



**AeroVironment**

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**Quarterly Report**

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Office of Pipeline Safety

Project Title: “Consolidated Research and Development for Pipeline Safety”

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## **Public Page**

This program will use available Unmanned Aerial Vehicles (UAVs) and sensor technologies to demonstrate a cost effective system solution to conduct aerial surveillance of pipelines, thereby closing existing gaps in safety, inspection and enforcement while reducing cost. Research conducted this quarter focused on six topics:

- Identification of pipeline aerial surveillance missions
- Identification of applicable Federal and State aerial surveillance regulations
- Identification of additional pipeline owner/operator operational requirements
- Determine data acquisition requirements
- Determine aircraft payload requirements
- Determine vehicle requirements

### **Identification of Pipeline Aerial Surveillance Missions**

The main pipeline aerial surveillance missions have been identified as: Encroachment Detection, Leak Detection, and Reducing Survey Costs.

The first objective is to detect pipeline right of way encroachments, map their location on a GPS map and provide a real time visual image of the problem area. A combination of visual (color video camera) and infra red imaging will be used with the ability for user to camera switch. Forward looking and side looking payloads will be employed.

The second major objective is to determine the system's reliability and accuracy in locating leaks associated with pipelines, map their location on a GPS map and provide a real time visual image of the problem area. Data collected may be incorporated into a geographic information system (GIS).

The third objective is to achieve survey data at a cost much less than other methods currently available. The predominate method of surveying pipelines in by manned flight using fixed wing and rotary aircraft.

### **Identification of Applicable Federal and State Aerial Surveillance Regulations**

A study of existing Federal and State requirements for owner/operators to conduct aerial surveillance of pipelines was completed in order to further identify mission needs. Federal regulations require companies to perform maintenance inspections on pipeline components at specified intervals. The entire pipeline right-of-way must be patrolled two to four times each year, depending on how densely populated the area around the pipeline is (the higher the population, the more frequent the patrol). Leak detection surveys are conducted at least annually in unpopulated areas and four times each year in populated areas. There are other inspection requirements specified in the [Federal pipeline safety regulations](#).

Excerpts from applicable regulations follow:

Code of Federal Regulations  
Title 49, Volume 3  
Revised as of October 1, 2004  
From the U.S. Government Printing Office via GPO Access  
CITE: 49CFR192.613

TITLE 49--TRANSPORTATION

CHAPTER I--RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION, DEPARTMENT OF TRANSPORTATION (CONTINUED)

PART 192\_TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE: MINIMUM FEDERAL SAFETY STANDARDS

Subpart L\_Operations

Sec. 192.613 Continuing surveillance.

(a) Each operator shall have a procedure for continuing surveillance of its facilities to determine and take appropriate action concerning changes in class location, failures, leakage history, corrosion, substantial changes in cathodic protection requirements, and other unusual operating and maintenance conditions.

(b) If a segment of pipeline is determined to be in unsatisfactory condition but no immediate hazard exists, the operator shall initiate a program to recondition or phase out the segment involved, or, if the segment cannot be reconditioned or phased out, reduce the maximum allowable operating pressure in accordance with Sec. 192.619 (a) and (b).

Code of Federal Regulations

Title 49, Volume 3

Revised as of October 1, 2004

From the U.S. Government Printing Office via GPO Access

CITE: 49CFR192.721]

TITLE 49--TRANSPORTATION

CHAPTER I--RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION, DEPARTMENT OF TRANSPORTATION (CONTINUED)

PART 192\_TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE: MINIMUM FEDERAL SAFETY STANDARDS

Subpart M\_Maintenance

Sec. 192.721 Distribution systems: Patrolling.

(a) The frequency of patrolling mains must be determined by the severity of the conditions which could cause failure or leakage, and the consequent hazards to public safety.

(b) Mains in places or on structures where anticipated physical movement or external loading could cause failure or leakage must be patrolled--

(1) In business districts, at intervals not exceeding 4\1/2\ months, but at least four times each calendar year; and

(2) Outside business districts, at intervals not exceeding 7\1/2\ months, but at least twice each calendar year.

**Identification of Additional Pipeline Owner/Operator Operational Requirements**

In addition to regulatory requirements, pipeline owners and operators require air visual support to complete a wide range of operational and maintenance missions. The frequency of patrols varies from daily during times of concern (construction, weather related damage, vandalism, terrorism, etc.) to annually in order to meet regulatory requirements. Frequently, the aircraft is called in to verify a report derived from other sources.

A few operational missions include:

- Annual count of houses adjacent to pipeline.
- Monitor for current and previous excavation in right of way areas.
- Identify surcharge loads
- Identify pipeline washouts
- Document construction errors

### **Determine Data Acquisition Requirements**

Data will be presented in the form of:

- written reports
- photographs
- real time video imaging (black and white, color, infra-red)
- tabular data (GPS, airspeed, altimeter, etc.)

### **Determine Aircraft Payload Requirements**

The system is capable of carrying a range of commercially available payloads including black and white, color and infra-red still and video digital imaging cameras, a host of environmental sensors, and a Global Positioning System (GPS). Concurrent data acquisition and processing is presented in real time images.

*Table 1.0 - Payloads*

Color Video
Infra red camera
Forward Imaging
Sidelooking Imaging
Camera switch function
GPS
Compass heading
Altimeter
Other Environmental Sensors (TBD)

### **Determine Vehicle Requirements**

The proposed UAV is a battle-hardened design consisting of an air vehicle and ground station (see Figures 1 & 2). The system is man portable, or light enough to be carried by two people. The system is designed for ease when employed by a trained operator. The system can be set up and deployed within five minutes.

**Table 4.0 – Vehicle Features**

Switchable Frequency
Computer Mapping
GPS
Autonavigation
Link Loss Default
Day and night operations
Hand Launched
AutoLand
Light Weight
Small Size
Man Portable

**Figure 1.0 - Unmanned Air Vehicle**



*Figure 2.0 – Unmanned Air Vehicle Ground Control Unit*

