mitre Corporation has programmatic understanding and technical depth across many DoD C4ISR-related programs. MITRE has been involved with most past DoD UAV programs, as well most of the current programs. Additionally, MITRE has extensive technical expertise in airborne sensors; signal processing; line-of-sight and satellite communications; analog and digital data links; mission planning; modeling and simulation; UAV ground stations; imagery compression, exploitation, processing and dissemination; software development and test; and systems architecture development and systems engineering. Specific efforts include:

- **Tiltrotor UAV System (TRUS)** - Systems engineering and demonstration support for PEO(CU)/NAVAIR (PMA-263).
- **Maritime VTOL UAV System (MAVUS)** - Systems engineering and demonstration support for PEO(CU)/NAVAIR (PMA-263).
- **Medium Range UAV (MR UAV)** - Systems engineering, and system and subsystem integration for all ten interfacing programs (TAMPS, AFMSS, F/A-18, F-16, sensor payload (ATARS), CHBDLST, JSIPS, JSIPS-N, H-60/MARS, Tomahawk) for PEO(CU)/NAVAIR (PMA-263).

- **Pioneer UAV** - Development of Joint UAV Evaluation and Simulation System (JUAVESS) Pioneer Readiness Model; C-Band data link (Pioneer and Cooperative Engagement Capability) interference analysis; and sensor payload repair cost-benefit analysis for PEO(CU)/NAVAIR (PMA-263).
- **High Altitude Endurance UAV (HAE UAV)** - Source Selection Technical Advisor; and Ground Segment Integrated Product Team (IPT), Sensor Payload IPT member; and system/subsystem test and evaluation for DARPA HAE UAV Program Office.
- **DARO HAE UAV Airborne Communications Node (ACN)** - Requirements definition and design of ACN Controller to monitor and control all ACN components and services.
- **PEO(CU) Tactical Control System (TCS)** - Concept of Operations development; Joint Operational Requirements Document finalization; and TCS C4I IPT participant.
- **Surface Combatant Twenty First Century (SC-21) Cost and Operational Effectiveness Analysis (COEA)** - Focused study addressing practical contributions of UAVs in support of SC-21 operations.
- **C4ISR Mission Assessment (CMA)** - Assessment of current and planned Intelligence, Surveillance and Reconnaissance (ISR) system performance, and development of investment strategy in support of Quadrennial Defense Review for ASD(C3I); Developed C4ISR Analytic Performance Evaluation (CAFE) Model to evaluate performance of ISR platform mix.
- **Defense Airborne Reconnaissance Office (DARO)** - Architecture development and integration of airborne reconnaissance and surveillance platforms, dissemination links and ground stations; implementation of new sensor suites on UAVs; and HE UAV test and evaluation.
- **Predator UAV Communications** - Support for DARPA/DISA JPO in developing and implementing the DISN LES ATM network in support of US and NATO forces during Operation JOINT ENDEAVOR, including the implementation and deployment of a seven-node VSAT-based ATM network.
- **Tactical Common Data Link (TCDL)** - Support for DARO/DARPA in the technical development and demonstration planning for the TC DL, a family of CDL-compatible, low-cost, lightweight, digital data links to support a wide range of ISR applications.
- **Common Imagery Ground/Surface System (CIGSS)** - Reconnaissance/Intelligence Ground Systems Program Office representative to CIGSS Standards Working Group, the CIGSS IPTs, and the CIGSS Engineering Reviews; providing engineering and technical support for the CIGSS Testbed.
- **Common Imagery Processor (CIP)** - Engineering and technical support to the Reconnaissance/Intelligence Ground Systems Program Office which is the CIP Acquisition Agent.

NORTHROP GRUMMAN ELECTRONIC SENSORS & SYSTEMS DIVISION

1. Company name, address:

Northrop Grumman Electronic Sensors & Systems Division
P.O. Box 17319
M.S. A170
Baltimore, MD 21203-7319

2. Company URL: <http://sensor.northgrum.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

John Pettitt (760) 375-2393 pettitt.john@postal.essd.northgrum.com	Fred Frissyn (410) 765-6316 frissyn.fred@postal.essd.northgrum.com
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4. Company products/service:

Electronic Sensors & Systems Division (ESSD), one of five divisions comprising the Northrop Grumman Corporation and the former Westinghouse Defense business, is a world leader in development of electronic sensing, processing, and communications technologies. We build products in the following categories: airborne radar, airborne surveillance and reconnaissance, air defense, electronic warfare, electro-optical sensors, air traffic control, shipboard radar, sonar, ASW systems, ground-based and satellite communications, and space-based systems. Core competencies are: system integration, sensor design development and production, signal and data processing hardware, signal and data processing software, advanced image processing, MMIC, VLSI, and ASIC design and fabrication, advanced antenna design, and satellite sensing and communications.

5. UAV-related company capabilities:

ESSD currently builds the SAR sensor for the Predator UAV (TESAR) and is under contract to build the SAR sensor for the TIER III (minus) UAV. TESAR has been deployed to Taszar, Hungary, in support of operation Joint Endeavor since March 1996 with Field Commanders praising it. A SAR/MTI capability has been developed and is being flight tested by the USA on a Sherpa aircraft. The SAR payload for TIER III (minus) has been delivered to the UAV prime contractor and is scheduled to test-fly Dec 97. ESSD is also a team member on the Predator Ground Control Station. Foliage Penetration radars are under development for future UAV use and ESSD is also capable of producing EW, EO/IR and programmable digital radio packages for UAVs. ESSD has built two IR payloads (RISTA) designed for the Hunter UAV.

ORINCON CORPORATION

1. Company name, address:

ORINCON Corporation
9363 Towne Centre Drive
San Diego, CA 92121

2. Company URL: None

3. Point of contact for UAV business area, telephone number, e-mail:

Dale Klamer
(619) 455-5530, extension 219
klamer@orincon.com

4. Company product/service:

Multisensor Data Fusion, Collaborative Planning, Intelligent Agents, Automatic Target Recognition, Artificial Intelligence/Expert Systems, Signal and Image Processing

5. UAV-Related Capabilities

Multisensor Data Fusion using a multiple hypothesis information fusion algorithm for combining location and kinematic information with classification information has improved decision making for estimating of the target's position, velocity, and classification. A taxonomic hierarchy, or Pearl tree, is a Bayesian evidential reasoning algorithm and is used to accumulate partial evidence over time for classification/identification.

- Multiple hypothesis, multiple sensor integration of information that accumulates and fuses both kinematic/positional and classification evidence over time;
- Multisensor image fusion from multiresolution sensors and combining of data from diverse sensors/different resolutions, such as EO/IR and SAR imagery; and
- Reduction in false targets and increase in detection and correct classification.

The MULTEX AI expert system environment provides

- An AI Expert System Environment that allows the combination of information from multiple neural networks, fuzzy logic, and expert systems;
- Combining fuzzy neural network, and symbolic logic from diverse systems;
- Self-adapting to individual system strengths and weaknesses; and

- Integration of multiple expert agents and blackboard systems.

Collaborative Planning uses multiple Intelligent Agents (IAs) to coordinate planning, tasking, and task-load balancing. An Agent Workbench allows rapid prototyping and development of IAs.

Resource Management uses a combined multihypothesis/N-dimensional assignment for dynamic allocation of sensor assets.

PACER INFOTEC, INC.

1. Company name, address :

Pacer Infotec, Inc.
2500 Maryland Road, Suite 400
Willow Grove, PA 19090-1225

2. Company URL: none

3. Point of contact for UAV business area, telephone number, e-mail address :

John R. Kolb Program Manager
(215) 657-7800 Ext 121
jkolb@pacerinfotec.com

4. Company product/service: Systems Engineering

5. UAV-related company capabilities:

Pacer Infotec Inc. (Pacer) has supported the Department of Defense (DoD) for 25 years in tactical, fixed wing and rotary wing avionics, including weapon systems, UAV target/drone systems, target/drone auxiliary and augmentation systems (TA/AS), support engineering and technical program support, and at both development laboratories and range facilities. Our operationally and technically experienced Targets/UAV systems group is staffed, organized and trained to meet the challenge for effective development of the DOD's integrated and UAV target/drone control and TA/AS systems now and into the next decade. Pacer engineers and analysts currently support PEO (CU) UAV efforts through NAVAIR PMA 208 and NAWCAD, Patuxent River in each phase of DOD life-cycle support process from concept, Engineering, Manufacture and Development (EMD) through production. Our technical personnel interface closely with our sponsoring staff to provide effective design, analysis, development, integration and follow-on support in all DOD Standard Target Systems. Pacer engineers and programmers have supported design and development of the UAV simulation/stimulation laboratory facilities and provided test and evaluation analysis of control systems for UAV platforms. Other technical support recently or currently provided includes: detailed full-scale and sub-scale aerial target systems requirements analysis and definition, threat analysis, advanced technologies (i.e., GPS Navigation/C2/payloads/sensors) applications and tradeoffs studies, system and equipment acquisition, avionics architecture design analysis and evaluation, target/drone systems integration planning and analysis, and technical support for test and evaluation of DoD UAV flight/mission support subsystems and equipment.

Pacer is currently supporting Pt. Mugu Threats and Targets division in the incorporation of GPS into the Vandel target system. This effort included modeling the mission scenario of the platform and simulating the inertial navigation and GPS subsystems to evaluate alternate integration schemes. By modeling Inertial Measurement Units (IMUs) of various quality and different types of GPS

receivers, basic performance vs. cost information is obtained. We believe this information can be directly applied to your Comm On Board Target Control, Sensor and Payload Architecture program.

Pacer is also currently providing engineering support to the USAF and NAVAIR Joint Tactical Combat Training Systems (JTCTS). We are supporting Raytheon, the prime in the design and development of the GPS/INS pods and algorithms that are used for tracking the ships, aircraft and submarines participating as players in the training exercises. JTCTS is an order of magnitude improvement over the existing TACTS training ranges. For the first time, Air Force and Navy training exercises will be able to be conducted using either fixed ranges, mobile ranges, or at-sea. The number of participants will be increased and the tracking errors of each player will be reduced to only a few meters through all dynamics.

Pacer also builds GPS simulation and test equipment. The GPST is a high fidelity fully dynamic, real-time satellite signal simulator which also generates consistent inertial aiding via standard interfaces to the receiver under test. Over the past 10 years, CAST, a wholly owned subsidiary of Pacer, has delivered over 40 GPST simulators to government and commercial customers around the world. CAST also delivered a Monte Carlo simulator (NAVSIM) which is used in the design and test of GPS-based integrated navigation systems.

Also, at Eglin the GPS-RAP navigation system software that CAST developed (under a contract with Interstate Electronics Corporation) combines pseudorange and delta-pseudorange measurements from a 5-channel P-code GPS receiver with acceleration and angular rate measurements from a low accuracy strapdown IMU. The system is used to instrument aircraft at U.S. military test ranges. It contains a 17-state (clock, position, velocity, tilts, gyro bias, and accelerometer bias) Kalman filter processes GPS pseudorange and delta-pseudorange measurements.

The navigation software that CAST developed for the USN's strategic Trident program was the predecessor of the GPS-RAP design, and it interfaced with a similar set of hardware. It was designed to provide accurate position, velocity, and attitude for a submarine during field tests. This was CAST's initial project for the development of GPS/INS integrated navigation software and was completed in 1986. It included an 11-state aided Kalman filter (clock, position, velocity, and tilts). This design was modified significantly for GPS-RAP based upon the lessons during the development process.

PHOTON RESEARCH ASSOCIATES

1. Company Name and Address:

Photon Research Associates
5720 Oberlin Drive
San Diego, CA 92121-172

2. Company URL: <http://www.photon.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

Mr. John A. Cone
619-455-9741
619-455-0658
jac@photon.com

4. Company products:

Synthetic Scene Generation Model: SSGM provides dynamic, high fidelity, physics-based simulations of combat or reconnaissance/surveillance scenarios from visible through far infrared as seen at a sensor aperture. Government and industry standard exhaust plume codes for aircraft and missiles are used as well as standard codes for target hardbodies and the radiative and transmissive atmospheric environment. These targets are placed within a dynamic environment of backgrounds, whether they be terrain, clouds, earth limb, or celestial either singly or in combination. SSGM can be used for mission planning as well as for simulation of dynamic imagery input to EO/IR sensors.

HYPEX: HYPEX is a commercial product for hyperspectral imagery simulation or exploitation for spectral system design or data extraction.

VISIG: VZSIG is the Visible and Infrared signature generation model which provides high fidelity rendering of hardbody images in addition to incorporation of environmental modeling of reflected earthshine, reflected sunshine, reflected skyshine, and thermal emission where temperatures are obtained from a variety of government standard codes. VISIG includes a large library of material reflectance databases.

FIST: Flexible Integrated Signature Technology is a NAIC sponsored program to provide, to NAIC, an in-house capability to model spectrally sensitive signatures of aircraft, ground vehicles, buildings, and other manmade structures and vehicles for use in reconnaissance and surveillance systems.

MOSART: MOSART is the Phillips Lab standard (follow-on to MODTRAN) atmospheric transmission and radiative environment model which includes a large variety of atmospheric databases and weather effects (wind speed, fog level, etc.) for use in "inverting" sensor data or predicting sensor performance in mission planning exercises.

Other: See accompanying list for PSI, a subsidiary of PRA.

Company services:

Sensor Design and Performance Prediction: A large library of sensor models, visible to IR to passive millimeter wave to SAR, exists to support sensor design and system architecture trades.

Mission Planning Support: An experience base and tool set exists to support experiment, system V&V, and operational mission planning related to a variety of combat, reconnaissance, and surveillance scenarios.

Data Analysis: Calibration of data, evaluation of artifacts (sensor and environment), and exploitation of data has been performed as a routine matter in the process of evaluating and updating target and environment models as well as cataloging target characteristics.

5. UAV-related Company Capabilities:

- Target and environment simulation for mission planning and performance prediction.
- Sensor (visible and infrared, scanning or staring, panchromatic to hyperspectral; SAR) concept development and evaluation in the context of dynamic target/background/environment scenarios.
- Detection, acquisition, tracking, and classification/recognition/exploitation algorithm development and analysis and evaluation.
- Experiment planning for V&V.
- Data analysis technique generation and exploitation ground station development, delivery, and database/software maintenance.

PHOTON SIMULATIONS, INC.

1. Company name, address:

Photon Simulations, Inc.
5720 Oberlin Drive
San Diego, CA 92121

2. Company URL: www.photon.com

3. Point of contact for UAV business area, telephone number, e-mail address:

Mr. Jeff Kass
619-597-3020
FAX: 619-455-0658
jrk@photon.com

4. Company products:

SensorVision™: SensorVision provides accurate real time, physics-based simulation of a scenario's optical and thermophysical properties as seen by an EO/IR device. Works with Paradigm Simulation's product Vega™.

SensorWorks™: (Due for Release May 1, '97): SensorWorks takes the SensorVision™ image after it has been rendered, but before it is displayed, adds user selected sensor effects and displays the image, in real time on Silicon Graphics™ (SGI) hardware. Effects are based on a set of input parameters specified by the user to match the characteristics of a specific sensor.

RadarVision™: (Due for Release May 1, '97): RadarVision simulates an RCS map for radars operating against synthetic environments comprised of natural backgrounds, cultural features and mobile objects This COTS radar scene simulation package provides a pixelized Radar Cross Section map of the desired area in real-time for frequencies ranging from 0.1 to 27 GHz.

RadarWorks™: (Due for release Jun 1, '97): Pick and choose features from a graphical user interface menu to produce realistic air-to-air, air-to-ground, and ground-to-air radar displays running in real-time. Works with RadarVision.

Texture Material Mapper™: Transforms multispectral imagery into textures of material codes, which have corresponding optical and thermophysical properties used by SensorVision and electromagnetic properties used by RadarVision.

MOSART Atmospheric Tool™: Builds multivariable databases of atmospheric quantities, to include solar/lunar irradiance, skyshine irradiance, path transmission, path radiance, and material surface temperatures for use by SensorVision.

Company services:

Multispectral database construction. Photon produces databases of terrain and objects in any wavelength, at any level of detail, for any area of the world, both classified and unclassified.

Material database development. Each material in the scene database has a unique spectral characteristic that Photon can compile for any area of the world. Measurements are taken both in the lab and on-site to provide verifiable material databases.

5. UAV-related company capabilities:

- Correlated visual, infrared, and radar simulations running from a single generated database in real-time. Works exceptionally well with models of typical UAV sensor payloads.
- Operates in the same wavelengths/bands as does state-of-the-art UAV technology.
- Photon's panel of database engineers can produce classified multispectral databases for any area of interest in their local in-house SCIF.

QUESTECH, INC.

1. Company name, address:

QuesTech, Inc.
1011 Camino del Rio South, Suite 600
San Diego, CA 92108

2. Company URL: cbrown@qtrd.cts.com

3. Point of contact for UAV business area, telephone number, e-mail address:

Mr. Chris Brown, Vice President

4. UAV-related company capabilities:

QuesTech has considerable experience with UAV and drones including several of the BQM series of aerial targets. Our expertise includes design of telemetry systems for UAV application, design of electronic packages to meet the space and aerodynamic constraints of small airframes, engineering modifications to drone airframes and propulsion, and planning and executing Applied Technology Demonstrations and field tests.

Under NRaD contract N66001-94-D-0009, QuesTech is supporting the Surveillance, Acquisition, Location Technology (SALT) sensor fusion feasibility demonstration project. For this project QuesTech is developing a high-fidelity simulation model to support integration of a multi-spectral sensor suite into a UAV platform for evaluation of the benefits to be derived from multi-sensor data fusion. The simulation consists of hardware sensor system models, an engagement scenario developed from DMA databases, target and scenario feature laydowns, a UAV flight dynamics model and propagation and atmospheric phenomenology models for specific geographic locations. Sensors being modeled in the simulation consist of an Electronic Surveillance Measurement (ESM) Sensor, a Synthetic Aperture Radar (SAR), a Forward Looking Infrared Sensor (FLIR) and a Vibration Sensing Laser (LADAR). This simulation will support engineering development of the hardware, algorithm, and software suites required for the integrated system sensor data fusion processor.

In support of the U.S. Army IEWD, QuesTech was the prime contractor for the successful demonstration of the over-the-horizon control of a Predator UAV by means of a satellite link between ground stations and the UAV. A data link with an onboard sensor package provided simultaneous real-time video transmission from the West coast to the East coast of the United States during this successful demonstration.

At Wright Patterson AFB, QuesTech provided the Air Force with technical support for the BQM family of drones on several COMPASS projects. RCMS is an example of a command and control system that was capable of launching multiple drones from an AC-130 and controlling the mission profiles of the UAVs from the aircraft monitoring consoles by the UAV pilots.

QuesTech is a diversified high-technology company providing scientific, engineering, and management services in advanced technologies to government and industry. We qualify as a small business with less than 750 employees. Our experience covers the spectrum from large conventional military standard developments to quick-react prototypes. Company headquarters are in Annapolis, Maryland with 26 offices nationwide. Revenues for the 1996 calendar year exceeded \$70 million. Customers include the DoD and the intelligence community: NRaD, NSWC-PHD, NAVSEA/PEO-TAD, NAWC-WD, China Lake/Pt. Mugu, NRL, ONR, SPAWAR, NAVAIR, U.S. Army, U.S. Air Force, NATC, AIA, DARPA, NSA, CIA, and DIA.

We look forward to discussing further how QuesTech can contribute to the support of NRaD's role in the development UAV system technologies.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

1. Company name, address:

Science Applications International Corporation
c/o Dr. Andre LeCault
4035 Hancock Street
San Diego, CA 92110

2. Company URL: www.saic.com

www.advtech543.saic.com

3. Point of contact for UAV business area, telephone number, e-mail address:

Dr. Andre LeCault
619-552-5111
andre.lecault@cpmx.saic.com

4. Company product/service:

This SAIC operation is focused on developing, integrating and delivering leading edge computer-based technology products for military end-users, including DARPA ISO and ITO, the Joint Staff, USACOM, USCINCPAC, CMCPACFLT, PACAF, ARPAC, SPAWAR, and NRaD.

5. UAV-related company capabilities:

An Internal Research and Development project over the past 14 months has resulted in a capability to conduct key word searches of live close-captioned television streams in order to capture video segments of user interest. Enhancements over the next several months will include the ability to conduct multiple concurrent background searches. This capability was successfully demonstrated to Dr. Alien Sears, DARPA ITO, who has subsequently awarded a \$5M Broad Agency Announcement-related contract to Dr. LeCault's operation. One of the first initiatives under the contract will be to develop a video segmenting capability for dubbed Predator videotapes based on speech-to-text technology developed by Caregie-Mellon University and the Oregon Graduate Institute. The system will enable an analyst to voice annotate Predator videotapes during post-flight review. The annotated tapes can then be cataloged and searched through voice-enabled keyword searches for video segments of interest. (The second focus of this IRaD project was to integrate speech recognition technologies with C4I systems. Two such systems have currently been "speech-enabled" through plug-and-play speech recognizers from both institutions: the Joint Readiness Automated Management System-JRAMS, a GCCS Leading Edge Services system, and an in-house prototype, the "Interactive Knowledge Environment-IKE," which provides for voice-driven searches of multimedia information from video, web-based, relational databases, and other heterogeneous sources. The IRaD, which is in its second year, is integrating both video segmenting and speech recognition technologies to provide various prototype information management and analysis capabilities.) It is expected that the Predator video segmenting prototype will be operational by early this summer. The initial goal will be to install an operational prototype at USCINCPAC/CINCPACFLT to support the segmenting, cataloging, and analysis of Predator videotapes.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION, APPLIED TECHNOLOGY GROUP

1. Company name, address:

Applied Technology Group, Science Applications International Corporation
6725 Odyssey Drive
Huntsville, Alabama 35806-3301

2. Company URL: Non-UAV specific Corporate URI is www.saic.com

3. Point of contact for UAV business area, telephone number, e-mail address:

Larry Alexander
205-876-0358
lalex@sed.redstone.army.mil

4. Company product/service:

SAIC ATG provides System and Software Engineering Support for the UAV Joint Technology Center/System Integration Laboratory (JTC/SIL). The JTC/SIL is located at the Software Engineering Directorate, Research, Development and Engineering Center, Redstone Arsenal, Huntsville, Alabama.

5. UAV-related company capabilities:

SAIC ATG is currently providing a full range of system and engineering services, including software development, system integration and testing, prototyping, simulation and modeling, sensor development and testing, data links, and military field exercise support. Specific systems being worked include development of the Tactical Control System (TCS), a common ground control station capability for the family of tactical UAVs, and development of the System Integration and Test Environment (SITE), incorporating the Hunter, Outrider, and Predator UAVs.

SEMCOR, INC.

1. Company name, address:

SEMCOR, INC.

West Coast

7170 Convoy Court

San Diego, California 92111

East Coast

East Plaza Professional Center, Suite 11

Havelock, North Carolina 28532

2. Company URL: <http://www.semcor.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

Mr. Charles E. Janes
(619)-560-7233 ext. 1839
cjanes@semcor.com

Mr. Charlie Evering
(919)-447-8811
cevering@semcor.com

4. Company product/service:

Technical Engineering and Management

5. UAV-related company capabilities:

- a.) Technical Shipboard Satellite engineering and integration support of PEO(CU) Program Office,
Cherry Point, NC.
- b.) Technical and Management support for seamless integration of tactical requirements in support of NWCS, TCS, TOMAHAWK, TUAV, etc.
- c.) Technical engineering and integration support for various PEO(CU) and various PMAs including PMA-281, 282, 258 and projects within their cognizance such as; SLAM (ER), TOMAHAWK, Harpoon (ER), ERGM, NWCS, TCS, *ATACMSMTACMS*, Multi-Band Satellite Communications System, JSTARS Integration, etc.
- d.) Technical and Engineering capabilities to provide reviews on UAV capabilities and requirements in support of TUAV & JPO, Predator, Hunter, Outrider, Dark Star, and Global Hawk Integration issues.
- e.) Technical Shipboard Satellite engineering and integration support of SPAWAR PMW 176-4, Arlington, VA and NRD D62, San Diego, CA.

- f.) Technical and Engineering capabilities to provide technical input to the Data Links Team for the selection of a Ku-band receive terminal setup for use in JWID 97. Procure (including satellite bandwidth), install and test designated segments of the selected receive terminal for JWID 97 as determined by the Data Links Team.
- g.) Technical and Programmatic capabilities to provide input and analysis to trade-off studies for determining an optimum long-term Ku-band receive terminal setup for BLOS Predator and Outrider maritime UAV operations.
- h.) Procurement, Installation and Testing capabilities of designated equipment to be used for long-term Ku-band receive terminal.
- i.) Technical and Programmatic capabilities to provide inputs and review plans of the TCS SATCOM demonstration IPT as well as other TCS IPT's as required.

SONALYSTS, INC.

1. Company name, address:

Sonalysts, Inc.
5675 Ruffin Road Suite 210
San Diego, CA 92123

2. Company URL: None

3. Point of contact for UAV business area, telephone number, e-mail address:

Steve Johnson

4. Company product/service:

Sonalysts, Inc. is the prime support contractor for the Research, Evaluation and Systems Analysis (RESA) Simulation Facility at NRaD, providing exercise/project development, exercise support, and post-exercise analysis, and software support.

The RESA simulation is a multi-level (theater to unit) naval warfare simulation compiled of models of varying fidelity. RESA is Distributed Interactive Simulation (DIS)-compliant and is networked via dedicated T-1 lines and DSI.

5. UAV-related company capabilities:

RESA was the key participant in the Synthetic Environments for Requirements and Concepts Evaluation and Synthesis (SERCES) program sponsored by DARPA via the UAV Joint Programs Office (JPO). These series of exercises led to the development of a high fidelity Electro-Optic Infrared (EOLR) sensor model and a Synthetic Aperture Radar (SAR) model used with the simulated Maritime UAV. This model was used in RESA stand-alone exercises and networked exercises with Joint Development Facility (JDF) in Virginia

RESA is one of the four key simulation sites networked via DIS protocols supporting the OSD-sponsored Joint Theater Missile Defense (JTMD) Attack Operations (AO) program. This Joint Test & Evaluation (JT&E) program has tasked RESA to simulate the Pioneer, Outrider, and Hunter UAVs, along with other naval and Joint force assets. These UAV models are low-to-medium fidelity, lookup- -table-driven models that are part of a Joint, multi-threat exercise environment.

SYSTEMS AND PROPOSAL ENGINEERING COMPANY

1. Company name, address:

Systems and Proposal Engineering Company
316 Glenmont Drive
Solana Beach, CA 92075

2. Company URL: No company URL at this time.

3. Point of contact of UAV business area, telephone number, e-mail address:

Dr. Steven H. Dam Systems Architecture
(619) 755-1091
Steve_Dam@msn.com

4. Company product/service:

My company supports the Federal Government and Contractors in the systems engineering/architecture development and procurement of systems. These services include program consulting and leadership to ensure sound system engineering practices are developed and followed in a project or organization.

We also support the business process reengineering activities of commercial and government organizations.

5. UAV-related company capabilities:

Currently we are supporting the Defense Airborne Architecture development in applying the C4ISR Architecture Framework to this study. Dr. Dam is a member of the DARO Architecture Development Team developing the objective architecture for 2010. Dr. Dam also led the successful proposal for the HAE UAV SETA and other ACTD programs, including Counter-Proliferation which included the concept of using UAVs to deploy unattended ground sensors.

SYSTEMS ENGINEERING AND MANAGEMENT COMPANY (SEMCO)

1. Company name, address

Systems Engineering and Management Company (SEMCO)
1430 Vantage Court
Vista, CA 92083-8596

2. Company URL: <http://www.semco.com>

3. Point of contact for UAV business area, telephone number, e-mail address.

Bill Tincup/Joyce McSorley
(619) 727-7800
FAX: 619-727-5200
bill_tincup@semco.com/joyce_mcsorley@semco.com

4. Company Product/Service

- (a) Design, development, and manufacturing of Radio Frequency (RF) products for DOD, Law Enforcement and Industrial Security.
- (b) Design, development, and manufacturing of RF-related communications systems for telemetry ground stations, covert surveillance, unmanned ground vehicles, etc.
- (c) DOD Support Services @.S, CM/DM, LSA, R & M, LCC, T & E, Technical Manuals, ISE)
- (d) Development and manufacturing of Automatic Test Equipment (ATE), Interconnect Devices (ICDs), Test Program Sets (TPSs) and related software support.
- (e) Design, develop, manufacture and install non-RF law enforcement & Industrial Security Products.

5. UAV-related company capabilities:

- (a) Design, development, and manufacturing of wireless transmitters and receivers for video, audio and telemetry data. These transmitters and receivers have been developed with the rigorous demands of airborne applications in mind.
- (b) Design, development and manufacturing of RF systems/subsystems for wireless ground control stations, unmanned aerial and ground vehicles, satellite receiving stations, etc.

(c) DOD Support Services (ILS, CM/DM, LSA, R & M, LCC, T & E, Technical Manuals, ISE)

(d) Development and manufacturing of Automatic Test Equipment (ATE), Interface Devices (Ids), Test Program Sets (TPSs) and related software support for both airborne and ground-based weapons systems.

TA MANUFACTURING INC.

1. Company name, address:

TA Manufacturing Inc.
375 West Arden Avenue
P.O. Box 2500
Glendale, CA 91209-2500

2. Company URL: In process

3. Point of contact for UAV business area, telephone number, e-mail:

John W. Dunlop
619-299-9950
FAX: 619-299-9955
galaxiel@ix.netcom.com

4. Company product/service:

TA Manufacturing Inc. manufactures wire and tube installation clamps and elastomer line blocks and grommets for the aerospace industry. Applications include aircraft, engines, missiles, and telecommunications equipment.

5. UAV-related company capabilities:

Installation clamps and line blocks for UAV aircraft and engines.

TECNOLOGY MANAGEMENT, INC.

1. Company name, address:

Technology Management, Inc.

2. Company URL: <http://members.aol.com/jeftmi/tmi2.htm>

3. Point of contact for UAV business area, telephone number, e-mail:

Larry A. Lacy or Richard Merrel
(619) 298-7877
squiresqp@aol.com

4. Company product/service: Technical management

5. UAV-related company capabilities:

- Participated in operational test and evaluation of Navy Drone Anti-submarine Helicopter.
- Managed and developed training programs for numerous Navy electronic systems.
- Performed system integration studies and analysis to adapt new weapons to the F-14 Aircraft.
- Principle Investigator on the NAVAIR F-14A+/F-14D Development Program.
- Managed the research, development, and full-scale testing of modifications of the Air force's A-10 and F-111 aircraft communication systems.
- Managed the Aircraft Intermediate Maintenance Department (AIMD) which was awarded consecutive awards for Material Management Excellence and Production Effectiveness.
- Reviewed, studied, and analyzed configuration management plan, software support plan, integrated logistic support plan, and logistics support Analysis records on the F-14 Aircraft.
- Acted as a Deputy Program Manager, supporting the S-3A/B Weapons System Improvement Program (WISP) performing the following:

A. Introduction, engineering, and logistics support for the WISP Program Office;

- B. Provided logistics, design engineering, and technical support to the S-3 Program Manager;
- C. Reviewed and Analyzed Contractor Prepared Logistics Documents;
- D. Chaired Readiness Improvement Program (RIP), executive and working group.
 - Analyzed life-cycle cost of Air Force and Navy RPV's using selected analytical models, recommending alternative actions amounting to cost savings of 15%.
 - Developed a Data Package for ECP MK46. Task was to provide engineering services on an on-call basis. Problems included providing quick response services in multiple disciplines (design engineering, CADD, logistics, validation, and etc.) on an intermittent basis. These services were provided using our in-house assets and locally available pool of available skilled personnel. Our management plan for this task facilitated the rapid up and down workload without impacting other programs while meeting all of the MK46 program requirements.
 - Maintained the MK50 Lightweight Torpedo configuration data base.
 - Directed the implementation of the first automated non-tactical data base system for scheduling and status tracking of Preventive Maintenance (PM) requirements for both NAVAIR/NAVSEA equipment.
 - Managed the CV/CVN/Airwing work-up management, integrated engineering and logistics studies, modernization management, availability planning for selected restricted and complex overhauls.
 - Managed C4T and Combat Systems technical and logistic programs from research and development through tactical operations.
 - Conceived and implemented plan for new approach to C4AI and Combat Systems testing for Pacific Fleet Ships.
 - Supervision, maintenance, operation and administration. Duties included scheduling all tests for missiles, underwater weapons, underwater test vehicles and providing total logistics support for all projects assigned to the five Naval Ocean System Center ranges.
 - Management the F/A-18 site activation management planning and coordination for CV-61.

TECHPLAN CORPORATION

1. Company name, address:

TECHPLAN Corp.
3940 Hancock St. Suite E
San Diego, Ca. 92110
Tel: (619) 222-0071
FAX: (619) 222-0625

2. Company URL: <http://www.techplan.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

Guy Wicks
(619) 222-0071
wicks@techplan.com

4. Company product/service:

Engineering and Technical Support to PMW-101 and -159 for JTIDS/MIDS/LEIP/LINK-22

5. UAV-related company capabilities:

Message standards and system architecture for data links to control UAVs and exchange tactical data utilizing J series or related messages.

TELEDYNE RYAN AERONAUTICAL

1. Company name, address:

Teledyne Ryan Aeronautical
2701 North Harbor Drive
San Diego, California 92101 (619) 291-7311

2. URL: www.tdyryan.com

3. Point of contact for UAV business area, telephone number, e-mail address:

Anthony C. Richards,
Vice President, Business Development (619) 260-4355
trichards@tdyryan.com

4. Company products/services:

Design, development production and operation of high-performance unmanned aerial vehicle systems, including:

- * Medium-Range Unmanned Aerial Vehicle (MR UAV) for DoD
- * Tier II Plus Global Hawk High-Altitude Endurance Unmanned Aerial Reconnaissance System for DARPA
- * Model 324 Unmanned Aerial Vehicle for Egyptian Air Force
- * BQM-34A/S Firebee high-performance aerial target system for USAF, USN, USA, Israel and Japan

5. UAV-related company capabilities:

- * Design and production of actuators
- * Design production of flight control computer systems
- * Airframe design and manufacturing
- * Systems test and integration

*Flight test

*Environmental testing

* Structural testing

* Flight control, mission planning, and systems integration software development

* Design and production of small-diameter jet engines

* Manufacture of aerospace ordnance products

TRW AVIONICS SYSTEM DIVISION

1. Company name, address:

TRW Avionics System Division
One Rancho Carmel
San Diego, CA 92128

2. Company URL: <http://www.rc.my.com>

3. Points of contact for UAV business area, telephone number, e-mail address:

Nick Yorio	Joel Sucov
(619) 592-4240	(619) 592-4229
nick_yorio@smtpgw.uavsd.trw.com	joel_sucov@smtpgw.uavsd.trw.com

4. Company product/service:

The TRW Avionics Systems Division (ASD) is a world-class supplier of aircraft communications, navigation and identification (CNI) systems. The division also has an exceptional record providing a wide range of engineering services at Air Logistics Centers around the U.S. In areas of range instrumentation and test systems, flight simulation software and independent verification and validation of developed software, our expertise assures top performance of electronic systems onboard a variety of military aircraft. Additionally, ASD engineers, integrates, and supports unmanned aerial vehicle systems, and designs, develops and builds multifunctional antenna systems, test and training systems, and simulation and modeling tools.

Major programs include the development of integrated modular avionics systems for the F-22 Advanced Tactical Fighter and the RAH-66 Comanche helicopter, the Industrial Base Pilot (IBP) program from which advanced engineering and manufacturing processes will be developed in support of the U.S. Air Force Design Engineering Program, Electronic Data Management programs for expansion of information management technologies and video teleconferencing, and the integration, test and delivery of the Joint Tactical - Unmanned Aerial Vehicle limited production program.

5. UAV-related company capabilities:

TRW, as the prime contractor, is responsible for the integration, test, delivery, and support of the Hunter UAV system for the JT-UAV limited production program. Production Hunter UAV systems have been delivered, fielded, and are being operated and maintained by Army personnel in active units, while TRW provides training, flight operations, logistics support and performs depot maintenance.

TRW has performed extensive conversion of off-the-shelf software to a DoD management structure and is developing downsized versions of portable ground control and communications elements, compliant with Tactical Control System (TCS) requirements, to support rapid deployment contingency operations.

As part of the Hunter marinization contracted activities, we demonstrated carrier take-off and landing. Additionally, TRW led design activities for a heavy fuel engine (HFE) suitable for Hunter maritime operations which completed a successful CDR and prototype demonstration in May 1996.

We have also supported the development and Hunter flight demonstrations of the following UAV payloads: communications data relay, EW (in ESM and EA modes), laser designator and ORION SIGINT; and are preparing for the demonstration of mine detection, hyperspectral imager (HSI), SAR and other reconnaissance sensors.

In addition to Hunter tactical UAV contracts, our Advanced Multi-function Software Radio and FIRESTORM (algorithms for blind separation and recovery of co-channel signals) IR&D efforts, coupled with our leadership of the "UAV Communications Payload Study" for AFCA and the pending award of the "UAV On-Board Switching Program" for Rome Labs, positions us to be a participant in the DARPA UAV Airborne Communications Node (ACN) program.

VEDA INCORPORATED

1. Company name, address:

Veda Incorporated
8799 Balboa Ave.
San Diego, CA 92123

2. Company URL: <http://www.veda.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

Kirk Herdman
619/467-1035
kherdman.sand@veda.com

4. Company product/service:

Veda Incorporated and its over 1400 employees specialize in providing cost-effective solutions to complex engineering and technical problems. Veda Systems, a wholly owned *subsidiary*, specializes in the design, manufacture, and marketing of high-performance telemetry equipment. The successful combination of services and products offered by Veda Incorporated and Veda Systems has established our reputation as a leader in the DoD aviation community.

5. UAV-related company capabilities:

Veda's engineering support of UAV systems for the U. S. Navy and other DoD agencies includes the following initiatives:

- Development of Technical Specifications for Medium Range UAVs (MRUAV).
- Integration Analysis for Launch Aircraft (i.e., F/A-18 and MRUAV).
- Development of System Concept Documents for Organic Endurance and Close Range UAVs.
- Aerodynamic heating analyses and propulsion system tradeoff assessments for UAVs.
- Development of a UAV compendium including a database of all UAVs and system characteristics.
- A joint effort between Veda Incorporated, the University of Maryland, and the Freewing Aircraft Corporation to develop a High-Performance Vertical Launch and Recovery UAV concept and proposal for PEG/Cruise Missiles and the UAV Joint Program Office.

Additionally, Veda has extensive experience in Low Observable Technologies including the integration of InfraRed (IR) signature reduction technologies and low Radar Cross Section (RCS) inlets, exhaust nozzles, and propulsion systems into tactical aircraft platforms. We have extensive knowledge and experience of aircraft IR measurement techniques and models, and the application of low IR and RCS treatments and materials to platform structures and propulsion systems. Veda designs low RCS antennas and integrates these antennas into UAVs. We also have experience in RCS diagnostics techniques, and in supporting static and dynamic RCS testing.

Other applicable Veda experience includes our design, development and testing of antennas and radomes for UAVs. This includes an in-house capability to conduct scale model and partial full-scale mockup antenna studies in our 20-foot anechoic chamber. Veda also has extensive experience in research, development, test and evaluation of airborne communications systems (i.e., JTIDSRMDS, covert communications, etc.) including experience in imagery compression and transmission techniques/systems employed by UAVs.

VISICOM LABORATORIES

1. Company name, address:

VisiCom Laboratories
10052 Mesa Ridge Court
San Diego, CA 92121

2. Company URL: <http://www.vvisicom.com>

3. Point of contact for UAV business area, telephone number, e-mail address:

Tim Elsmore
(619) 457-2111
tim@vigra.com

4. Company product/service:

Hardware, software, and integration engineering services in support of the UAV program

5. UAV-related company capabilities:

VisiCom's Vigra VGS-882 VMEBus Graphics Server board provides the graphics displays for the General Atomics Predator UAV. The VGS boards are used in conjunction with video capture and genlock boards to provide the operator console display. The console user interface is built upon VisiCom's VxWorks based X-Windows package, VxWindows. VisiCom also provided integration services in the development of the console and developed a code layer, Mux-a-Mouse, to provide the capability of running dual X-servers with a single mouse and trackball.

VisiCom's new Vigra Sliver product provides a second generation capability which integrates two live video windows (for nose and observation cameras) with higher performance graphics into a single slot VMEBus board. This will provide for a reduction in overall system cost, weight, and complexity and a resulting increase in system reliability.

VisiCom has also developed a Virtual Keyboard interface for VxWindows which can be used to simulate existing hardware keys and switches.

WHEAT INTERNATIONAL COMMUNICATIONS CORPORATION

1. Company name, address:

Wheat International Communications Corporation
10515 Vista Sorrento Parkway
San Diego CA 92121

2. Company URL: www.wheatintl.com

3. Point of Contact for UAV business area, telephone number, e-mail address:

Mark Waumans
619-558-3222
mwaumans@wheatintl.com

4. Company product/service:

Mobile Communications, Network Engineering, System Integration and Engineering

5. UAV-related company capabilities:

RPV Operations

Wheat International and partner AT&T provided two mobile ATM setups for the Marine Corps to demonstrate ATM technology in conjunction with RPV operations during the Marine Corps Commandant's Warfighting Laboratory Exercise Hunter Warrior, which took place January through mid-March, 1997. For the exercise, NTSC analog video signals from an EXDRONE RPV flying at the Marine Corps Air Ground Weapons Training Center (Seagle Remote Airfield), 29 Palms, CA were transmitted to a mountain top signal repeater and, in turn, to the RPV ground control station, then via a T-1 satellite link to the Command Center at the Marine Corps Tactical Systems Support Activity (MCTSSA), Camp Pendleton, CA. The real-time video signal in ATM format was encoded and compressed to allow full-motion, high-quality video transfer and the additional demonstration of multimedia capabilities of video teleconferencing, file transfer, white boarding, and image transfer. The live video displays from the RPV were available for viewing on a monitor and on the large command center board at MCTSSA.

This endeavor proved highly successful in transferring real-time high-quality information from an RPV, and was invaluable in providing up-to-date intelligence of ground movements and battle damage assessments. The small size of the EXDRONE and high-quality electronics embedded in the drone made this a virtually invisible eye in the sky.

