Aerostats - Emergency Communication and Sensor Platforms

Introduction

New requirements for the protection of the public at large entertainment events, security for key industrial and government facilities, domestic transportation infrastructure and border crossings require the development of new platforms for wide-area communications and situational awareness for incident response. Such incidents include environmental emergencies, industrial, transportation accidents and acts of terrorism. These surveillance platforms include satellites, conventional aircraft, uninhabited aerial vehicles (UAVS), airships and tethered aerostats. One of the most promising and economical of these platforms is the use of tethered aerostats that can be moved easily and deployed rapidly by a small group of operators. Tethered aerostats can provide highly portable and affordable platforms for ad hoc emergency services for weeks or months before a scheduled event and after an emergency incident. Their use is expected to grow significantly both nationally and internationally over the next several years accordingly. To meet this need for mobile, affordable, temporary and persistent communications and airborne sensors, Western DataCom has developed an integrated communications and sensor system on tethered aerostats for scheduled or emergency event coverage. Such systems can also be for seasonal environmental studies when they are not needed for scheduled events or emergency situations.

Western DataCom

Western DataCom (WDC) is a twenty five year old business located in Westlake, Ohio. WDC designs, develops and manufactures hardware for securely transmitting voice, video and data over Internet Protocol (IP) based networks. WDC occupies 12,500 square feet that has a Top Secret facility clearance being held by the National Security Agency. Production capabilities can be scaled exponentially because of WDC's outsourced manufacturing model. WDC has spent the past seven years designing, testing, building and successfully marketing a suite of new products that emanated from collaborated research with NASA-Glenn and Cisco Systems. Cisco classifies WDC as a Hardware Development (HD) partner and the company designs and manufactures complimentary products to Cisco 3200 Series of Mobile Access Routers.

AeroCentric Federation

The AeroCentric Federation began in January 2007 with the intent to design, build and operate a High Altitude, Long Endurance (HALE) test bed for future payloads that are proposed to operate on stratospheric vehicles at 65,000 feet. The AerOhio 1 test bed combines a tethered aerostat, world-class NASA test facilities and ranges. Western DataCom, various Ohio Universities, and NASA Glenn Research Center Plum Brook Station (PBS) and the goal are to prove concepts and test payloads at low altitude with an economically efficient platform and professional crew. In September, 2007 a 23,000 cubic foot aerostat was launched and operated by Western DataCom at NASA Plum Brook Station in Sandusky, Ohio. As operational experience builds and funding becomes available, the AerOhio 1 Team intends to fly this aerostat higher with increasingly capable payloads at night as well as during daytime.

As a result of this research WDC has developed an integrated communications and sensor system on tethered aerostats for emergency response. Such systems can also be used for short-term security at large public events such as major sporting events and political events as well as for seasonal environmental studies when they are not needed by emergency responders. The emergency communication equipment deployed would include cellular, security force radios and Wi-Fi, all connected to the Internet by satellite when the high speed cellular infrastructure is not available. The sensors would also include chemical, biological, radiological detection and monitoring capabilities. Acoustic and video surveillance would also be included in this sensor monitoring system.

Emergency Communications Equipment Supported

- CDMA Cellular - back-up for all National and International CDMA providers
- GSM Cellular - back-up for all National and International GSM providers
- Radio – National Security forces or local government sponsored system. All other radio frequencies (RF) supported for EMS, fire, police any other government agency frequency required by users.
- Wi-Fi – a Wi-Fi hot zone would be created by the aerostat and, depending on the airship's altitude, the coverage radius for this hot zone will vary from a few to several miles. For example, in 2004 Western DataCom designed a Wi-Fi system for a U.S. Army Aerostat that is being used at Camp Victory in Baghdad; this aerostat currently operates at an altitude of 2,500 feet and has a Wi-Fi coverage area of 60 nautical miles.

Emergency Response Wireless System Enhanced

Cell phone and cell data technology is ubiquitous. Cell technology is a fast area of technological innovation and the need for restoration of cell communications is the basic function of short and long term emergency response. The Emergency Response Wireless System (ERWS) will provide cellular coverage to an area without the need to construct a new stand alone cellular communications site. Examples are catastrophic response and Continuity of Operation (COOP) for federal, state and local government

agencies. The proposed system will be quickly deployed to provide wireless infrastructure that may have been damaged by disaster or an emergency.

Faster Cellular Voice and Data Access for Emergency Response

The cellular communication system is the Qualcomm 3G CDMA Broadband data system that acts as a compact Microcell base station. This system uses proven 3G CDMA 1XEv-DO Rev A technology in the 1.25 MHZ spectrum and supports data speeds up to 3.1 Mbps. Soon, Ev-DO rev B will be supported in the fall of 2008 with data speeds up to 10 Mbps. GSM based cellular systems are available on the aerostat from Ericcson and other manufactures. The GSM equivalent to Ev-DO is HSDPA and provides for high speed data networks in GSM cellular coverage areas.

Use of Land Mobile Radio Access for Emergency Response

This system will provide mobile communications for 1st responders and also help in the restoration of communications for essential business functions. The system also supports Land Mobile Radio (LMR) functions that can integrate 1st responder radios and allow radio users to communicate with cellular phones or any land based telephone systems. The system also provides Internet Service Provider (ISP) data communications for Personal Data Assistants (PDA), Personnel Computers (PC), Handheld PCs, Video Cameras and other Internet Protocol (IP) devices. The estimate coverage when used with a tethered Aerostat at 1,500 ft is 20 to 30 miles and this coverage area is similar to commercial cellular coverage areas. Coverage is based on numerous factors that include the operating band, local terrain, foliage, buildings, antenna gain and receive strength, and operational scenarios that include stationary and mobile users and RF prorogation physics. The ERWS system can be expanded with additional Radio Area Network modules. The expansion transit case contains 2 additional Power Amplifiers with three sets of RF Antennas allowing for high capacity (more users) and or more range.

Use of Existing Wide Area WiFi Access for Emergency Response

The communication system will also support 802.11b/g wireless technologies. This wireless system will consist of an access point and wireless bridges providing an 802.11 b/g cone providing communications for PDAs, PCs, and other 802.11b/g wireless devices. The distance of this cone will be the similar to the cellular system coverage. The 802.11 b/g technology will be integrated with the cellular system for seamless voice, video and data. The total system package will provide rapid deployment for Land Mobile Radio (LMR), 802.11b/g, ED-VO rev A communication integration that will support 1st responders, and reestablish critical business communications for many types of emergencies and disasters.

Aerostat System Sensor System

The Aerostat can include a suite of sensors that WDC as developed as follows:

- Chemical, biological, radiological detection and monitoring (CBRM) – sensors will detect traces of these elements and monitor air movement and quality. For example, if a radioactive plum was created as the result of a "dirty bomb," this system would perform detection and monitoring safely, at a distance.

- Video Cameras – powerful gimbaled, pan, tilt and zoom (PTZ) video cameras, high-resolution digital still cameras for change detection, and lower resolution, wide area contextual geo-referenced video, and hyperspectral sensors designed to determine composition of unknown substances can be mounted on the aerostat for monitoring disaster recovery activities and for security purposes. These video cameras would have infrared and low light monitoring capabilities for nighttime surveillance activities with an intelligent video surveillance allowing computers to detect people, vehicles and changes in the video. High Definition cameras and compression equipment is available for sporting event coverage

- Acoustic – acoustic monitors mounted on the aerostat could detect sounds (such as bullets from a gun or underground noise from a tunnel under construction).

Non Emergency Government Uses

When the aerostat is not being used for emergency communications and sensing, it could be deployed for other government related activities such as:

Environmental Studies
- Species Tracking and Analysis
- Natural Resource Program Management
- Air Quality Services
- Water Resource Monitoring
- Land Use Planning

Land Management

- Public Involvement
- Cultural Resource Management
- Archeological Site identification and Engineering
- Ecosystem Assessments

Scientific Services

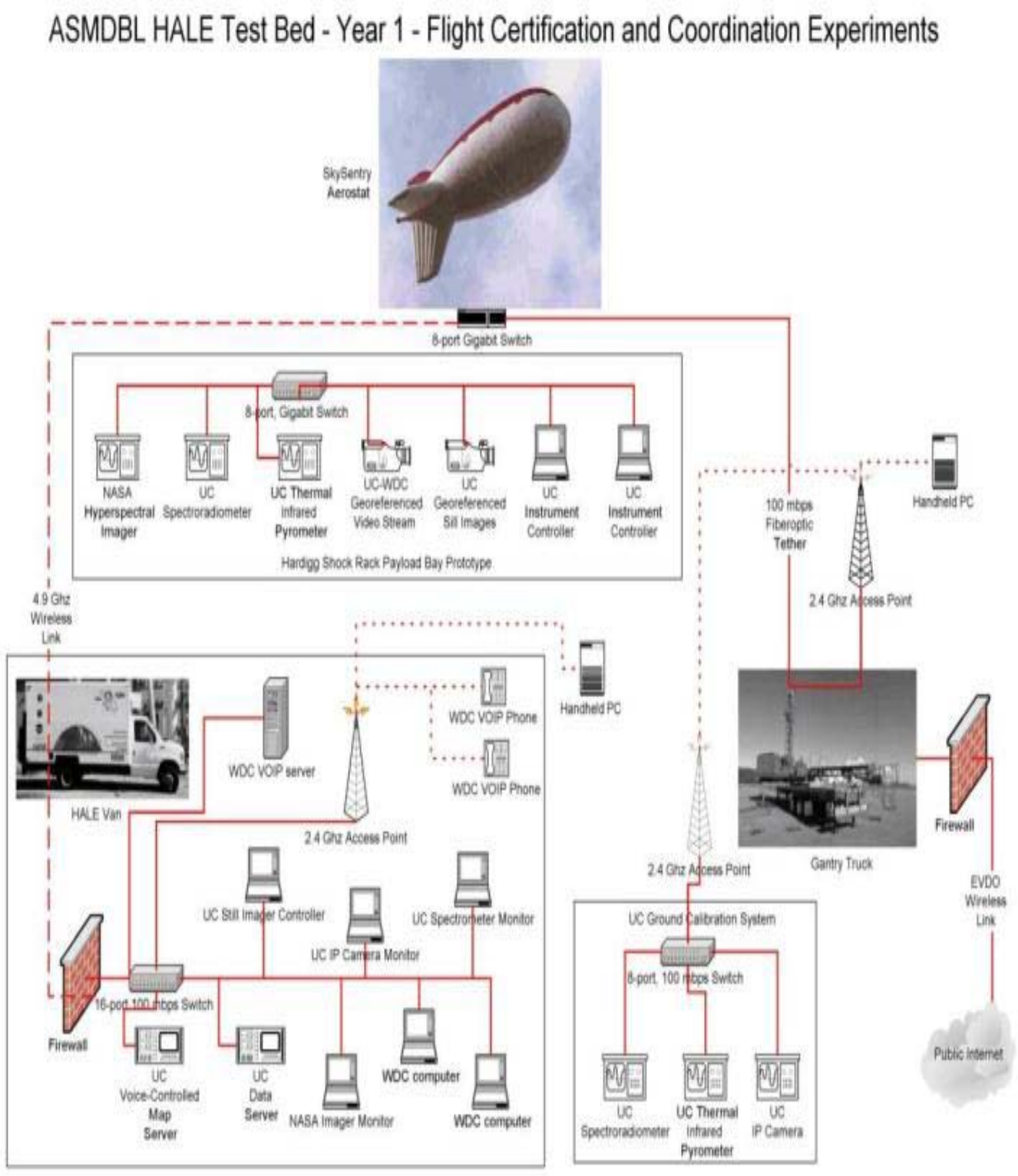
- Botanical and Biological Surveys
- Physical Oceanography

- Marine Metrology
- Species Identification
- Fisheries Database Construction
- Chemical and Geological Oceanography

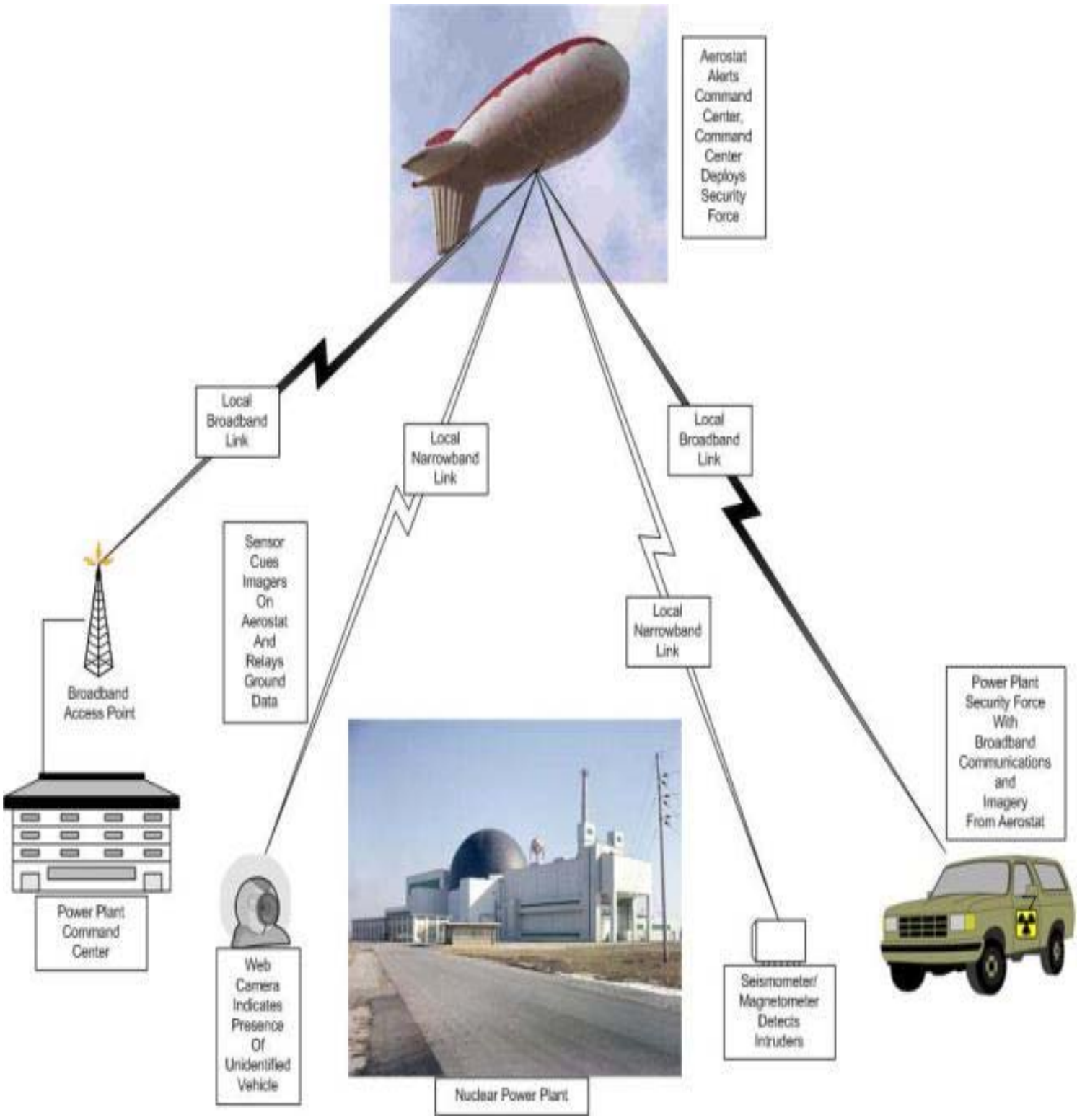
Regulatory Compliance for:

- National Environmental Policy Act (NEPA)
- Clean Air Act (CAA)
- Hazardous Materials
- California Environmental Quality Act (CEQA)

Aerostat System Diagrams on the following pages



Schematic Diagram of the Information Architecture



SCAN-2/AECS Product Integration of basic HALE Sensor and Communications Network for Homeland Security Applications.

Payload: size, weight and power of capability of existing Aerostat

1. 100 feet long x 25 feet wide x 25 feet high
2. Weight handling capability - 200 lbs
3. Power AC 1 kilowatts, 110 to 115V AC 60 Hz

Payload: Communications equipment

1. Wi-Fi 5 watt 802.11g amp with a CISCO WMIC 802.11G bridge.
2. One 120 degree Panel antenna (pointing down).
3. 8-port Ethernet switch in the payload bay.
4. Qualcomm CDMA switch

Payload: Sensor equipment

1. CBRM
2. Video Surveillance
3. Acoustic

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